

THE 25<sup>TH</sup> INTERNATIONAL  
EXHIBITION OF INVENTIONS

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# **INVENTICA 2021**

IAȘI – ROMÂNIA

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# **AWARDS**

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**JUNIOR INVENTOR PRIZE**

**SENIOR INVENTOR PRIZE**

**PERFORMANCE IN SCIENTIFIC RESEARCH ACTIVITY AWARD**

**TECHNOLOGICAL TRANSFER AWARD**

**DIPLOMA OF HONOR AND INVENTICA 2021 GOLD MEDAL**

**DIPLOMA OF EXCELLENCE AND INVENTICA 2021 SILVER  
MEDAL**

**DIPLOMA OF ACHIEVEMENT AND INVENTICA 2021 BRONZE  
MEDAL**

**DIPLOMA OF PARTICIPATION**



## **INVENTICA la ediția a XXV-a**

În anul 2016, la 14 nov., aniversam 25 de ani de la înființarea Institutului Național de Inventică din Iași, entitate care structura ca o consecință a dezvoltării și maturizării Școlii de Inventică din Universitatea Tehnică “Gheorghe Asachi” din Iași. Institutul a avut, la rândul său, o evoluție care a fost influențată de realitățile sociale și economice din țară, desfășurând o activitate specifică în domeniul dezvoltării culturii creativității tehnice, a transferului tehnologic, al proprietății intelectuale. Firesc, Institutul organiza, periodic, două manifestări științifice dedicate Inventicii, Salonul și Conferința care, iată, anul acesta au ajuns la ediția a XXV-a. Decalajul de cinci ani dintre cele două momente festive este determinat de unele sincope care au apărut în continuitatea organizării acestor manifestări, sincope provocate de realitățile social-economice mai sus-amintite.

De-a lungul timpului, Institutul a mai organizat și Simpozionul Național de Inventică, în cadrul Zilelor academice ieșene. De asemenea, din anul 1983 a funcționat Comisia de Inventică a Academiei Române, condusă de prof. Vitalia Belousov până în anul 2000, după care conducerea acesteia a fost preluată de către prof. Boris Plahteanu.

Toate aceste realizări au condus la nașterea unei adevărate culturi instituționale, care a permis ca aceste entități de organizare și de manifestare a creativității să treacă proba timpului și să-și pună amprenta asupra a numeroase generații de studenți, cadre didactice, cercetători, ingineri, diverse persoane cu preocupări în domeniul inventicii. În ultimii ani s-a deschis mai mult accesul copiilor, al elevilor la evenimentul Inventica. De asemenea, nu au fost uitați inventatorii seniori, în fiecare an acordându-li-se acestora diverse premii de consacrare., în acest fel cercul închizându-se, având contact cu toate

generațiile, dar, ceea ce este mai important este că s-a reușit o interacțiune între generații, care au, oricând, ceva să-și comunice, deoarece este cunoscută zicerea conform căreia „...*ceea ce învață bunicul pe nepot este știință, iar ceea ce învață nepotul pe bunic este tehnologie*”.

Inventica se află la a doua ediție on-line... Sperăm să fie și ultima! Așa cum au făcut și alți colegi de-ai noștri, am încercat să asigurăm continuitatea Inventicii, dar, mai mult decât atât, am încercat să dăm încredere celor care participă la manifestarea noastră că dispunem de resursele tehnologice, de infrastructură și de resursă umană pentru a trece peste această încercare planetară a solidarității umane.

Așa cum a ține ore în on-line a însemnat un efort neașteptat de mare, tot așa și organizarea unei manifestări științifice presupune, dacă nu eforturi mai mari, cu siguranță eforturi de altă natură decât cele cu care eram obișnuiți. În acest sens, să le fim recunoscători colegilor mei mai tineri (Ana-Maria, Dragoș, Adriana, Andrei, Mariana, Carmen), la care se adaugă și domnul Octav Păuneț, pentru timpul și energia pe care le-au oferit cu generozitate și ediției de anul acesta al Inventicii.

Fie ca de-acum înainte Institutul, Salonul și Conferința de Inventică să-și desfășoare activitățile și edițiile viitoare în mod neîntrerupt, în regim on-site, spre dezvoltarea culturii creativității și a proprietății intelectuale în România.

Președinte al Salonului Internațional de Invenții, INVENTICA 2021,  
Prof. univ. dr. ing. **Neculai Eugen SEGHEdin**  
Manager al Institutului Național de Inventică  
Universitatea Tehnică „Gheorghe Asachi” din Iași

## **INVENTICA at the XXV<sup>th</sup> edition**

In 2021, on 14 November, we celebrated the 25th anniversary of the National Institute of Inventics in Iasi, as a result of development and evolution of the School of Inventics from the “Gheorghe Asachi” Technical University of Iași. The institute had, in its turn, an history that was influenced by the social and economic realities of the country, carrying out a specific activity in the field of developing the culture of technical creativity, technological transfer, intellectual property. Naturally, the Institute organizes, periodically, two scientific events dedicated to the Creativity and Inventions, the Inventics Exhibition and the Inventics Conference, which, this year, have reached the XXV edition. The gap of five years between the two festive moments is determined by some synopes that appeared in the continuity of the organization of these manifestations, synopes caused by the above-mentioned socio-economic realities.

Over time, the Institute also organized the National Invention Symposium, during the Iasi Academic Days. Also, since 1983, the Inventions Commission of the Romanian Academy has functioned, chaired by prof. Vitalia Belousov until 2000, after which its leadership was taken over by prof. Boris Plahteanu.

All these achievements have led to the birth of a true institutional culture, which allowed this entity specialized in organizing and manifesting creativity to pass the test of time and to make its mark on many generations of students, teachers, researchers, engineers, various people with concerns in the field of invention. In recent years, the access of children and students to the Inventica event has been more open and encouraged. Also, the senior inventors were not forgotten, every year they are awarded various prizes of consecration, in this way the circle closes, having contact with all generations, but, what is more important is that there has been an interaction between generations, who always have something to communicate, because it is known that “... what the grandfather teaches the grandson is science, and what the grandson teaches the Grandpa is technology”.

The Inventica Inventics Exhibition is in its second online edition ... We hope it will be the last! As other colleagues of ours have done, we have tried to ensure

the continuity of the Invention, but, more than that, we have tried to give confidence to those who participate in our event that we have the technological resources, infrastructure and human resources to overcome this global test of human solidarity.

Just as having online courses and seminar meant an unexpectedly great effort, so too, organizing a scientific event involves, if not greater efforts, certainly efforts of a different nature than the ones we were used to. In this sense, let us be grateful to my younger colleagues (Ana-Maria, Dragoş, Adriana, Andrei, Mariana, Carmen), to which is added Mr. Octav Păuneţ, for the time and energy they generously offered and this year's edition of Invention.

May the Institute, the Exhibition and the Inventics Conference from now on carry out its activities and future editions uninterruptedly, on-site, towards the development of the culture of creativity and intellectual property in Romania.

Chairman of International Exhibition of Inventions INVENTICA 2021

Prof. **Neculai Eugen SEGHEDIN**, PhD.

Manager of National Institute of Inventions  
Technical University "Gheorghe Asachi" of Iaşi

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**INVENTICA  
2021**

**STUDENT'S  
PARTICIPATION**

***„Gheorghe Asachi” Technical University of Iași***



# International Exhibition of Inventions INVENTICA 2021 23.06.2021 – 25.06.2021



“GHEORGHE ASACHI” TECHNICAL UNIVERSITY OF IASI

## HOME AUTOMATION APPLICATION USING INTERNET OF THINGS



This software can be accessed by the user with a smartphone, tablet or computer.

**Tab 1** is a weather panel with real-time information regarding current forecast, 6 days forecast, 6 hours forecast and a graphic representation of current urban air quality (data is taken from the “National Meteorological Administration of Romania”)

**Tab 2** contains graphical representations of current temperature and humidity; the previous sensors values are plotted as a graph

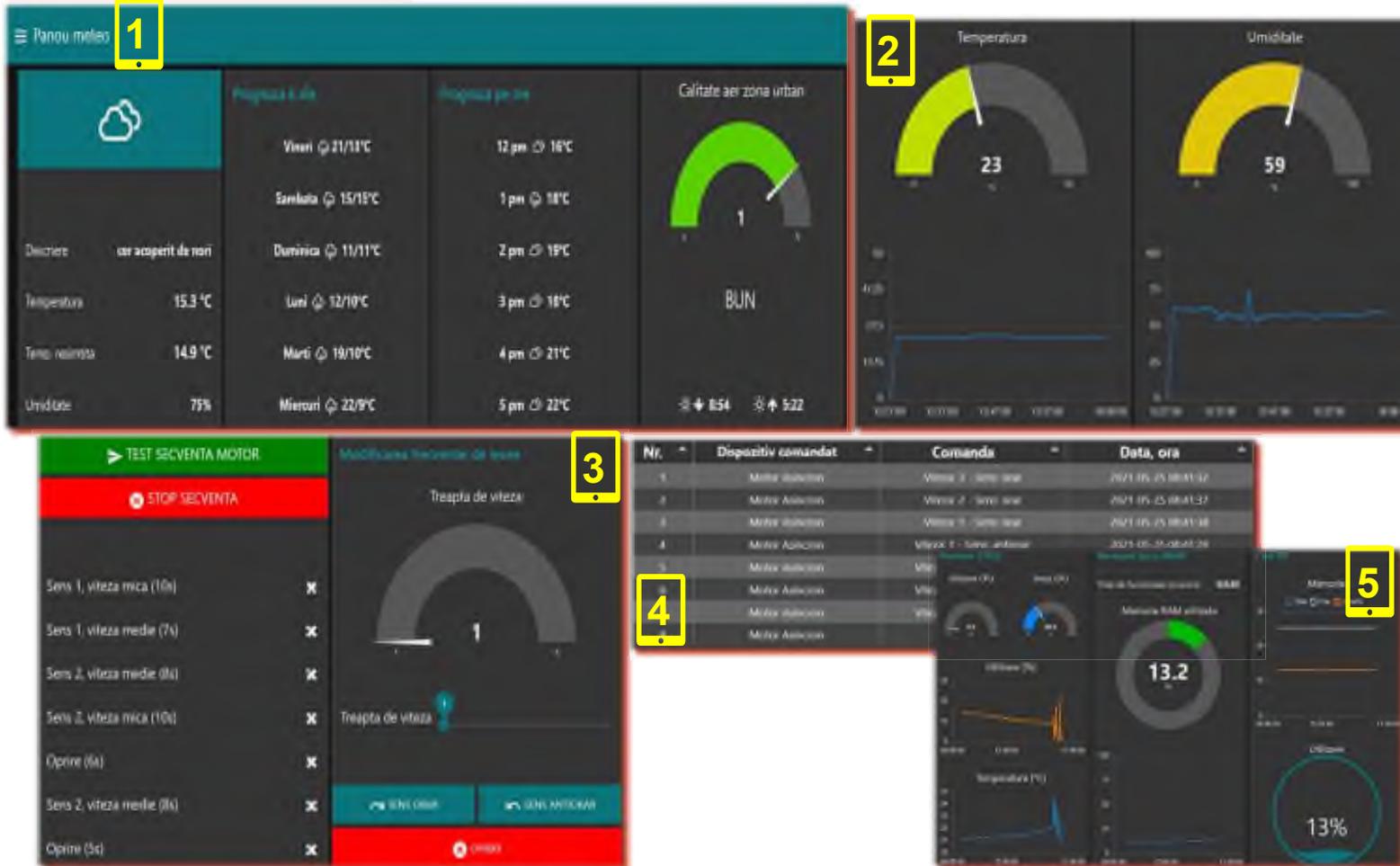
**Tab 3** is created for controlling an asynchronous motor.

- **left panel** gives the user the ability to test the motor with only a tap on the green button: the actuator will run a series of timed commands until the user stops it

- **right panel** has the purpose of manually controlling the motor (start, stop, 4 stages of rotational speed, direction of rotation)

**Tab 4** communicates with a database in order to display the history of the manual commands with the following data: identification number, actuator controlled, command, date

**Tab 5** shows the real-time usage of the system running the application (CPU usage, RAM usage, physical memory)



Proiect studențesc (Student Research Project)

Autor / Author: PISCUC TIBERIU



**“GHEORGHE ASACHI” TECHNICAL UNIVERSITY OF IAȘI  
 ROMANIA**



**EQUIPMENT FOR THE STUDY OF THE BEHAVIOR OF  
 METAL MATERIALS DURING THE CHEMICAL ETCHING  
 PROCESS**

**Patent number**

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The present invention relates to equipment intended to allow the study of the influence of the variation of some input factors in the processing process by chemical erosion on the values of some output parameters of the process. A simple tub-shaped piece of equipment containing a chemically active liquid is known. The initial roughness of the surface to be treated, the temperature, the concentration and the pH of the substance used could be taken into account as input factors in the chemical erosion process.

Prezenta invenție se referă la un echipament destinat să permită studiul influenței variației unor factori de intrare în procesul de prelucrare prin eroziune chimică asupra valorilor unor parametri de ieșire ai procesului. Este cunoscut un echipament simplu de forma unei cuve, în care se află o substanță lichidă chimic activă. În calitate de factori de intrare în procesul de eroziune chimică se pot lua în considerare rugozitate inițială a suprafeței de prelucrat, temperatura, concentrația și pH-ul substanței utilizate.

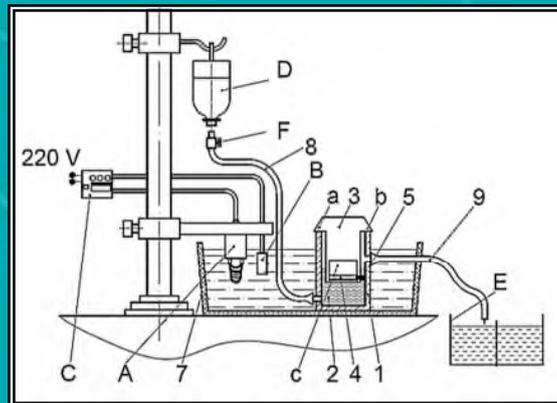


Fig. 1 Equipment for the study of the behaviour of metal materials during the chemical erosion process



The equipment according to the invention has as a basic part a tank 1, made of material resistant to the action of a chemically active liquid substance 2, located inside the tank. On the walls of tank 1, at the top of it, it can be supported by means of its shoulders a and b. a support piece 3, also made of material resistant to the action of the chemically active liquid substance 2. At the bottom of the support piece 3, there is a recess c in which a specimen 4 can be fixed, of the material whose chemical erosion behaviour is to be studied, the fixing being carried out with the help of a screw 5, made of material resistant to the action of the chemically active liquid substance.

Echipamentul conform invenției are ca parte de bază o cuvă 1, din material rezistent la acțiunea unei substanțe lichide chimic active 2, aflate în interiorul cuvei. Pe pereții cuvei 1, la partea superioară a acesteia, se poate sprijini, prin intermediul unor umeri a și b ai săi. o piesă suport 3, realizată de asemenea din material rezistent la acțiunea substanței lichide chimic active 2. În partea inferioară a piesei suport 3 se află o degajare c în care poate fi fixată o epruvetă 4, din materialul a cărei comportare la eroziune chimică urmează a fi studiată, fixarea efectuându-se cu ajutorul unui șurub 5, realizat din material rezistent la acțiunea substanței lichide chimic active.



***Technical University of Cluj-Napoca***

• **Title**

**SOIL STABILIZATION WITH PLASTIC WASTE MATERIALS (PET)**

• **Inventor/s - Contact**

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• **Patent/ Application number**

Patent pending

• **Short presentation**

In this study, an approach for the recycling of plastic waste from water and soda bottles as stabilizing material in geotechnical and civil engineering practice is purposed. The aim of this research is to observe the variation of the shear parameters for clay mixed with polyethylene terephthalate waste. To investigate the effects of polyethylene waste on the strength of the soil, a series of test have been performed on the mixture.

By performing a compaction Proctor test, we determined the optimum water content (19%). First samples consisting of clay in the initial state were subjected to direct shear test. Thereafter, tests were performed on a mixture of clay and polyethylene terephthalate at a rate of 2%, 4%, 6% (by weight of the clay). Polyethylene was coming from shredded bottles (PET) and was provided by a local recycle deposit. The clay – PET mixture was prepared at optimal water content of 19% and subjected to the direct shear test.

The initial experimental results show that there is a significant improvement on the shear parameters. This increase is depending on the amount of waste plastic added to the clay.

• **Applicability**

Reusing plastic waste is vital for the development of a clean environment. One of the most recent ways to reuse plastic wastes is mixing them with soils, in order to improve their geotechnical properties. By using this method, a part of plastic waste is reused and the consumption of natural materials is reduced.

• **Images**



Figure 1.  
Shredded plastic waste



Figure 2.  
Shredded plastic waste and clay



Figure 3.  
Mixture of clay + 6% PET at  
optimum water content



Figure 4.  
Clay-PET mixture

⚙️ **Title**  
**INNOVATIVE USE OF SHEEP WOOL FOR OBTAINING NEW MATERIALS WITH  
 SOUND-ABSORBING PROPERTIES**

⚙️ **Inventor/s - Contact**  
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 ioana.Muresan@staff.utcluj.ro

⚙️ **Patent/ Application number**  
 Patent Pending

⚙️ **Short presentation**

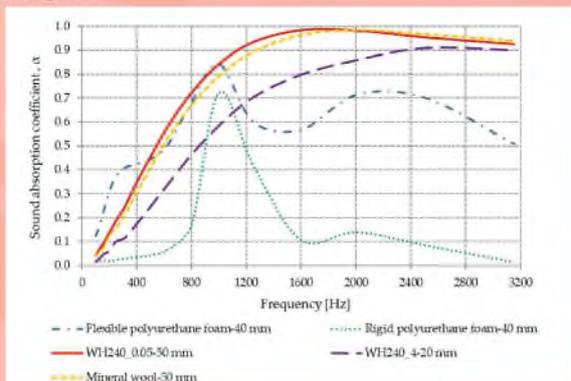
The aim of this study is to obtain new materials with sound absorbing properties using the sheep's wool as raw material. Seven new materials were obtained by hot pressing ( $60 \div 80$  °C and  $0.05 \div 6$  MPa) of wool fibers and one by cold pressing. Results shown that by the simply hot pressing of the wool, a new product is obtained which can be processed and easily manipulated. The obtained materials have very good sound absorption properties with acoustic absorption coefficient values over 0.7 for the frequency range  $800 \div 3150$  Hz; the results prove that the sheep wool has a comparable sound absorption performance to that of mineral wool or recycled polyurethane foam. Hot pressed materials have a much higher density than cold pressed materials. The density of materials made from hot pressed sheep's wool increases with increasing pressure.

The hot pressed material (WH240\_0.05) at 80 °C and 0.05 MPa, of 240 mm layer of wool, with 50 mm in thickness has the highest sound absorption coefficient values over the entire analyzed frequency range in comparison with WH120\_0.05 material, obtained in the same conditions, but with a smaller thickness for it started from a 120 mm layer of wool. The WH240\_0.05 material obtained in this study has the best sound-absorbing properties at frequencies below 2000 Hz, while in the frequency range  $2000 \div 3200$  Hz it has values almost identical to mineral wool. Thus, hot pressed sheep's wool has better sound absorbing properties or at least equal to mineral wool, which is one of the most widely used sound absorbing fibrous material. Obtaining the environmentally friendly materials with very good acoustic properties from natural and renewable raw materials, such as sheep wool, without using any binder is an important step in solving environmental problems and in the same time in finding new methods of using the wool.

⚙️ **Applicability**

The study explores alternative usage of sheep wool as a construction material with improved sound absorbing properties beyond its traditional application as a sound absorber in textile industry or using of waste wool in the textile industry as a raw material. Sound absorbing materials can be used to reduce noise and to obtain an adequate acoustic for enclosed spaces. They can have many uses, both outdoors and indoors: in industry, commercial areas, relaxation and leisure areas, in areas used for education, in constructions, on building sites, highways, roads and streets, airports, ports, railways, etc. Materials studied in this research can be used to reduce noise impact, as decorative panels with sound absorbing role, to improve acoustic conditions, and to reduce or stop reverberations.

⚙️ **Images**



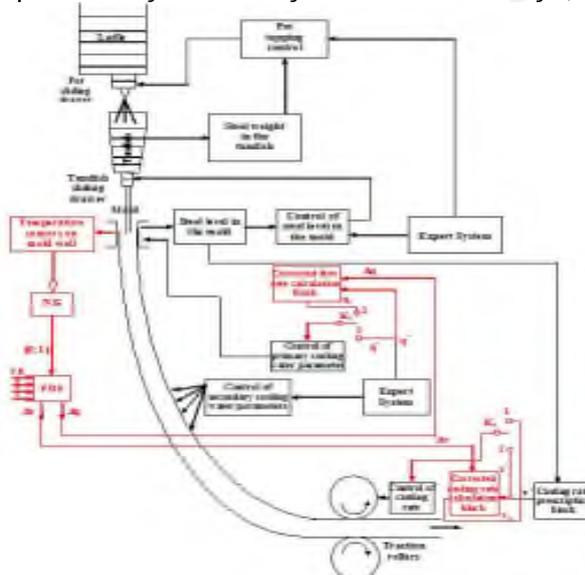
*Polytechnic University of Timișoara*



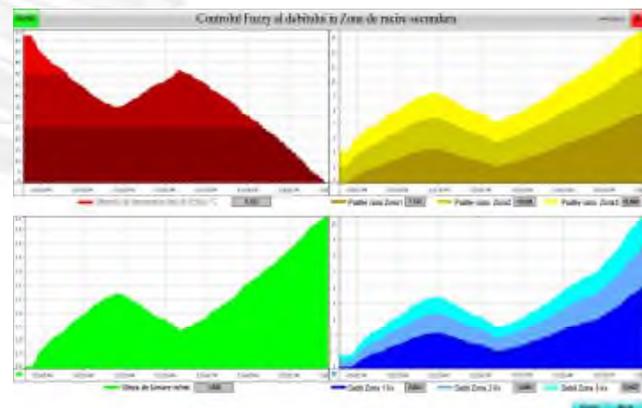
## Sistem inteligent de conducere a procesului de turnare continuă pentru reglarea debitului de apă la răcirea secundară Intelligent control system for continuous casting based on water flow control in the secondary cooling

Autor: **Gelu-Ovidiu TIRIAN**

S-a realizat dezvoltarea și implementarea unei soluții de conducere a procesului de turnare continuă bazată pe un sistem inteligent fuzzy, care să permită un control al debitului apei de răcire secundară, printr-o repartitie adecvată pe zone de răcire. Această necesitate este impusă de faptul că sistemele actuale de reglare nu realizează corelarea în timp real între variațiile multiplelor variabile aferente procesului de turnare continuă și se limitează la o repartitie rigidă a debitului de apă pe fiecare zonă de răcire. Sistemul inteligent are capacitatea de a elimina acest inconvenient, putând modifica în timp real aceste repartitii ale debitului de apă în funcție de situația reală din instalație, operând ca un sistem adaptiv.



It was realised developed and implemented, meant to control the casting process by an intelligent fuzzy-type system, allowing the control of the water flow rate in the secondary cooling, by appropriate distribution along the cooling area. This necessity is imposed by the fact that actual control systems do not correlate in real time the variations of the multiple variables related to the continuous casting process and stick to a rigid distribution of the water flow rate on each cooling area. The intelligent system is capable of eliminating this shortcoming, by controlling in real time the distribution of the water flow rate according to the real situation in the installation, working as an adaptive system.



Structure of the controlling system for the continuous casting process

## New Nature-Inspired Cycloidal Propeller for Low-Reynolds-Number Hovering Flight

*Prototype (Research Project)*

Authors: Francisc Bereczky and Ioan Silea

A new type of pivoting-blade cycloidal propeller having the appearance of damselfly wings, which can equip aircraft with vertical take-off and landing capability was designed and tested. This propeller is emerging as an alternative solution for electrically powered Planetary Aerial Vehicles capable of operating in the rarefied atmosphere of Mars.



Pivoting-blade cycloidal propeller  
and devices equipped with it

Authors and a prototype for testing the  
pivoting-blade cycloidal propeller

The theoretical analysis and experimental results proves that both forces (lift and drag) contributes to the net vertical force, and the contribution of drag is at least 50%. The results, recognized by the world of research, were published in the AIAA Journal - a scientific journal of the American Institute of Aeronautics and Astronautics, covering all areas of aeronautics and astronautics, especially in terms of new theoretical and experimental developments.

The article and auxiliary materials (films, pictures) can be obtained for a fee by accessing: <https://arc.aiaa.org/doi/abs/10.2514/1.J057270>

**Contact:** Francisc Bereczky, Telephone: +40742155930.

Email: [fbereczky@echitron.ro](mailto:fbereczky@echitron.ro); or Ioan Silea, email: [ioan.silea@upt.ro](mailto:ioan.silea@upt.ro).



# METHODS TO DETERMINE THE PREVENTIVE MAINTENANCE CYCLES OF ROLLING MILLS

*PhD Thesis*

Author: Budiul Berghian Adina

This survey presents two mathematical models of preventive maintenance that take into account stochastic factors which influence the failure rates and working life of an entity. The models are hybrid so that they combine the reduction of proper operation time with failure rate. The starty point consists in idea that preventive maintenance is done with imperfections: it is not reduced the proper operation only but it is increased the probability of entity failure as much as the number of maintenance is increased.

The target of this survey is to determine the optimal graphic of planned maintenance activities either to reduce the related costs or to maintain the reliability above a prescribed minimum level.

**Table 1. Cycles of preventive maintenance for the wire rod rolling mill, based on cost minimization**

$C_r/C_m$	2	5	10	20	50
$N$	2	6	11	16	25
Continuous operation time elements between two planned interventions [hours]					
$x_1$	8.791	11.652	14.067	16.557	20.758
$x_2$	6.598	6.842	8.260	9.723	12.190
$x_3$		5.71	6.893	8.114	10.172
$x_4$		5.077	6.129	7.214	9.044
$x_5$		4.62	5.577	6.565	8.230
$x_6$		5.989	5.133	6.041	7.574
$x_7$			4.753	5.594	7.014
$x_8$			4.419	5.201	6.520
$x_9$			4.118	4.847	6.077
$x_{10}$			3.845	4.525	5.674
$x_{11}$			5.197	4.231	5.304
$x_{12}$				3.959	4.963
$x_{13}$				3.707	4.647
$x_{14}$				3.473	4.354
$x_{15}$				3.255	4.081
$x_{16}$				4.459	3.826
$x_{17}$					3.589
$x_{18}$					3.367
$x_{19}$					3.159
$x_{20}$					2.965
$x_{21}$					2.783
$x_{22}$					2.613
$x_{23}$					2.453
$x_{24}$					2.303
$x_{25}$					3.186

**Table 2. Cycles of preventive maintenance for the wire rod rolling mill, based on limitation of failure rates**

$C_r/C_m$	2	5	10	20	50
$N$	2	6	11	17	26
Continuous operation time elements between two planned interventions [hours]					
$x_1$	8.81	9.37	9.95	10.780	12.339
$x_2$	5.42	5.76	6.12	6.634	7.593
$x_3$		4.84	5.14	5.569	6.375
$x_4$		4.32	4.59	4.969	5.688
$x_5$		3.94	4.18	4.534	5.190
$x_6$			3.63	4.181	4.786
$x_7$			3.58	3.878	4.439
$x_8$			3.33	3.610	4.132
$x_9$			3.11	3.368	3.855
$x_{10}$			2.90	3.147	3.603
$x_{11}$			2.72	2.944	3.370
$x_{12}$				2.757	3.156
$x_{13}$				2.583	2.956
$x_{14}$				2.421	2.771
$x_{15}$				2.270	2.599
$x_{16}$				2.130	2.438
$x_{17}$				1.998	2.287
$x_{18}$					2.146
$x_{19}$					2.014
$x_{20}$					1.891
$x_{21}$					1.775
$x_{22}$					1.667
$x_{23}$					1.565
$x_{24}$					1.470
$x_{25}$					1.380
$x_{26}$					1.297

From Table 1 has been ascertained that operation time elements between two successive repairs are reduced, except the latest time element for which is observed a certain increase. That means that it is properly to be done a preventive maintenance work in accordance with the entity age and, in the same time, it is advisable that latest planned intervention to be executed as late as possible, because the next repair work is the overhaul one. From technical point of view, Table 2, the operation times between two planned interventions decrease because the maximum admitted failure rate is reached faster with increasing the entity working life and age.

# DYE-SENSITIZED SOLAR CELL MODULE FOR WAVELENGTH-SELECTIVE PHOTOVOLTAIC GREENHOUSE



Melinda Vajda<sup>1,2</sup>, Miclau Marinela<sup>1</sup>, Albuiescu Daiana<sup>1</sup>, Daniel Ursu<sup>1\*</sup>

Project number : PN-III-P2-2.1-PED-2019-2091

<sup>1</sup>National Institute for Research and Development in Electrochemistry and Condensed Matter, Str. Plautius Andronescu 1, 300224 Timisoara, Romania  
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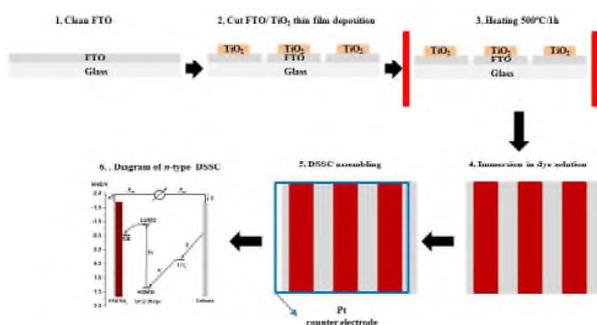
## Description

A photovoltaic greenhouse must strike a balance between two contradicting requirements: maximize the flow of photosynthetic active radiation (PAR) which is essential for the growth and photosynthesis of the plants and enhance the production of energy which increases along with the increase in size of the opaque surface of the panels. The greatest challenge of a PV greenhouse is the competition between PV roofs and plants. The main limitations of the integration in greenhouse concern the fact that these PV cells do not transmit sunlight and form a permanent shadow region which has negative effects on production, reducing the crop growth or the amount of biomass.

Simple manufacturing process, the low fabrication cost, flexibility in scaling, low material usage and low light level sensitivity, but mainly the variation in color and transparency of the dye sensitized solar cell (DSSC) are essential characteristics that could make these cells the ideal candidate for greenhouse application. The selection of the color of DSSC given by the dye can act as a plant growth regulator or serve as a photo selective covering adsorbed with dye to manipulate the light spectrum entering the greenhouse.

In this context, the invention proposed to design, build, and test the wavelength-selective solar cell module (DSSC module), as a technically and economically credible alternative concept of a PV roof for PV greenhouses.

## Construction of DSSC module



The working principle of DSSC involves four basic steps:

- Light absorption,
- Electron injection,
- Transportation of carrier,
- Collection of current.

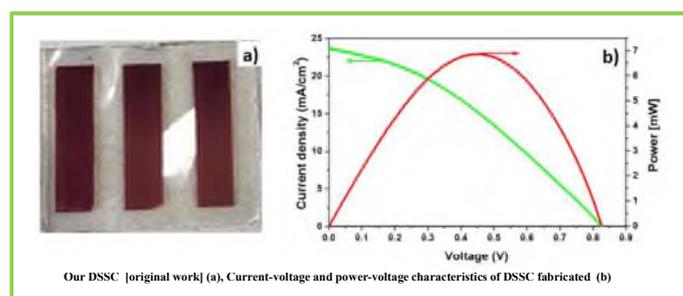
The following steps are involved in the conversion of photons into current.

➤ This technology could be able to deliver impressive benefits in contrast to conventional PV due to its solar radiation manipulation through the optimum choice of photosensitizer.

### Acknowledgment

This work was supported by a grant of the Romanian National Authority for Scientific Research and Innovation, UEFISCDI, Project No. PN-III-P2-2.1-PED-2019-2091, within PNCDI III.

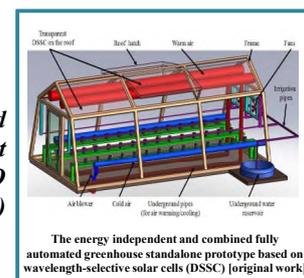
- Simple manufacturing process, the low fabrication cost, flexibility in scaling, low material usage and low light level sensitivity, but mainly the variation in color and transparency of the dye sensitized solar cell (DSSC),
- One of the third generation of PV cells, are essential characteristics that could make these cells the ideal candidate for greenhouse application.



## Future perspectives

➤ Design, build, test and implementation of efficient and low-cost n-p type DSSC based on TiO<sub>2</sub> and Cu<sub>2</sub>O using dyes (synthetic and natural) which absorb in UV and NIR

➤ Design, build, test and the energy independent and combined fully automated greenhouse standalone prototype based on wavelength-selective solar cells (DSSC), as a technically and economically credible alternative concept to present day conventional greenhouses.



The energy independent and combined fully automated greenhouse standalone prototype based on wavelength-selective solar cells (DSSC) [original work]

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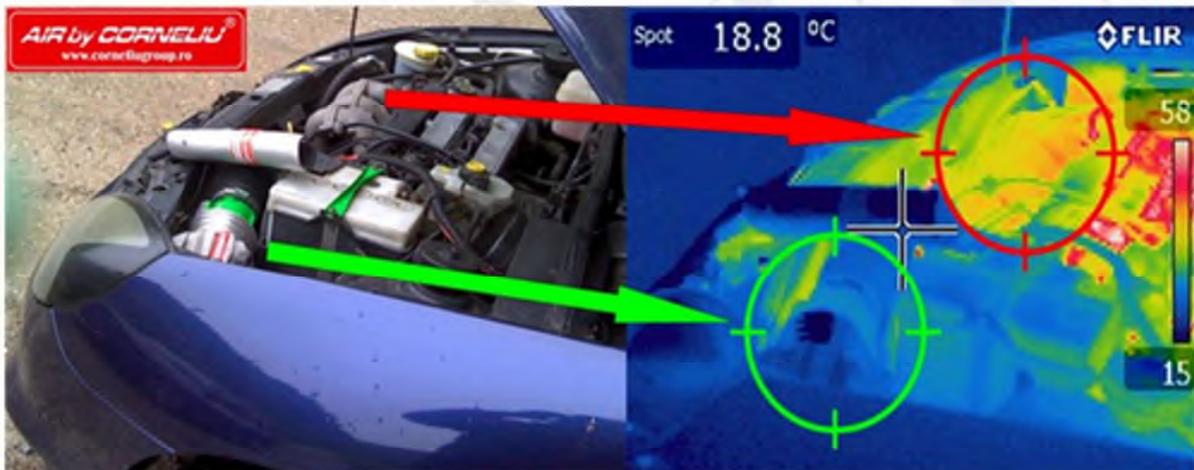
## AIR by CORNELIU intake manifold insulation layer

*PhD thesis*

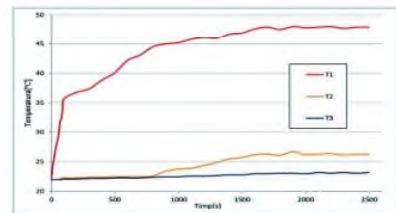
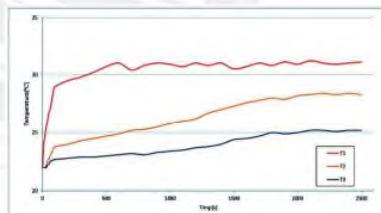
**Author: Corneliu Birtok Baneasa**

This product is dedicated to the reduction of heat transfer on the intake system, mainly in the case of the aluminum alloy intake manifold. To this end, a series of solutions for reducing heat loss have been adopted, implemented and tested. These consist in the design and insulation of the intake manifold with a new type of composite material with thermal insulation, whose composition contains natural, organic and recyclable elements.

The thermal insulation layer called SPTI (Silicone Polyurethane Thermo-Insulating), offers protection to the thermally stressed components (convection, conduction and radiation) of vehicles, such as intake manifolds, air conditioning systems, various components of the braking system, etc.



În cazul galeriei de admisie din aliaj de aluminiu se recomandă implementarea unui deflector termic din polietilenă expandată multistrat sau un strat termoizolator denumit S.P.T.I. (silicone polyurethane thermo-insulating) care oferă protecție subansamblurilor solicitate termic.



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**air power**  
 by corneliu  
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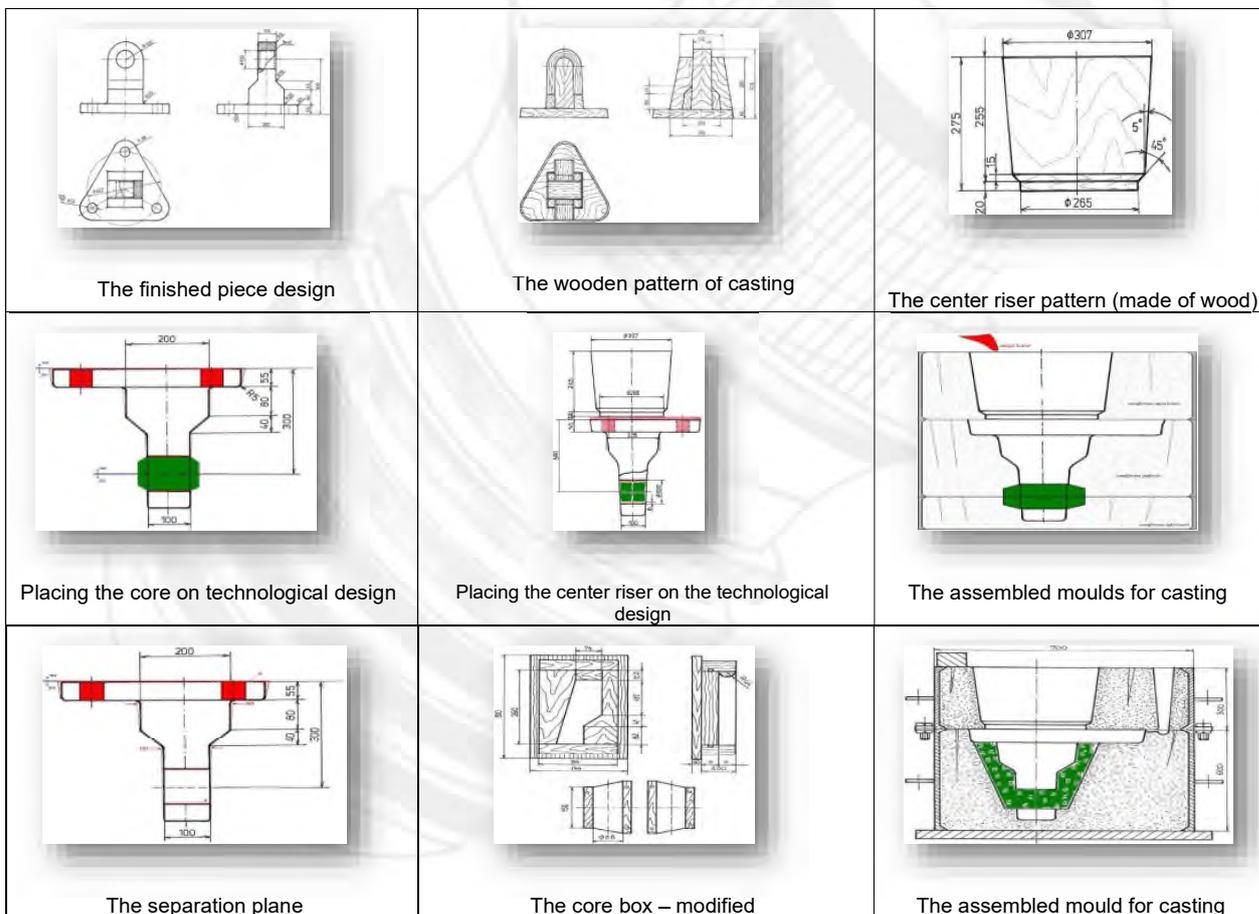
## Research on the influence of moulding-casting technology on the quality of castings

*research project*

Authors: **Josan Ana, Pinca Bretotean Camelia, Rațiu Sorin, Ardelean Erika, Ardelean Marius**

The quality of castings has a particularly role in the Romanian foundries. In this context, quality assurance is the overall objective of the foundries. The critical analysis performed on moulding-casting technology of the type *Lifting mechanism* is presented. This casting is a subset of the lifting and rotating mechanism of the furnace vault. The casting analysed is a medium size, with weight of 114 kg. The current moulding-casting technology involves moulding into three mould-parts leading to the occurrence of defects (decentering of the core, displacement of the lower mould and the middle mould and occurrence of burrs in area separated. Thus, to reduce the percentage of defects registered in industrial practice is necessary to change the moulding-casting technology. Thus, to reduce the percentage of defects registered in industrial practice is necessary to change the moulding-casting technology.

This requires the use of two mould-parts, re-dimensioning of the core and the core box and dimensioning of the runner network. The adoption of these changes in industrial practice has direct implications on the cost of casting and foundry costs default.



Application in industrial practice of all the technological method applied lead to the decrease the percentage of rejects registered from 13% to about 4%. This aspect has a positive influence in castings costs respectively in the company costs.

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## Development and implementation of an interdisciplinary virtual laboratory-classroom *research project*

Authors: **ALIC Daniela Delia** , **RACKOV Milan**

Politehnica University of Timisoara, Faculty of Engineering Hunedoara, Romania  
 University of Novi Sad, Faculty of Technical Sciences, Serbia

The project is focused on the development of an interdisciplinary virtual laboratory-classroom, based on the multimedia potential as learning and teaching tool. Currently operational in our faculty, the laboratory is dedicated to our students, future mechanical engineers, who have the opportunity to use, via internet or face-to-face, innovative and advanced educational software solutions.

a. Educational software **SCHEMATRICE**  
 (source [https://eduscol.education.fr/sti/ressources\\_pedagogiques/schematrice](https://eduscol.education.fr/sti/ressources_pedagogiques/schematrice) )

b. Hooke's Law  
 (source <https://phet.colorado.edu/>)

c. 1DOF model car suspension

d. Forced oscillations  
 (source <https://www.vasck.cz/> )

e. Educational software **Mechanics of Deformable Solids4.1.0**  
 (source <http://www.mdsolids.com> ; <https://web.mst.edu/~mdsolids/>)

f. Collisions  
 (source <https://www.vasck.cz/> )

g. Damped oscillations (source <https://www.vasck.cz/physicsanimations.php?l=en> )

**Figure 1 a-g. Teaching resources used in the virtual laboratory-classroom. Java Applets. Animations. Educational software**

### Conclusions:

The most important benefit provided by multimedia resources can be considered the interactivity. Results of surveys indicate that the use of multimedia educational software in the virtual laboratory-classroom was extremely well received by our students and helped in understanding the training material in mechanical engineering subjects.

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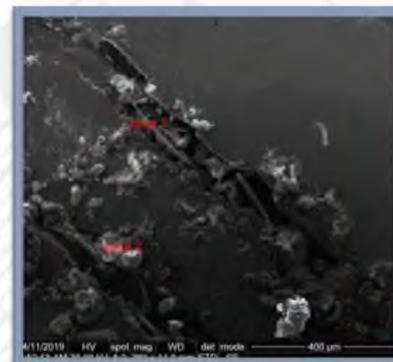
## Non-metallic inclusions in steels intended for the automotive industry

### PhD Thesis

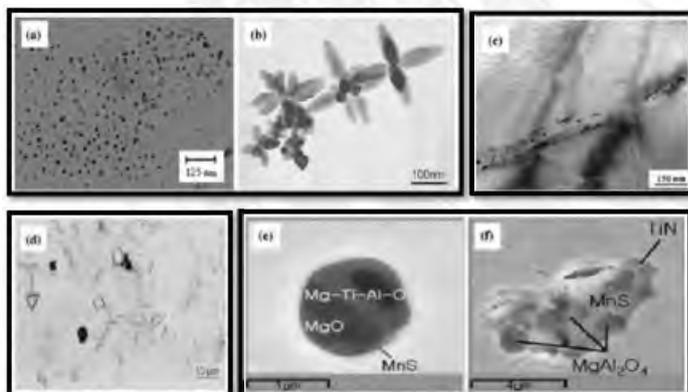
Authors: Poenaru Iulia Olivia, Popa Alina-Maria, Ana Virginia Socalici,  
 Adina Budiul-Berghian, Corneliu Birtok Baneasa

Performantele deosebite în exploatare ale oțelurilor microaliate cu titan, vanadiu sau niobiu sunt determinate de compoziția chimică, puritate avansată și adăosuri mici de elemente de aliere în scopul finisării granulației și îmbunătățirii proprietăților mecanice respectiv prin aplicarea unor tehnologii moderne de laminare și tratamente termice.

În lucrare, se prezintă rezultatele cercetărilor industriale efectuate cu privire la microalierea cu titan a oțelurilor destinate fabricării țevilor cu pereți groși.



Analiza SEM a probelor experimentale, 280x  
 SEM analyse of experimental tests, 280x



Exemple de precipitate în oțeluri microaliate  
 Examples of precipitates in microalloyed steels

- a) precipitate de AlN sferice; b) nituri cruciforme de Ti sau V, apărute după recoacere la 1100°C; c) carburi de Ti sau Nb precipitate pe limite de grăunte; d) nitru cubică de Ti; e,f) precipitate multiple apărute prin nucleere eterogenă

Outstanding performance in development of microalloyed steels with titanium, vanadium or niobium are determined by the chemical composition, advanced purity and small additions of alloying elements in order to finish the granulation and to improve the mechanical properties, but also by modern laminations technologies and heat treatments. In this scientific study, are presented the results of the industrial researches regarding the titanium microalloying of steels that are destined to manufacturing of thick-walled pipes for the automotive industry.

Contact: Poenaru Iulia Olivia: [poenaruIuliaolivia@yahoo.com](mailto:poenaruIuliaolivia@yahoo.com)



## Experimental determination of filtration efficiency for porous ceramic cabin filter prototype

*PhD thesis*

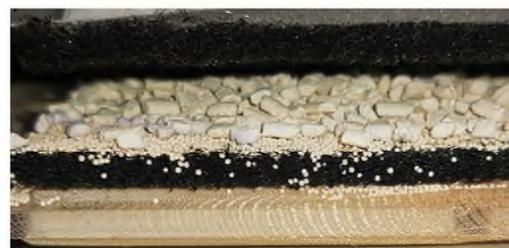
**Authors: Robert Bucevschi, Ana Virginia Socalici, Adina Budiul-Berghian,  
 Corneliu Birtok Baneasa**

This project presents the results obtained from the experimental analysis of the filtration efficiency for two prototypes of full ceramic cabin filters. The innovation presented by these concepts is the exclusive use as a filtration medium of a combination of porous ceramic materials. The project also presents the influence of the granulation of the ceramic filtration medium on the pressure drop and the filtration efficiency.



**Element de filtrare  
 Prototip nr. 1**

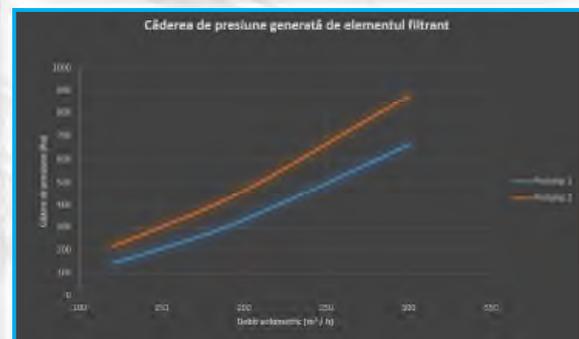
*The analysis presented is part of the development process carried out within the doctoral research supported by the author.*



**Element de filtrare  
 Prototip nr. 2**



**Stand de testare Topas PAF113  
 Utilizat in determinare căderii de presiune  
 și cuantificarea capacității de retenere a  
 elementelor fintrante**



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## Puma AIR by CORNELIU

*Educational program*

**Authors: Corneliu Birtok Baneasa, Adina Budiul Berghian,  
Diana Stoica, Oana Gaianu, Alin Stoianov**

Puma AIR by CORNELIU is a project realized by the FIH-UPT students through the educational program Dexter's Laboratory.

The goal is to transform a street car into a sports car in order to participate at specific competitions.



*The materialization of the project involves the design within the student diploma works by approaching the various necessary modifications: reducing weight, increasing body strength, implementing a roll cage, improving braking efficiency, increasing engine power etc.*

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**air power**  
by corneliu

## Increase of weld strength by micro alloying for HSLA steel

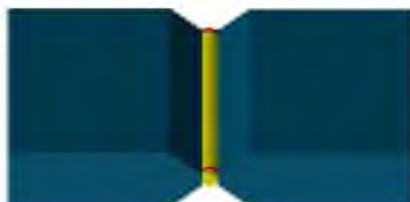
*PhD Thesis*

**Author: Laurentiu Zgripcea, Teodor Heput**

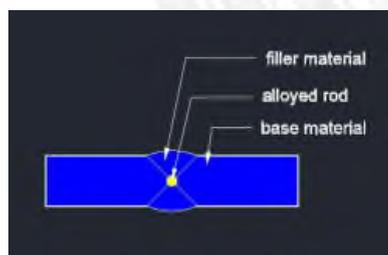
For special repairs of steel armors, standard welding cannot assure the strength required in normal exploitation. This is a safety requirement and cannot be minimized. As example repairs of armored vehicles, digging shovels for excavator or heavy machineries wearing plates.

The common elements of these steel grades are equivalent carbon which is much higher than ordinary steel grades. For this reason, special precaution must be taken during welding and special techniques also.

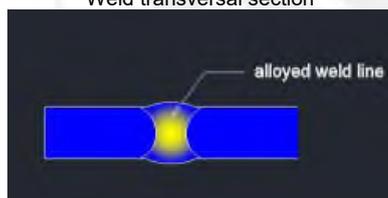
The new idea is to use a superalloyed cold wire, positioned in the welding center which will diffuse during the welding in the whole joint section.



Position of the superalloyed wire



Weld transversal section



Weld after diffusion



Typical application of wearing plate repair



Aspect of high resilient  
weld



Aspect of non-conform  
fragile weld

Special welding using superalloyed wire and effect of weld microalloying is tested at impact, using Charpy machine. The sample must absorb higher energy and aspect of the breakage must be resilient, without fragility.

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## A new dimension in the understanding of human perceptions using View Point System and Captiv L7000 Premier technology

### PhD thesis

Authors: **Popa Mihaela, Mutu Robert Marian**

The heart of View point system is the VPS 16 glasses. These Eye Hyper-Tracking glasses with stereoscopic cameras in the nose bridge enable for the first time like spatial plane in which the user is looking to be precisely determined.



Added to this is the outstanding light immunity, which allows for reliable results even outdoors and under suddenly changing lighting conditions. The corrective power of the glasses can also be adapted to the wearer, and the eye tracking glasses can be comfortably worn with contact lenses. With the very short calibration time compared with other options, the glasses can be quickly adapted to the wearer and made ready for use. Once calibrated, the Eye Hyper-Tracking glasses can be used again and again for hours at a time – comfortably and unobtrusively.



CAPTIV-L7000 Premier is a flexible research software for the synchronization of video and measurements from sensors and interfaced third-party hardware and measurement devices, including advanced analysis and processing features.

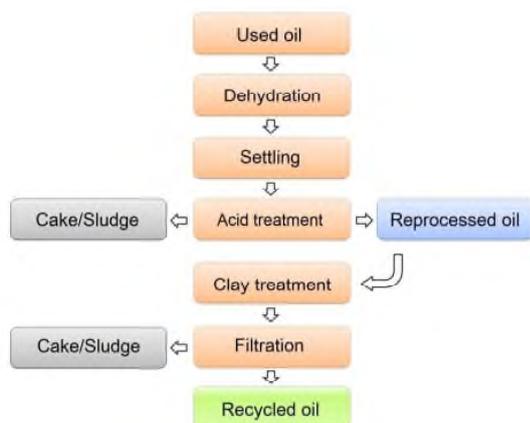


# Study on the recycling methods of used engine oil

*student project*

Author: Diana Miruna Armioni

The study presents an overview of the main technologies for recycling used engine oil, as well as a comparative analysis of the impact of these technologies on the properties of recycled oil. The aim of this research is to highlight the importance of proper management of this type of hazardous waste.



Block diagram of the acid/clay recycling method



Overview of the used engine oil recycling process

The best known such methods are: acid/clay treatment, solvent extraction, vacuum distillation and clay treatment, vacuum distillation and hydrogenation process and membrane filtration technology. Each of these techniques has a number of advantages and disadvantages, from an economic point of view as well as environmentally, depending on its specifics. The acid/clay method is no longer encouraged globally because it generates toxic waste, but other technologies (solvent extraction and vacuum distillation) are developed industrially in different countries and are in a continuous process of improvement.

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## Antik “Energy Tree”

### Student project

**Authors:** Saptă Doru Ioan, Marinut Gabriel Paul, Obrenovici Lavinia Ioana,  
Golcea Julia Daiana, Strugaru Dragos

**Coordinator:** Corneliu Birtok Baneasa

Stația de încărcare **Antik “Energy Tree”** este un dispozitiv multifuncțional bazat pe energie regenerabilă cu scopul de a remedia problema cetățeanului modern care de multe ori când este în spațiul public ajunge în situația de a fi nevoit să își încarce dispozitivul mobil, dar acesta nu are acces.

Acesta este construit din materiale rezistente indiferent de condițiile meteo, cu diferite tehnologii moderne pentru a oferi utilizatorului său o experiență cât mai plăcută.

**Antik Energy Tree** are ca scop să crească autonomia dispozitivelor mobile, să ofere ergonomie toate într-un design **Eco-Friendly**



The Antik “Energy Tree” charging station is a multi functional device. Based on renewable energy in order to fix the problem of the modern citizen who often when is in the public space ends up in the situation of having to charge his mobile device, but has no power source.

It is made of durable materials regardless of weather conditions, with various modern technologies to offer its user a pleasant experience. Antik Energy Tree aims to increase the autonomy of mobile devices, and to provide ergonomics in an **Eco-Friendly** design

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## Adaptive exhaust cover Air by Corneliu

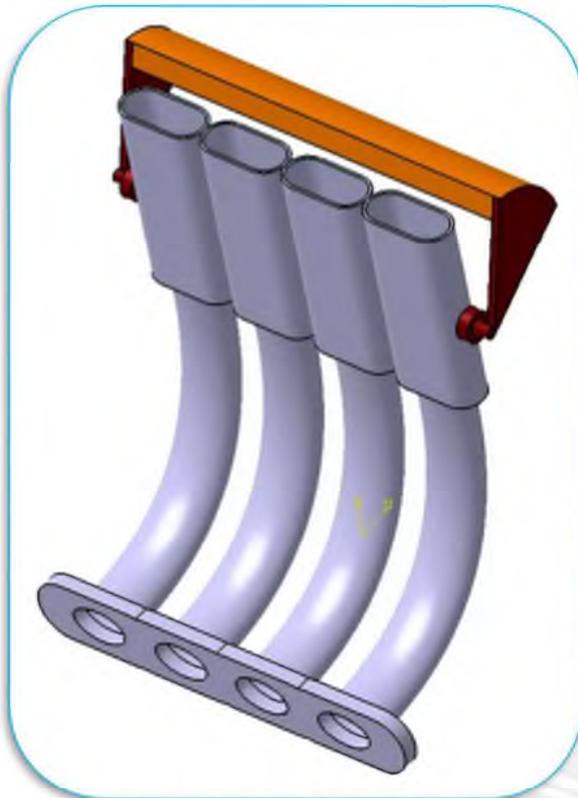
**Authors:** Marinut Gabriel Paul, Saptu Doru Ioan, Golcea Julia Daiana,  
Obrenovici Lavinia Ioana, Strugaru Dragos

**Coordinators:** Birtok Baneasa Corneliu, Budiul-Berghian Adina

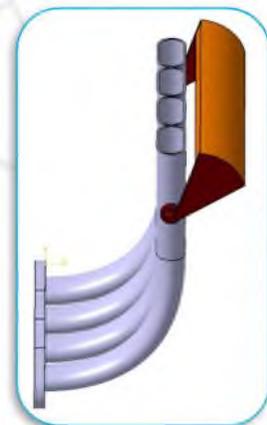
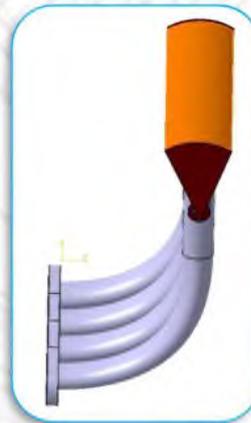
Adaptive exhaust cover (AEC) is a device for competition engines equipped with dynamic exhaust systems, especially the Air by Corneliu type.

AEC este un dispozitiv destinat motoarelor de competiție echipate cu sisteme de evacuare dinamice, în special de tipul Air by Corneliu.

Implementarea AEC împiedică pătrunderea în sistemul de evacuare dinamic a particulelor solide (praf, nisip, frunze) sau apă când motorul este oprit.



The implementation of AEC prevents the entry into the dynamic exhaust system of solid particles (dust, sand, leaves) or water when the engine is stopped.



AEC has a smart control unit that allows it to operate according to the following parameters: temperature, humidity, wind speed, light intensity etc.

AEC are o unitate de control inteligentă care îi permite să funcționeze în funcție de următorii parametri: temperatura, umiditatea, viteza vântului, intensitatea luminii.





# Experiments on the wear of ball mill armor

## PhD thesis

Author: **Teodor VASIU**

The study analyzes the wear behavior of armor execution materials in an experimental ball mill  $\varnothing 700 \times 700$  depending on the parameters of the mechanical regime and also the wear of the metal lining of an industrial mill.

For experiments, a number of ten stages of experimental mill operating regimes were proposed. At each stage, the wear behavior of some armor materials was monitored, namely for: the supply and the exhaust cover - manganese steel, Relon P type polyamide (only for feeding), sormait, 5HNSV steel (GOST 5950/73) and Fc300 cast iron; body mill - OLC45 and sormait. The thickness of the layer lost by wear was measured with a Krautkramer Branson DME-DL ultrasonic device with a measuring accuracy of 0.01 mm.

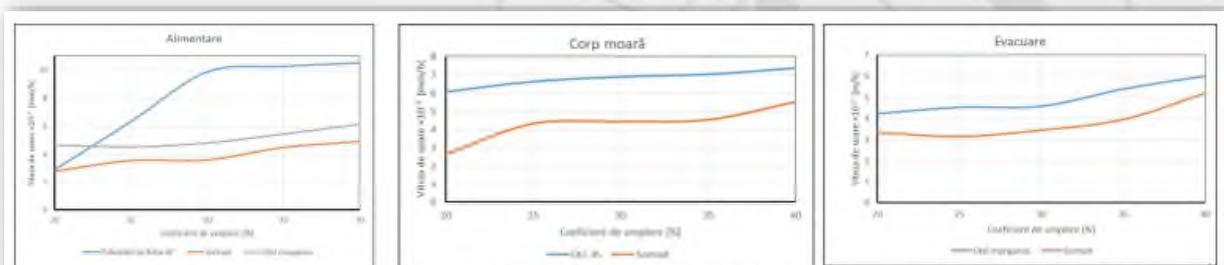


Figure 1. Variation of average linear wear rate as a function of filling coefficient at relative speed 33%

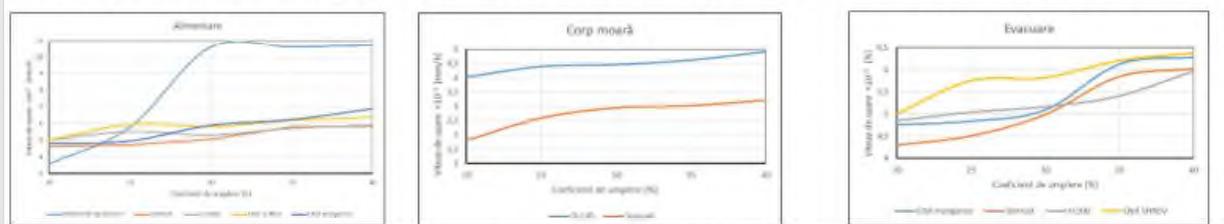


Figure 2. Variation of average linear wear rate as a function of filling coefficient at relative speed 80%

Graphical representations of the dependence of the average linear wear speed as a function of the mill filling coefficient, for the relative speeds of 33% and 80% respectively (Figures 1 and 2) show that the shields plated with sormait, both those at the ends and those at on the mill body, they have the lowest wear speeds. This finding led to the study of this material in a mill  $\varnothing 2700 \times 3000$  in operation.

- Relon P type polyamide, with all the advantages of a low specific weight and low cost price compared to metallic materials, has low wear rates only at filling coefficients of approx. 20%, which is not recommended for the manufacture of shields on the supply side.
- The wear rates of the end shields are increased if the mill speed increases; this is because the relative sliding speeds in the points of contact between the armor and the load increase, which leads to the intensification of tribological processes in those areas.
- At high bars, their wear rates decrease as the mill speed increases, as the movement of the balls changes. If at the relative speed 33% is characteristic the rolling regime, at the relative speed 80% the ball regime is throwing, the relative sliding armor-load being lower.



# CLOS DRESS

**Authors: Albescu Corina, Tîrnăvean Alexandru Adrian**

**Student project 2020001R/13.08.2020**



Rochița în clos este o ținută versatilă, având croiul perfect pentru orice tip de siluetă și înălțime, ceea ce îți conferă o libertate de mișcare. Rochița în clos e realizată din materiale vapoaroase, cum ar fi voalul, iar talia este pusă în evidență de o curelușă delicată. Această rochiță trei sfert se închide la spate cu un năsturel tip perlă, având un decolteu tip barcuță. Iar pentru că albul și negrul nu se demodează niciodată, poți miza oricând pe combinația acestor două culori.

The kirtle dress is a versatile fit with the club perfect for any form of silhouette and height, giving you freedom to move. The kirtle dress is made of shirs, such as the veil, and the waist is exposed by a delicate strap. This three-quarter dress is closed behind with a pearl-type button, with a boat neck-neck. White and black never gets fashioned, you can always rely on the combination of these two colors.

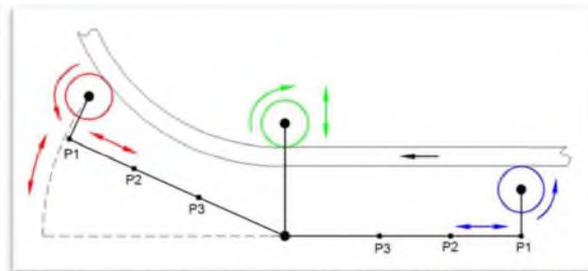
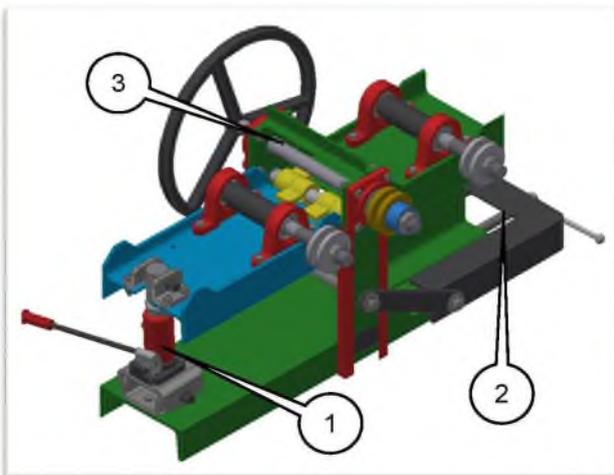


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## Dispozitiv de roluit bare Bar rolling device

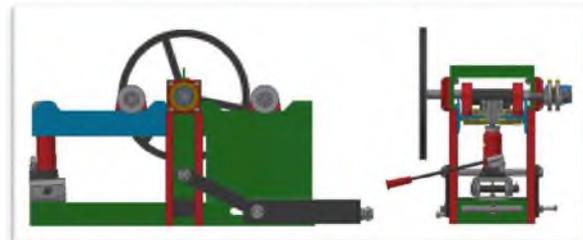
**CIOROAGĂ Bogdan-Dorel, CIOATĂ Vasile George, ALEXA Vasile**



Schema de funcționare / reglare

### Componentă:

- (1) Mecanismul de reglare a gradului de deformare acționat prin intermediul cricului hidraulic;
- (2) Mecanismul de reglare a poziției pe axa verticala a rolei motoare;
- (3) Mecanismul de acționare a rolei motoare.



### Caracteristici:

Dispozitivul de roluit bare este utilizat la curbarea controlată a barelor drepte, indiferent de profilul acestora.  
 Dimensiuni de gabarit: 1365 x 824 x 948 mm.  
 Acționarea este manuală.  
 Corp cu construcție rigidă, din profile laminare, îmbinate prin sudură.  
 Utilizabil în atelierele de confecții metalice.

### Characteristics:

The bar rolling device is used for the controlled bending of straight bars, regardless of their profile.  
 Overall dimensions: 1365 x 824 x 948 mm.  
 The operation is manual.  
 Body with rigid construction, made of laminated profiles, joined by welding.  
 Usable in metal workshops.

### The device has 3 main mechanisms:

- (1) The mechanism for adjusting the degree of deformation operated by the hydraulic jack;
- (2) The mechanism for adjusting the position on the vertical axis of the drive roller;
- (3) The drive mechanism of the drive roller.

### Contact:

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## Mobile Pavilion for Rainwater Collection

Phd.eng. Pisleaga Mihaela<sup>1</sup>, MAA Arch. Gabriel Aranda<sup>2</sup>, Phd.eng. Cristina Capotescu<sup>3</sup>  
 Polytechnic University of Timisoara, <sup>2</sup> Glomad, <sup>3</sup> Aquatim  
 mihaela.pisleaga@upt.ro

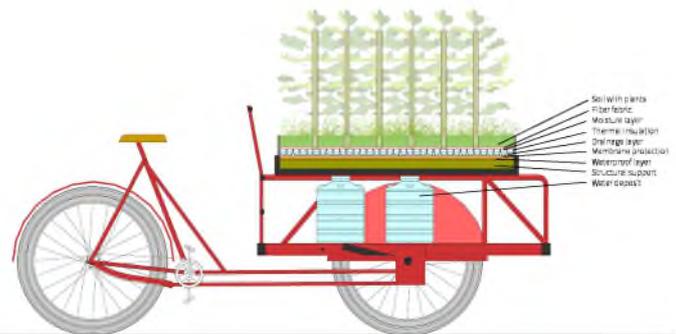
### Novelty & Usefulness

In this period of population growth and in which we can observe the impact of climate change through extreme events, we must, more than ever, take care of natural resources that are not inexhaustible. Rainwater harvesting is used as a way to save money and as a way to take care of the environment. In this context, rainwater harvesting is the easiest way to educate the population about adapting to climate change. Thus, through this mobile rainwater collection stand we propose green solutions for residential buildings (roof, walls) that sensitize the population, understanding the importance of caring for resources, in this case water.



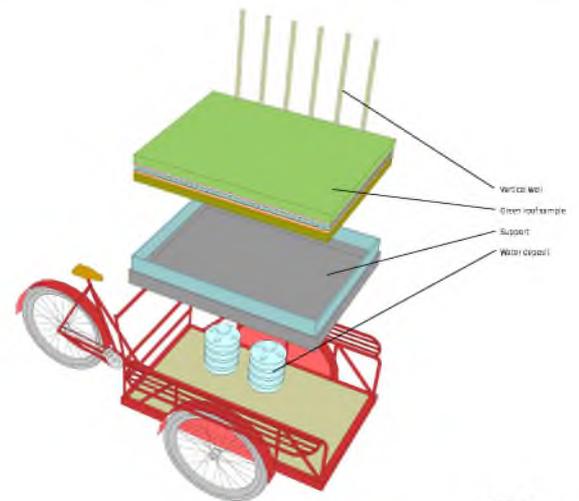
### Low cost design

Green roof meets public. The main idea is to adapt a regular 2 wheels bicycle into a cargo bike, 3 wheels. After to adapt a 1 x 1 meter sample of a green roof, and 60 cm height green wall, including all the necessary pipes and water deposit(s), in order to show how all the elements works together. The installation will provide all the necessary information regarding the function of a green roof and wall. Will be an interactive experience between the city dweller and the buildings, promoting good praxis and awareness related with rainwater.



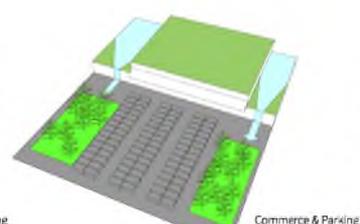
### Social and economic impact

The mobile pavilion has a design that allows placement in public areas without the need for additional fees. In this case, the pavilion will be located in the space of the Faculty of Civil Engineering Timisoara, so that students understand what solutions exist for rainwater collection. In the future, as engineers they will have the ability to understand the importance of green roofs in buildings, especially since there are countries where the legislation imposes the obligation to build green roofs and it is possible that the legislation requires this in Romania.



### Market opportunities

The construction of green roofs, for buildings, as a solution to adapt to climate change is a current issue, in some countries the legislation still does not clearly specify this aspect. But this is the future, we need green spaces in the urban area and green roofs, for buildings is a solution. The team includes two engineers and an architect, and the market opportunities part consists of consulting on the design and execution of green roofs for new and old buildings.





# Off-road Suzuki Grand Vitara by Lucian

## Student Project

Author: Hențiu Lucian Nicolae

Suzuki este un brand japonez, care s-a impus riguros in lumea off-road, inca din cele mai vechi timpuri. Factorii principali care m-au incurajat sa aleg acest brand sunt calitatea, si pretul scazut. Specificatiile autovehiculului sunt: motor de 2000cc, 129cp, 4X4, transmisie automata, 3 usi, an de fabricatie 1999. Masina beneficiaza in prezent de o garda la sol marita cu 5 cm, lucrare efectuata cu ajutorul unui kit de inaltare din teflon pentru arcuri si prelungiri metalice la telescoape. Prelungirea cardanului de pe spate s-a efectuat cu o placa din Teflon de 20mm. Corectarea unghiului de cadere al rotilor din fata, s-a efectuat cu ajutorul unor suruburi excentrice(camber-bolt). Pentru imbunatatirea stabilitatii, am folosit flanse de 30mm pentru fiecare roata. Avand in vedere ca masina circula si pe sosea, beneficiaza de un set de cauciucuri cu profil Mud-Terain de la Insa Turbo. In prezent, masina ruleaza in parametri optimi, cu performante ridicate in regim off-road.



Suzuki is a Japanese brand, which has established itself rigorously in the off-road world. The main factors that encouraged me to choose this brand are the quality and the low price. The specifications of the vehicle are: 2000cc engine, 129hp, 4X4, automatic transmission, 3 doors, year of manufacture 1999. The car currently benefits from a ground clearance increased by 5 cm, work done with the help of a teflon lifting kit for springs and metal extensions to telescopes. The extension of the cardan shaft on the back was made with a 20mm Teflon plate.



The correction of the falling angle of the front wheels was made with the help of eccentric screws (camber-bolt). To improve stability, we used 30mm flanges for each wheel. Considering that the car also travels on the road, it benefits from a set of tires with Mud-Terain profile from Insa Turbo. Currently, the car runs in optimal parameters, with high performance in off-road mode.



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0728707760

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***Technical University of Moldova***

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# THE 25<sup>th</sup> INTERNATIONAL EXHIBITION OF INVENTICS "INVENTICA 2021"



NATIONAL INSTITUTE OF  
INVENTICS, IASI, ROMANIA



23.06.21 – 25.06.21, Iași - România

Technical University of Moldova



## Design Concept TRANSFORMABLE FURNITURE FOR CHILDREN

Ana Bogdevici, Mihail Stamati

### Description:

Transformable furniture, intended for children from the age of infant to the age of 10-12 years, made in order to prolong the life of the product and save space.

As a result of the transformation of the furniture, we obtain a bed, a table and storage spaces. The pieces of furniture are made of ecological materials (wood).

### Stage:

At the laboratory level (digital model).

### Application domain:

Residential spaces, children's rooms, kindergartens, etc.





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NATIONAL INSTITUTE OF  
INVENTICS, IASI, ROMANIA



23.06.21 - 25.06.21, Iasi - Romania

Technical University of Moldova

## Design Concept KITCHEN ACCESSORIES FOR BLIND

Iulia Emelina, Valeriu Podborschi, Iurii Cebotari

### Description:

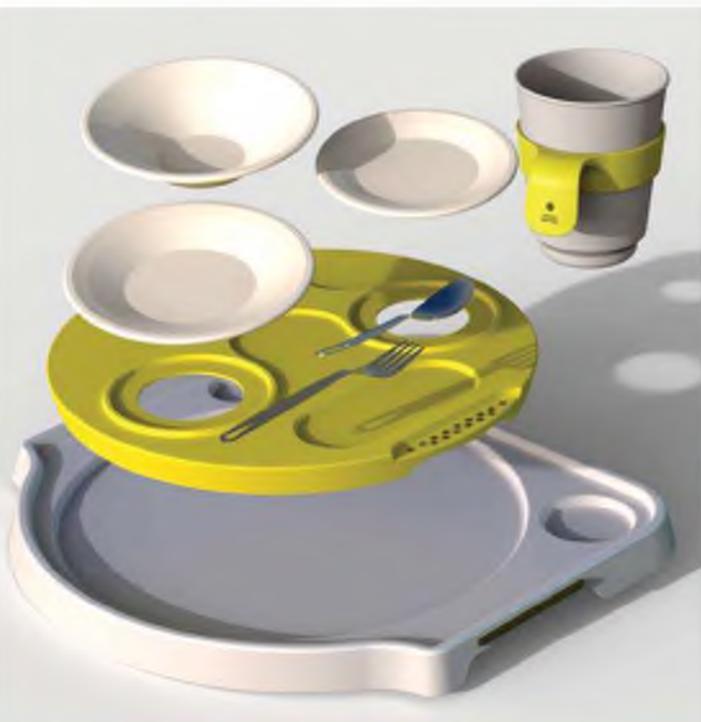
Set of kitchen accessories that would facilitate the spatial orientation of visually impaired people. The set consists of a plate and a portable tray with palpable volumetric orientation signs, equipped with cutlery locations, which rotates on the plate, to facilitate the person's orientation. Applications: kitchens, canteens, nursing homes, hospitals, etc.

### Stage:

At the laboratory level (digital model).

### Application domain:

Kitchens, canteens, nursing homes, hospitals, etc.





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Technical University of Moldova



## Design Concept PUBLIC BUS STATION WITH OVERHEAD PASSAGE

Ecaterina Golubeva, Valeriu Podborschi

### Description:

Public transport station designed to streamline road traffic during peak hours, reduce accidents, create comfortable conditions for pedestrians and passengers.

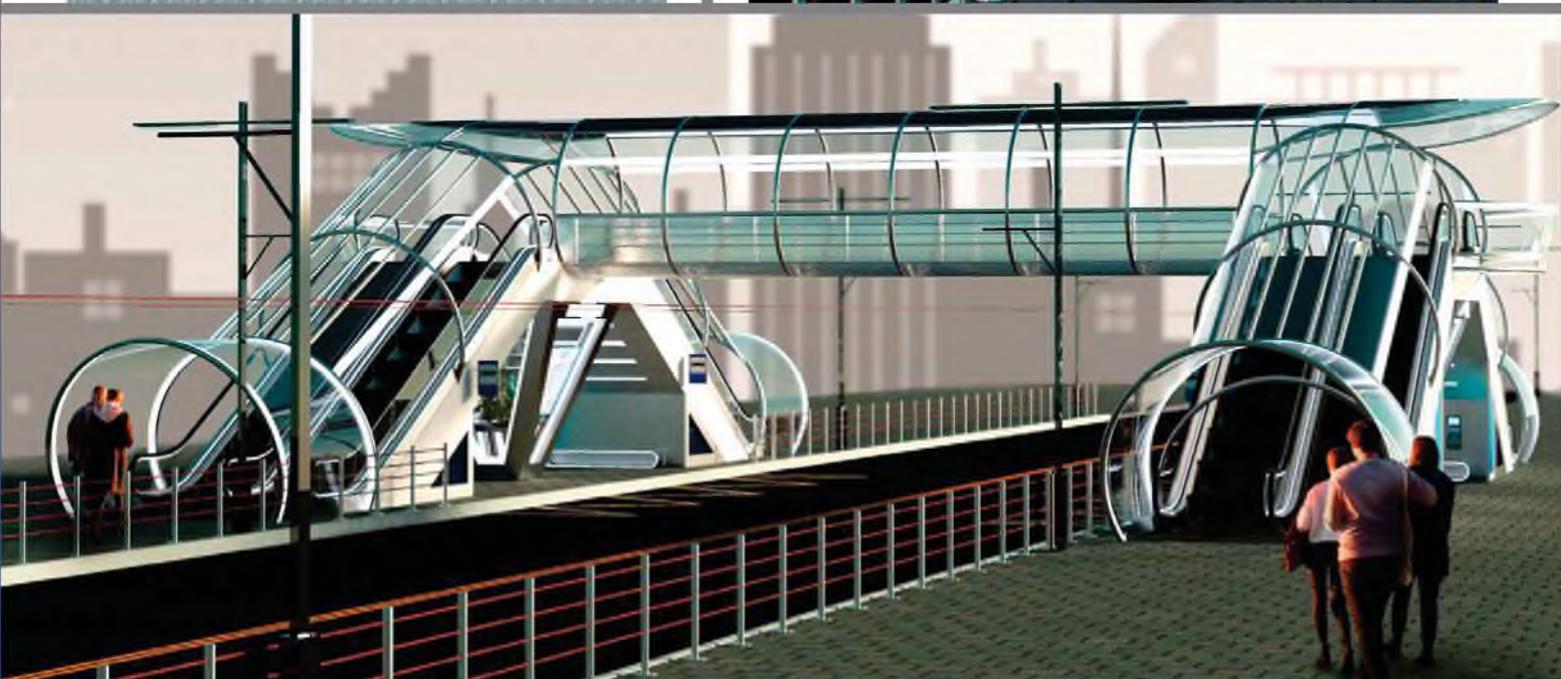
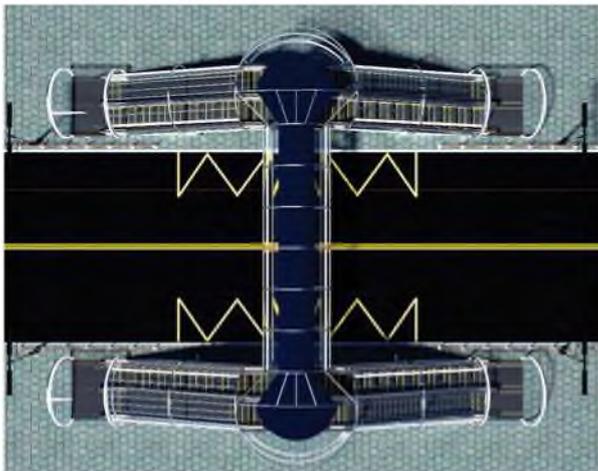
The station is double (direction and opposite direction), the connection between both directions is through an above-ground passage. Photovoltaic panels are placed on the roof of the passage, which allows energy autonomy of the object. The station is equipped with storage places for batteries, benches, LED lighting, information panels, etc.

### Stage:

At the laboratory level (digital model).

### Application domain:

Urban transportation systems.





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23.06.21 - 25.06.21, Iasi - Romania

Technical University of Moldova

## Design Concept INTELLIGENT WASTE COLLECTION POINT

Maxim Jechiu, Mihail Stamati

### Description:

The intelligent point of collecting household waste primarily motivates people to sort household waste into several categories - metal, glass, plastic, paper and cardboard, etc.

The point is equipped with technical means to request the services of firefighters, ambulance, police.

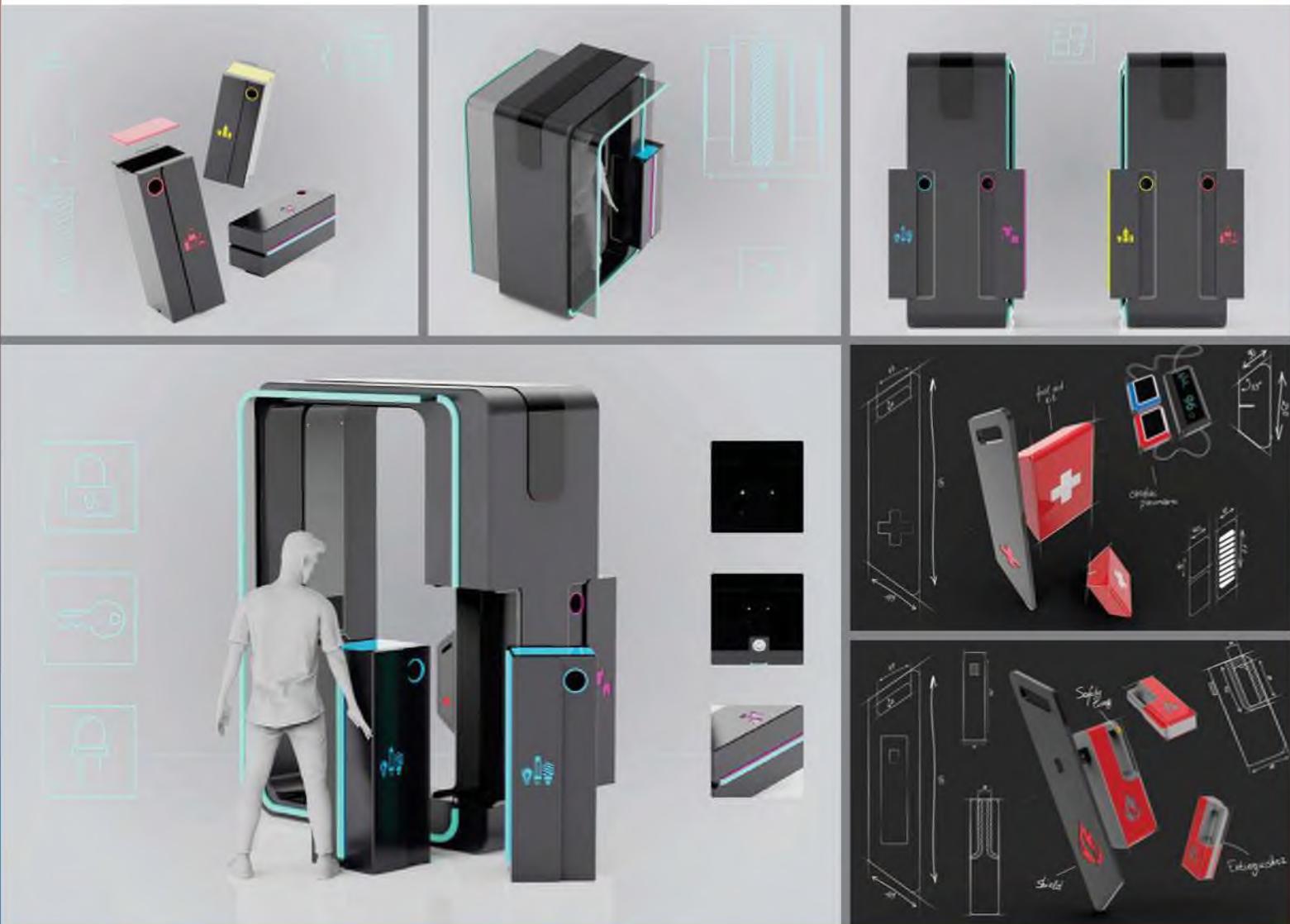
Also to save time in exceptional cases there is a container equipped with items needed to provide first aid (medical kit, extinguisher, defibrillator), etc.

### Stage:

At the laboratory level (digital model).

### Application domain:

Waste collection areas.





23.06.21 - 25.06.21, Iași - România

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INVENTICS, IASI, ROMANIA



## Design Concept KINETIC TOY FOR CHILDREN

Sandu Gorită, Valeriu Podborschi

**Description:**

Kinetic toy, made of wooden material (plywood), intended for preschool age children for fun and educational purposes. The toy is assembled-disassembled by the child, which perfects his skills.

The character of the toy presented is inspired by the Dachshund dog breed, which reproduces some characteristics of this breed, but by changing a few pieces a series of characters can be made.

**Stage:**

At the laboratory level (digital model).

**Application domain:**

Children's rooms, kindergartens, etc.



**Universities from ROMANIA**

*"Dunărea de Jos" University of Galati*



# International Exhibition of Inventions INVENTICA 2021 23.06.2021 - 25.06.2021



**DUNAREA DE JOS UNIVERSITY GALATI**

## **FORTIFIED JAM WITH KERNELS AND MANUFACTURING PROCESS**

**Cerere brevet (Patent application): A/00126**

**Inventatori (Inventors/ authors): Baston Octavian**

### **Patent description**

**EN:** The proposed invention refers to a sweet food product, made for people who exert intense physical effort and need a high energy intake.

Jam is a gelled food obtained by boiling fruit with sugar and sometimes pectine. According to the invention, the product consist of 80... 95 % jam, 5... 20 % kernels and 0... 2 % spices. The manufacturing process is made by processing and grinding the kernel, producing the jam by known industrial methods, grinding the spices, filling the recipients, homogenizing the contents and sterilizing the product.

**RO:** Invenția se referă la un produs alimentar de tip desert destinat persoanelor care depun efort fizic intens și au nevoie de aport energetic ridicat.

Gemul este un aliment obținut prin fierberea fructelor cu zahăr și gelificare. Produsul, conform invenției, este constituit, în procente masice, din 80...95 % gem, 5...20 % miez de sâmburi grași și 0...2 % condimente. Procedeu de obținere a gemului fortifiat cu miez de sâmburi grași constă în procesarea și mărunțirea miezului de sâmburi grași, producerea gemului prin metodele cunoscute industrial, mărunțirea condimentelor, umplerea recipientelor, omogenizarea conținutului și sterilizarea produsului.

**Bioactive compounds**  
**Nutrients**  
**Aroma**  
**Energy**





# International Exhibition of Inventions

## INVENTICA 2021

23.06.2021 - 25.06.2021



NATIONAL INSTITUTE OF  
INVENTICS, IASI, ROMANIA



DUNAREA DE JOS UNIVERSITY

111 Domneasca Street, 800201, Galați, Romania

### COMPOZIȚIE DE IAURT CU PREPARAT DE FRUCTE DIN FAMILIA MALEAE YOGURT FLAVORED WITH MALEAE FRUITS

Patent application: A/00099

Inventors: Baston Octavian, Barna Octavian, Pricop Eugenia Mihaela

#### PATENT DESCRIPTION

EN: The proposed invention is about the composition of the fruit flavored yogurt, intended for all consumers, except those suffering from diabetes or lactose intolerance. Fruit yogurt is obtained by mixing yogurt with fruit preparations in different proportions. Only the edible parts of the *Maleae* family (quince, apples, pears) are used. The fruit flavoring is obtained by osmoconcentration using sugar or sweeteners from the group of polyols. The product is a functional food due to the intake of prebiotics and probiotics that have a beneficial effect on the digestive system and consumer health

RO: **Invenția se referă la realizarea compoziției** produsului alimentar de tip iaurt cu fructe destinat tuturor consumatorilor, cu excepția celor care suferă de diabet sau intoleranță la lactoză. Iaurtul cu fructe se **obține** prin amestecul în diferite proporții a iaurtului cu preparatele de fructe. Fructele utilizate sunt din familia *Maleae* (gutui, mere, pere) și se introduc **bucăți** comestibile, fără a se îndepărta coaja acestora. Preparatele de fructe se **obțin** prin osmoconcentrare cu ajutorul zahărului sau a îndulcitorilor din grupul polioliilor. Produsul **obținut** este un aliment **funcțional** datorită aportului de prebiotice și probiotice, având efect benefic asupra sistemului digestiv și sănătății consumatorilor.





# International Exhibition of Inventions INVENTICA 2021 23.06.2021 – 25.06.2021



**DUNĂREA DE JOS UNIVERSITY**

## **GLUTEN AND LACTOSE FREE MUSHROOM-BASED SAUCE AND MANUFACTURING PROCESS**

**Brevet/ Cerere brevet / Proiect (Patent/Patent application/ Research project): A/00123**

**Inventatori (Inventors/ authors): Baston Octavian**

### **Patent description**

**EN:** The proposed invention is a sauce made for the people who are intolerant to lactose and gluten. According to the invention, the product consists in 20... 40 % mushrooms, 15... 20 % soy milk, 30... 40 % sunflower oil, 0... 10 % yeast flakes, 0... 10 % potato starch or corn starch, 0... 15 % white wine or water, 5... 10 % onion, 0... 2 % lemon juice, 0... 1 % salt, 1... 3 % spices. The manufacturing process of mushroom sauce consist in grinding the ingredients, heat processing and cooling, obtaining the mayonnaise, mixing the ingredients, adjusting the viscosity of the sauce and packaging.

**RO:** Invenția se referă la un produs alimentar de tip sos destinat persoanelor care au intoleranță la lactoză și gluten. Produsul, conform invenției, este constituit, în procente masice, din 20...40 % ciuperci, 15...20 % lapte de soia, 30...40 % ulei de floarea soarelui, 0...10 % drojdie fulgi, 0...10 % amidon din cartofi sau amidon din porumb, 0...15 % vin alb sau apă, 5...10 % ceapă, 0...2 % zeamă de lămâie, 0...1 % sare, 1...3 % condimente. Procedul de obținere a sosului fără gluten și lactoză constă în mărunțirea ingredientelor, procesare termică și răcire, obținerea maionezei, amestecare ingredientelor, reglarea vâscozității sosului și ambalare.

#### **Novelty**

Mushrooms bioactive substances use

Sensorial improvement

Health protection

#### **Category**

Culinary Sauces



#### **Technology description**

Raw materials cleaning and cutting  
Thermal tratment  
Cooling  
Viscosity improvement  
Packaging

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***“Victor Babes” University of Medicine and Pharmacy  
Timisoara***

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UNIVERSITATEA  
 DE MEDICINĂ ȘI FARMACIE  
 VICTOR BABEȘ | TIMIȘOARA

## Medicated composition with propranolol hydrochloride and eucalyptol for topical treatment of infantile hemangiomas

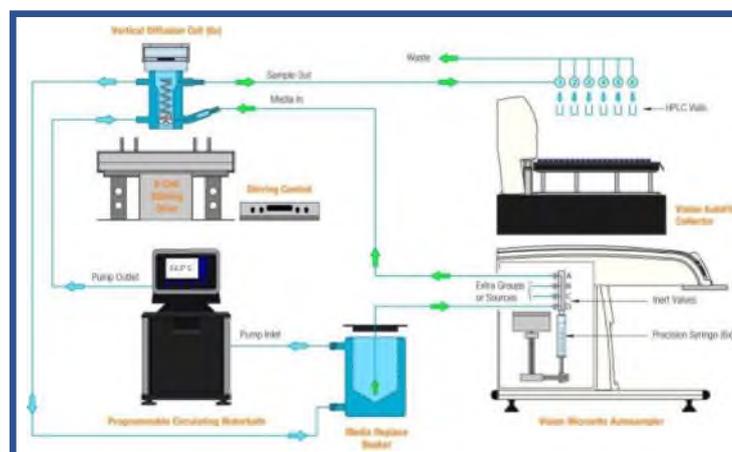
Vlaia Lavinia-Lia, Olariu Ioana-Viorica, Coneac Georgeta-Hermina, Lupuliasa Dumitru, Vlaia Vicențiu, Muș Ana-Maria  
**Patent No. 130963/2021**

This patent refers to a novel composition of medicated hydrogel for human use, containing propranolol hydrochloride and eucalyptol, intended for topical treatment of infantile hemangiomas. The medicated composition overcomes the disadvantage of low percutaneous permeation of propranolol hydrochloride, due its combination with eucalyptol, monoterpene used as penetration enhancer. According to the patent, the composition is: 1...3% propranolol hydrochloride, 2...5% eucalyptol, 2.5% hydroxypropylmethylcellulose, 10...20% propyleneglycol, 30...50% ethanol and distilled water to 100% (w/w). Compared to few topical propranolol hydrochloride compositions described in literature, the present invention can be considered a safer and more effective drug for topical treatment of infantile hemangiomas.

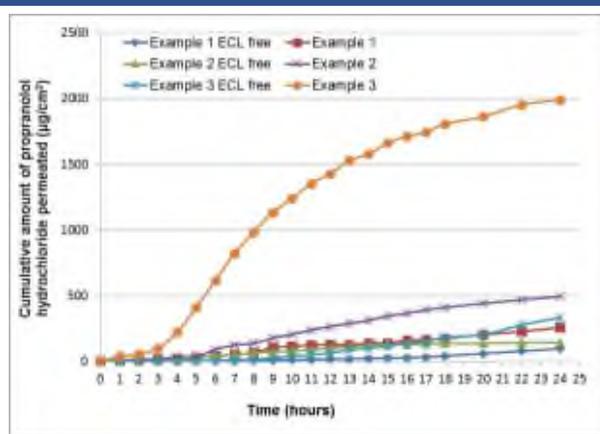
### Materials and Methods

Propranolol hydrochloride was kindly donated by S.C. Sintofarm S.A (Bucharest, Romania). Eucalyptol was obtained from Sigma-Aldrich Chemie GmbH (Germany). Hydroxypropylmethylcellulose (Methocel K4M, Colorcon L.t.d., UK) was received as gift sample. Ethanol (96%) and propyleneglycol were purchased from Chimopar S.A. (Romania) and Sigma Aldrich (Germany) respectively. Double distilled water was used throughout the study. All chemicals and reagents were of pharmaceutical or analytical grade and were used without further purification.

Components of hydrogel formulation	Weight (%) and formulation codes		
	Example 1	Example 2	Example 3
Propranolol hydrochloride	1	2	3
HPMC	2.5	2.5	2.5
Ethanol 96% (V/V)	30	40	50
Propyleneglycol	10	15	20
Eucalyptol	2	3	5
Distilled water	54.5	37.5	19.5



Parameter	<i>In vitro</i> release test conditions
Average diffusional surface area	1.767±0.1 cm <sup>2</sup>
Average receptor fluid volume	6.5±0.1 mL
Temperature	32±1°C
Biological membrane	Excised pig ear skin
Receptor fluid	Phosphate buffer saline (PBS) pH 7.4
Dose	approx. 0.300 g
Sampling time	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 20, 22 and 24 h
Sample volume	0.5 mL
Sample analysis	UV Spectrophotometry (290 nm)



Formulation <sup>a</sup> PR/ECL/HPMC/PG/EA/DW (% m/m)	$J_{ss}$ (µg/cm <sup>2</sup> /h) <sup>b</sup>	$Q_{24}$ (µg/cm <sup>2</sup> ) <sup>b</sup>	ER <sub>flux</sub> <sup>c</sup>
1/0/2.5/10/30/56.5	4.724 ± 0.16	96.29 ± 32.55	1
1/2/2.5/10/30/54.5	15.467 ± 4.24	358.89 ± 20.47	3.27
2/0/2.5/15/40/40.5	10.170 ± 0.56	145.05 ± 28.72	1
2/3/2.5/15/40/37.5	45.538 ± 1.84	794.97 ± 18.38	4.48
3/0/2.5/20/50/24.5	16.324 ± 9.89	333.046 ± 27.15	1
3/5/2.5/20/50/19.5	122.451 ± 1.69	1988.564 ± 16.21	7.50

<sup>a</sup>PR – propranolol; ECL – eucalyptol; HPMC – hydroxypropylmethylcellulose; PG – propylene glycol;

EA – ethylic alcohol 96% V/V; DW – distilled water

<sup>b</sup>media±DS

<sup>c</sup>ER<sub>flux</sub> – enhancement ratio

### Discussions and Conclusions

Eucalyptol acted as skin penetration enhancer in all three tested formulations, the intensity of this effect being proportional to its concentration. Used at a concentration of 5% in the hydrogel formulation of the present invention (Example 3), eucalyptol showed the most pronounced effect of increasing the percutaneous permeation of propranolol hydrochloride, producing the highest values for steady-state flow and cumulative amount of drug permeated through the skin, that were approximately 7.5 times and respectively 6 times higher than those obtained with the control formulation.

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***Babeş-Bolyai University***

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# International Exhibition of Inventions

## INVENTICA 2021

23.06.2021 – 25.06.2021



NATIONAL INSTITUTE OF INVENTICS, IASI, ROMANIA

Babeş-Bolyai University, Cluj-Napoca, Romania



### Material composite obtaining process of nanoporous carbon/graphene/bismuth and iron nanoparticles/titanium dioxide with analytical and photodegradation properties

-OSIM PATENT No.: RO133255B1/27.11.2020

-Inventori (Inventors/ authors): Liviu Cosmin COTET\*, Lucian Gheorghe BAIA,

Carmen Ioana FORȚ, Lucian Cristian POP, Mihai RUSU

#### ABSTRACT

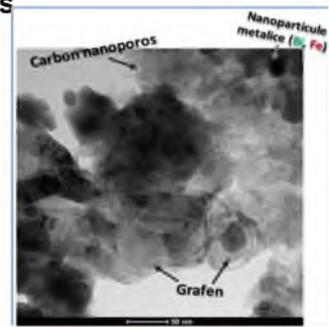
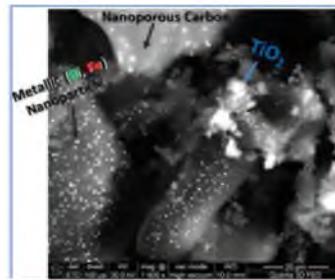
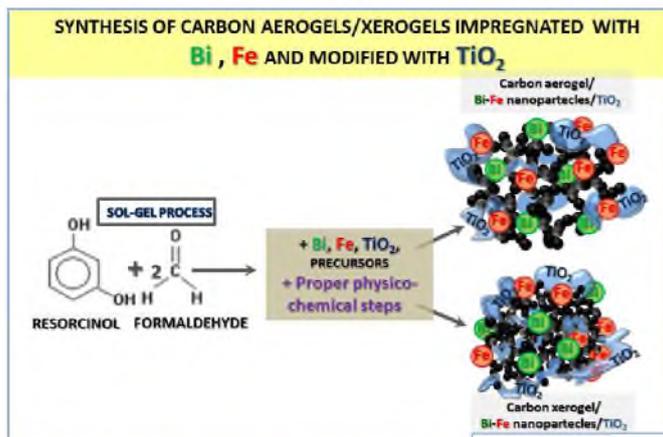
The patent describes the obtaining process of quadrant-component multifunctional nanocomposites (Carbon-Bismuth-Iron-Titanium Oxide). These are made up of carbonic structures (e.g. aerogel, xerogel, graphene) impregnated with Bi and Fe nanoparticles and modified with structures of TiO<sub>2</sub>.

**Carbon:** is presented as a high surface area electric conductor support for sensing centers done by 3D-interconnected carbon nanoparticles [1].

**Bismuth:** possesses analytical properties for heavy metal (Pb<sup>2+</sup>, Cd<sup>2+</sup>, Zn<sup>2+</sup>, Hg<sup>2+</sup>, etc.) detection from aqueous solution. In this way, highly toxic Hg electrodes can be replaced in sensing applications. In this study, Bi dispersed nanoparticles into a porous carbon framework were formed [2,3].

**Iron:** exhibits sensing activity for organic compounds detection (e.g. H<sub>2</sub>O<sub>2</sub>, drugs, etc.) [3], increase the electrical conduction, exhibit magnetic properties and, in high temperature pyrolysis (i.e. 1050°C/Ar), generates the formation of graphene structures [4] which increase the electrical conductivity and analytical performances.

**TiO<sub>2</sub>:** presents photocatalytic activity for the degradation of organic compounds [5], and therefore it plays an important role in the environmental depollution and self-cleaning surface processes



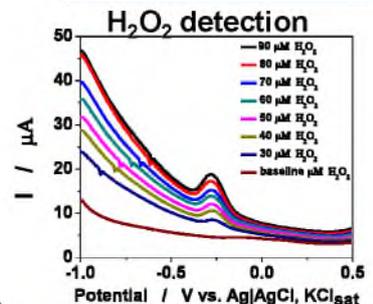
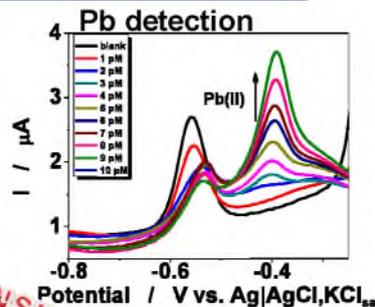
#### APPLICATION FIELDS [2]:

**Multi-functional material!**

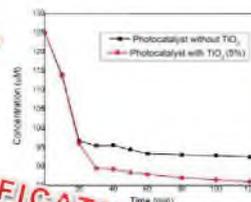
- miniaturized sensors for pharmaceutical compounds and heavy metals detection;
- pollutant photodegradation or adsorption;
- magnetic captures, etc.



**SENSING APPLICATION!**



Detection limit for H<sub>2</sub>O<sub>2</sub> → 8.72 μM  
Sensitivity → 3.14 μM/μA



[1] L.C. Cotet, A. Roig, I.C. Popescu, V. Cosoveanu, E. Molins, V. Dancu, Rev. Roum. Chim. 52(11), 1077, (2007).  
 [2] M. Glch, C. F.-Sanchez, L.C. Cotet, P. Nu, A. Roig, J. Mater. Chem. A, 1, 11410, (2013).  
 [3] C.I. Fort, L.C. Cotet, A. Vulpoi, G.L. Turdean, V. Dancu, L. Baia, I.C. Popescu, Sens. Actuators, B, 220, 712, (2015).  
 [4] M. Baia, L.C. Cotet, L. Baia, L. Barbu-Tudoran, V. Cosoveanu, V. Dancu, J. Popp, J. Optoelect. Adv. Materials-Symposia, 2, 9, (2010).  
 [5] G. Kovacs, L. Baia, A. Vulpoi, T. Radu, E. Karacsanyi, A. Dombi, K. Hernadi, V. Dancu, S. Simon, Zs. Pap, Appl. Catal. B Environmental, 147, 508, (2014).



# International Exhibition of Inventions INVENTICA 2021 23.06.2021 – 25.06.2021



-“Babeş-Bolyai” University, Cluj-Napoca, Romania<sup>1</sup>  
-Institute of Materials Science of Barcelona, Spain<sup>2</sup>

## Method For Obtaining A Flexible Electrode

-WIPO (Geneva, Switzerland) No. : WO 2019/234284 A1; -Spanish No.: ES 2734729 B2.  
-Inventori (Inventors/ authors): Liviu Cosmin COTEȚ<sup>1\*</sup>, Alex Ygnacio CHUQUITARQUI VALLADARES<sup>2</sup>, Ángel PÉREZ DEL PINO<sup>2</sup>

### ABSTRACT

● Novel method for obtaining graphene-based flexible electrodes is presented [1].

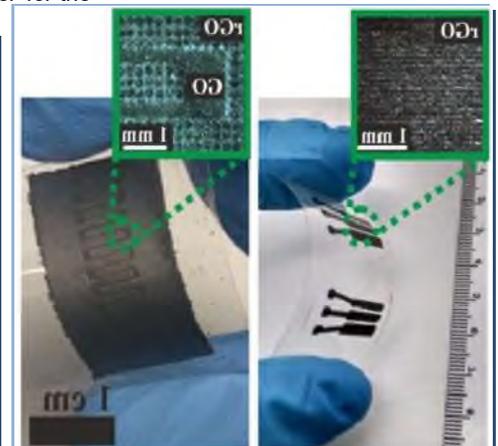
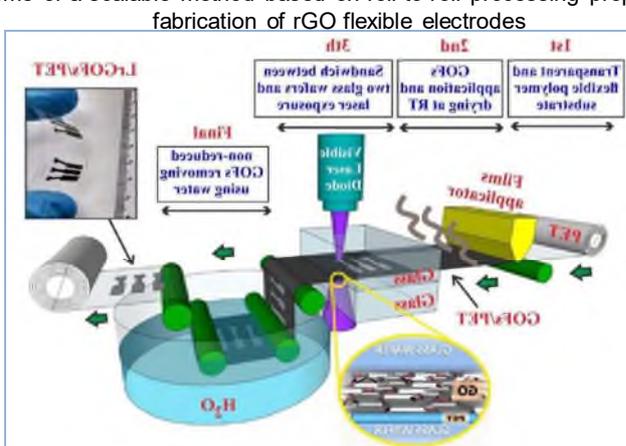
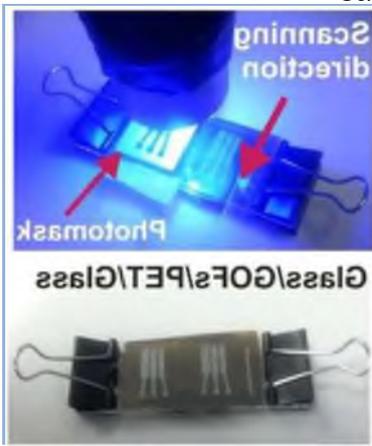
■ Conductive films were obtained by means of the visible irradiation, through a 1 W laser diode system, of graphene oxide (GO) layers deposited on polymeric substrates (e.g. polypropylene, PET, polycellulose) and self-standing membranes sandwiched between glass slides.

● Despite the low power of the laser system, the numerical simulations indicate the development of temperatures over 1000 K throughout the irradiated material. The laser-induced spatially confined heating leads to the reduction of the GO material, whereas the glass-based sandwich assembly avoids reoxidation from the surrounding air.

■ By scanning and pixelated modes, reduced graphene oxide (rGO) electrodes, up to 100 μm in thickness, and with a **resistivity** as low as  $6 \times 10^{-4} \Omega\text{m}$ , were obtained in an easy and versatile way.

■ Proof-of-concept microsupercapacitors and electrochemical sensors were fabricated with this technique, showing promising performance.

Scheme of a scalable method based on roll-to-roll processing proper for the fabrication of rGO flexible electrodes



### APPLICATION FIELDS [1,2]:

- ELECTRONICS: portable electronics, platform for electric circuits, etc.
- ENERGY: supercapacitors, photovoltaic devices, etc.
- SENSORS: miniaturised electrochemical and biological analytical devices, etc.
- CATALYSIS: active catalytic part and support for active catalists.

[1] A. Chuquitarqui, L.C. Cotet, M Baia, E György, K Magyari, L. Barbu-Tudoran, L. Baia, M. Díaz-Gonzalez, C. Fernandez-Sanchez, A. Perez Del Pino, *Nanotechnology* **31** (2020) 325402.

[2] Á. Pérez del Pino, E. Gyorgy, L.C. Cotet, L. Baia, C. Logofatu, *RSC Advances*, **6** (2016) 50034.

#### Acknowledgments

The authors are grateful for the financial support of the Spanish Ministry of Economy, Industry and Competitiveness under the project ENE2017-89210-C2-1-R, and support from AGAUR of Generalitat de Catalunya through projects 2017 SGR 1086 and 2017 SGR 1771. ICMAB acknowledges financial support from the Spanish Ministry of Economy and Competitiveness, through the ‘Severo Ochoa’ Programme for Centres of Excellence in R&D (SEV- 2015-0496). Also, this work was supported by a grant of the Romanian Ministry of Research and Innovation, CCCDI—UEFISCDI, project number PN-III-P1-1.2-PCCDI-2017-0350/01.03.2018 (Graphene4Life), within PNCDI III.

\*cosmin.cotet@ubbcluj.ro



# International Exhibition of Inventions

## INVENTICA 2021

23.06.2021 – 25.06.2021



NATIONAL INSTITUTE OF  
INVENTICS, IASI, ROMANIA



### Smart Systems for Public Safety through Control and Mitigation of Residential Radon linked with Energy Efficiency Optimization of Buildings in Romanian Major Urban Agglomerations – SMART-RAD-EN

**Brevet/ Cerere brevet / Proiect (Patent/Patent application/ Research project):** The project was part of the Competitiveness Operational Programme 2014-2020, Priority Axis 1 Research, with the Contract no. 22/2016, Identification number P\_37\_229, MySmis Code 103427

**Inventatori (Inventors/ authors):** Sainz Carlos, Cucos Alexandra, Dicu Tiberius

The **SMART\_RAD\_EN** project addresses interdisciplinary research on “*Smart Cities*” from the perspective of intelligent integrated solutions and aims to increase comfort, safety and indoor energy efficiency. The scope of the project represents a premiere at national and international levels, by associating *radon research with studies on other carcinogenic chemical pollutants* in correlation with comfort and energy efficiency of housing in major urban agglomerations of Romania. The main objective was to develop an innovative integrated prototype systems with reduced energy consumption, adapted to the needs of the population of smart cities to monitor, control and reduce/prevent exposure to radon and indoor pollutants.

**Contact person:** Cucos Alexandra, Senior Researcher (CSI) PhD. Eng., Head of LiRaCC Laboratory

**Phone:** 004 0740479814

**E-mail:** alexandra.dinu@ubbcluj.ro





# International Exhibition of Inventions

**INVENTICA 2021**  
23.06.2021 – 25.06.2021



**Babeş-Bolyai University**

## **INTELLIGENT SYSTEM AND METHOD OF DETERMINATION AND CONTROL OF RADON CONCENTRATION INSIDE CIVIL BUILDINGS**

**Brevet/ Cerere brevet / Proiect (Patent/Patent application/ Research project): The patent application was published in RO-BOPI no. 3/2020 of 30.03.2020, submitted to OSIM with No. 15/2019 CP of 29.07.2019**

**Inventatori (Inventors/ authors): Tunyagi Arthur Robert, Cucos Alexandra Laura, Dicu Tiberius, Botos Marius Lucian, Chiorean Cosmin Gruia, Fernandez Sainz Carlos**

**An Innovative prototype (ICA)** monitoring system to control indoor air quality (**Radon, CO<sub>2</sub>, CO, VOC, temperature, pressure, humidity**) with remote data transmission. A novel application for the continuous analysis of the data sets provided by ICA and the control of radon mitigation system. ICA automatically and efficiently controls the remediation and ventilation system of the room in which it is installed, in case the air quality falls below a threshold set by the user/ owner or authority. ICA system was test and metrological validated by Czech Republic Metrological Institute and CSTB France and internationally certified CE for safety of users.



ICA prototype - **SMART HEALTH Award 2019** at the Smart City Industry Awards Gala 2019, Smart Living Category

**Contact person:** Cucos Alexandra, CSI PhD. Eng.,

Head of LiRaCC Laboratory

**Phone:** 004 0740479814

**E-mail:** alexandra.dinu@ubbcluj.ro



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***"Gheorghe Asachi" Technical University of Iasi***

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International Exhibition of Inventions  
**INVENTICA 2021**  
 23.06.2021 – 25.06.2021



**“GHEORGHE ASACHI” TECHNICAL UNIVERSITY OF IASI ROMANIA**



**SOFTWARE TOOLS FOR TEXTILE CREATIVES *OptimTex*,**  
**Erasmus+ Strategic partnership,**  
**2020-1-RO01-KA203-079823**

**M. BLAGA, C. PIROI, R. HARPA, S.D. IONESI**

**INCDTP – The National R&D Institute for Textiles  
 and Leather**

**Project Coordinator,**  
<http://www.incdtp.ro>

TecMinho - University of  
 Minho  
 Guimaraes, Portugal  
<http://www.tecminho.uminho.pt/>

Ghent University  
 Faculty of Engineering and  
 Architecture  
 Ghent, Belgium  
<https://www.ugent.be/ea/en>

University of Maribor  
 Faculty of Mechanical  
 Engineering  
 Maribor, Slovenia  
<https://www.um.si>

“Gheorghe Asachi” Technical University of Iasi  
 Faculty of Industrial Design and Business Management  
 Iasi, Romania  
<http://www.dima.tuiasi.ro>

University West Bohemia  
 Faculty of Electrical  
 Engineering  
 Pilsen, Czech Republic  
<https://www.fel.zcu.cz/en/>

**The main aim of OptimTex project**

Improving knowledge and skills in the field of textile software applications for students of Higher Education, as well as their employability within textile enterprises, by providing the adequate training instruments for their profession.

Objective	Needs	Key indicators
1. Preparing new educational materials on up-to-date textile design software applications.	Adaptation of educational materials in textiles by new design software applications.	5 educational modules on textile software applications; 60 HEI students prepared.
2. Improving employability of textile creatives within industry & research by means of adequate instruments.	Applying theoretical educational materials within the practice of textile enterprises and textile research.	One Guide on SWOT for technology transfer; 115 young professionals approached within multiplier events.
3. Fostering digital skills uptake by implementing e-learning instruments, platform and glossary of modern textile terms.	Orientation towards valuable web content.	E-learning instrument and platform, digital multimedia content, Glossary with 100 modern textile terms
4. Creating educational synergies by enabling student mobility.	Coping with challenges of new technological development and multidisciplinary fields.	Mobility for 36 HEI students and 15 lecturers within 3 Intensive Study Programs.

**Project website:**  
[www.optimtex.eu](http://www.optimtex.eu)  
**Project e-learning platform:**  
[www.advant2tex.eu/portal/](http://www.advant2tex.eu/portal/)

**TUIASI project coordinator:**  
 Prof. Dr. Habil. Ing. Mirela BLAGA  
[mblaga@tex.tuiasi.ro](mailto:mblaga@tex.tuiasi.ro)

**THE 25<sup>TH</sup> INTERNATIONAL EXHIBITION OF INVENTICS INVENTICA 2021, IAȘI – ROMÂNIA**

**DiaSHOE**

Ref: 2020-1-PT01-KA202-078687

[www.diashoeproject.eu](http://www.diashoeproject.eu)



# DiaSHOE - Digital Education for Diabetic Foot Control

**Aura Mihai, Mariana Costea \*, Arina Seul, Bogdan Sarghie,**

*Gheorghe Asachi Technical University of Iasi, [mariana.costea@academic.tuiasi.ro](mailto:mariana.costea@academic.tuiasi.ro)*

Statistics show that diabetes affects 463 million people in the world (2019). In Europe, there are approximately 60 million people diagnosed with diabetes, representing nearly 8% of the European population.

The project's overall aim is to inform and guide footwear manufacturers, patients, informal caregivers, healthcare workers, and shoe-store clerks to best to tackle this issue through prevention and skills development.



- Footscan 2D Gait Scientific, RSScan, UK and Pedar

2D Rescan Platform. Source: [www.footscan.com](http://www.footscan.com)

*Example*

- Subject B-V
- Name: B-V
- Genre: Female
- Age: 63 years old.
- Diagnosis: Type 2 diabetes for 18 years
- Excess weight- BMI = 26 kg / m<sup>2</sup>; G = 60kg

Methods and equipment



The European Commission support for the production of this publication does not constitute an endorsement of the contents which reflects the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.



The project will produce 3 Digital Education Packages for different target groups:

- Digital Education Package for designers, footwear technicians, and product managers
- Digital Education Package for health technicians and shoe shop assistants
- Self-care Digital Education Package targeting patients, their families, informal caregivers, and school teachers/educators.



**INFOOT System**



**Anthropometrical parameters**

Dimension	Left	Right
Foot length	235.8 mm	240.7 mm
Foot breadth	98.8 mm	103.5 mm
Heel breadth	231.4 mm	232.4 mm
Ball breadth	98.8 mm	97.0 mm
Forefoot breadth	179.0 mm	188.9 mm
Heel width breadth	181.8 mm	189.0 mm
Heel of Foot of Ball girth	85.9 mm	86.9 mm
Heel of Heel	88.7 mm	89.7 mm
Foot girth angle	22.5°	21.9°
Heel of Foot girth	20.3 mm	20.3 mm
Heel of Heel girth	16.8 mm	16.0 mm
Heel of Heel breadth	88.8 mm	93.5 mm
Heel of Ball breadth	49.4 mm	47.5 mm
Heel of Heel breadth	8.8 mm	9.5 mm
Heel of Heel breadth	84.4 mm	82.5 mm
Heel of Heel breadth	7.8 mm	7.8 mm
Heel of Heel breadth	5.4°	4.4°
Heel of Heel breadth	26	25.5

INFOOT is a three-dimensional scanner with optical laser scanning system, INFOOT scans the shape of the foot and takes the anatomical points and automatically measures approximately 20 dimensions (foot length, toe width, toe perimeter, risk perimeter, etc.).





THE 25<sup>TH</sup> INTERNATIONAL EXHIBITION OF INVENTICS INVENTICA 2021, IAȘI – ROMÂNIA



PROJECT OBJECTIVES:

- Joint digital international course "Training through virtual practice" for footwear manufacturing, fully anchored in digital strategies.
- Virtual laboratory for footwear and corresponding contents in Augmented Reality (AR). It also includes a course for trainers, teachers and instructors on how to use tools to develop innovative and engaging content in AR.
- Common training methodology for augmented reality (AR) learning itineraries that includes textbooks for teachers, instructors and trainees, and training opportunities for end-users.



DIGITAL  
FABLAB

FOOTWEAR VIRTUAL LEARNING BY DOING

2020-1-PT01-KA226-094924

Mariana Costea, Aura Mihai, Arina Seul\*, Bogdan Sarghie  
Gheorghe Asachi Technical University of Iasi, arina.seul@academic.tuiasi.ro

IO1 Joint International course for digital "Learning by Doing" on Footwear manufacturing



Joint International course for digital "Learning by Doing" on Footwear manufacturing consisting in the co-creation, by all partners, of a digital joint international course for the practical learning on Footwear manufacturing, supported on practical already existing certified Units of Learning Outcomes (ULOs), integrally anchored in digital strategies. This IO will make possible the creation of a high-quality certified joint digital practical learning methodologies for the footwear industry, design and pilot relevant practices for training/education, adapted to specific challenges and local realities and to reinforce and extend networking between European training institutions for the footwear industry.



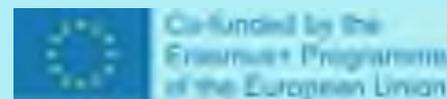
IO2 Joint virtual Shoe Fab Lab and correspondent contents in Augmented Reality (AR)

Joint virtual Shoe Fab Lab and correspondent contents in Augmented Reality (AR) consisting in a range of results from the virtual ShoeFabLab to the footwear related contents in AR on footwear manufacturing and will make possible the joint functional and active digital tool for the development of practical skills on footwear manufacturing which will integrate the most expertise of the footwear VET providers in Europe. This IO also includes a LTTA which consists in a course for trainers, teachers and coaches on how to use authoring tools (Vuforia or Blippar) for the development of innovative and attractive contents in AR which is a pillar for the development of capacity and autonomy of the training entities.

IO3 Methodology for training itineraries based on augmented reality (AR)



Common methodology on training/teaching/coaching for training itineraries based on augmented reality (AR) which includes manuals for trainers/teachers, coaches and trainees will develop capacity to implement innovative digital training/education strategies designed in IO1 and IO2, extending collaboration with technological specialists on advance educational technologies as it's the case of HESO.



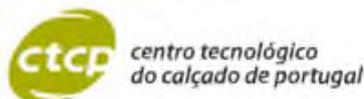
Partners:



HeartHands SOLUTIONS  
HANDS ON KNOWLEDGE



Łukasiewicz Instytut Przemysłu Skórnianego



INESCOP FOOTWEAR TECHNOLOGICAL INSTITUTE



Confederación Europea de Industrias de Calzado European Confederation of the Footwear Industry



THE 25<sup>TH</sup> INTERNATIONAL EXHIBITION OF INVENTICS INVENTICA 2021, IAȘI – ROMÂNIA



LANGUAGE GUIDE FOR FOOTWEAR AND LEATHER INDUSTRY

Project 2020-1-TR01-KA202-092689

WWW.DICSHOENARY.EU

PROJECT OBJECTIVES:

- To anticipate the job related requirements of the future managerial occupations more effectively in partner countries.
- To establish a common professional technical language framework in order to enable employees with international activities in European and Turkish footwear industry to establish more effective communication.
- Developing multimedia methodologies and learning tools to restructure the technical language teaching process for existing and new employees from the shoe industry.



Mariana Costea, Aura Mihai, Arina Seul, Bogdan Sarghie\*  
Gheorghe Asachi Technical University of Iasi, amihai@tex.tuiasi.ro

NEW EXPLANATORY 10 LANGUAGE GUIDE FOR FOOTWEAR INDUSTRY ON INTERNET

O1 Need Analysis & State of the Language Report

Identifying and analysing those characteristics of the footwear and its connected industries today, regarding the provided training, the existing trends in the industry, the anticipated skills, and the training needs, using desk and field research done by all partners in the project, will result in a research report. This research report is the compass of the following actions and subsequent decisions in the project.



O2 Language guide in 10 languages

Selection and set of 3000 vocational terms with explanation in English : The output of this activity will be the language guide with a comprehensive overview of the footwear vocabulary in 10 languages (English, Turkish, Czech, Romanian, Polish, Slovenian, Portuguese, Italian, Greek and Spanish). This will include explanation used in production, technology, materials, retail trade, design, research, teaching and trading. This output will be used as a background for the future multilanguage guide as the major output of this project.

O3 Interactive web portal

Web portal represents main output of the project. This is a platform for full run of prepared multimedia dictionary (terms + explanation in 10 languages) on internet. Web portal is the communication platform for dissemination of the project results and available tool for sustainable using of created multilanguage guide. Electronic version of the explanatory language guide will be mainly focused on target groups which have got used to using the internet and web translators for their common work with vocational foreign language.

Partners:





## Footwear in the 21st century: New skills for the design of drastically improved comfort, sustainable, fashion-oriented and scientifically-led footwear products

Project reference: 601137-EPP-1-2018-1-RO-EPPKA2-KA  
 Duration: 01/01/2019 – 31/12/2021



### Objectives

- To analyse the product life-cycle and the parameters that affect footwear quality with respect to sustainability, comfort and performance.
- To introduce technologies and innovative computer-based tools such as human bio-models and simulation scenarios.
- To stimulate the collaboration between higher education institutions and research institutes with companies.
- To refine and improve the curricula for the Footwear Designer and Product Manager, and to produce accredited university-level educational materials.

### Expected results

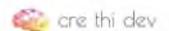
- A new profile in line with European Qualifications Framework (EQF) and corresponding educational material to produce an improved high-performance product.
- Improved and modernised training modules to support the new profile for current and future employees working as Footwear Product Managers and Designers.
- A more comfortable, personalised and sustainable footwear in line with a decarbonised economy, which will ameliorate the consumers' living standards as well as contribute to fight climate change.
- Collaboration between higher education institutions and research centres with companies to jointly develop new learning and training methods.

Coordinator



Partners

[www.sciled.eu](http://www.sciled.eu)





THE 25<sup>TH</sup> INTERNATIONAL EXHIBITION OF INVENTICS INVENTICA 2021, IAȘI – ROMÂNIA



# Innovative Training for the Leather Goods sector across Europe



<http://www.trainingleathergoods.eu>

**Bogdan Sarghie\*, Aura Mihai, Arina Seul, Mariana Costea**

*Gheorghe Asachi Technical University of Iasi, bogdan-theodor.sarghie@academic.tuiasi.ro*

The project envisages to **design, develop and pilot a new profile and training opportunities in ICT and work-based learning** combined with trainers/learners mobility actions, in line with the actual needs of the companies and mainstream it at European and National level, **boosting the sector workforce upskill, promoting the entrepreneurship of new talent designers and the development of a new generation of high-skilled leather goods manufacturers**, oriented to **high-end products** to strengthen the high-end leather goods manufacturing across Europe.

### Target-group

- Companies in leather goods sector;
- New talent designers;
- Single entrepreneurs in the field;
- Trainers / coaches.

### Impact expected

- Strengthening of the high-end leather goods production across Europe;
- The enhancement of employability of fashion designers and single entrepreneurs in the field;
- Emergence of a new generation of trainers in advanced learning methodologies;
- The leverage of the level of employment in the sector;
- High level of cooperation among entities across Europe in Leather Goods and VET.





# International Exhibition of Inventions INVENTICA 2021 23.06.2021 – 25.06.2021

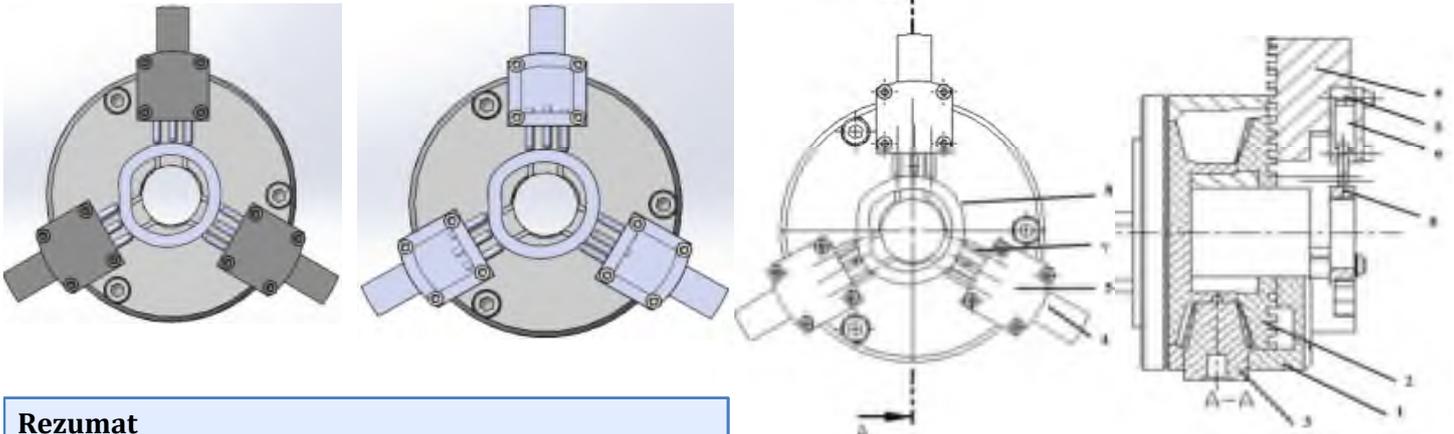


**Gheorghe Asachi” Technical University of Iași**  
Faculty of Machines Manufacturing and Industrial Management

## Universal chuck with jaws, plunger and hydroplast Mandrina universală cu fălci, plunjere și hidroplast

**Cerere brevet (Patent application):** 5315/01.04.2021

**Inventatori (Inventors):** Seghedin Eugen Neculai, Chitariu Dragoș-Florin, Articuci G., Clipa M., Diaconu Al., Dron S., Moldovanu F., Pântea F., Rusu A., Scorțanu C., Sofia I.



### Rezumat

Invenția se referă la un dispozitiv de tip mandrină autocentrantă utilizată la strângerea și centrarea pieselor cu pereți subțiri și a celor cu profil neregulat la prelucrarea pe mașini-unelte.

Mandrina universală cu fălci, plunjere și hidroplast, autocentrantă, conform invenției, este compusă dintr-un corp 1 pe care este amplasat un disc turnant 2 care prezintă un canal arhimedic, discul rotindu-se sub acțiunea unui pinion 3, la rotirea discului turnant 2, produce deplasarea radială a unor fălci 4 (3 bucăți) care angrenează cu canalul arhimedic, în fălcile 4 fiind practicate niște incinte 5 în care este amplasată o masă plastică- hidroplast 6, fălcile 4 prezentând niște plunjere 7 care realizează prinderea piesei 8, legătura între plunjere realizându-se prin intermediul masei plastice 6.

Mandrina universală cu fălci, plunjere și hidroplast, autocentrantă, conform invenției, prezintă următoarele avantaje: permite aplicarea forțelor de strângere pe mai multe direcții, permite prinderea pieselor cu pereți subțiri, permite prinderea pieselor cu profil neregulat.

### Abstract

The invention relates to a self-centering chuck used for tightening and centering thin-walled parts and with an irregular profile when machining.

The self-centering chuck according to the invention is composed of a body to which is attached a rotating disk with an archimedical channel, the disk rotating under the action of a pinion, which produces the radial displacement of three jaws engaging with the archimedical channel of the rotating disk, in each jaw being practiced an enclosure in which oil is introduced, and each jaw has some plungers that hold the piece, the connection between the plungers being ensured by a plastic material.

Benefits:

- allows the application of clamping forces in several directions;
- allows the attachment of thin-walled parts;
- allows the attachment of parts with an irregular profile

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***Polytechnic University of Timișoara***

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## 3D Porous dimensionally stable anode-integrated particulate electrode-electrochemical filtering system for advanced treatment of cytostatics-containing water (3DSAPECYT)

**Authors: Florica Manea, Corina Orha, Constantin Adrian Tudoran**

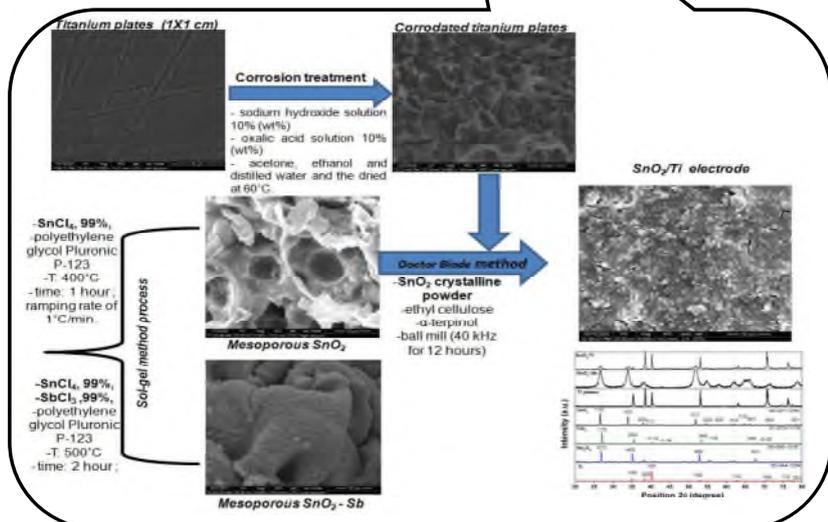
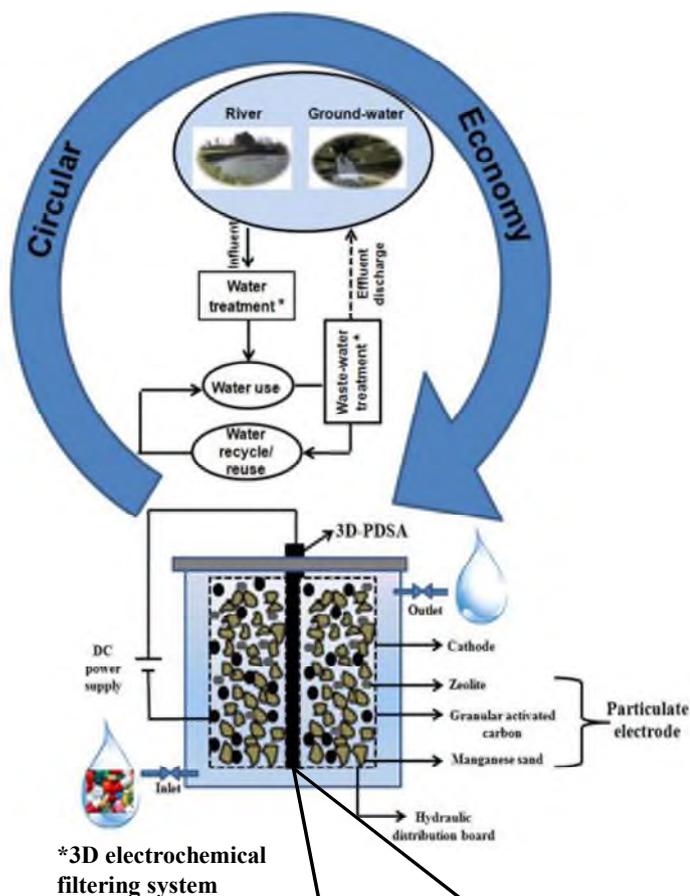
**Project no. PN-III-P2-2.1-PED-2019-4492, 441PED/2020**

The development of improved innovative technology and process for water treatment represents a prerequisite condition within the context of the circular economy, considering its fundamental principles focus on reduce, reuse and recycle in order to close the loops of the water use cycle.

**Objectives** of the project consists of:

1. Synthesis and characterization of new porous dimensionally stable anodes through spin coating and hydrothermal techniques.
2. Development of new filtering composition within fluidized bed as particulate electrode based on activated carbon (mature technology) / Romanian zeolite (natural material) / manganese sand (depleted filtering waste generated in the drinking water treatment technology using manganese containing groundwater source).
3. Fabrication of an innovative *three-dimensional (3D) Porous Dimensionally Stable Anode-integrated Particulate Electrode-Electrochemical Filtering System (3D-PDSA-PE-EFS)* for advanced treatment of cytostatics containing water.
4. Validation and integration of *3D-PDSA-PE-EFS* system within advanced surface water treatment technology.

The *scope* of the present project is to develop an innovative three-dimensional (3D) Porous Dimensionally Stable Anode-integrated Particulate Electrode-Electrochemical Filtering System (*3D-PDSA-PE-EFS*) for advanced water treatment, which will be validated at the lab-scale for advanced treatment of cytostatics containing water, starting from *TRL-2* and reaching *TRL-4* in 24 months. The system (*3D-PDSA-PE-EFS*) will be flexible and enable for an advanced treatment of water/wastewater characterized by a wide range of contaminants (organics and inorganics) by combination of advanced electrooxidation process (AEOP) with adsorption/catalysis (A/C) process within one reactor.



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**Morpho-structural characterization of 3D-PDSA**

## ELECTRODE AND METHOD FOR FAST ELECTROCHEMICAL DETECTION OF ARSENIC(III) FROM AQUEOUS SOLUTIONS

**Florica MANEA\*, Aniela POP, Anamaria BACIU, Adriana REMEȘ**

Politehnica University of Timisoara, Romania, <https://www.upt.ro>

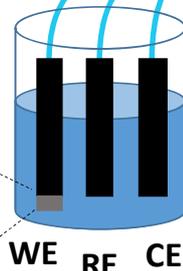
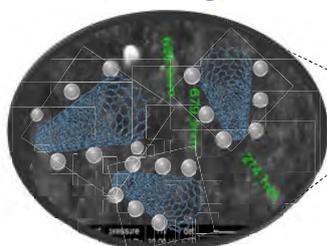
\*e-mail: [floricamanea@upt.ro](mailto:floricamanea@upt.ro)

Patent no RO 129026 B1, released on 30.10.2020

The invention refers to the elaboration of a n electrode and a method for the electrochemical detection of arsenic (III), known as a very toxic pollutant, from aqueous solutions. Also, the working electrode (WE) and the procedure can be applied both for the detection of other pollutants from water (e.g., heavy metals, organic pollutants) and for other applications (e.g., pharmaceutical analysis, food quality control and safety, clinical analysis). The problem solved through this patent consists on the elaboration of a product and a process based on an electrochemical procedure for fast detection of arsenic (III) from aqueous solutions using an electrode made from relatively inexpensive materials, viable and exhibiting high electroanalytical performances as limit of detection, sensitivity, reproducibility, accuracy.



Electrode composition  
(CNF/Ag)



Square-wave voltammetry procedure

**Step I. Cathodic reduction:**  $\text{As}^{3+} + 3\text{e}^- \rightarrow \text{As}^0$

working conditions: - applied potential: -0.4 V/SCE

- time: 120 seconds

**Step II. Anodic stripping:**  $\text{As}^0 \rightarrow \text{As}^{3+} + 3\text{e}^-$

provides the electrochemical response corresponding to the detection of arsenic (III) at the potential of -0.01 V / ESC by square wave voltammetry application.

+  $\text{Ag}(\text{NO}_3)$

**Electrochemical deposition**

$E = -0.4 \text{ V/SCE}$   
 $t = 60 \text{ s}$

- The electrode and the procedure of fast arsenic (III) electrochemical detection from aqueous solutions according to the invention consists on using an electrode, called working electrode (WE), in an assembly together with a counter electrode (CE) and a reference electrode (RE), and based on the anodic stripping method and by applying the square wave voltammetry technique in the presence of a supporting electrolyte for the detection of arsenic (III) from a contaminated water through the electrochemical response of the working electrode in the presence of the target pollutant. The WE is a composite electrode obtained by carbon nanofibers dispersion in an epoxy matrix, followed by the electrochemical modification of the electrode surface with silver particles.
- The process and the electrode for rapid electrochemical detection of arsenic (III) in aqueous solutions according to the invention have the following advantages: very high electroanalytical performances (i.e., limit of detection, sensitivity, reproducibility, accuracy), low costs of materials used for the working electrode construction, long life use (at least 1 year).
- This method allowed determining As(III) concentrations of 5 ppb, 45 ppb and 105 ppb in three groundwater sources from west side of Romania.

# INSTALLATION FOR REMOTE MONITORING OF CORROSION OF THE GROUND CONSTRUCTIONS COATED OR NOT WITH ZINC

U/ 00037 03.08.2020

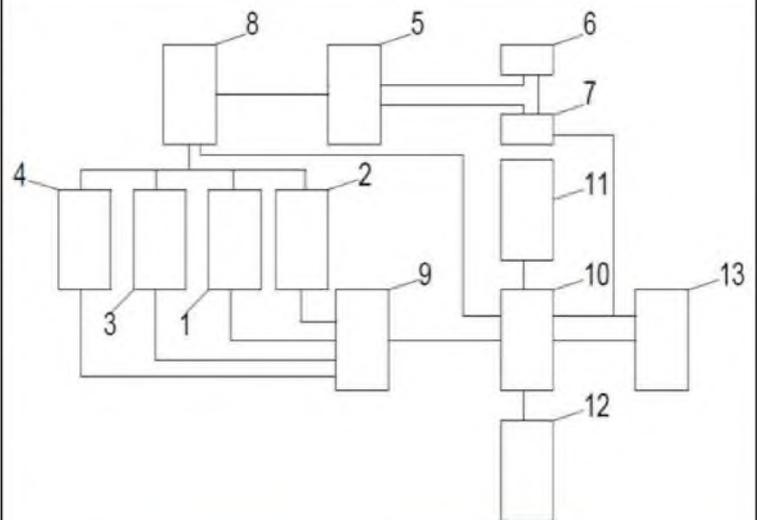
Authors: Pavel Ștefan, Ungureanu Daniel-Viorel, Bînzar Alexandru, Moldovan Aurel

### DESCRIPTION

Installation for real-time remote monitoring of ground constructions coated or not with zinc. The technical issue solved by this invention, consists in making an installation for real – time remote monitoring of the coated or no coated ground metal constructions found at predetermined depths and data recording, transmission of the obtained data and archiving it.

### ADVANTAGES:

- Ensures remote monitoring of the installation;
- Provides recording, saving, archiving and real-time data transmission;
- Provides remote control.



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# ELECTRICAL INSTALLATION FOR AIR AND SURFACE DISINFECTION FROM THE PUBLIC TRANSPORT

**U/ 00024 24.06.2020**

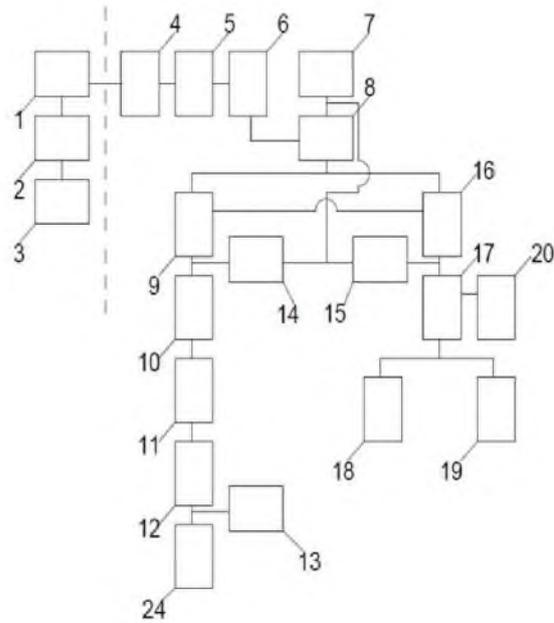
autori: Pavel Ștefan, Ungureanu Daniel-Viorel, Bînzar Alexandru, Tutelcă Ancuța Letiția, Suciuc Silviu Cristian, Popoiu Călin Marius

**DESCRIPTION**

The technical problem which is solved by the invention, consists in realization of a fixed electrical installation which is used for surface and air disinfection with UVC ultraviolet radiation from the public transport, mounted on the ceiling of the transportation vehicle, powered by the electrical source of the public transport vehicle. The command of the disinfection installation can be executed manually or via Wi-Fi, from a predetermined distance

**ADVANTAGES:**

Being a fixed technical solution, located on the ceiling of the vehicle and powered by the electrical source of the public transport vehicle, compared to other types of similar solutions, for the same disinfection effect, it offers a lower manufacturing and operation costs. It uses three UVC germicidal lamps (26), two at the wavelength of 253.7 nm, and one at the wavenlngth of 183 nm [3], UVC radiation generators and ozone. The disinfection lamps are incorporated in an assembly protected by a slotted stainless steel with rhomboidal slots (perforations), expanded (successive “zig-zag” L-bends), with multiple reflection surfaces for the dispersion of the radiation into the device, for air disinfection, and into the exterior, onto the surfaces which necesits disinfection found inside the space of the public transport vehicle. The installation operates, disinfects the air and the surfaces, within 10 minutes, during the intended break of the tram driver or the bus driver, at the end of the public transportation vehicle route, place where the Wi-Fi transmitter is mounted and/or in the depot.



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# EARTHING ELECTRODE WITH CORROSION RESISTANT CONNECTIONS

**A/ 00757/28.09.2018**

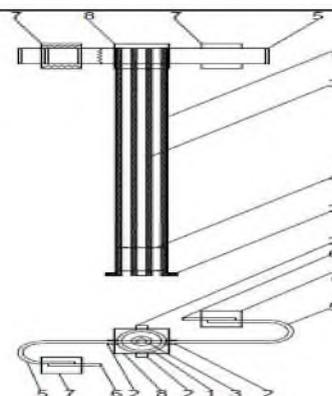
authors: Pavel Ștefan, Ungureanu Daniel-Viorel, Mocan Marian Liviu, Doboși Ioan Silviu, Topală Florin-Ionel

### DESCRIPTION

The electrode consists of some concentric tubes, an outer galvanized steel tube, and an inner galvanized steel tube joined to the bottom by welding with a plate, and at the top by a flattened metal plate in the shape of „S”, so that the connections are made through the heads of the flattened metal plate through welding with the flattened horizontal metal plate of the earthing installation. The connection are covered with bitumen inside a plastic corrosion protection box and the top of the electrode assembly, the connection area between the electrode’s flattened metal plate, and the horizontal earthing installation flattened metal plate has and access zone for periodic checks and measurements. The externally galvanized steel tube provides, at a limited length, at least 4 equidistant longitudinal grooves that allow the material of the tube so that on said tube some wings materialize, transversely on its axis, in the form of a rosette, which defines a larger contact surface of the galvanized steel tube with the soil.

### ADVANTAGES

- *Allows a better contact with the soil;*
- *Provides through a lower electrical resistance, a better passage and dissipation of the lightning surge through the soil ;*
- *Provides anticorrosive protection for the horizontal earthing flattened metal plate joining pieces*
- *Ensures a simpler assembly work so that the possibility of friction with the soil is removed, implicitly the removal of the zinc coating.*



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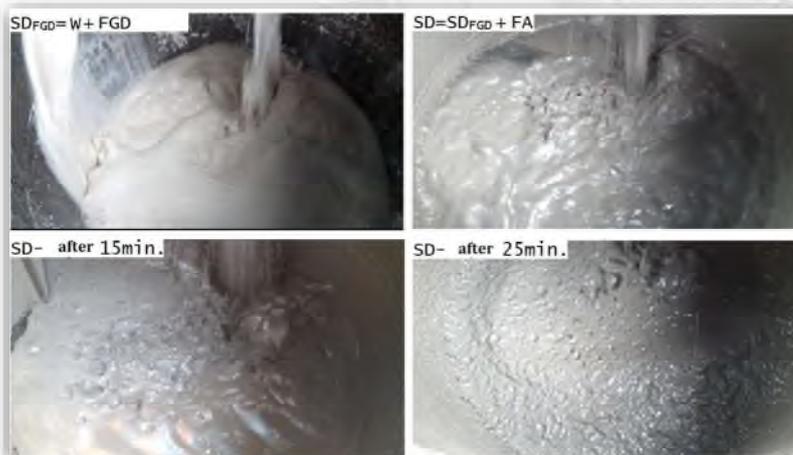
## PROCESS FOR INTEGRATING THE DRY DEFLECTION BY-PRODUCT INTO THE DENSITY SLAM RECIPE FOR HYDRAULIC TRANSPORT THROUGH PIPE SYSTEMS

RO 20131485A0

Authors: **WÄCHTER** Mihail Reinhold, **IONEL** Ioana, **NEGREA** Petru

The invention relates to a process for integrating the by-product resulting from dry desulfurization by applying the dense sludge technology for hydraulic transport through piping systems, as all the storage in the dump of the desulfurization by-product resulting from the technological process of flue gas treatment related to coal-fired power plants. The field of the invention is that of environmental protection.

The process does not influence the self-hardening properties of dense sludge, prevents the deposition phenomena on the walls of transport pipes, reduces the cost of transport and storage of desulfurization by-product, involves a low implementation cost, has a low energy consumption in operation compared to other methods and does not pollute the environment. Added to this is the outstanding light immunity, which allows for reliable results even outdoors and under suddenly changing lighting conditions. The corrective power of the glasses can also be adapted to the wearer, and the eye tracking glasses can be comfortably worn with contact lenses. With the very short calibration time compared with other options, the glasses can be quickly adapted to the wearer and made ready for use. Once calibrated, the Eye Hyper-Tracking glasses can be used again and again for hours at a time – comfortably and unobtrusively.



AD=additive;  
FA=electrofilter fly-ash;  
SD=dense sludge;  
FGD=by-product of dry  
desulfurization;  
W=water.

Applications: The dense sludge prepared according to the process described according to the invention solves the problem of preparing the dense sludge recipe, which also includes the desulphurization by-product, resulting in a slurry fluid, capable to be hydraulically transported through pipes to the slag and ash depot, specific to coal thermal power plants. According to the experimental results, it is found that the process of integrating the dry desulfurization by-product into the dense sludge preparation recipe according to the invention provides a technological solution for the hydraulic transport of the dense sludge containing dry desulfurization by-product.

Contact: [wachter\\_reinhold@yahoo.com](mailto:wachter_reinhold@yahoo.com); +40 742 171 963

# INSTALLATION FOR THE EVALUATION OF THE MAGNETIC FIELD EXPOSURE EFFECTS

**A/ 00336/15.05.2018**

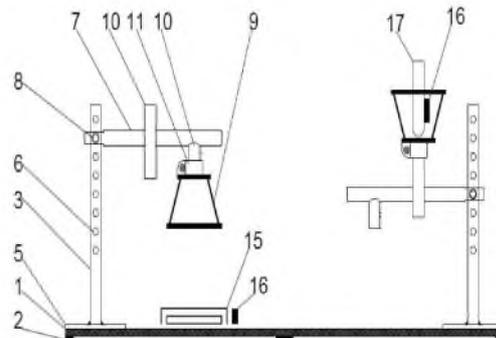
authors: Pavel Ștefan, Lupa Lavinia Afrodita, Mocan Marian Liviu, Ungureanu Daniel-Viorel, Doboși Ioan Silviu, Moldovan Aurel, Simina Alina Georgiana, Bînzar Alexandru, Suciu Silviu Cristian

## DESCRIPTION

The invention relates to an installation which can be used to evaluate the effects of a oscillating, pulsed, low frequency magnetic, 20÷70 Hz, and adjustable intensity on the cells of a biological sample: extracted tissue, organic fluid, living organism, seeds. The installation according to the invention consists of a support plate on which at least two perpendicular supports are positioned, depending on the number of workstations required to perform the study. On each arm attached to the support it is fixed an inductance, which can be positioned and fixed both in perpendicular plane for approach or distancing of the work sample so as to obtain the desired intensity of the magnetic field, as well as horizontally plane by sliding or (and) by rotation on the mounting support in front of the studied sample. The adjustable power source is controlled by a scheduler and connected to a variable frequency rectangular pulse generator.

## ADVANTAGES:

- Ensures the possibility of performing experiments under controlled exposure conditions;
- Allows evaluation of the effects of a low frequency magnetic field, 20 ÷ 70 Hz, on the sample cells under specific exposure conditions;
- It is a compact, unitary, portable investigation tool and it doesn't require any auxillary measuring and recording equipment;
- It provides flexibility in configuration, depending on the investigation needs, simplicity and safety in operation.



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# ELECTRICAL LIGHT INSTALLATION FOR DENTAL ESTHETICS

**U/00018 28.04.2017**

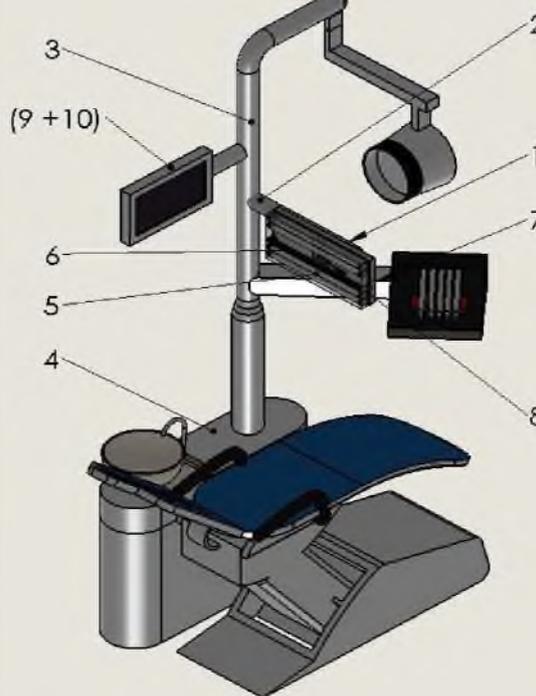
autori: Pavel Ștefan, Krems Cristina, Mocan Marian Liviu, Doboși Ioan Silviu

## DESCRIPTION

*The invention relates to a fixed electrical lighting installation used in the dental cabinets which provides illumination to the dental area of the patient, illumination which is very close to the daylight parameters. The installation is made up of a mobile metal body made from a mirror coated inoxidable steel, attached to the dental pillar unit, in which 5 lamps with the true color rendering index are mounted, 97 Ra8 and the color temperature of 5300<sup>0</sup>Kelvin, a black light type of lamp, and between the lamps is mounted a camera connected to a computer with the monitor fixed (optionally) on the dental pillar unit.*

## ADVANTAGES:

- Ensures transparency in the incisal zone of the teeth;
- Ensures an illumination very close to the daylight parameters on the dental work area ;
- It ensures that the teeth are photographed with an illumination very close to the daylight parameters before and after the medical procedure of dental aesthetics;
- It ensures a better color setting in dental aesthetics.



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# Automatic siphon installation

Patent A 00492, 04.08.2020

Authors: Popa Gabriel Nicolae, Popa Iosif

Description: The invention relates to a hydraulic installation which can be used to transfer a liquid between two basins, the first for storage and the second for feeding consumers, located at different levels at which the route of the supply pipe must pass, due to natural causes, over the water level in the accumulation basin. The hydraulic flow pump is used for a short time, and the principle of the siphon is used to transfer the liquid. The proposed installation has the role of transferring the liquid between two basins by achieving a significant saving of electricity. The hydraulic installation is connected between three basins: two main basins and one for filling and aeration of small capacity (Fig.1.a). The control of the siphon system can be done with microcontroller or PLC (Figs.1.b,c).

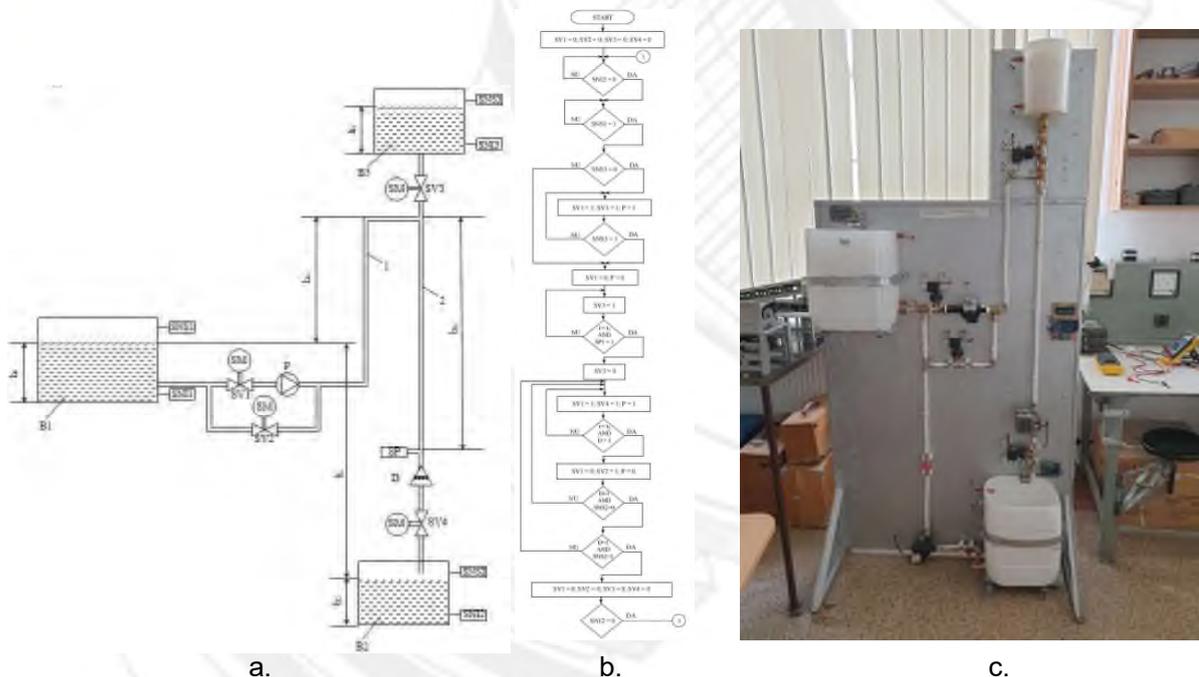


Fig.1. a. Block diagram of the automatic siphon system can have various fields of use; b. The flowchart of the program; c. Picture of the laboratory stand.

The automatic siphon system can have various fields of use:

- at the drinking water supply installations of the localities;
- in mining operations;
- other industrial branches;
- in agriculture.

**Contact:** Popa Gabriel Nicolae, e-mail: [gabriel.popa@fih.upt.ro](mailto:gabriel.popa@fih.upt.ro), tel. 0040254207541



# Economical system for automatic adjustment of the power factor, with capacitor banks, in three-phase low-voltage installations

Patent A 00491, 04.08.2020

Authors: Popa Gabriel Nicolae, Diniș Corina Maria, Popa Iosif

The invention relates to an economical system for automatic regulation of the power factor with capacitor banks in three-phase low-voltage installations. The technical problem is the realization of an economical system of automatic regulation of the power factor, with capacitor banks, from three-phase low voltage installations, which uses a three-phase static electronic power relay common to all stages of capacitor banks. To improve the power factor in three-phase low-voltage installations. It consists of a current transformer (which measures current in a phase), a VAR-metric controller with microprocessor, two small capacity PLCs, a three-phase static electronic power relay, twelve electromagnetic contactors and six capacitor banks.

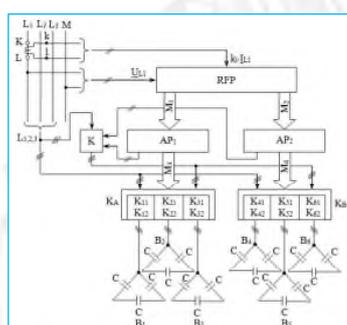


Fig.1. Block diagram of the economic system for automatic adjustment of the power factor

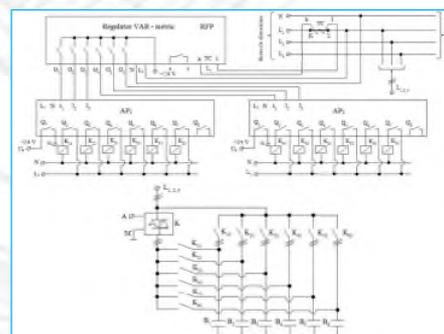


Fig.2. Wiring diagram of the economic system for automatic adjustment of the power factor

The advantages of the invention are the following: the currents at the connection of the capacitors are much diminished, from (20-50) xIn to In; switching is done at zero voltage; no electric discharge occurs at switching; high reliability; lower costs than when using a three-phase solid state relay for each capacitor bank; very high input/output isolation voltage; does not generate disturbing electromagnetic fields; superior service life compared to systems where the connection of capacitor banks is made with conventional contactors.

**Contact:** Popa Gabriel Nicolae, e-mail: gabriel.popa@fih.upt.ro, tel. 0040254207541

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***Technical University of Cluj-Napoca***

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• **Title**

**VARIABLE RELUCTANCE MOTOR WITH OUTER ROTOR AND MODULAR CONSTRUCTION FOR E-BIKE**

• **Inventor/s - Contact**

Nicolae Florin Jurca, contact: Florin.Jurca@emd.utcluj.ro

Răzvan Alexandru Ințe, contact: Razvan.Inte@mae.utcluj.ro

• **Patent/ Application number**

Patent OSIM: R0131721 -B1/30.03.2020

• **Short presentation**

The patent refers to a variable reluctance synchronous motor with outer rotor and modular construction. The rotor is made up of six modules, between modules is an element of non-magnetic separation. Each module is made up of three separate magnetic elements fixed to each other by a dovetail joint. The connecting elements are made of non-magnetic material. Each pole rotor is provided with holes that allow attachment of 3 different lengths of spokes on the same module. Each spoke is fixed by means of safety spring pin. Using this motor with outer rotor and modular construction, facilities maintenance operations for a such systems making them more reliable and simple. Depending on the type of defect can be removed the entire motor or only components (rotor poles, spokes).

• **Applicability**

This type of machine is designed to propel small electric vehicle as an electric bike. The electric machine will be mounting in the wheel to obtain a high efficiency of the mechanical transmission. The advantage of the machine is the simple maintenance which can be achieved by anyone thus is perfect suitable for an electric bike.

• **Images**

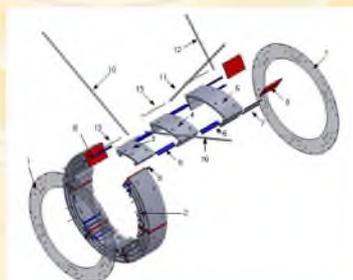


Figure 1. Spatial view of the motor with all the elements in details.



Figure 2. Spatial view of a bike wheel with the electric machine incorporated



Figure 3. Prototype machine

⚙️ **Title**

**SPHERICAL ROBOT FOR THE MEDICAL REHABILITATION OF THE PROXIMAL AREA OF THE UPPER LIMB**

⚙️ **Inventor/s - Contact**

Vaida Calin, Plitea Nicolae, Pisla Doina, Carbone Giuseppe, Gherman Bogdan, Ulinici Ionut, Pisla Adrian  
CESTER, Technical University of Cluj-Napoca, Romania

Prof. dr. Ing. Doina Pisla, doina.pisla@mep.utcluj.ro, Prof. Dr. Ing. Calin Vaida, calin.vaida@mep.utcluj.ro

⚙️ **Patent/ Application number**

Patent OSIM: RO132233 -B1/30.03.2020

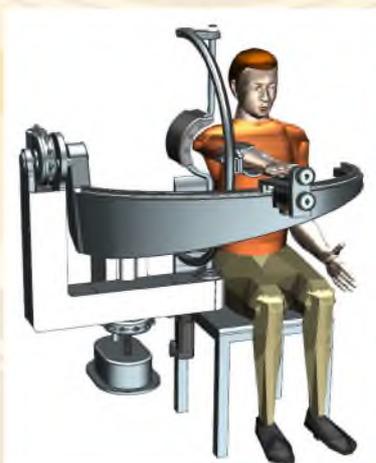
⚙️ **Short presentation**

The invention relates to a spherical robotic system for the rehabilitation of the proximal zone of the upper limb, containing three active couplers for the purpose of reproducing the abduction/adduction and flexion/extension of the shoulder in the horizontal and vertical plane and reproducing the forearm pronation/supination in the vertical plane. The invention is directed towards post-stroke patients suffering from paralysis at the level of the upper limb following stroke, but its use may be extended to other afflictions that result in the partial or total loss of upper limb mobilization capacity. The robot has three degrees of freedom, achieved through three active rotation joints that have the axis intersection in a single point, more specifically the centre of a sphere, which relative to the patient will be transposed over the centre of rotation of the shoulder joint, for the first two rotations, and the third being done around the midline of the upper limb.

⚙️ **Applicability**

Medical rehabilitation for patients with upper limb brachial monoparesis caused by a neurological disease. In the figures below the roadmap towards a successful product is shown, starting from a patient centred design to the development of the experimental model and its validation in an 5 months long clinical study.

⚙️ **Images**



⚙ **Title**

**PARALLEL ROBOTIC SYSTEM FOR THE MEDICAL REHABILITATION OF THE UPPER LIMB**

⚙ **Inventor/s - Contact**

B. Gherman, D. Pisla, N. Plitea, C. Vaida, G. Carbone, A. Pisla, A. Banica  
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Prof. dr. Ing. Doina Pisla, doina.pisla@mep.utcluj.ro, Assoc. Prof. Dr. Ing. Bogdan Gherman, bogdan.gherman@mep.utcluj.ro

⚙ **Patent/ Application number**

Patent OSIM: RO132234 -B1/30.03.2020

⚙ **Short presentation**

The invention relates to a robotic system for the medical rehabilitation of the upper limb, having a modular structure, each module having a parallel architecture, with two degrees of freedom. The first module (fig. 1) has been designed for the mobilization of the forearm (achieving the elbow flexion) and for performing training exercises for the rehabilitation of the pronation/supination motion. It uses a universal joint and a spur gear mechanism for motion transmission to the end-effector, a custom designed ergonomic handle. The second module (fig. 2) has been designed for the rehabilitation of the patient's wrist, namely flexion/extension and abduction/adduction motions, using a spherical motion of the patient's hand around his/hers wrist.

⚙ **Applicability**

The specific application of this invention consists in the treatment of the stroke related impairments of the upper limb and brachial monoparesis. The advantages of the robotic system presented in this invention consist in a great range of motions, modularity, while the parallel architecture increases the stiffness and payload capacity. A complex human-robot interaction has been developed to achieve a great variety of rehabilitation exercises using different control types like: passive, active, assistive, active-assisted, corrective, path-guidance and resistive. The system has been validated in a hospital, with patients, for a period of 5 months.

⚙ **Images**



Fig. 1



Fig. 2



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## Title

### WIPING DEVICE OF SURFACE OF THE STEEL WIRE AFTER GALVANIZING



## Inventor/s - Contact

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## Patent/ Application number

Patent OSIM: RO130512 -B1/30.01.2020



## Short presentation

The patent relates to a device for wiping the surface of steel wire after galvanizing

This device, which will finally create a thin but strong zinc layer shiny appearance.

It is known that by immersing a steel wire in a molten Zn bath,

on its surface are formed seven concentric layers of Fe-Zn alloy having a matte appearance; the phases formed differing by micro- hardness, by mode of crystallization and (of course) by their chemical composition.

The basic, incipient ideas for achieving of this device refer to:

1. Proper wiping of the wire on which the zinc is deposited
2. Sudden cooling of the whole assembly: deposited steel-zinc wire

In these moments is used to wipe the surface of the steel wire after galvanizing, a different technique variant, in a horizontal version where some pills of asbestos are pressed on the outer surface of the wire, the wire following an ascending path (given by the its pulling system of accumulation) after its exit from the molten zinc bath.

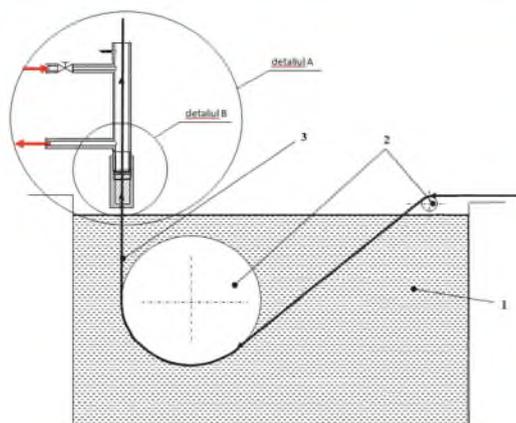


## Applicability

In the metallurgical industry, when obtaining galvanized steel wire



## Images



Vedere de ansamblu a dispozitivului de ștergere a suprafeței sârmei de oțel, după zincare, a vanei și a sârmei de oțel supusă ștergerii



Vedere de ansamblu (în manieră explodată) a detaliului A

⚙ **Title**

**MULTILAYERED COMPOSITE PANEL AND THE METHOD USED FOR OBTAINING IT**

⚙ **Inventor/s - Contact**

TĂMAȘ-GAVREA Daniela-Roxana, IȘTOAN Raluca, TIUC Ancuța Elena

⚙ **Patent/ Application number**

Patent OSIM: R0133261 -B1/30.04.2020

⚙ **Short presentation**

The invention relates to a multilayered composite panel and the method of obtaining it. The panel has two rigid perlite-based boards, reinforced with natural flax fiber nets, with a compact layer of flax fiber between them, using white cement as a binder. The purpose of the panel is to improve the quality of life and human health in buildings' environment by providing optimum acoustic comfort based on users' requirements.

The acoustic absorption coefficient of the non-perforated composite panel is high at medium frequencies. The peak of sound absorption coefficient of 0.98 is reached at the frequency of 500 Hz.

In order to optimize the sound absorbing properties of the multilayered composite panel, perforations were made on one of the rigid boards of the panel. Thus, perforated panels have acoustic absorption coefficients above 0.70 for a wider frequency range, of 500-3000 Hz. The maximum absorption coefficient is 0.98 at the frequency of 900 Hz.

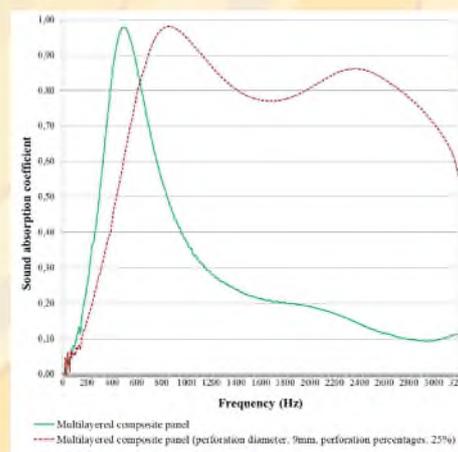
⚙ **Applicability**

The invention consists in obtaining of a multilayered composite panel for vertical partition walls in buildings, with acoustic properties comparable to the existing sound absorbing composites by using flax, which is a viable natural alternative to synthetic fibers.

⚙ **Images**



Multilayered composite panel



Sound absorption coefficient variation

**Title**  
**PROGRAMABLE METHOD FOR CURRENT SENSOR FAULT DETECTION OF 3-PHASE ELECTRONIC INVERTERS**

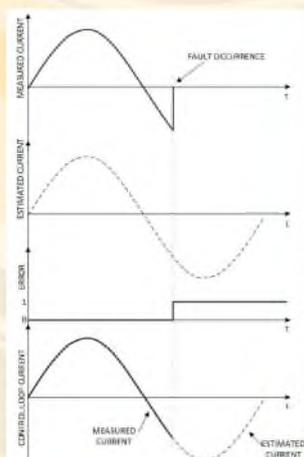
**Inventor/s - Contact**  
 MIRCEA RUBA  
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**Patent/ Application number**  
 Patent OSIM: R0132781 -B1/30.12.2020

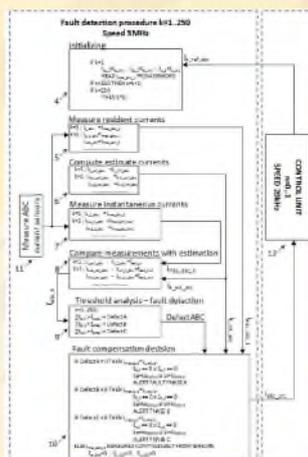
**Short presentation**  
 The invention refers to a method of detecting the current sensors faults of 3-phase inverters that is running at a rate of 250 time higher than the rate of the actual control loop. It permanently monitors readings from the sensors and computes the difference between the reference values and the actual measured ones. The difference than is compared with an adaptive threshold. The comparison yells if a fault occurred on a certain sensor and decides the replacement of the faulted measurement with an estimated one and also modifies the gains of the control loop's PI regulators, adapting them to the new operational regime. In the same time, it stops the fault detection procedure for a certain period of time till the eventual occurred transient due to the current replacement passes. By this, the detection, isolation and compensation of the fault occurred is handled by the strategy in-between two consecutive iterations of the actual inverter control loop. The fault detection procedure executes 250 calculations (detection) between two consecutive calculations of the control loop.

**Applicability**  
 The invention is dedicated for the most used type of electronic inverters used in industry, green energy as well as in automotive industry. It refers to 3-phase inverters that are always equipped with current sensors on at least 2 or even all the 3 phases. The method can very easily be used to detect and compensate line current faults as the exact same approach is applied in order to monitor the currents passing via the sensors.

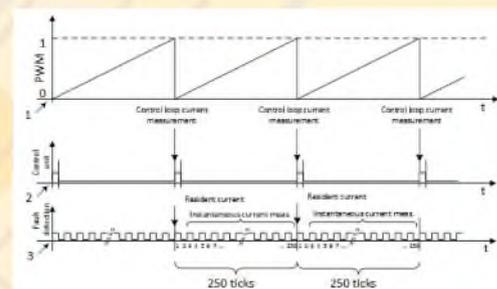
**Images**



The detection, isolation and replacement of the faulted measured current with the estimated one



The fault detection/isolation/compensation algorithm with block diagrams



The speed difference computation frequency between the fault detection and inverter control loop



**Title**

**STAND FOR STUDY OF TRIBOCOROSION**



**Inventor/s - Contact**

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**Patent/ Application number**

Patent OSIM: RO130936 -B1/30.12.2020



**Short presentation**

The invention consists of an experimental stand for the determination of surfaces tribocorrosion. The experimental stand for the study of tribocorrosion offers technological and building simplicity. It allows precise measurement of frictional force and other tribocorrosion parameters. It allows adjustment of working parameters, positioning and fixing of electrodes for the corrosion study. The synergistic action of tribocorrosion factors leads to surface degradation and hence loss of material, the result being superior to that obtained by simply summing up the individual degradation processes. The patent will be useful in determinations of tribocorrosion resistance of various machine parts which are working in both corrosive and wear environment.

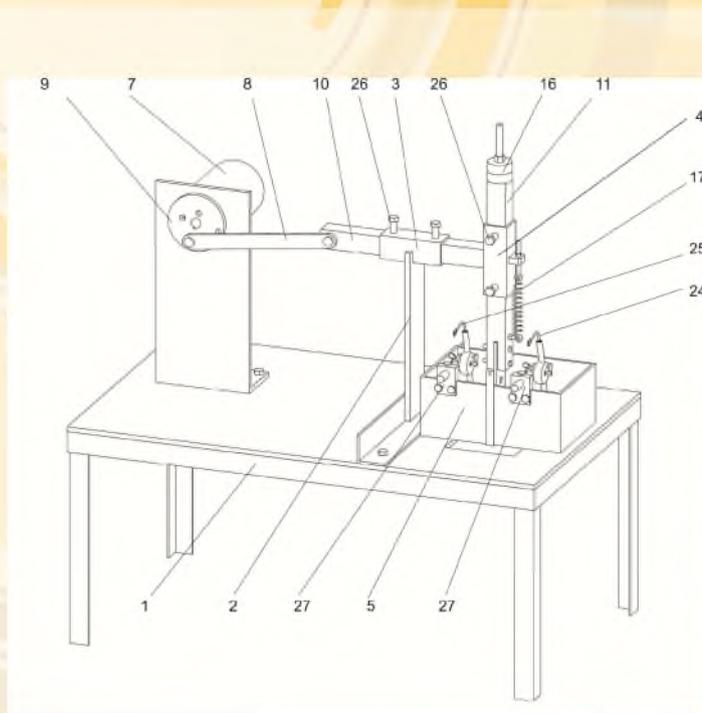


**Applicability**

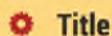
The invention is applicable in the automotive industries; mechanical installations, electrical engineering, aeronautics, car manufacturers, civil engineering.



**Images**



1. table;
2. Support;
3. horizontal translation mode;
4. vertical translation mode;
5. tribocorrosion cell;
6. study sample;
7. gear motor;
- 8, 9 connecting rod-crank mechanism;
- 10, 11 mobile assembly;
12. polygonal guidance;
13. lamellar arc;
14. insulating support;
15. glass ball;
16. weights;
17. stretching spring;
- 18, 19. eye screw;
- 20 nut;
21. gasket;
22. working electrode;
23. tensometric translators;
24. reference electrode;
25. auxiliary electrode;
26. Screws;
27. Support



### Title

## SYSTEM FOR FIXING PLASTIC BOTTLES IN ROTARY TIGHTNESS TESTING APPARATUSES



### Inventor/s - Contact

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miorita.ungureanu@cunbm.utcluj.ro



### Patent/ Application number

Patent OSIM: RO133200 -B1/28.08.2020



### Short presentation

The invention relates to a system for fixing plastic bottles in rotary tightness testing apparatuses while maintaining the bottles in vertical position in transport means and ensuring their transfer from one transport means to the other. According to the invention, the system comprises three devices: the rotary bottle fixing device consisting of a metal drum on which a profiled rubber bush and two identical bottle fixing linear devices consisting of two vertical drums on which a profiled rubber belt.

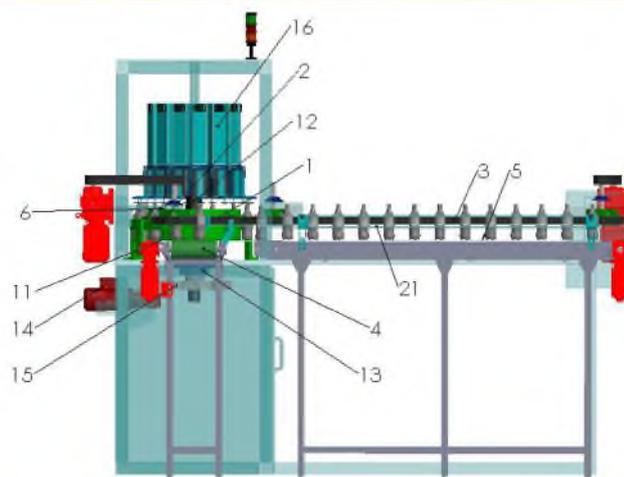


### Applicability

The invention proposes a flexible system for fixing the bottles on the means of transport of the rotary apparatus of high speed testing of plastic bottles for the detection of possible leaks. A problem of these devices is the transport of the bottles without being deformed and their maintenance in a vertical position.



### Images



• **Title**

**ADAPTIVE SYSTEM DESIGNED TO ENSURE ELECTRIC POWER QUALITY IN LOW VOLTAGE NETWORKS**

• **Inventor/s - Contact**

Sacerdotianu Dumitru, Nicola Marcel, Ivanov Sergiu, Ciontu Marian, Chindriș Mircea Dorin, Cziker Andrei Cristinel, Radu Alexandru, Dumitrescu Camil-Sorin.

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• **Patent/ Application number**

Patent OSIM: RO132402 -B1/28.08.2020

• **Short presentation**

The invention relates to an adaptive system that compensates for most of the supply voltage disturbances (mainly harmonics, unbalance, dips and swells, slow and fast fluctuations of short or long duration), respectively of the electric current (mainly harmonics and unbalance), in low voltage electrical networks. The system consists of two active filters: one is connected in parallel with the electrical network and the load; the other one is connected in series with the electrical network. Each asset is made up of two voltage source inverters, interconnected through a joint DC voltage circuit. The installation of this equipment ensures a satisfactory quality of the electricity supplied to the consumers as follows:

- Supply voltage in the imposed range
- Voltage unbalance less than 2%
- Voltage THD less than 8%
- Current THD less than 5%
- All voltage and current harmonics in the limits imposed by the present norms
- Compensation of single-phase voltage dips with depth up to 70% and duration up to 180 ms
- Compensation of three-phase voltage dips with depth up to 50% and duration up to 90 ms.

The proposed system ensures increased response speed to compensate for disturbances by constantly monitoring the electrical quantities in the network and adapting the control in real-time to optimize operation. In addition, the equipment provides a power factor of the unit at the connection point.

• **Applicability**

The adaptive system for electric power quality improvement is used in low voltage networks to ensure their correct operation in accordance with existing regulations. It is extremely useful especially in weak networks or in alternating voltage microgrids that contain numerous electronic equipment. In both cases, significant violations of normal operating conditions may occur. Other fields of use are ensuring the quality of electricity in the connection points of generation assets based on renewable resources, respectively of sensitive or disruptive consumers.

Supplementary, the equipment provides the required reactive power in the connection point.

• **Images**





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**Title**

**INDUCTION MACHINE WITH ROTOR IN MODULAR CONSTRUCTION**



**Inventor/s - Contact**

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Răzvan Alexandru Ințe, contact: Razvan.Inte@mae.utcluj.ro

Dan-Cristian Popa, contact: Dan.Cristian.Popa@emd.utcluj.ro



**Patent/ Application number**

Patent application OSIM: A/00341/18.06.2020



**Short presentation**

The conception of the induction machine with rotor in modular construction is based on building the short-circuit rotor of the most used electric machine at industrial level from modules in which aluminum bars are placed. Modules are fixed to the rotor yoke, common to all modules, by dovetail clamps. The shape of the modules is of such a nature as to allow their fixation on the yoke. The short circuit ring will be fixed to the bars using the two holes with which each bar is provided at the ends.

The proposed induction machine, with the rotor in modular construction, retains all the operating characteristics specific to this type of electric machine. The advantage of this rotor construction is the reduction of the time and maintenance cost of such a structure.



**Applicability**

Industrial areas in which induction machines are used in classical construction, but especially those in which the loads are constantly of high values and the risk of failure of the rotor bars is higher.



**Images**

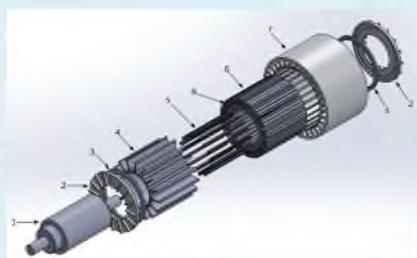


Fig.1

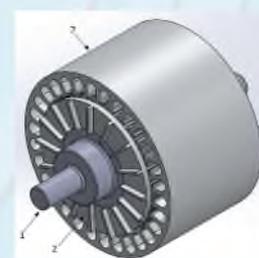


Fig. 2



Fig.3

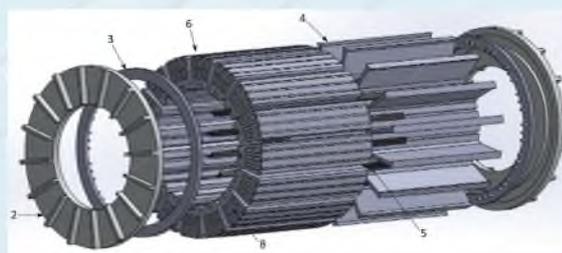


Fig. 4



**Title**

**REAR LOCATED AERODYNAMIC DEVICE FOR RIGID TRANSPORT SEMI-TRAILERS**



**Inventor/s - Contact**

Mariasiu Florin, Scurtu Liviu Iacob, Varga Bogdan Ovidiu



**Patent/ Application number**

Patent application OSIM: A/00714/09.11.2020



**Short presentation**

The invention relates to a rear aerodynamic device for rigid semi-trailers (with rigid walls) in the composition of a road freight train, which reduces the value of its aerodynamic coefficient. The rear aerodynamic device for rigid transport semi-trailers is characterized by the fact that the active operating principle is based on the use of variable geometric shapes (aerodynamic cushions) located at the rear of a rigid semi-trailer, made of a waterproof elastic material (rubber), which allows it to swell with compressed air until the desired shape is obtained.

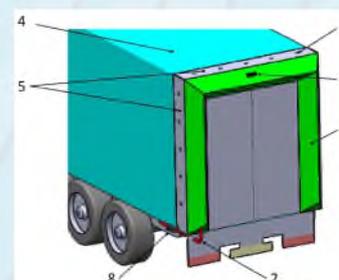
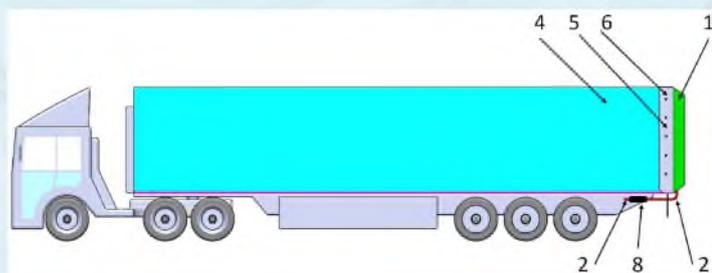


**Applicability**

The applicability of the device in the road transport industry derives from the need to carry out the transport process in the best conditions of economic efficiency (achieved by reducing fuel consumption) and indirectly by reducing the pollutant emissions caused by road transport.



**Images**



**Legend:**

- 1- aerodynamic cushion
- 2- pipes
- 4- rear of the semi-trailer
- 5- side folds

- 6- mounting holes,
- 7- safety valve,
- 8- command and control system



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**Title**

**SUPERIOR LOCATED AERODYNAMIC DEVICE FOR RIGID TRANSPORT SEMI-TRAILERS**



**Inventor/s - Contact**

Mariasiu Florin, Scurtu Liviu Iacob, Varga Bogdan Ovidiu



**Patent/ Application number**

Patent application OSIM: A/00716/09.11.2020



**Short presentation**

The invention relates to a superior located aerodynamic device for rigid semi-trailers in the composition of a road freight train, which reduces the value of its aerodynamic coefficient. The superior located aerodynamic device for rigid transport semi-trailers is characterized by the fact that the active operating principle is based on the use of variable geometric shapes (aerodynamic cushions) located at the superior part of a rigid semi-trailer, made of a waterproof elastic material, swell with compressed air until the desired shape is obtained.

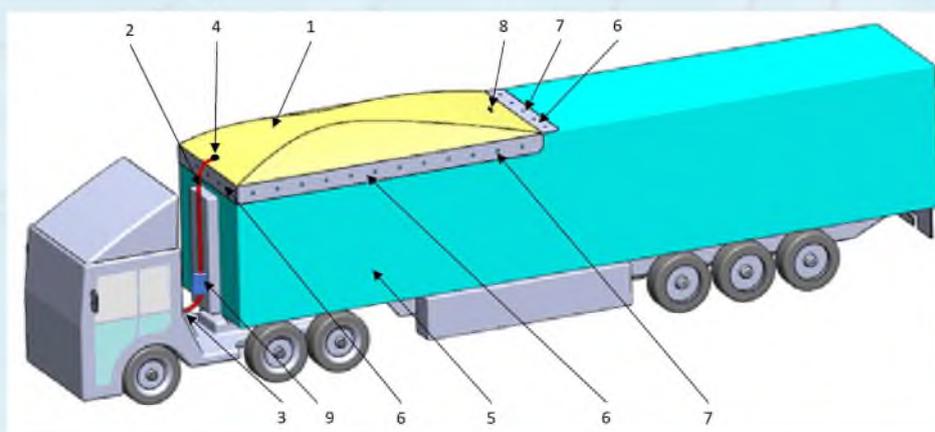


**Applicability**

The applicability of the device in the road transport industry derives from the need to carry out the transport process in the best conditions of economic efficiency (achieved by reducing fuel consumption) and indirectly by reducing the pollutant emissions caused by road transport.



**Images**



Legend:

1- aerodynamic cushion

2- pipes

3- compressed air system of the road train

4- pneumatic coupling system

5- front part of the semi-trailer

6- side folds

7- mounting holes

8- safety valve

9- automatic command and control system



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**Title**

**ELECTRONIC EXTREMAL REGULATOR**



**Inventor/s - Contact**

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**Patent/ Application number**

Patent application OSIM: A/00287/26.05.2020



**Short presentation**

The invention relates to an extreme electronic regulator intended for the control of a conventional electronic power converter by which the operation at the maximum power point of an afferent photovoltaic panel is ensured. The regulator contains a generator that produces a triangular disturbance signal that is applied to the control of the electronic power converter, simultaneously with two short pulses, synchronized with the triangular signal. The effects of the disturbance are detected by a power transducer whose output signal is stored in two sample-and-hold circuits (S&H) in alternating successive moments, controlled by the generator pulses. The signal resulting from the decrease of the signals stored in the sample-and-hold circuits is applied to a usual integrating regulator to produce the intermediate control signal which will be added to the triangular signal, thus obtaining the control signal for the electronic converter which will ensure the operation of the photovoltaic panel at the point of maximum power (PPM).



**Applicability**

The application of the invention shows the following advantages:

- simplifying the construction and reducing the price of the extreme regulator that ensures the operation of photovoltaic panels in the Point of Maximum Power (PPM), by avoiding the signal multiplier and by using the usual low-cost electronic circuits;
- increasing the efficiency of medium and low power photovoltaic panels (of the order of tens of watts) by up to 30% (depending on the operating conditions), thus justifying the attachment of the extreme regulator to the electronic power converter;
- increasing the efficiency of photovoltaic panels of any power, due to the robust stability of the algorithm implemented in the extreme regulator, according to the invention.



**Images**

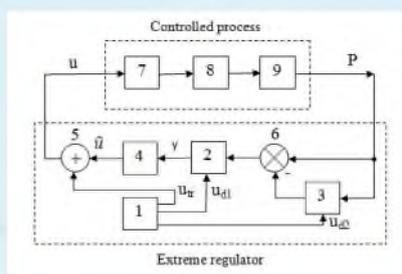


Figure 1. The structure of the extreme regulator and the controlled process

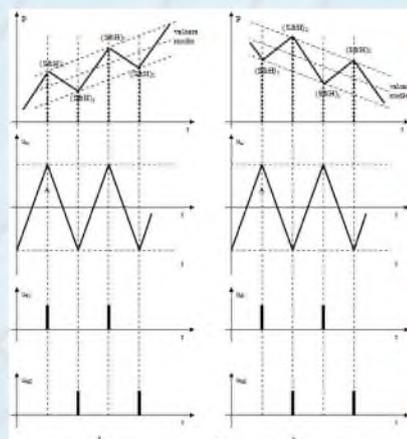


Figure 2. Operation of the extreme controller, according to the invention:  
 a) operation to the left of the maximum power point (PPM);  
 b) operation to the right of the maximum power point (PPM)



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## Title

### COMPLIANT MINI-GRIPPER WITH HIGH FLEXIBILITY



## Inventor/s - Contact

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Noveanu Dan Cristian, [Dan.Noveanu@ipm.utcluj.ro](mailto:Dan.Noveanu@ipm.utcluj.ro)



## Patent/ Application number

Patent application OSIM: A/00103/26.02.2020



## Short presentation

The compliant minigripper (1) with piezoelectric actuator type stack (2), is made with ten flexible couplings (4), identical, with rectangular profile with fillets, arranged symmetrically on the single-block structure, having attached piezoelectric actuators of type band (3) to the clamping kinematic elements (6). The flexible couplings (4) are made by thinning the section of kinematic elements (5), so as to ensure the movement by elastic deformation of the material from which they are made. The body of the compliant mini-gripper (1) is operated by the piezoelectric actuator (2), positioned on the symmetry axis of the structure, which by means of flexible couplings (4) and kinematic elements (5), transmit movement to the clamping kinematic elements (6), which perform the manipulation of objects. The piezoelectric actuators type band (3) fixed to the clamping kinematic elements (6) allow the extension of the workspace. The attachment of the assembly is carried out by the fastening holes (7), which are positioned in such a way that both the piezoelectric actuator and the mini-gripper frame ensure optimal operation.

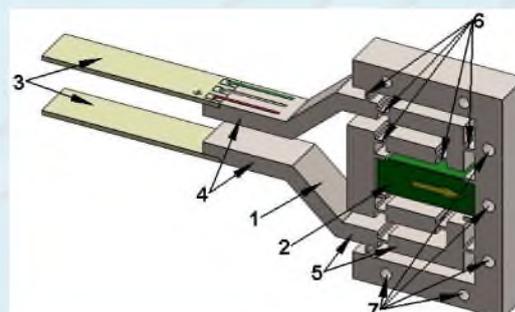


## Applicability

The compliant minigripper with high flexibility is used for precise handling of small objects in mini and microsystem-specific applications, micromanipulation of various shapes objects in different environments. By modifying the geometric shape of the flexible couplings (elliptical, rectangular, parabolic, circular or rectangular with different fillet radii), the choice of the material from which the compliant minigripper is made (steel, brass, polymethylmethacrylate, polytetrafluorethylene, etc.), as well as by the variation of the supply voltage of piezoelectric actuators ensures a wider range of manipulated objects and its use in different environments.



## Images





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**Title**

**LINEAR TUBULAR MOTOR WITH MODULAR CONSTRUCTION FOR DIRECT DRIVING VEHICLE ELECTRICAL POWER STEERING**



**Inventor/s - Contact**

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 Technical University of Cluj-Napoca, 400114 Cluj-Napoca, str. Memorandumului nr. 28, Romania



**Patent/ Application number**

Patent application OSIM: A/00260/14.05.2020



**Short presentation**

The linear tubular motor with modular construction for direct driving vehicle electrical power steering has simple parts. The stator modules are built up of ring type iron core pieces alternated by non-magnetic space holders. Round their yokes concentrated coils are wound, which are connected in series and form a phase of the motor. The mover is passive, and it is constructed by alternating ferromagnetic and non-magnetic rings.

The motor works upon the variable reluctance principle. By sequentially supplying its phases a bidirectional linear movement can be achieved.



**Applicability**

Due to its very simple but robust construction, this linear tubular motor with modular construction is an excellent solution for direct driving the electrical power steering system of any type of vehicle.



**Images**

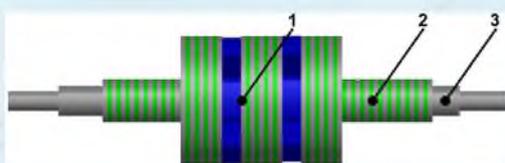


Fig.1

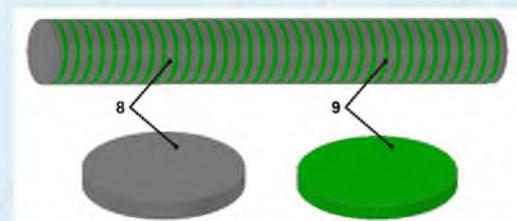


Fig.3

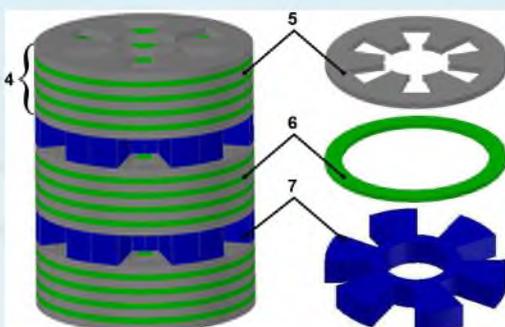


Fig. 2

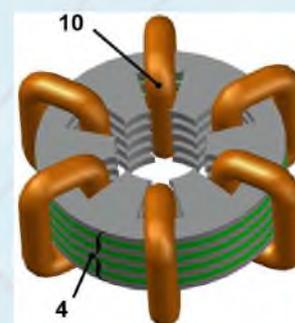


Fig. 4



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**Title**

**DESULFATIZATION, OPTIMIZATION AND APPLICATION TECHNIQUE OF THE SPENT PLATES PROVIDED FROM CAR BATTERY**



**Inventor/s - Contact**

Simona RADA<sup>1,2</sup>, Răzvan OPRE<sup>1</sup>, Andrei PINTEA<sup>1</sup>, Eugen CULEA<sup>1</sup>

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**Patent/ Application number**

Patent application OSIM: A/00531/24.08.2020



**Short presentation**

This patent relates to an efficient desulfatization technique of the spent plates from a lead acid battery by the doping with a suitable content of nickel (II) oxide or double cobalt (II and III) oxide in order to obtain optimized materials which can be used to make new electrodes for batteries. The process according to the invention uses as raw materials: the anodic electrode as source of Pb, the cathodic electrode as source of PbO<sub>2</sub> from a spent car battery with high wear and powder of nickel (II) oxide or double cobalt (II and III) oxide. The mixture of substances in the xNiO (100-x)[4PbO<sub>2</sub>, Pb] or xCo<sub>3</sub>O<sub>4</sub> (100-x)[4PbO<sub>2</sub>, Pb] with x = 8 mol % NiO or 20 mol% Co<sub>3</sub>O<sub>4</sub> chemical formulas is introduced into alumina crucibles, melted in an electric oven and then overturned on a stainless steel plate directly at room temperature. The analysis of the XRD data (see Figure b) indicates: i) the recycling temperature of the spent plates must be achieved at 1050oC because at this temperature takes place the decomposition of the 4PbO PbSO<sub>4</sub> crystallized phase; ii) the disappearance of the sulfated crystalline phases, respectively Pb<sub>2</sub>SO<sub>5</sub> (with the peak of 100 % intensity centered at 26.66 o) and 4PbO PbSO<sub>4</sub> phases below the detection limit of the diffractometer for the doped samples. The cyclic voltammograms (see Figure c) show that the undoped electrode does not give an electrochemical signal while for the materials doped with NiO or Co<sub>3</sub>O<sub>4</sub>, voltammograms have a high degree of irreversibility, especially for the doping with NiO.



**Applicability**

This invention proposes two types of recycled and metal-doped materials for the applications as new electrodes at batteries.



**Images**

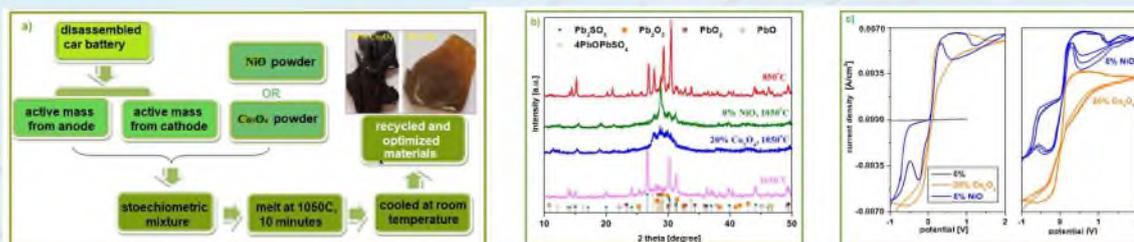


Figure: a) The preparation scheme of recycled and metal-doped materials;

b) X-ray diffractograms of the recycled materials obtained at varied temperature and with different dopant contents;

c) Cyclic voltammograms scanned for first cycle and after three cycles of the electrode materials in electrolyte solution of 5 M H<sub>2</sub>SO<sub>4</sub>.



**TECHNICAL UNIVERSITY**  
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• **Title**  
**BEAMFORMING COMPACT RADIANT SYSTEM**

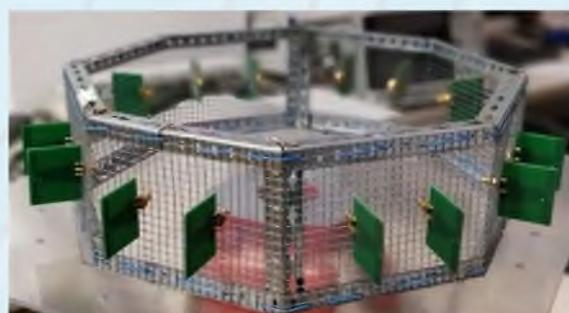
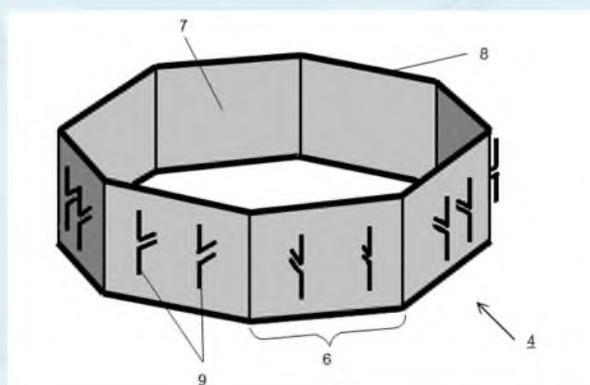
• **Inventor/s - Contact**  
Palade Tudor-Petru, Pastrav Andra-Elena-Iulia, Pușchiță Emanuel-Dumitru, Dolea Paul,  
Cristea Octavian, Dascăl Paul Vlăduț, Rațiu Ovidiu  
Contact: Prof. Tudor Palade, e-mail: Tudor.Palade@com.utcluj.ro

• **Patent/ Application number**  
Patent application OSIM: A/00082/18.02.2020

• **Short presentation**  
The invention describes a compact radiant system with beamforming capabilities. The radiant system, according to the invention, comprises a 1:16 combiner / splitter, a switching / phase shifting block and a radiant element block. The radiant element block comprises eight identical panel antennas, whose reflecting panels form a regular octagonal prism structure, each panel antenna including two open dipoles. The radiation pattern of the radiant system can be modified horizontally to obtain a radiation pattern with a circular symmetry or one that favors a certain direction. The system is controlled digitally, without the need for mechanical modifications of the system.

• **Applicability**  
Radio transmissions, cellular communications, terrestrial wireless communications, radio spectrum surveillance, radio detection, direction finding, target location (RADAR)

• **Images**





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### Title

**SYSTEM AND METHOD FOR WIFI TERMINAL POSITIONING USING ANCHORS EQUIPPED WITH RETRO-DIRECTIVE ANTENNAS**



### Inventor/s - Contact

Palade Tudor-Petru, Pastrav Andra-Elena-Iulia, Pușchiță Emanuel-Dumitru, Rațiu Ovidiu, Dolea Paul, Cristea Octavian, Dascăl Paul Vlăduț  
Contact: Prof. Tudor Palade, e-mail: [Tudor.Palade@com.utcluj.ro](mailto:Tudor.Palade@com.utcluj.ro)



### Patent/ Application number

Patent application OSIM: A/00081/18.02.2020



### Short presentation

The invention describes a system and a method of locating a WiFi terminal using the directions found by two or more WiFi anchors. The WiFi anchors are equipped with retro-directive antennas and are connected to a computing system to which they transmit the information regarding the determined WiFi terminal direction. The computing system, knowing in advance the positions and orientations of the anchors, determines the location of the WiFi terminal.

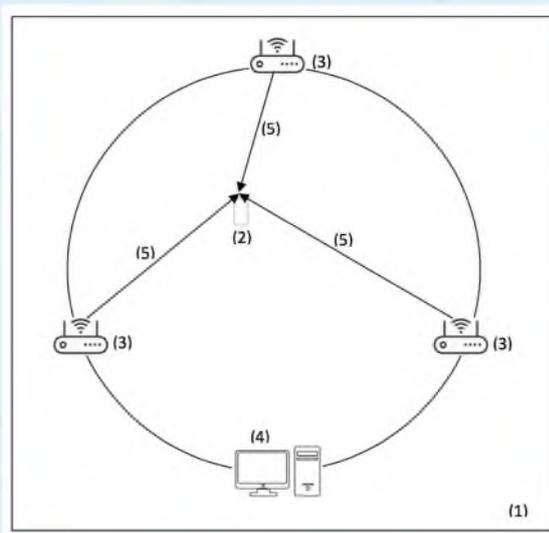


### Applicability

Wireless positioning and location, cellular communications, terrestrial wireless communications



### Images



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*University of Craiova*

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# International Exhibition of Inventions INVENTICA 2021 23.06.2021 – 25.06.2021



University of Craiova

## ELBOW PROSTHESIS TYPE BALL JOINT

Patent No: 129147/30.08.2018 Patent Assignee: UNIVERSITY of CRAIOVA

Inventors: Prof.PhD. Tarnita Danut Nicolae<sup>1</sup>, Prof.PhD. Tarnita Daniela<sup>2</sup>, Boborelu Cristian<sup>3</sup>, Popa Dragos<sup>2</sup>

<sup>1</sup>University of Medicine and Pharmacy, Craiova, <sup>2</sup>University of Craiova, Craiova, <sup>3</sup> Emergency Hospital Craiova

### Description

The invention relates to a new model of elbow prosthesis which has the operating principle hinge model, with a spherical shape.

The elbow prosthesis according to the invention has the following advantages:

- › It has a simple construction, easy to perform; It consists of two components that are implanted separately easily;
- › The destruction of bone for implantation is small;
- › Intracapsular implantation is performed, which provides greater stability elbow prosthesis after implantation;
- › The two components are coupled without using other devices.

### Advantages

Regarding the design and the insertion – the new prosthetic model, consisting of two components, abundantly fulfils the criterion of simplicity; The simplicity of the prosthetic components allows them to be made with classical tools in small workshops with no special equipment; Due to the simplicity of the components, the costs are much smaller than in the case of current prostheses; Making the prosthesis from stainless steel, titanium or cobalt-chrome gives the prosthesis a high durability in terms of component wear and mechanical strength. By increasing the options and reducing the technical barriers in the revision surgery of the damaged prosthetic components, the service is easy to carry out due to the very simple manner of implantation which does not involve difficult and hard to conduct manoeuvres; The implantation kit is simple and it does not use special tools.

**Applications** Medicine, orthopaedics, surgery, rehabilitation

### Contact person

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# International Exhibition of Inventions INVENTICA 2021 23.06.2021 – 25.06.2021



University of Craiova

## ORTHOTIC DEVICE USED FOR OSTEOARTHRITIC HUMAN KNEE

Patent No. 132075 / 30.09.2019

PhD. Catana Marius, Prof. PhD. Tarnita Daniela, Prof. PhD. Tarnita Danut Nicolae,  
University of Craiova & University of Medicine and Pharmacy, Craiova

### Description

The invention relates to an orthotic device used in the human knee joint orthotics affected by osteoarthritis in the medial compartment. It has the possibility of adjusting the angles of the components. Orthotic device used in the human lower limb orthotics wherein presents new elements that lead and contribute to minimizing the internal space of the lower limb and orthotic device by change of position components. Through fixing and tightening there are stabilized lateral movements in flexion-extension movements. The orthotic device makes it possible to conduct the people affected in the human knee showing the various stages of the osteoarthritis. The orthotic device minimizes, through adjustments, the internal space between the orthosis and the human lower limb, respecting the maximum amplitudes of flexion-extension movements between the femur and tibia and a dynamic shape with the natural appearance on the human lower limb.

#### Advantages

This system \*is modular and adaptable to a diverse sample of patients is simple,\* is easy to manufacture in terms of components with simple shapes \*has a much lower cost, \*is lighter, \*has no blunt elements to damage the tissues, \*is more supple and adapts much more easily to the knee due to the multiple joints of the system which gives it \*a much higher adaptability to affected knee landmarks; \*it allows correct and progressive recovery of the function of locomotion.

### Applications

Rehabilitation, Medicine, Orthopedics

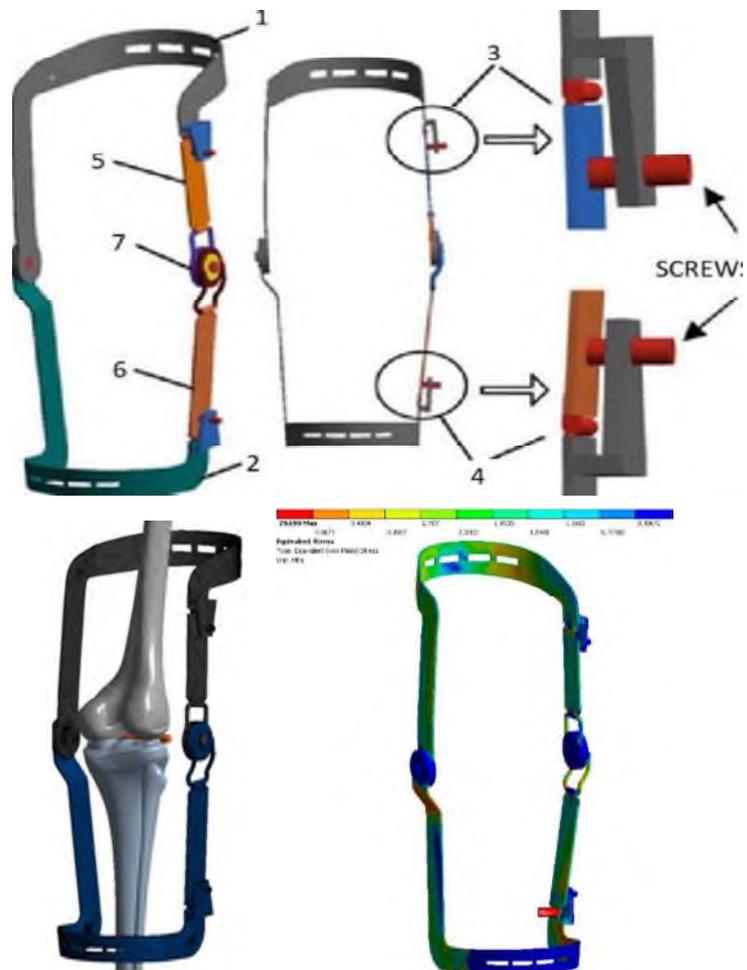
### Contact person

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# International Exhibition of Inventions INVENTICA 2021 23.06.2021 – 25.06.2021



University of Craiova

## DEVICE USED FOR THE OSTEOSYNTHESIS AND COMPACTION OF LONG BONE FRACTURES

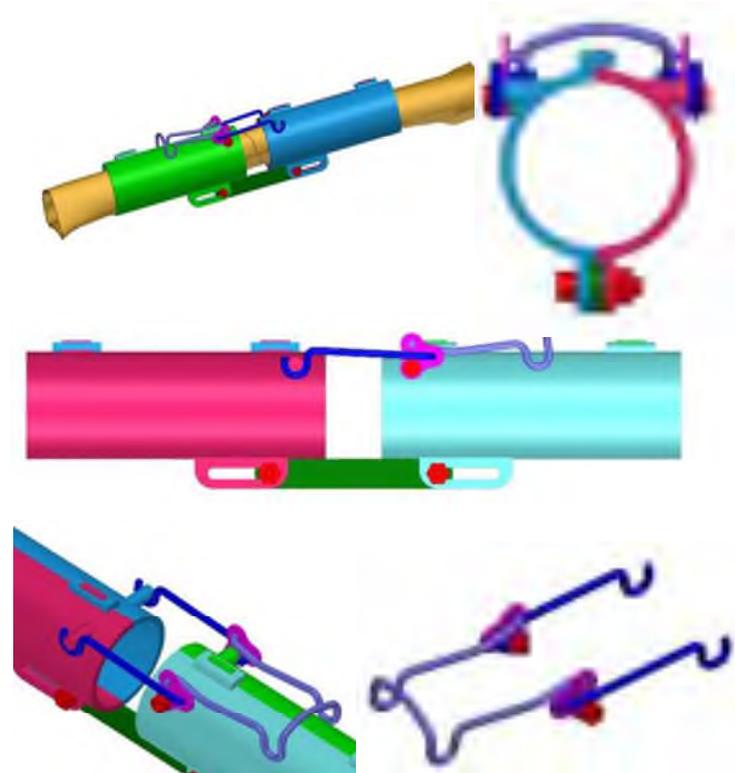
Patent application No. A00162/2019

Prof. PhD. Tarnita Daniela

Prof. PhD. Tarnita Danut Nicolae,

### Description

The device for the osteosynthesis and compaction of long bone fracture consists of two biocompatible metal collars, adjustable to the thickness and shape of the bone. They are made up of two halves of a cylinder, assembled at an edge with two clamps and at the opposite edge, fastened by a screw. The collars are joined by a metal bridge formed by a rectangular metal blade provided with two holes at the ends, whereby it is fastened to the two collars by two screws, thus stabilizing the fracture. On the opposite side of the metal bridge, there is a device made steel wire with two arms articulated to each other and connected with two identical intermediate pieces placed on both sides of one of the collars. Intermediate parts are provided with two holes. Each piece is fixed in a hole through a bolt to a necklace, and the two lever arms are held in the other hole. One of the lever arms ends with two hooks that are applied to two bolts located on the other necklace of the system. The second lever arm has a U-shaped push-fit system that will adapt and mold on the lower collar when the lever is actuated. The two hooks of the other arm will slide under the two bolts of the other necklace creating constant tension and stabilizing the fracture area as well.



### Advantages

- Very good adjustment to fractured bones due to the two necklaces that are made of two cylinder halves coupled together and screwed together;
- Stabilization of potential fractures of the fracture fragments;
- Ensuring a continuous compaction, which contributes to the healing of the fracture;
- Providing a very good stabilization of the fracture area;
- The device is installed on small incisions without large blood loss and without the destruction of soft tissues;
- Removal of the device after consolidation is accomplished without difficulty and without the destruction of bone tissue.

### Applications

Orthopaedics, Traumatology Modular-adaptive orthopaedic implants for the treatment of the long bones fractures.

### Contact person

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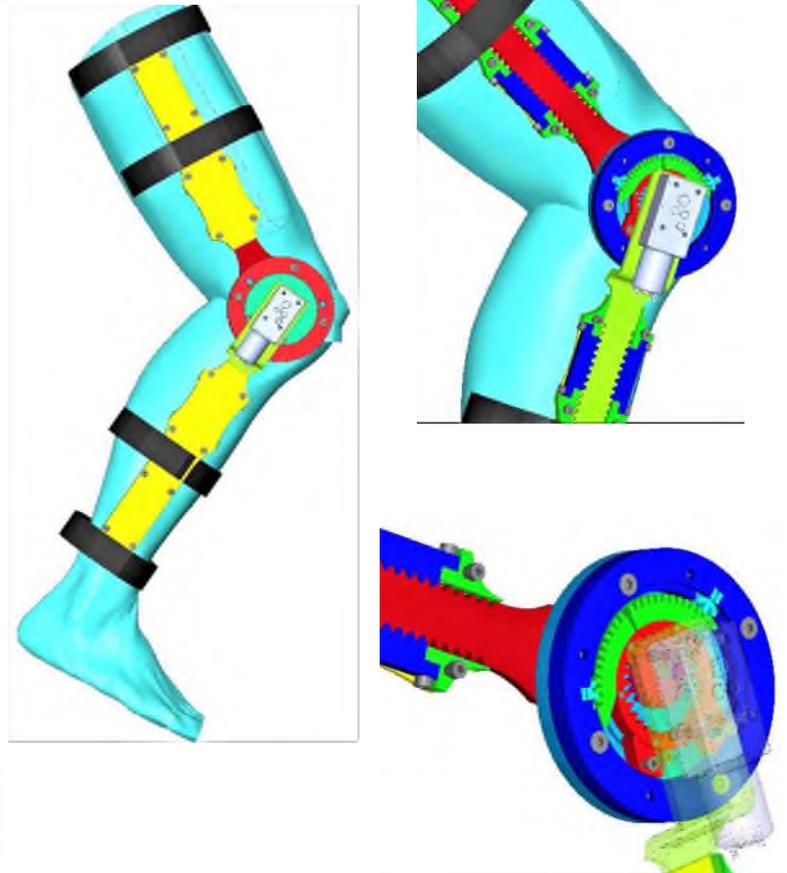
## DEVICE FOR RECOVERING THE PROGRESSIVE MOVEMENTS OF HUMAN JOINTS USED IN ORTHOTIC SYSTEMS

Application Patent Number: A/00081, 2016

PhD. Petcu Alin Ionel, Prof. PhD. Tarnita Daniela, Prof. PhD. Tarnita Danut Nicolae,  
University of Craiova & University of Medicine and Pharmacy, Craiova

### Description

The invention relates to a device for recovering the progressive movement of human joints used in orthotic systems. The main feature of the device is the possibility to control the angle of flexion extension of the affected joint that requires rehabilitation therapy so that recovery can be achieved while progressive movement. The major advantage is the versatility of the device, it can be used in both orthotic systems: passive and active. The level of security given by this system in order to prevent a flexion or extension out of range of motion clinically indicated or permitted at some stage of the recovery, makes possible its efficient use taking into account the type and severity of the disease, effective degree of joint mobility, patient age or capabilities.



### Advantages

- 1) It's modular and adaptable to a diverse sample of patients;
- 2) Provide an extra control and safety of patients during recovery.
- 3) Can be inserted in a orthotic system both passive and active ;
- 4) Allows absorption of shocks that can appear at the end of flexion extension movement;
- 5) Allows limiting the minimum and maximum angle of flexion extension movement;
- 6) Allows correct and progressive recovery of the function of locomotion

### Applications

Medicine, Rehabilitation, Biomechanics,

### Contact person

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# International Exhibition of Inventions INVENTICA 2021 23.06.2021 – 25.06.2021



University of Craiova

## MODULAR EXOSKELETON WITH LOWER LIMB RECOVERY APPLICATIONS

Patent proposal: A/00147/2017

Authors: Assoc. Prof. PhD. Geonea Ionut<sup>1</sup> Prof.PhD. Tarnita Daniela<sup>1</sup>

<sup>1</sup>University of Craiova, Craiova

### Description

The invention relates to an exoskeleton system for assisting the locomotion of persons with locomotor disabilities, useful in facilitating locomotor recovery activities. The exoskeleton system, according to the invention, integrates two mechanisms with articulated bars for the legs, which have in the structure 9 kinematic elements. The driving element of the articulated bar mechanism of each leg is actuated by the movement of the motor, which rotates an shaft, on which the motor elements of the foot mechanisms are fixed. The two motor elements are mounted at 180 °, to ensure the succession of the steps of the two legs. The green and red elements of the mechanisms materialize the femur and tibia of the human foot, and are characterized by the possibility of changing the lengths, to adapt to subjects with different heights. The exoskeleton is attached to the human subject with the help of fastening systems; the movement of the exoskeleton helps the patient with locomotor disabilities to perform the activity of locomotor recovery.

### Advantages

- ✓ The structure of the exoskeleton used is simple, because it has a single drive motor, which drives the two legs by means of a motor shaft;
- ✓ The elements of modularity and adjustment, consist in modifying the length of the components for the femur and tibia, (within the limits imposed when designing the mechanism), in order to ensure the same anthropomorphic movements necessary for walking;
- ✓ It is not necessary to apply a control system, because the mechanism for the exoskeleton legs, by design, ensures anthropomorphic movements, being necessary only a drive motor for which the control part is a simple and cheap solution (motor, controller);
- ✓ The exoskeleton solution is easy and safe to use, because the moving elements of the mechanism do not interfere with the patient. For this purpose, the chain drive is mounted in the rear, and the patient is protected with a guard plate. The fixation of the patient to the exoskeleton is done simply, by means of fabric bandages, provided by the tightening straps in the fabric.

### Contact person

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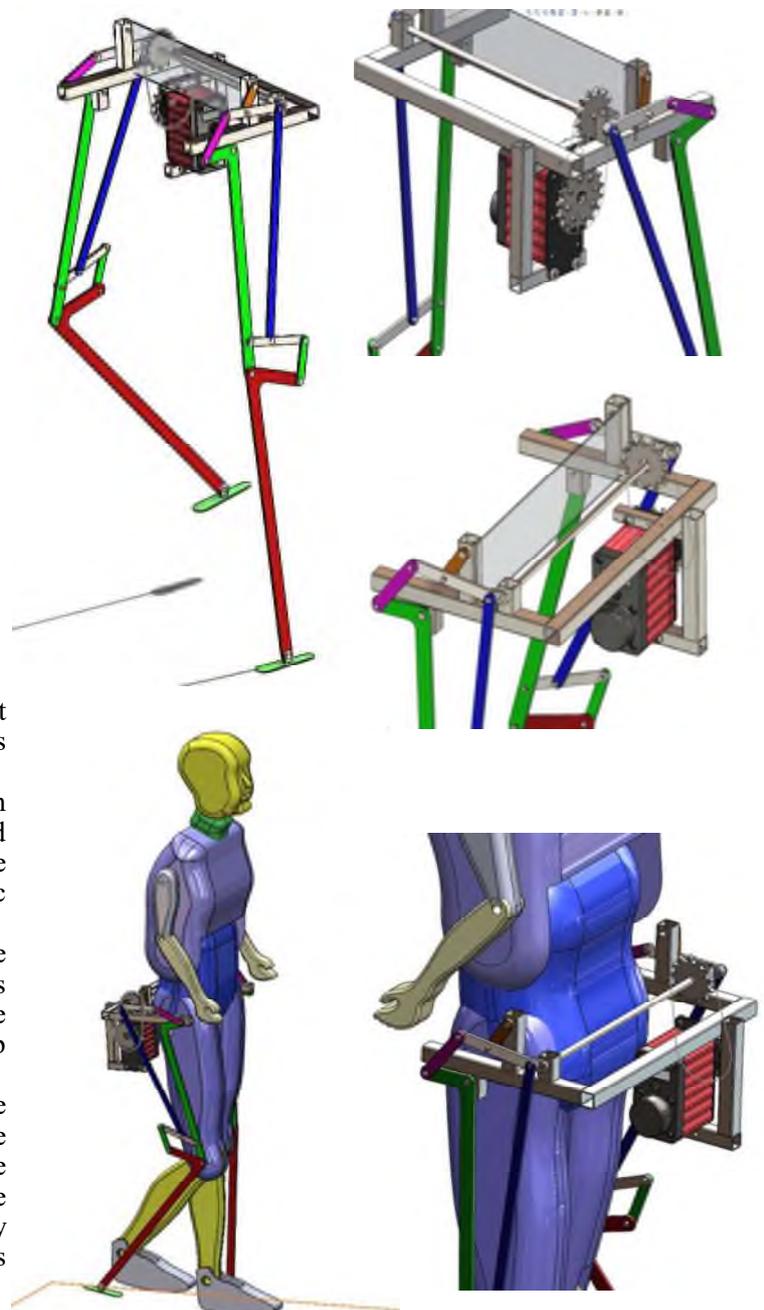
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### Applications

locomotor recovery clinics, medicine,  
medical engineering, biomechanics.



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***University POLITEHNICA Bucharest***

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# International Exhibition of Inventions INVENTICA 2021 23.06.2021 – 25.06.2021



**UNIVERSITY POLITEHNICA OF BUCHAREST**

## INVENTION NAME

**DENTAL ALLOY OF COBALT-CHROMIUM-MOLYBDENUM TYPE USED FOR MAKING METAL-CERAMIC DENTAL PROSTHESES, COMPRISES COBALT, CHROMIUM, MOLYBDENUM, SILICON, NIOBIUM, RUTHENIUM, ZIRCONIUM AND SILVER (patent no: RO134131)**

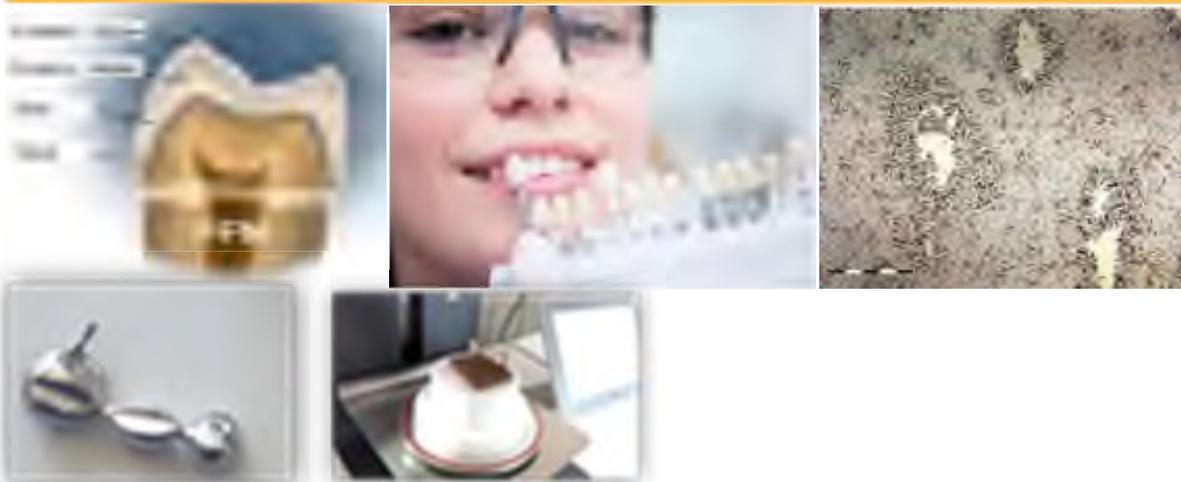
**Inventors :** ANTONIAC Vasile Iulian, RAU Dzuletta, SEMENESCU Augustin, DAWOD Nazem, GEANTA Victoras, VOICULESCU Ionelia, MATES Ileana Mariana, SOLEA Marina Roxana

## PRESENTATION



Dental alloy of cobalt-chromium-molybdenum type comprises 47-53 wt.% cobalt, 22-26 wt.% chromium, 4-7 wt.% molybdenum, 0.9-1.2 wt.% silicon, 3-5 wt.% niobium, 0.8-1.1 wt.% ruthenium, 10-14 wt.% zirconium and 2-4 wt.% silver, where the alloy has biocompatible metals comprising molybdenum, zirconium, niobium, silver and ruthenium, and is prepared by elaboration in electric arc furnace in neutral atmosphere.

## ADVANTAGES



The alloy exhibits excellent biocompatibility and corrosion resistance.

## PROBLEM SOLVED



The alloy is used for making metal-ceramic dental prostheses.



# International Exhibition of Inventions INVENTICA 2021 23.06.2021 – 25.06.2021



## UNIVERSITY POLITEHNICA OF BUCHAREST

### INVENTION NAME

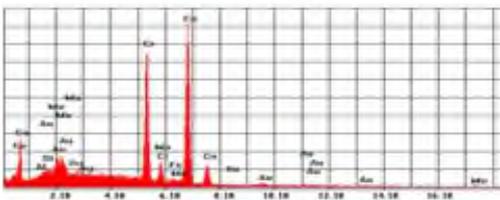
**COBALT, CHROMIUM AND NOBLE METAL CONTAINING ALLOY USED FOR MANUFACTURING METAL-CERAMIC DENTAL PROSTHESES, COMPRISES COBALT, CHROMIUM, SILICON, RUTHENIUM, ZIRCONIUM AND SILVER (patent no: RO134132 A0)**

**Inventors :** ANTONIAC Vasilea Iulian, RAU Dzuletta, SEMENESCU Augustin, DAWOD Nazem, GEANTA Victoras, VOICULESCU Ionelia, MATES Ileana Mariana, SOLEA Marina Roxana

### PRESENTATION



Cobalt, chromium and noble metal containing alloy comprising 58-61 %mass cobalt, 28-30 %mass chromium, 3.4-4.4 %mass silicon, 2-4 %mass ruthenium, 0.7-1.4 %mass zirconium and 0.8-1.2 %mass silver and obtained by elaboration in an electric arc furnace in a neutral atmosphere, with or without magnetic levitation.



### ADVANTAGES



The alloy has high biocompatibility. DETAILED DESCRIPTION - Cobalt, chromium and noble metal containing alloy of formula: CoCrMn comprises 58-61 %mass cobalt, 28-30 %mass chromium, 3.4-4.4 %mass silicon, 2-4 %mass ruthenium, 0.7-1.4 %mass zirconium and 0.8-1.2 %mass silver and obtained by elaboration in an electric arc furnace in a neutral atmosphere, with or without magnetic levitation. Cobalt, chromium and noble metal containing alloy of formula: CoCrMn comprises 58-61 %mass cobalt, 28-30 %mass chromium, 3.4-4.4 %mass silicon, 2-4 %mass ruthenium, 0.7-1.4 %mass zirconium and 0.8-1.2 %mass silver and obtained by elaboration in an electric arc furnace in a neutral atmosphere, with or without magnetic levitation

### PROBLEM SOLVED



The alloy is useful for manufacturing metal-ceramic dental prostheses.



# International Exhibition of Inventions INVENTICA 2021 23.06.2021 – 25.06.2021



UNIVERSITY POLITEHNICA OF BUCHAREST

## SELF-INJECTION SYRINGE FOR THE ADMINISTRATION OF ANTIDOTES WITH AN INNOVATIVE ACTIVE SUBSTANCE RELEASE SYSTEM

**Cerere brevet (Patent application): a/00232/07.05.2021**

**Inventatori (Inventors/ authors): Cristina Anca SECARĂ, Ionuț DUMITRACHE, Bogdan PĂTRINICHI, Adrian Claudiu POPA, Aurelian ZAPCIU, Cătălin Gheorghe AMZA, Diana Popescu, Augustin SEMENESCU**



### BACKGROUND

The risk of CBRN ((chemical, biological, radiological and nuclear) attack remains current, despite international law, which prevents the proliferation of weapons and CBRN agents and formally prohibits the use of weapons of mass destruction in the form of biological weapons (Geneva 1972) and chemical weapons (Geneva 1993).

The need for fast and easy administration of antidotes with high efficacy and broad spectrum and the achievement of a shorter absorption time of active substances were technological challenges that led to the design and development of a device to enable self-help and mutual aid in situations of risk.

### PROBLEM SOLVED

- The main object of the present invention is to present an innovative solution for an intramuscular injection antidote delivery device which is compact, robust and versatile, and can be provided with various volumes of active substance for injection.
- The technical problem solved by the invention consists in the realization of an auto-injector type device for the administration of antidotes in the post-exposure treatment in case of chemical attacks. This device must be easy to handle and carry (compact) and be made of a sturdy construction to be reliable.



### ADVANTAGES

- Increased robustness by limiting the number of components and their complexity using the trigger mechanism based on the release of a piston actuated by a prestressed spring;
- Reducing the maximum size of the device (length) by using a helical spring with an outer diameter smaller than that of the ampoule, the spring partially entering the ampoule during injection;
- The triggering system is self-guided due to the cylindrical construction of the components;
- The injection needle is maintained in an optimal orientation during the injection due to the guide elements, unlike solutions that use the needle integrated in the ampoule without guidance;
- The dosage can be adjusted at the factory by modifying a minimum number of specific components.



# International Exhibition of Inventions INVENTICA 2021 23.06.2021 – 25.06.2021

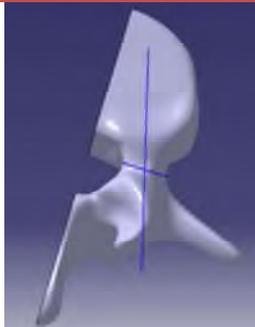


**UNIVERSITY POLITEHNICA OF BUCHAREST**

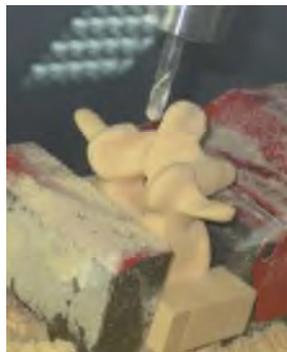
## INTELLIGENT X-RAY METHOD AND SYSTEM FOR SURGICAL INSTRUMENTS FOR THE INSERTION OF THE PEDICLE SCREWS

**Brevet (Patent): RO 128174 B1**

**Inventori (Inventors/ authors): Diana Popescu, Catalin Gheorghe Amza, Dan Constantin Laptoiu, Gheorghe Amza, Augustin Semenescu, Vasile Iulian Antoniac, Dumitru-Titi Cicic**



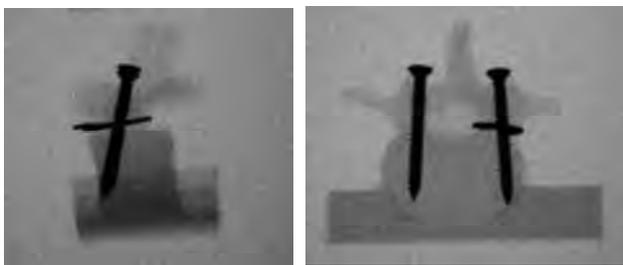
Digital vertebra model obtained from CT / MRI data



Manufacture of the vertebral physical model



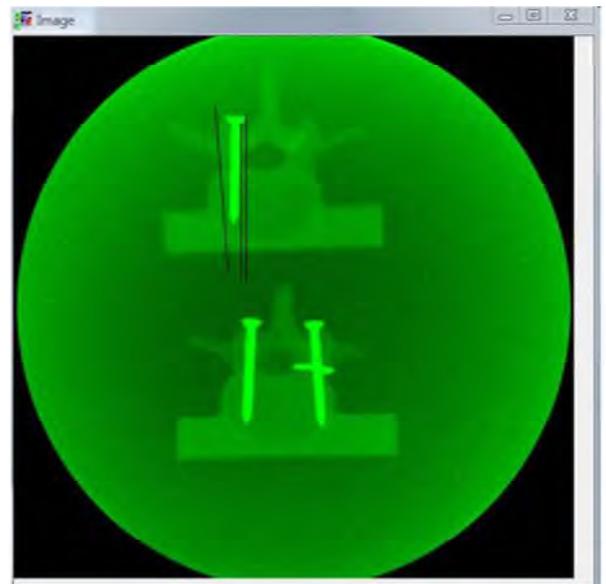
Vertebral perforation and pedicle screw insertion



Acquisition of X-ray images in the sagittal and transverse planes

The invention relates to an intelligent method and system based on X-rays which can be used to train surgeons in the insertion of screws into the pedicles of human vertebrae, an operation necessary for the posterior stabilization of the spine. The training method involves the use of polyurethane vertebrae as working models and the following steps:

- identification on the vertebrae of the entry point for the pedicular screw and choosing its diameter and length,
- drilling the vertebra and inserting the screw,
- acquisition, image processing with X - rays,
- determination of the value of the deviation of the insertion trajectory from the pedicle axis and framing or not in the safety zone, with the computer, using a special image processing software based on image segmentation using a Hopfield neural network;
- display the value of the deviation and the corresponding evaluation messages.



Hopfield neural network application for image segmentation and pedicle screw attributes extraction

The intelligent training system is based on the acquisition of X-ray images and their segmentation by applying an algorithm based on a Hopfield neural network, with automatic extraction of the pedicle screw as a separate object, followed by the calculation of the main attributes of the obtained image (screw diameter, trajectory). insertion), the information thus extracted being used for the automatic determination of the deviation of the screw trajectory from the pedicle axis, considered as the ideal trajectory, in order to evaluate the insertion accuracy.

Display deviation value and information / evaluation messages



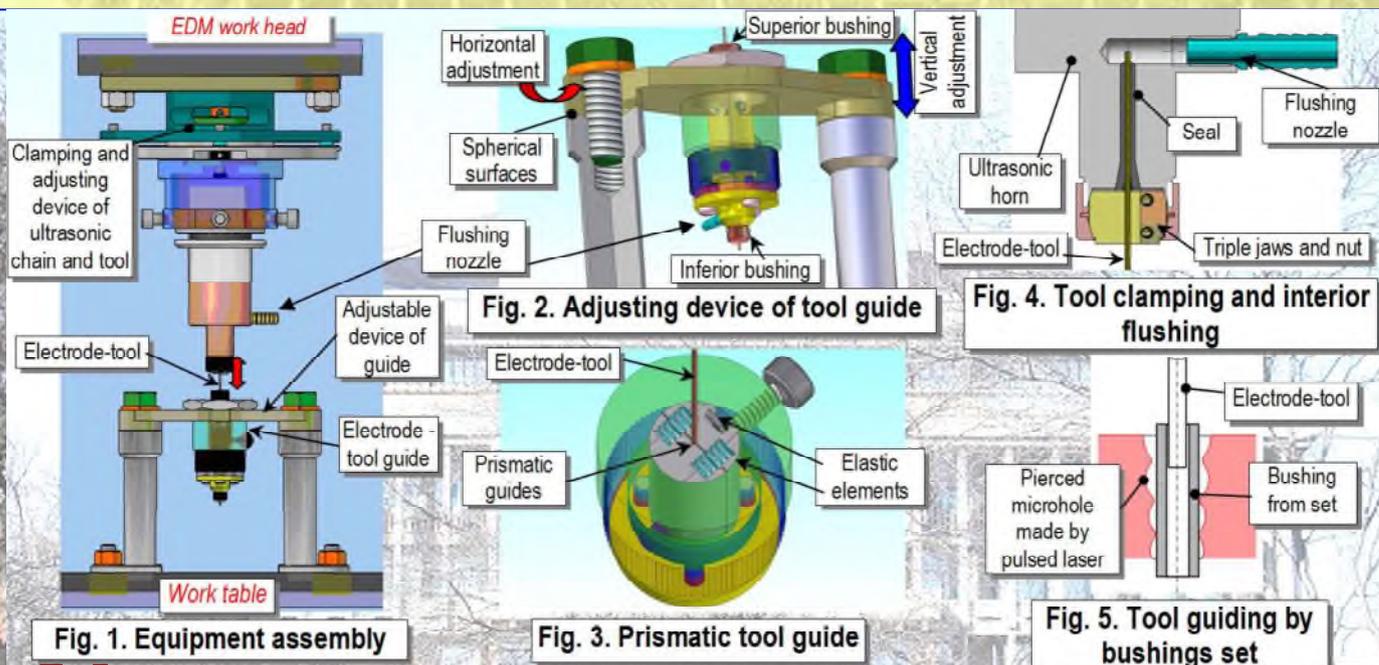
## Equipment for microhole finishing by ultrasonically aided electrical discharge machining

**Patent number: RO-126381/2015-07-30**

**Authors: Niculae Ion Marinescu, Liviu Daniel Ghiculescu, Alexandru Sergiu Nanu**

### *Novelty*

- Finishing technology of microholes, previously machined by pulsed laser, by electrical discharge machining aided by ultrasonic longitudinal vibrations of electrode-tool (fig. 1).
- Adjusting device of electrode-tool guide: rotation around horizontal axis on spherical surfaces, and rough and fine translation on vertical axis (fig. 2);
- Multiple guiding of electrode-tool, by superior and inferior bushing (fig. 2), prismatic surfaces and elastic elements (fig. 3).
- Electrode-tool clamping in antinode point by triple jaws and screwed nut (fig. 4);
- Dielectric lateral flushing through inferior bushing (fig. 2) and interior flushing in case of tubular tools by a nozzle that enters the horn in nodal point (fig. 4).



### *Advantages*

- High machining rate and surface quality due to ultrasonically induced cavitation within working gap and tool guiding through bushings set (fig. 5);
- High quality of electrode-tool guiding in terms of position and shape precision;
- Efficient clamping and flushing of electrode-tool.



## Mobile equipment for ultrasonically aided electrochemical machining of big dimensions workpieces

**Patent number: RO - 128982/30.04.2019**

**Authors: Niculae Ion Marinescu, Liviu Daniel Ghiculescu, Alexandra BANU, Alexandru Sergiu Nanu**

### *Novelty*

- Ultrasonic aiding of electrochemical machining using an electrode-tool positioned at the end of an ultrasonic chain and electrolyte liquid supplying through a nozzle located in nodal point (fig. 1);
- Ultrasonic aiding of electrochemical polishing using a rotary electrode-tool and a hopper supplied with electrolyte liquid on which an ultrasonic transducer is assembled (fig. 2);
- Ultrasonic removal of passivated layer works when polishing by tool rotation stops (fig. 2).

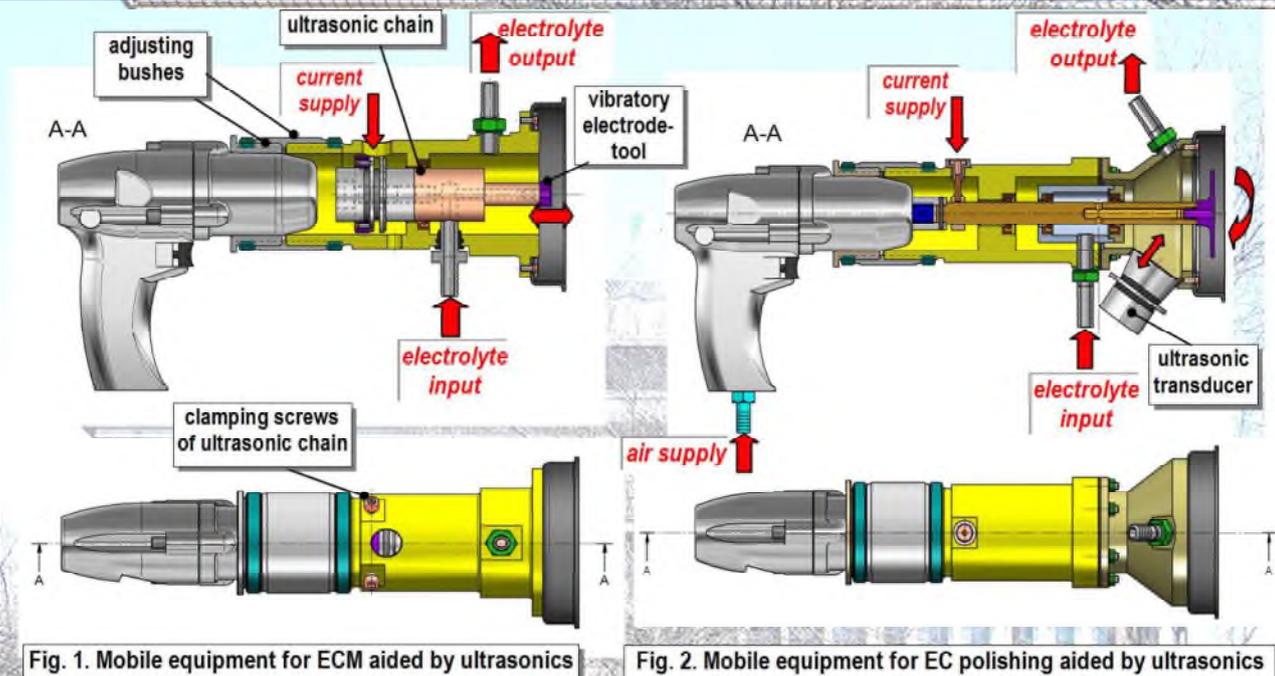


Fig. 1. Mobile equipment for ECM aided by ultrasonics

Fig. 2. Mobile equipment for EC polishing aided by ultrasonics

### *Advantages*

- Electrochemical machining complex surfaces of workpieces with overall great dimensions located indoor and outdoor;
- Efficient removal of passivated layer by ultrasonic aiding, increasing process stability and machining rate without supplying with high pressure of electrolyte liquid;
- Uniform circulation of electrolyte liquid on machined surface using rotary electrode-tool, decreasing surface roughness.



# International Exhibition of Inventions INVENTICA 2021 23.06.2021 – 25.06.2021



UNIVERSITY "POLITEHNICA" OF BUCHAREST

## Machining of Advanced Materials Based on Ti and Co Alloys through Ultrasonically Aided Electrical Discharge Micro-drilling (AM\_ED\_US)

Project (Research project): Project code: PN-III-P2-2.1-PED-2019-0367,  
Contract no.: 329 PED from 03/08/2020

Authors: Daniel Ghiculescu, Gheorghe Jitianu, Alexandra Banu, Andrei Drumea, Nicoleta Căruțașu, Nicolae Ionescu, Ovidiu Alupei, Gabriela Pârvu (Ene), Claudiu Pîrnău

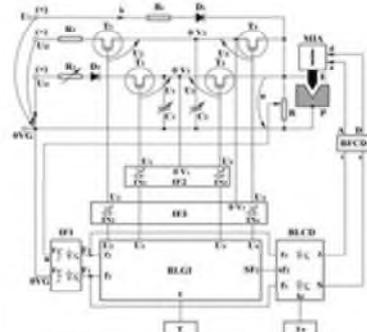
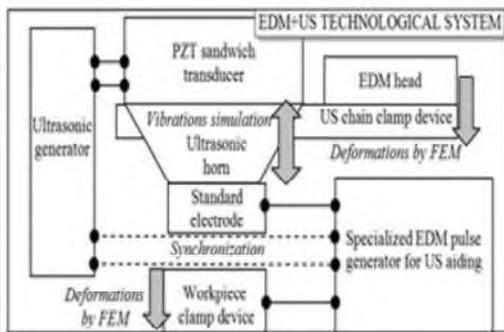
### Project goals

- EDM+US microdrilling technology applied on advanced materials validated at laboratory level (TRL4).

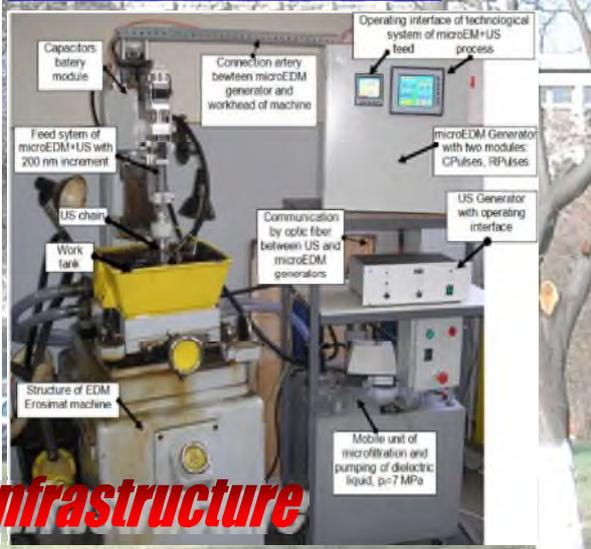
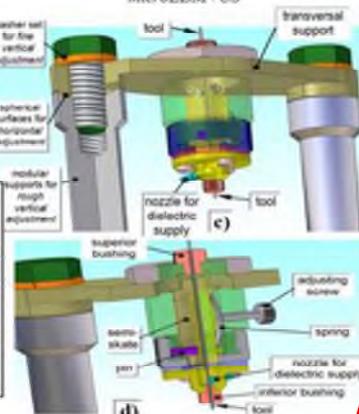
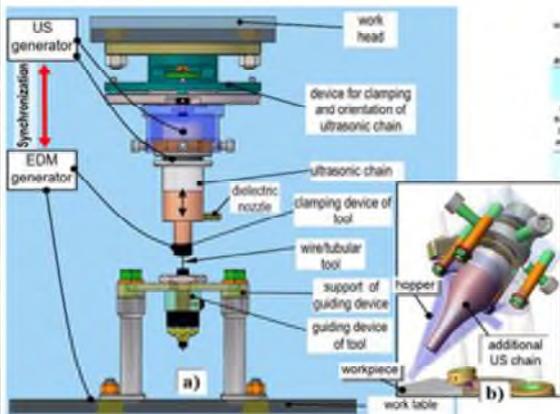
### Advanced materials

- nanotubes of  $TiO_2$  thin layers on Ti alloy support, Ti aluminides with different proportions of  $Ti_2Al$  ( $\alpha_2$ ) and  $TiAl$  ( $\gamma$ ) phases, and CoCr alloys

- Applications: medicine, automotive, aerospace, military, nuclear, food industry etc.



Jitianu, Gh., Method and equipment for growing machining rate of finishing process of surfaces through electrical discharge machining. Granted patent, RO-129537, 30.05.2016.



### Project objectives

- increase of machining rate with at least 100%, decrease of volumetric relative wear and decrease of surface roughness  $R_a$  with at least 50% in comparison with classic EDM, for with microholes range diameters of 0.2-0.8 mm, validating the technology of EDM+US microdrilling at laboratory level;

### New patent applications

- Equipment for machining micro pins and micro holes by electrical discharge with torsional and longitudinal ultrasonic vibration of tool-electrode A / 00698 / 31.10.2019; Method and flushing device of the working gap at ultrasonically aided micro-electrical discharge machining A / 00779 / 25.11.2020.

Contact person: Prof. Habil. Daniel GHICULESCU, Ph.D., Eng,  
e-mail: daniel.ghiculescu@upb.ro





# International Exhibition of Inventions INVENTICA 2021

23.06.2021 – 25.06.2021



NATIONAL INSTITUTE OF  
INVENTICS, IASI, ROMANIA



University "Politehnica" of Bucharest



## COMPOSITE MATERIALS CONTAINING MESOPOROUS SILICA, BIOLOGICALLY ACTIVE SUBSTANCE AND A RELEASE CONTROL AGENT, OBTAINING PROCEDURE AND THEIR APPLICATIONS AS CONTROLLED RELEASE SYSTEMS

**Patent number: RO 131769 B1/ 30.10.2018, BOPI nr. 10/2018**

**Inventors: Daniela BERGER, Cristian MATEI, Raul-Augustin MITRAN**

### WAY

- A simple and general process for development of drug delivery systems is needed, especially for high soluble drugs:
  - ✓ Development stage: fast R&D, small costs, minimum number of synthesis steps
  - ✓ Production stage: reliable; flexible; reduced costs; minimum environmental impact

### HOW

- Drug carrier: mesoporous silica with excellent properties - biocompatible; high porosity; various structures
- Controlling the drug release kinetics:
  - ✓ To avoid the silica functionalization: time-consuming chemical step; high grade and expensive organo-silanes; solvents of environmental concern
  - ✓ Using of a release control agent adsorbed on the silica particles surface: a water-insoluble organic substance (solubility less than 0.5 g/L), non-toxic from the class of insoluble aliphatic or aromatic alcohols or aliphatic hydrocarbons

### WHAT

- A new concept of drug delivery system was developed
  - ✓ based on mesoporous silica irrespective to the pore size and pores framework
  - ✓ for active pharmaceutical ingredient with high water solubility, regardless to the drug structure
  - ✓ the release control agent is physically adsorbed on the silica particles surface: no chemical reaction; no solvent used; no silica structure alteration

Contact: Prof. dr. ing. Daniela BERGER

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The 25th International Exhibition of Inventions  
**“INVENTICA 2021” Iași, România**

**Sită cilindrică cu trei sectoare acționate individual prin arbori tubulari**

VOICU Gheorghe, CONSTANTIN Gabriel-Alexandru, PARASCHIV Gigel, COSTOIU Mihnea

**REZUMATUL INVENȚIEI**

Invenția se referă la o sită cilindrică, cu trei sectoare acționate individual, **caracterizată prin aceea că**, este constituită dintr-un racord (1) de alimentare a primului sector (2) al sitei, un al doilea sector (3) și un al treilea sector (4) al sitei cilindrice dispuse în serie cu sectorul (2), un arbore tubular (5) de acționare a primului sector (2) al sitei cilindrice, un arbore tubular (6) de acționare a celui de-al doilea sector (3) al sitei cilindrice, un arbore (7) de acționare a celui de-al treilea sector (4) al sitei cilindrice, carcasa utilajului (8), un reductor conic (9), o roată de curea (10) montată pe arborele de intrare în reductorul conic pentru transmisia de la un motor electric, tremiile colectoare (11) și racordul (12) pentru evacuarea refuzului..

**STADIUL ACTUAL**

Corpurile străine, ca potențiali contaminatori a materialelor granulare și pulverulente, pot fi de diverse tipuri: fragmente de metal, sticlă, plastic, lemn, cauciuc, semințe ale altor culturi, fragmente de tulpină, pietre, bolovani de pământ, etc. Materiile prime pot fi contaminate cu aceste corpuri străine dinainte de recepția calitativă și cantitativă, sau se pot contamina chiar pe fluxul tehnologic al unității de prelucrare.

În industria morăritului, spre exemplu, standardele în vigoare prevăd la recepția cantitativă și calitativă un conținut de maxim 3% corpuri străine din lotul de cereale care intră în unitatea de morărit. Conținutul acesta de corpuri străine este separat din amestecul inițial în special pe baza diferențelor între proprietățile fizice. Astfel, se poate face separare după diferența între dimensiunile geometrice ale componentelor unui amestec (după lățime sau grosime prin cernere cu ajutorul sitelor plane antrenate în mișcare oscilatorie sau sitelor cilindrice/hexagonale antrenate în mișcare de rotație, dar și după lungime cu ajutorul trioarelor), după viteza de plutire (cu ajutorul coloanelor de aspirație), după coeficientul de frecare, după densitate, dar și după proprietățile magnetice. Este de menționat aici că există și utilaje care fac o separare mai completă, folosind diferența dintre mai multe proprietăți fizice ale componentelor amestecului.

Sitele cilindrice se folosesc (în industria morăritului), în special, în faza de condiționare a cerealelor (faza de modificare a proprietăților tehnologice a semințelor de cereale) pentru separarea, după lățime sau grosime, a impurităților din lotul de cereale. De regulă, utilajul este format dintr-o singură sită cilindrică cu o singură zonă de lucru (orificiile având aceleași dimensiuni pe toată lungimea sitei, vezi WO 02/38290A1 și Japanese Patent Laid-Open Gazette No. H-6-321335) sau cu mai multe zone de lucru (dimensiuni ale orificiilor diferite în fiecare zonă de lucru, vezi Japanese Patent Laid-Open Gazette No. H3-131372, No. H-11-244784, No. S-63-69577, No. H6-303 și No. S-57-12278). Dacă sita cilindrică are mai multe zone de lucru, atunci zonele sunt dispuse crescător din punct de vedere al dimensiunilor orificiilor, din zona de alimentare către zona de evacuare, împărțind astfel amestecul inițial în mai multe fracții dimensionale. Acționarea în mișcare de rotație a sitei se face, de regulă, de la un motor electric prin intermediul unei transmisii cu curele trapezoidale sau transmisii cu lanț la arborele de acționare al sitei cilindrice. Susținerea sitei cilindrice pe arborele de acționare se face prin intermediul unor spițe prinse radial, la un capăt de arbore, iar la celălalt capăt de interiorul sitei cilindrice. Dezavantajul unui astfel de sistem de cernere poate consta tocmai în faptul că, indiferent de numărul de zone de lucru, sita cilindrică are aceeași viteză unghiulară pe toată lungimea ei, iar pentru unele amestecuri se poate realiza o sortare mai bună dacă diferitele zone de lucru ale sitei ar avea viteze unghiulare diferite.

**PREZENTAREA INVENȚIEI**

Invenția prezintă următoarele avantaje:

- acționarea individuală a fiecărei site din cadrul utilajului prin intermediul arborilor tubulari, ceea ce va conduce la majorarea randamentului operației de cernere.
- corelarea modului de distribuție a orificiilor cu caracteristicile materialului de procesat.

Se dă în continuare un exemplu de realizare a invenției, o sită cilindrică cu trei sectoare acționate individual care va separa un amestec inițial în 4 fracții (3 fracții de cernut și o fracție de refuz). În figura 1 este prezentată o vedere izometrică a utilajului, în figura 2 este prezentată o secțiune a acestuia, în figura 3 este prezentat modul de acționare a sectoarelor de sită prin intermediul unor angrenaje conice, în figura 4 este prezentată modalitatea de sprijinire a arborilor tubulari cu ajutorul unor rulmenți cu bile capsulați iar în figura 5 se prezintă modalitatea de susținere a sitelor pe arborii tubulari prin intermediul unor spițe.

Alimentarea cu material se face prin racordul de alimentare 1 în interiorul sitei cilindrice 2. Cernutul acestei site va fi recoltat în prima tremie colectoare, iar refuzul acestei site va alimenta sita cilindrică 3. Cernutul acestei site va fi evacuat prin a doua tremie colectoare, iar refuzul va alimenta ultima sită din utilaj, sita cilindrică notată cu 4. Refuzul ultimei site va fi evacuat prin racordul de evacuare 12. Sitele cilindrice sunt dispuse în ordinea crescătoare a dimensiunii orificiilor și sunt susținute pe arborii tubulari prin intermediul unor spițe dispuse radial între arbori și interiorul sitelor (vezi fig. 5). Cele trei site cilindrice sunt antrenate în mișcare de rotație de la un motor electric prin transmisie cu curea trapezoidală la roata 10, iar apoi prin intermediul angrenajelor conice la arborii tubulari 5, 6 și 7 (vezi fig. 3). Arborii sunt dispuși concentric, trecând unul prin interiorul celui alt, lungimea lor depinzând de poziția sitei cilindrice pe care o acționează. Arborele cu lungimea cea mai mare antrenează în mișcare de rotație sita cilindrică cu orificiile cele mai mari (sita cilindrică 4). Susținerea arborilor tubulari se face prin intermediul unor rulmenți cu bile capsulați (vezi fig. 4), atât la capetele utilajului, cât și în zonele de trecere de la o sită cilindrică la alta. Pentru a asigura funcția de transport a fracției de refuz, sitele cilindrice se dispun înclinat față de orizontală. Unghiul general de înclinare este reglabil. Este de menționat că acționarea fiecărei site cilindrice în mișcare de rotație se face individual, putându-se astfel alege turația optimă de cernere la fiecare sită, în funcție de cerințele liniei tehnologice din care va face parte acest utilaj. Modificarea turației se face prin schimbarea roților din angrenajele conice, deci prin modificarea rapoartelor de transmitere. Trecerea de la o sită la alta se face printr-o zonă fără orificii, în unghi drept, de circa 3 cm, fără ca particulele de material să se blocheze între site.

Invenția prezintă avantajul că se poate schimba regimul cinematic în funcție de necesitatea amestecului supus procesului de separare. Mai mult, această modificare a regimului cinematic se poate face pe fiecare sector de sită cilindrică în parte, rezultatul fiind acela de mărire a productivității utilajului, micșorând astfel posibilitatea blocării particulelor de cernut în fracția de refuz.

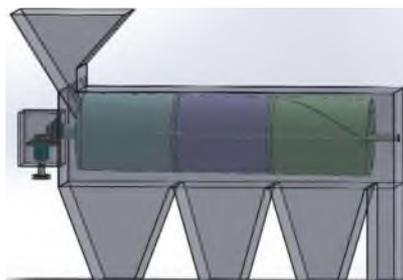


Fig. 1. Vedere izometrică a utilajului

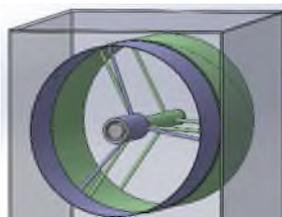


Fig. 5. Spițele de susținere a sitelor cilindrice

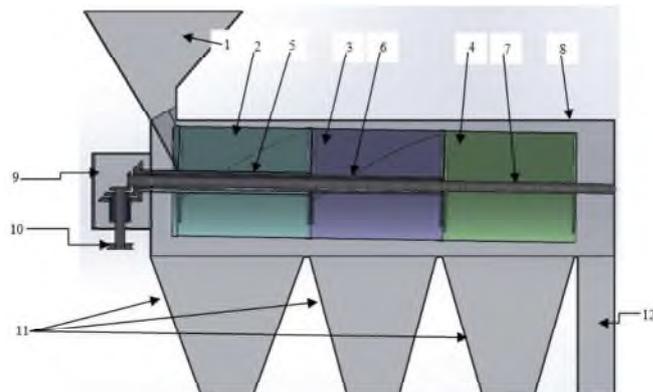


Fig. 2. Secțiune longitudinală prin utilaj

- 1 – Racord de alimentare; 2 – Sector de sită cilindrică (a); 3 – Sector de sită cilindrică (b); 4 – Sector de sită cilindrică (c); 5 – Arborele tubular de acționare a sectorului de sită cilindrică (a); 6 – Arborele tubular de acționare a sectorului de sită cilindrică (b); 7 – Arborele de acționare a sectorului de sită cilindrică (c); 8 – Carcasa utilajului; 9 – Reductor conic; 10 – Roată condusă pentru transmisia pe curea trapezoidală de la motorul electric; 11 – Tremii colectoare cernuturi; 12 – Racord evacuare refuz



Fig. 3. Reductorul conic



Fig. 4. Sprijinirea arborilor tubulari cu rulmenți cu bile

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# International Exhibition of Inventions

## INVENTICA 2021

23.06.2021 – 25.06.2021



NATIONAL INSTITUTE OF INVENTIONS, IASI, ROMANIA



Lucian Blaga University of Sibiu

### Method and Devices for Rehabilitation of therapeutic properties of bathing water in lakes by stratified salt concentration

**PATENT No: 125497 from: 30.12.2013**

**AUTHORS: NEDERIȚA Victor; OPREAN Constantin; OPREAN Letiția; CIUDIN Rodica; TÎȚU Mihail**

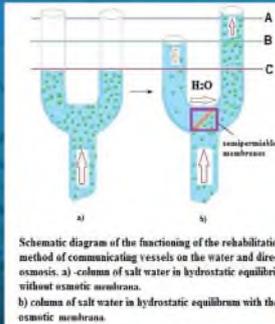
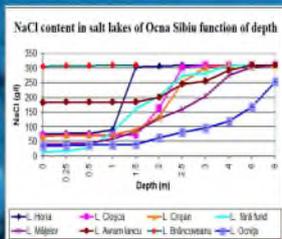
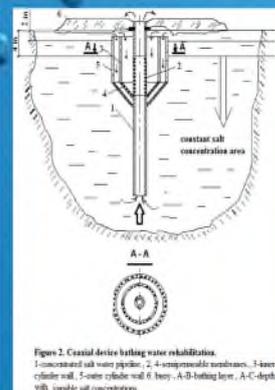
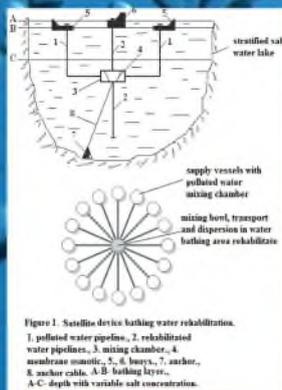
#### Description

The invention concerns a new method and devices for rehabilitation of therapeutic properties of bathing water in lakes by stratified salt concentration. The method is to induce surface water with low salinity concentration under lower layers of water, with a higher salinity concentration in a gravitational continuous water flow; water mix, water transportation and diffusion of rehabilitated water on the surface, in the upper layer under the direct osmosis. The method is based on the two principles: 1.principle of communicating vessels, 2.principle of direct osmosis, Operation takes place automatically according to the gradient of concentration in the mixing chamber.

#### Advantages

Water mixing is done in laminar regime without causing any natural imbalance in the lake. The method is carried out based on exclusive use of natural phenomena without the involvement of artificial sources of energy. The method is environmentally friendly and they do not affect the natural balance of lakes. Other advantages are:

- 1:novel method for the rehabilitation of water treatment properties of bathing in salt lakes layer with stratified salt concentration.
- 2: introduction of gravitational water bathing the surface layer of brine flow in the substrate at any depth and rehabilitation of its therapeutic qualities of direct osmosis brine from underground.
- 3: summer use is organic method without artificial energy sources



#### Applications

The invention is the result of research carried out under AGRAL / PNCDI the project on "Studies on the complex assessment and recovery solutions for lakes in Ocna Sibiu as a tourist and leisure spa healing" developed during 2004 - 2006 (Research Contract No. 8471. 2004) and one of the technological solutions proposed for the recovery of lakes within the project. Field of use is the water quality rehabilitation curative bathing in salt lakes layer is missing vertical movement of water through water stirring with high concentration by the deep and communicating vessels through direct osmosis.

#### Contact:

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# International Exhibition of Inventions

**INVENTICA 2021**  
23.06.2021 – 25.06.2021



NATIONAL INSTITUTE OF  
INVENTICS, IASI, ROMANIA



„Lucian Blaga” University of Sibiu

## Method and Devices for Rehabilitation of therapeutic properties of bathing water in lakes by stratified salt concentration

Patent application: A 00004 2013 / 04.01.2013

Inventors: Sabău Dan, Sabău Alexandru Dan, Dumitra Anca Maria, Țițu Aurel Mihail

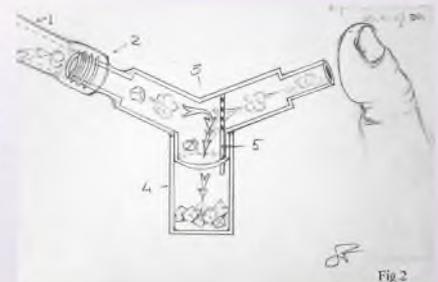
### DESCRIPTION

The invention refers to a method and a device of abdominal collection of some corpuscular/hydrous structures with a diameter smaller than 10 mm. The collecting methods are based on the existence of a closed, hyperbaric chamber (abdominal cavity) and of several gallstones fragments, coagulates, tissue dispersed or agglutinated, possibly hydrous, which require a relatively quick evacuation without any unnecessary movements of fragmentation and/or contamination.

The device, is made out of a tube with the interior diameter of circa 9-9.5-10 mm capable to evacuate the structures due to the difference in pressure between the interior and exterior of the abdomen, difference which can be emphasised by attaching an exterior aspirator.

On the path of the tube there is an eccentric collector which collects the structures or the evacuated liquid with the help of a deflector/ filter, which separates the air or liquid from the evacuated structures. The collector, is detachable and voidable when full. The filter can be quickly extracted and it can be cleaned. The device is kept airtight when pausing and decompressed intermittently after selecting and applying the intra-abdominal orifice of the suction unit on the solid or liquid structure that is aimed with the diameter smaller than the diameter of the tube which the abdominal decompression or the additional suction at the level of the external orifice could lead to the evacuation of the foreign matter.

Decompression is done manually (with the thumb) or instrumentally through a valve with flapper (rapid, sensitive, efficient) The efficiency of the evacuation can be increased by connecting with valve the evacuation ramification to a suction unit and connecting a rinsing system under the flapper which closes the system, it ensures the cleaning of the filter and device alternatively with the suction. The filter ensures the continuous functionality, without "plugs" of the external suction unit by creating a detour for the corpuscular structures and leaving the air or water pass through.



### ADVANTAGES

- the extraction of the pathological products located or dispersed in the abdomen is done rapidly with storing for their intra-operative analysis;
- the efficiency and the accessibility of the device in the entire abdomen, as well as in tight spaces, are remarkable;
- elimination of the contamination risk under the conditions of obtaining quick information;
- reduces the duration of the interventions;
- reduces the clogging of the suction unit by interposing the deflector filter;
- the capacity to quickly wash and clean the intra-operative device which is modular with partial dismantling;

### APPLICATIONS

- Destined for the minimal invasive surgery, especially laparoscopic, but also for open surgery;
- The method can be applied to gallstones up to 9-9.5 mm with container storage, quickly applying it to manoeuvres and protecting the tubular suction unit system from the cleaning/clearing manoeuvre by interposing a deflector filter which



### Contact:

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Manager of Regional Centre OSIM-EPO for Intellectual Property Protection (PatLib Sibiu);  
President of Romanian Association for Alternative Technologies Sibiu (A.R.T.A. Sibiu);

The Academy of Romanian Scientists Associate Member;  
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# International Exhibition of Inventions INVENTICA 2021 23.06.2021 – 25.06.2021



“LUCIAN BLAGA” UNIVERSITY OF SIBIU

## STABLE SYNERGISTIC COMPOSITION WITH ANTIOXIDANT AND ANTI-INFLAMMATORY PROPERTIES BASED ON BIOACTIVE PHYTOEXTRACTS

Patent application: [A 003932 / 09.07.2020](#)

Inventors: Oancea Rodica Simona, Tecucianu Andreea Cristina, Dulf Francisc Vasile

### DESTINATION

The invention relates to: (1) **the new synergistic composition, 100% natural, in the form of an emulsion**, containing extracts of  $\beta$ -carotene from pumpkin, anthocyanins from red cabbage and inulin from parsnip; (2) the method of its preparation and bioactive properties.

Practical importance – valorization of local plants rich in bioactive compounds to obtain extracts with special biological properties, - application of sustainable technologies for extracts and final product preparation.



### PRINCIPLES USED

The process according to the invention consists in combining 50% and 25%, respectively,  $\beta$ -carotene oily extract from pumpkin, 25% and 15%, respectively, concentrated anthocyanin extract from red cabbage and 25% and 60%, respectively, aqueous inulin extract from parsnip, in the presence of 0.5% guar gum relative to the composition, resulting in a stable composition of phytoextracts with bioactive properties tested *in vitro*.

### Fatty acids and antioxidant activity of the new developed compositions

Attributes	Composition 1	Composition 2
Saturated fatty acids	8.58	8.68
Monounsaturated fatty acids	23.11	27.71
Polyunsaturated fatty acids	68.30	63.61
Omega-3	0.04	0.05
Omega-6	68.26	63.56
FRAP (mg ascorbic acid/ 100 ml extract)	84.78	53.49
DPPH (% inhibition)	39.35	19.38

### APPLICATIONS

- the invention is situated at the intersection of food science and health, focused on the food supplements industry;
- the invention offers the possibility of an efficient combination of 3 phytoextracts with multifunctional properties;
- the invention shows significance for the development of nutraceutical products.



### ADVANTAGES

Obtaining synergistic natural compositions by combining 3 natural extracts of pumpkin rich in  $\beta$ -carotene, red cabbage rich in anthocyanins and parsnips rich in inulin, with beneficial effects on human health;

The new compositions are advantageous in terms of costs, as it would reduce the costs of importing similar products;

The new compositions allows creating a Romanian registered trademark product by exploiting the research in this area.

### Contact

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# International Exhibition of Inventions

## INVENTICA 2021

23.06.2021 – 25.06.2021



NATIONAL INSTITUTE OF INVENTICS, IASI, ROMANIA



**Titulars:** OVIDIUS UNIVERSITY OF CONSTANȚA  
ASOCIATIA DE PROTEJARE A OMULUI SI MEDIULUI PENTRU O  
DEZVOLTARE DURABILA IN LUME- ECOM;  
„POLITEHNICA” UNIVERSITY OF BUCHAREST  
NORWAY INSTITUTE FOR WATER RESEARCH

### ECOLOGICAL FERTILIZER BIOCOMPOSITE AND PROCESS FOR PREPARING THE SAME

**PATENT no. 126038/ 30.03.2012**

**Invention Classification: Biology - agronomy - horticulture**

**INVENTORS:** Negreanu-Pîrjol Bogdan-Ștefan, Negreanu-Pîrjol Ticuța, Meghea Aurelia, Năstac Maria, Paraschiv Gabriela Mihaela, Bratu Mihaela Mirela, Sîrbu Rodica, Roncea Florentina Nicoleta, Bucur Laura Adriana, Badea Nicoleta, Meghea Irina, Baltă Andreea Gabriela, Gheorghiu Alina Karina, Zuliang Liao, Are Pedersen

#### **NOVELTY:**

The patent relates to the recovery in the bioeconomy of natural residual products, by obtaining an ecological fertilizer biocomposite based on natural waste from marine biomass, vegetal origin - algae and animal - zoobenthos and shells, in association with the residual sludge from treatment plants wastewater, being intended for improving, restoring quality and fertilizing soils in agriculture, viticulture, horticulture, forestry and to prevent soil erosion.

The invention also relates to a process for obtaining this fertilizer biocomposite by steps of conditioning the raw materials (washing, dehydration), drying, sanitizing, grinding, dosing, mixing, maceration, deodorization, granulation, drying, packaging.

#### **APPLICATIONS:**

- The ecological biocomposite fertilizer based on marine biomass and sewage sludge is aiming for improve the restoration of the soil quality and to fertilize agriculture soils, horticulture, forestry and for the prevention of the soil erosion.
- The composition formula of this ecological biocomposite was never been used as fertilizer.



Residual marine algae biomass from South Romanian Coastal area of the Black Sea; Raw materials



Sewage sludge from the temporally deposition from the waste water treatment plans; Raw material



Preparing the raw material, sewage sludge



Preparing the raw material marine and freshwater macroalgae vegetal biomass; Zoo-benthos biomass tube-shells, shell rock, crustacean, decapods, crabs



Ecological fertilizer biocomposite - Final product

**POTENTIAL BENEFICIARIES:** Farmers, Water and Environmental Protection Companies, Tourism Companies

**Fundig sources:** Norway Grants, Innovation Norway, Project: KNRIN-2008/115241



# International Exhibition of Inventions

## INVENTICA 2021

23.06.2021 - 25.06.2021



NATIONAL INSTITUTE OF INVENTIVES, IASI, ROMANIA



**Titulars: „OVIDIUS” UNIVERSITY OF CONSTANȚA  
„POLITEHNICA” UNIVERSITY OF BUCHAREST  
UNIVERSITY OF BUCHAREST**

**RESEARCH AND DEVELOPMENT NATIONAL INSTITUTE OF BIOLOGICAL SCIENCES  
S.C. PRODIAGNOSTIC S.R.L.**

### **PREPARATE FARMACEUTICE DE TIP GELURI BIOADEZIVE PE BAZĂ DE COMPLECȘI METALICI AI CLORHEXIDINEI ȘI PROCEDEU DE OBTINERE A ACESTORA PHARMACEUTICAL PREPARATIONS TYPE BIOADHESIVE GELS BASED ON CHLORHEXIDINE METAL COMPLEXES AND PROCESS FOR OBTAINING THEM**

**PATENT no. 127726/29.11.2013** Invention Classification - Medicine, Pharmacy, Cosmetics

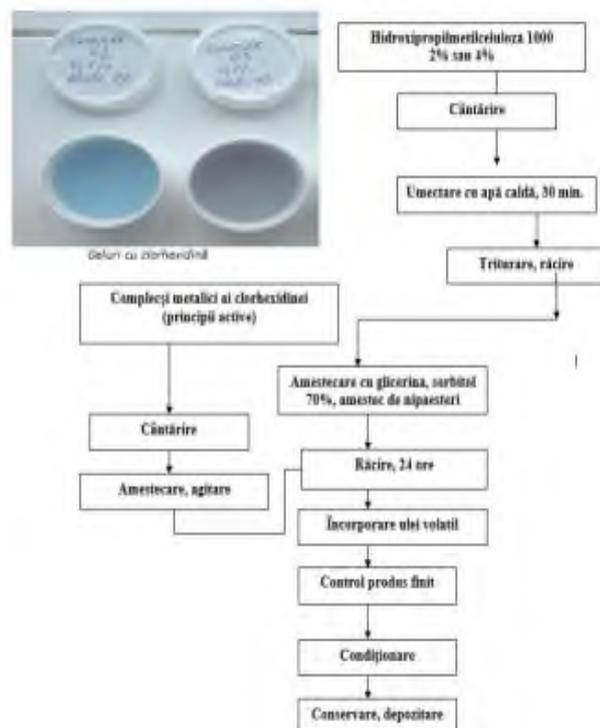
**INVENTORS: Negreanu-Pîrjol Ticuța, Negreanu-Pîrjol Bogdan-Ștefan, Guran Cornelia, Călinescu Mirela, Oancea Anca, Gorun Elena, Roncea Florentina, Dumitru Florina, Meghea Aurelia, Badea Nicoleta, Țarălungă Gheorghe, Sîrbu Rodica, Moldovan Lucia**

**NOVELTY:** Pharmaceutical preparations type bioadhesive gels based on metal complexes of chlorhexidine, consist of the active principle represented by Cu (II) and Zn (II) complexes of chlorhexidine (0.05 - 0.15%), mucoadhesive polymer of hydroxypropylmethylcellulose 2% or 4% (90 - 100%), sorbitol (1 - 5%), volatile peppermint oil (0.05 - 0.1%), EDTAN $\alpha_2$  (0.05 - 1%), preservative solution (0.05 - 0.1%), the percentages being by weight. It comes in the form of a translucent, homogeneous mass, without agglomeration of particles or air bubbles, blue in color, with a sweet taste, characteristic odor. The gels quality control was performed, consisting of organoleptic control, degree of homogeneity, determination of pH, rheological determinations, extensiometric and penetration capacity. It pack in aminoplast boxes and store in a cool place, away from light. The topical pharmaceutical preparations according to the invention have antimicrobial and antioxidant activity, are biocompatible, have low or negligible toxicity and are not environmental pollutants.

**APPLICATIONS:** Product for human health and / or veterinary, with disinfectant and antifungal action, for the treatment of mucosal.

#### **ADVANTAGES OF THE INVENTION:**

- Bioadhesive gel formulas based on complexes of chlorhexidine diacetate with Cu (II) and Zn (II) salts allow the prolongation of the therapeutic action and are maintained for a longer time in the mouth to achieve an increased concentration of the released drug substance and maintains its cohesion against the phenomena of salivary and mechanical erosion.
- The pharmaceutical form falls within the official quality parameters.
- The antimicrobial activity evaluated *in vitro* against the microbial strains *Staphylococcus aureus*, *Escherichia coli* and *Candida albicans* is increased compared to the chlorhexidine and metal salts from which they were obtained.



#### **POTENTIAL BENEFICIARIES:**

Human Pharmacies, PET Pharmacies, Pharmaceutical Industry, Dental Medicine Cabinets, Veterinary Medicine Cabinets



# International Exhibition of Inventions

## INVENTICA 2021

23.06.2021 – 25.06.2021



### PROJECT CONSORTIUM:

**CO: UNIVERSITATEA „OVIDIUS” DIN CONSTANȚA**

**P1: INSTITUTUL NAȚIONAL DE CERCETARE-DEZVOLTARE MARINĂ „GRIGORE ANTIPA”**

**P2: UNIVERSITATEA POLITEHNICA DIN BUCUREȘTI**

**P3: INSTITUTUL NAȚIONAL DE CERCETARE-DEZVOLTARE PENTRU ȘTIINȚE BIOLOGICE**

**P4: INSTITUTUL DE CHIMIE-FIZICĂ „ILIE MURGULESCU”**

**P5: STAȚIUNEA DE CERCETARE-DEZVOLTARE PENTRU VITICULTURĂ ȘI VINIFICAȚIE MURFATLAR**

**COMPLEX VALORISATION OF BLACK SEA REGION BIORESOURCES BY DEVELOPING AND APPLYING INNOVATIVE AND EMERGING BIOTECHNOLOGIES (Acronim INOBIOMAR)** (<https://univovidius.wixsite.com/inobiomar>)

**RESEARCH PROJECT no. 85PCCDI/2018, Project code PN-III-P1-1.2-PCCDI-2017-0701**

**AUTHORS: Negreanu-Pîrjol Ticuța, Roșioru Daniela-Mariana, Berger Daniela-Cristina, Prelipcean Ana-Maria, Moldovan Lucia, Mitran Raul-Augustin, Ranca Aurora**

**Domeniul proiectului de cercetare complex: Tehnologii noi și emergente, Perioada: 2018-2021**

**SCOPUL PROIECTULUI COMPLEX:** Aplicarea unor tehnologii inovative pentru obținerea de sisteme cu eliberare controlată de medicamente pentru dezvoltarea de produse farmaceutice bioregeneratoare și dermato-cosmetice prin încapsularea în structuri mezoporoase a unor compușilor bioactivi prezenți în organisme marine de origine vegetală și animală și biomasa vinicolă reziduală din regiunea Mării Negre, evaluarea efectelor acestora la nivel celular, precum și a potențialului antimicrobian și antioxidant.

### PROIECTE COMPONENTE:

**Titlul Proiect 1:** "Noi biotehnologii de valorificare a bioresurselor marine pentru obținerea de compuși naturali, bioactivi, utilizați la fabricarea de produse dermato-cosmetice" (Responsabil proiect P3: INCDSB)



Alge marine verzi, *Ulva lactuca* syn. *Ulva rigida*, *Cladophora vagabunda*; Materii prime



Gasteropode *Rapana venosa*; Materii prime

**Titlul Proiect 2:** "Tehnologii de încapsulare a unor substanțe biologice active în vederea valorificării bioresurselor din zona Mării Negre pentru biomedicină" (Responsabil proiect P2: UPB)



Produse secundare rezultate din procesele de vinificație; Materii prime



Moluște marine *Mytilus galloprovincialis*; Materii prime

**Rezultate estimate:** Organisme marine bogate în compuși bioactivi; biotehnologii de extracție a proteinelor și polizaharidelor; testarea a efectului biologic; protocol de prelucrare deșeurilor biologice; modele experimentale *in vitro* de evaluare a efectului de regenerare, antiinflamator și antitumoral; pulberi de silice mezoporoasă; metode de încapsulare, teste de viabilitate celulară optimizate, teste de activitate antioxidantă specifice, tehnologii de obținere a unor matrici mezoporoase de tip silice /TiO<sub>2</sub> pure sau funcționalizate, compozite silice-bioextract / TiO<sub>2</sub>-bioextract, biomasă reziduală, 3 tipuri de preparate farmaceutice și dermato-cosmetice cu efect bioregenerativ/ antimicrobian / antitumoral; tehnologie de obținere a unui biostimulator-regenerator, 10 participări la conferințe, 8 articole ISI/BDI, 2 capitole carte în străinătate, 4 cereri de brevet de invenție.

### Mulțumiri:

Autorii își exprimă aprecierea pentru suportul financiar oferit de Ministerul Român al Cercetării - UEFISCDI, pentru Proiectul complex no. 85PCCDI / 2018, Acronym INOBIOMAR, Project code PN-III-P1-1.2-PCCDI-2017-0701

***"George Emil Palade" University of Medicine, Pharmacy, Science and  
Technology of Târgu Mureș***



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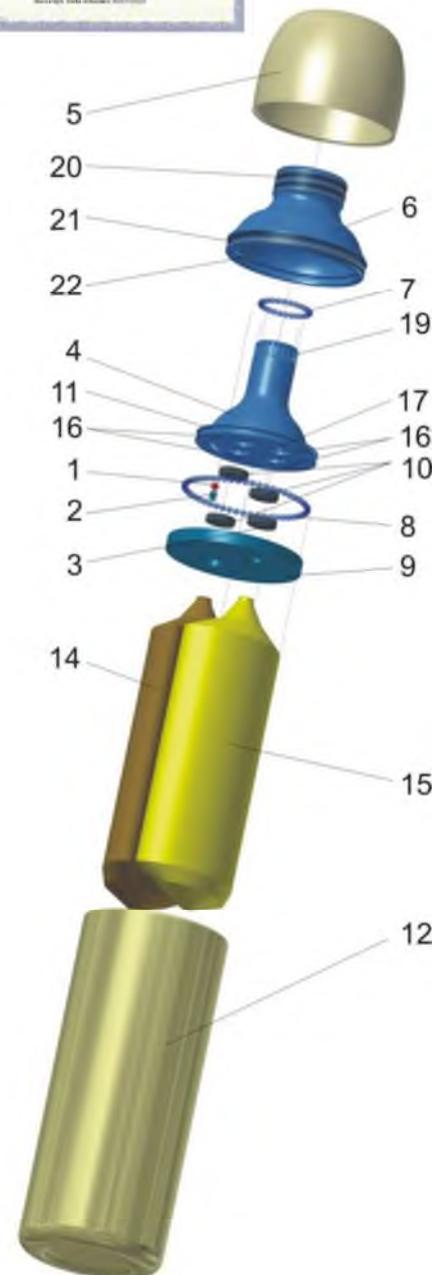
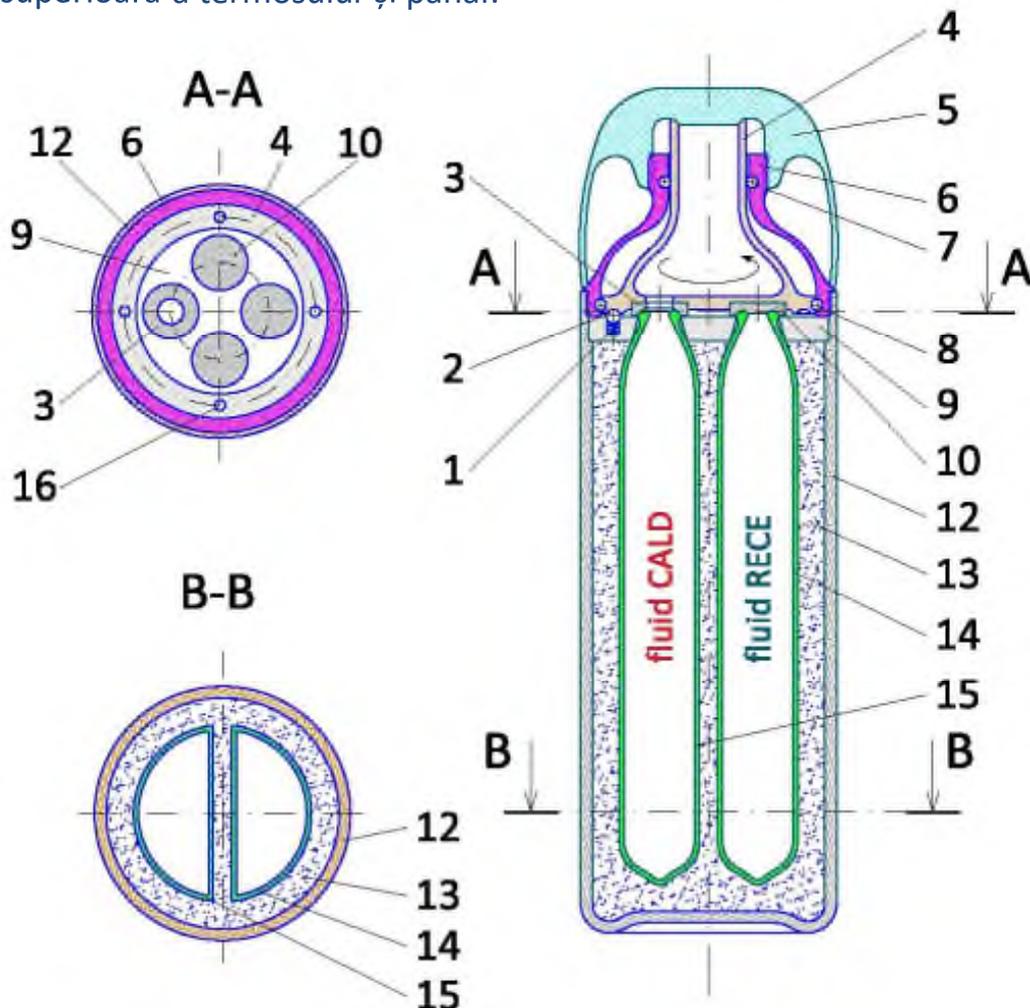
UMFST "G.E.Palade" din Tg.Mureș

## DOUBLE COMPARTMENTED THERMOS CONTAINER

Brevet de Invenții: **NR. 129338**

Inventator (Inventors/ authors): **Dr.ing. Bogdan BUCUR**

Invenția implementează o soluția tehnică simplă și fiabilă prin utilizarea unui sistem modulat de capace care să permită captarea, ghidarea, etanșarea și opturarea camerelor în orientarea separată a fluidelor spre golire sau umplere din/în termos, precum și utilizarea unui sistem de indexare-blocare și selectare golire/umplere a fluidelor aflate la temperaturi diferite, consumate pe rând fără a se produce amestecul lor. Forma capacului exterior al termosului completează armonios estetica și ergonomia termosului, prezentînd totodată o combinație de două funcții: capac prin infiletare în partea superioară a termosului și pahar.





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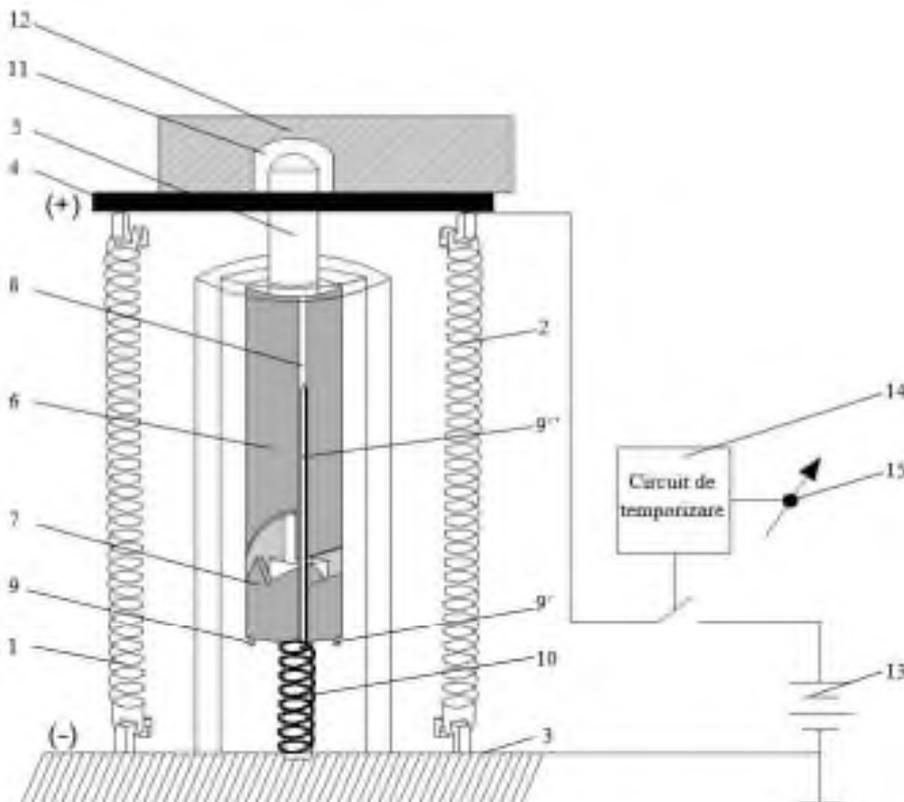
„STEFAN CEL MARE” UNIVERSITY OF SUCEAVA

## INTERLOCKING SYSTEM

European Patent No. EP3536880/2020

**Inventori (Inventors/ authors):** NIȚAN Ilie, MILICI Laurențiu-Dan, POIENAR Mihaela, CERNUȘCĂ Dumitru, PAȚA Sergiu Dan, PIANÎH Alexei, PENTIUC Radu Dumitru, POPA Cezar, RAȚĂ Mihai, UNGUREANU Constantin

According to the invention, the interlocking system consists essentially of two Nitinol springs (1) and (2) attached to one end of the fixed plate (3), and at the other end of the movable plate (4) with the locking element (5), whose bi-directional displacement obtained by heating the springs, controls the position of two cams (6) and (7) by means of guiding grooves (8'), (8''), (9), (9'), (9'') and leads to the locking or unlocking of the mobile element (12).



### Advantages:

- constructive simplicity;
- safety in exploitation;
- reduced gauge;
- the ability to remotely command.



# International Exhibition of Inventions INVENTICA 2021 23.06.2021 – 25.06.2021



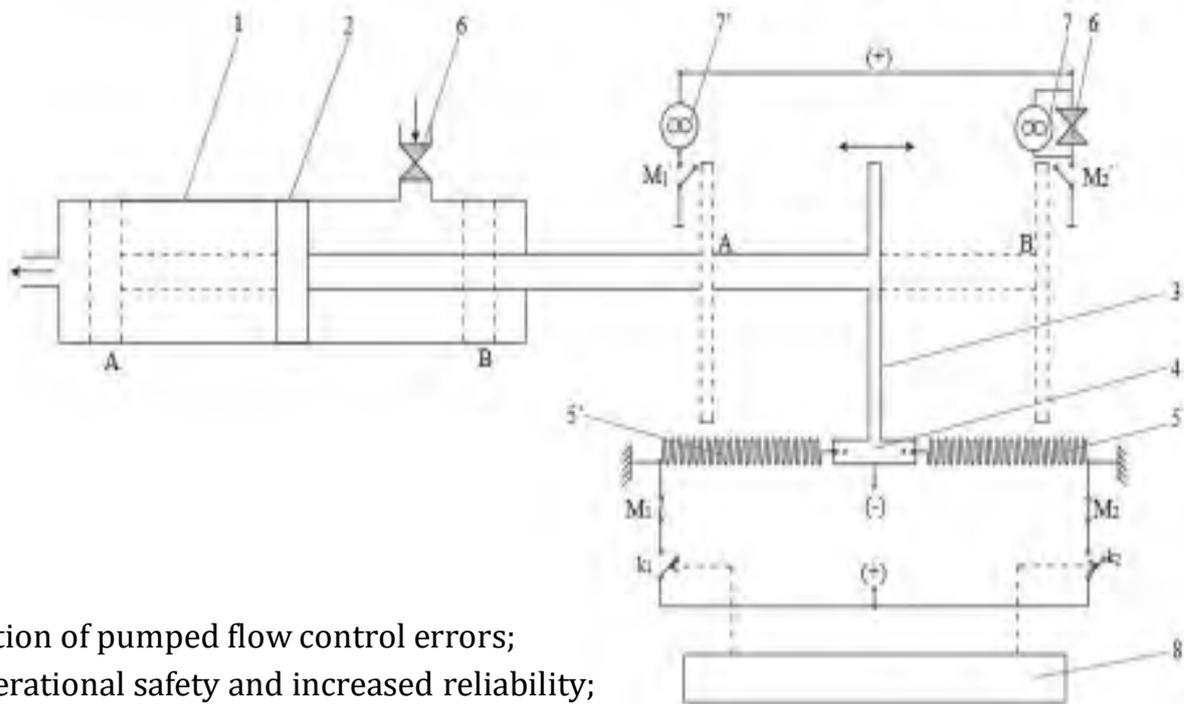
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## PUMPING SYSTEM

European Patent Application No. EP20464011.4/2020

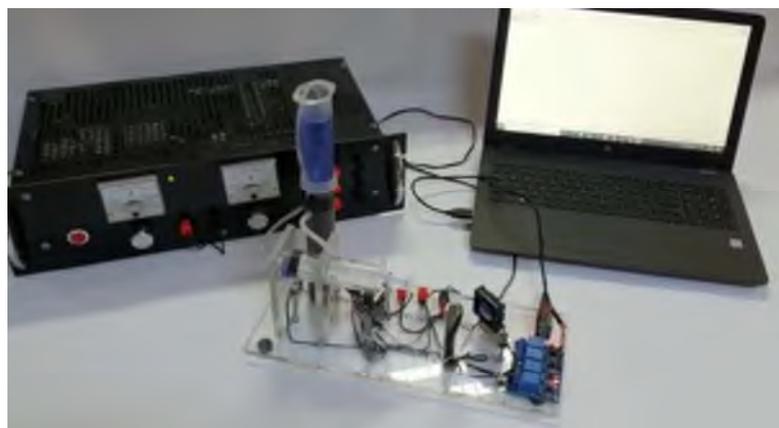
**Inventatori (Inventors/ authors):** TOADER Eusebiu, NIȚAN Ilie, PAVĂL Mihaela, MILICI Dan Laurențiu, CERNUȘCĂ Dumitru, MILICI Mariana Rodica, GRAUR Adrian, DIMIAN Mihai, UNGUREANU Constantin

The pumping system according to the invention consists of a cylindrical container (1), provided with a piston (2) which is moved by means of a rod (3) terminated with a T-shaped profile, provided at the lower end with a support (4) fixing two nitinol springs (5) and (5'), and the upper part of the rod profile (3) acts at the ends of the stroke the double microcontacts ( $M_1$ ), ( $M_1'$ ) and ( $M_2$ ) respectively, ( $M_2'$ ), which controls the closing and opening of the electrovalve (6), the fans (7) and (7') and disconnects the heating circuits of the nitinol springs (5) and (5') controlled alternately by the relay contacts ( $k_1$ ) and ( $k_2$ ) by means of a microcontroller (8).



### Advantages:

- ✓ elimination of pumped flow control errors;
- ✓ high operational safety and increased reliability;
- ✓ high fluid control accuracy.





# International Exhibition of Inventions INVENTICA 2021 23.06.2021 – 25.06.2021



STEFAN CEL MARE UNIVERSITY OF SUCEAVA



Stefan cel Mare  
University  
of Suceava

## TROUT PASTE WITH CHANTERELLE MUSHROOMS AND WILD GARLIC AND PROCESS FOR OBTAINING IT

Patent application A/00450/2020

Inventors: Adriana Dabija, Georgiana Gabriela Codină

The trout paste with chanterelle mushrooms and wild garlic, according to the invention, is a canned fish paste type, with a high nutritional value, which contains only natural ingredients without any food additives addition and to a process for obtaining it. The obtaining of the trout paste with chanterelle mushrooms and wild garlic, according to the invention, consists: vacuum boiling of gutted and decapitated trout, cooling, deboning, the raw materials addition according to the manufacturing recipe, mixing–homogenization composition up to a creamy paste is obtained, unctuous, dosing in glass jars followed by airtight closure, sterilization jars and cooling.



The chanterelle mushrooms combat fatigue and asthenia, prevent the cardiovascular diseases and even cancer due to it B vitamins (riboflavin, niacin, folic acid, thiamine and B6), vitamin D and minerals (potassium, copper, zinc, selenium, iron, magnesium, phosphorus and calcium) content, they are very rich in amino acids, especially glutamate, which gives them a taste close to that of meat; they contain a low amount of sodium, does not contain cholesterol and they have a low energy value.

The wild garlic is a spicy plant with phytotherapeutic properties from the recipe, as follows: wild garlic has a purifying, detoxifying, antiseptic, antiviral, antimicrobial effect, immunomodulatory role, antihypertensive action, peripheral vasodilator, antithrombotic, blood thinner, bronchodilator, expectorant and antitumor action; consumed for a long period of time, this plant through its substances is an effective remedy in heart disease treatment, in memory improving and in treating insomnia; contains allyl sulfide, vitamins A,C, carotenoids, ethereal oil, volatile oils, allicin, mineral salts (calcium, iron, phosphorus, copper, sodium).



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# International Exhibition of Inventions INVENTICA 2021 23.06.2021 – 25.06.2021



STEFAN CEL MARE UNIVERSITY OF SUCEAVA



## YOGURT WITH BUCKWHEAT AND OAT FIBERS

Patent application R0133923 (A2)/2018

Inventors: Adriana Dabija, Georgiana Gabriela Codină

The invention relates to a fermented dairy product, with the role of a functional food, in the composition of which only natural ingredients are included: fresh cow's milk with 3.5% fat, sweet cream with 32% fat, flakes and buckwheat flour, oat fibers, cultures of lactic acid bacteria, without the addition of food additives and to a process for obtaining it. Yogurt with buckwheat and oat fibers has an increased content of bioactive compounds, minerals, dietary fibers, with a high biological value.



In terms of composition, the innovation consists in the combination of these two ingredients: buckwheat and oat fiber with yogurt, mix that is not found on the world market for dairy products. Buckwheat and oats are important sources of energy due to the high starch content, high-quality lysine and arginine-rich proteins, dietary fibers, and lipids which rich in unsaturated fatty acids. This yogurt is refreshing, has a pleasant taste and flavor and can be consumed anytime ensuring total satisfaction of consumer's expectations. It is recommended by its satiability that can be felt while enjoying the amazing taste.

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***"Iuliu Hațieganu" University of Medicine and Pharmacy of  
Cluj-Napoca***



# International Exhibition of Inventions

## INVENTICA 2021

23.06.2021 - 25.06.2021



NATIONAL INSTITUTE OF INVENTICS, IASI, ROMANIA



Universitatea de Medicină și Farmacie "Iuliu Hațieganu",  
Universitatea de Științe Agricole și Medicină Veterinară Cluj-Napoca,  
Universitatea Babeș-Bolyai, SPS IMPEX SRL



### BRIOȘE DIN HRIȘCĂ FERMENTATĂ CU MĂR ȘI BANANĂ

**Cerere brevet / Proiect : A01144 / PN-III-P2-2.1-CI-2017-0415**

**Inventatori:** Fodor Adriana, Cozma Angela, Romana Vulturar, Suharoschi Ramona Dana, Mureșan Crina, Sitar Tăut Adela Viviana, Sitar Tăut Dan, Cornelia Giuglea

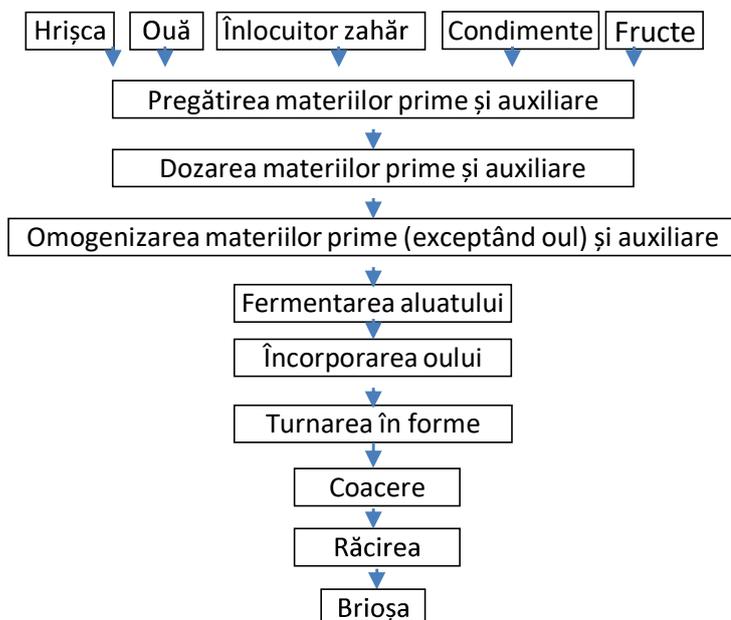
Invenția de față face referire la două produse de panificație inovative, dietetice, pe bază de hrișcă fermentată: brioșa cu 40% fructe și brioșa cu 55% fructe.

Aspectul inovativ este reprezentat de utilizarea făinii de hrișcă fermentată în locul făinii de grâu și a agenților de afânare, pentru realizarea de produse dietetice care se adresează persoanelor cu alergii /sensibilitate la gluten, intoleranță la lactoză. Folosirea îndulcitorilor naturali, acalorici: eritritol și ștevie, precum indexul glicemic scăzut al făinii de hrișcă extinde adresabilitatea acestor produse și la persoanele cu diabet zaharat, respectiv obezitate.

Prin aplicarea invenției se obține produse inovative cu următoarele avantaje: • conținut nutrițional îmbunătățit, • proprietăți senzoriale crescute, • adresabilitate largă a consumatorilor, inclusiv cei cu intoleranțe /sensibilitate la gluten / lactoză, diabet, obezitate.

Materii prime și auxiliare	Brioșa 40%	Brioșa 55%
Hrișcă hidratată [%]	38.75	30.75
Ouă (un ou aprox 55 g) [%]	14	14
Eritritol : Ștevie (100 : 0.8) [%]	7	0
Scorțișoară [%]	0.25	0.25
Măr : banană (1:1) [%]	40	55
Conținut caloric [kcal/gr produs crud]	1	1
Conținut proteine [%]	4	3.71
Conținut carbohidrați [%]	18.55	19.12
Din care fibre [%]	3.1	3
Conținut lipide [%]	1.91	1.85

### Rețete & procesul tehnologic





# SOLID PLASMONIC SUBSTRATE BASED ON SILVER NANOPARTICLES FOR SURFACE ENHANCED RAMAN SPECTROSCOPY

**Authors:**

Valentin Toma<sup>1</sup>  
 Ioana Pavel<sup>2</sup>  
 Nicolae Leopold<sup>3</sup>  
 Mihai Constantin Lucaciu<sup>4</sup>  
 Rareș Ionuț Știufiuc<sup>1,4</sup>

<sup>1</sup>MedFuture Research Center for Advance Medicine, "Iuliu Hațieganu" University of Medicine and Pharmacy, Cluj-Napoca, Romania;

<sup>2</sup>Department of Chemistry, Wright State University, OH, USA;

<sup>3</sup>Faculty of Physics, "Babeș-Bolyai" University, Cluj-Napoca, Romania;

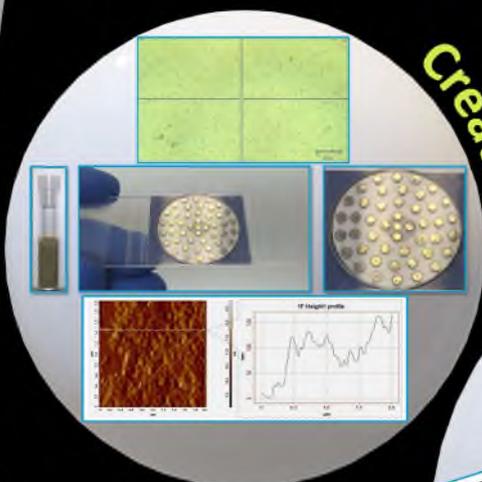
<sup>4</sup>Department of Pharmaceutical Physics-Biophysics, "Iuliu Hațieganu" University of Medicine and Pharmacy, Cluj-Napoca, Romania

The large-scale application of the SERS method in clinical practice implies reaching certain goals that are vital to achieve in order to implement the technique in routine diagnostics. These characteristics are: the robustness of the method, a low cost per sample and last but not least an easy to operate and translate workflow.

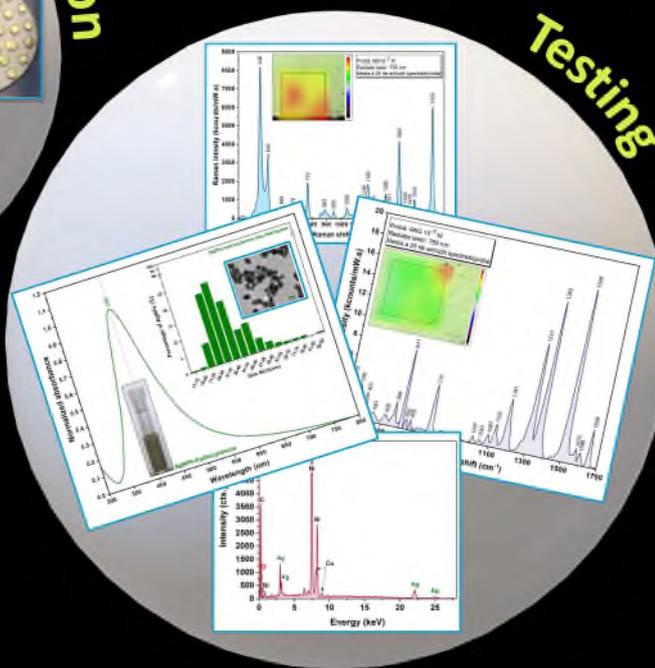
As part of this invention we present a simple procedure used to obtain solid substrates for SERS investigations. These substrates are capable of providing high intensity SERS signals from low molecular weight molecules found in biological liquids such as: plasma, serum, saliva, cellular lysates, without the need for a preliminary deproteinization step and at high reproducibility rates. The method is based on the self-assembly of highly concentrated and purified silver nanoparticles (obtained by reducing silver ions with hydroxylamine) on a Raman transparent CaF<sub>2</sub> glass slide. The colloidal solution used to prepare the substrates was obtained using the Leopold-Lendl method. Purification and concentration of the samples was performed by running the colloid through a tangential flow filtration device equipped with different sized porous filters (10-100 kDa).

The efficiency of the substrate was analyzed by performing measurements on reference molecules that possess good Raman cross-sections such as methylene blue and rhodamine 6G, and also on biological liquids such as plasma, serum, saliva, etc. We have observed a variation coefficient of the SERS signal below the 10% margin.

The spectra recorded using these substrates have been employed for early breast cancer detection by means of Multivariate Analysis of the spectra collected on blood samples.

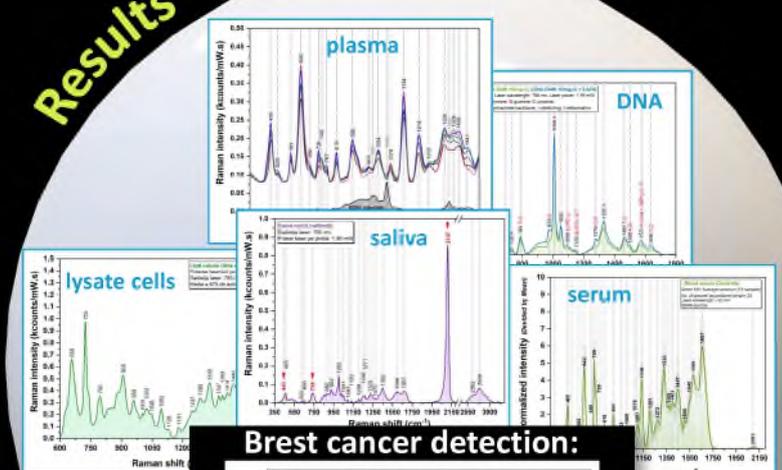


Creation

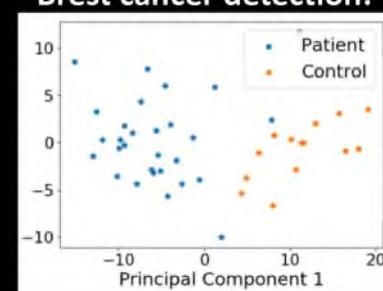


Testing

Results



**Breast cancer detection:**



Sensitivity: 90%  
 Specificity: 89%  
 Accuracy: 89%



# THE 24<sup>th</sup> INTERNATIONAL EXHIBITION OF INVENTIONS INVENTICA 2021, IAȘI – ROMÂNIA, 23<sup>th</sup> – 25<sup>st</sup> of June 2021



**EUROINVENT**  
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Iasi, Romania, 20-21 May 2021  
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**Babes Bolyai University, Cluj-Napoca**



**ICCRR  
Raluca Ripan Chemistry  
Research Institute**

## Natural antiplatelet agents based on *Allium cepa L.* extract used in primary cardiovascular prevention

Moldovan Marioara, Oprean Radu, Saplonțai-Pop Aniela Cristina, Prodan Doina, Saroși Liana Codruța, Silaghi-Dumitrescu Laura, Cuc Stanca, Agapescu Camelia

Iuliu Hatieganu University of Medicine and Pharmacy, Cluj-Napoca; Babes Bolyai University, Cluj-Napoca- Raluca Ripan Chemistry Research Institute

Corresponding author: [mmarioara2004@yahoo.com](mailto:mmarioara2004@yahoo.com)

### PRESENTATION

The present invention relates to the composition of the solid, lyophilized formulation, presented in encapsulated form, obtained on the basis of *Allium cepa L.* extract. The presented formulation is intended for primary cardiovascular prevention, **for the demonstrated antiplatelet effect**. According to this patent, the encapsulated formulation consists of a liquid extract obtained from the white variety of *Allium cepa L.* stabilized with excipients to decrease the degree of hygroscopicity and increase the stability in lyophilized form.

**THE NOVELTY ACCORDING TO THE CURRENT PATENT** - it is the composition of the product used in the antiplatelet effect, by obtaining a solid, lyophilized formulation, in encapsulated form, based on *Allium cepa L.* extract, with proven antiplatelet effect, used in primary cardiovascular prevention.

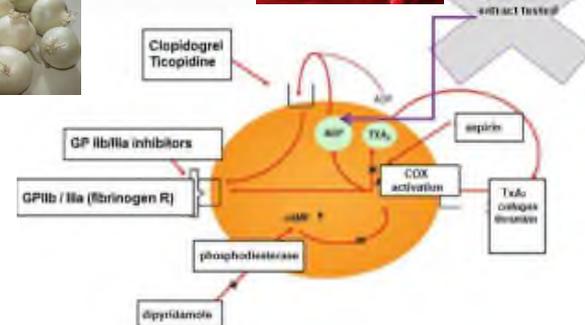
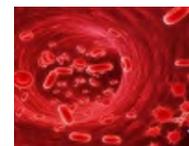
### FIELDS OF USE

The obtained product from this patent is ideal for:

- Primary prevention in patients with cardiovascular risk factors for atherothrombotic pathology;
- Primary prevention in the patient with intolerance / allergy to the synthetic antiplatelet agent;
- Primary prevention of atherothrombotic pathology in the elderly patient.

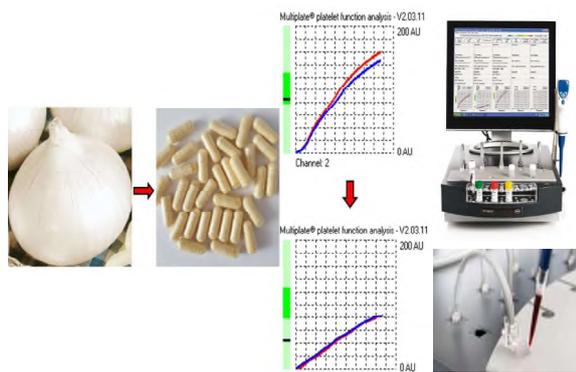
### TECHNICAL CHARACTERISTICS

- Synthetic antiplatelet agents - among the most used drugs by the cardiologist.
- Numerous studies attesting - similar effect, exerted by extracts obtained from various varieties belonging to the family Alliaceae (*Allium cepa*, *Allium sativum*, *Allium ampeloprasum*) - they contain organosulfur compounds, with inhibitory effect on platelet aggregation, formed by S-alk lysis) il-L-cysteine sulfoxide under the action of the specific enzyme, alinase.

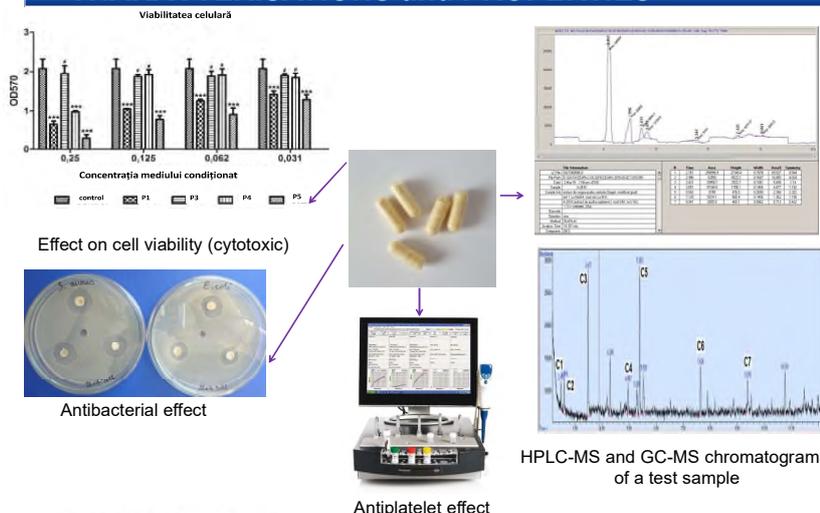


Mechanism of action of *Allium cepa L.* extract, at the level of platelet aggregation process

Obtaining the encapsulated formulation and demonstrating its antiplatelet effect by *in vivo*, prospective clinical study



### CHARACTERISATIONS and PROPERTIES



### Advantages of use

- Antiplatelet effect demonstrated;
- Reduced side effects, being a compound based on natural extract;
- High biocompatibility;
- Low cost price.

### Contraindications

- Cardiovascular secondary prevention (no studies);
- Known allergy / intolerance to the excipients used.



**DO NOT FORGET the real and viable  
alternative for many cases of  
cardiovascular disease**



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 CLUJ-NAPOCA

## A fiber glass reinforced composite for CAD CAM applications in dentistry

**Authors:** Bogdan Culic<sup>1</sup>, Mihai Varvară<sup>1</sup>, Diana Dudea<sup>1</sup>, Alexandru Grecu<sup>1</sup>, Alexandru Burde<sup>1</sup>, Cristina Gasparik<sup>1</sup>, Cristina Prejmerean<sup>2</sup>, Mărioara Moldovan<sup>2</sup>, Doina Prodan<sup>2</sup>, Codruța Sarosi<sup>2</sup>, Laura Silaghi-Dumitrescu<sup>2</sup>, Mițuța Filip<sup>2</sup>

### Authors' affiliations:

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<sup>2</sup> Institute of Research in Chemistry "Raluca Ripan", Babes- Bolyai University, Cluj Napoca, Romania



### Introduction

In the last three decades, exciting new developments in dental materials and computer science have led to the success of contemporary dental computer-aided design - computer-aided manufacturing (CAD-CAM) technology. Each year, new materials appear with improved properties and qualities.

The **objective** of the work was to develop a new cad cam milling material using fiber glass reinforced composite.



Figure 1. CAD-CAM restorative materials

### Materials and method

A selection of 2 different types of resins (R1 composed from 25%Bis-GMA, 40%UEDMA, 35%DMTEG and R2 composed from 65%Bis-GMA, 35% DMTEG) with 2 different types of hybrid filler (F1 with 42% quartz, 42% radiopaque glass and 16% hydroxyapatite and F2 with 90% quartz and 10% colloidal silica) and 3 different types of E type fiber glass geometries (veil 30g/m<sup>2</sup>, twill 163g/m<sup>2</sup> and stratimat 300g/m<sup>2</sup>) in 4, 6, 8 and 10 layers were used in this in vitro study. Inside of a silicon cube of 1 cm side, layers of resin and fiber glass were placed one above another. After each layer a light curing process of 10 seconds was done in 5 different points. 2 mm thick samples were cut with a precision saw (Isomet 1000, Buehler, USA) and investigated with SEM and Raman spectroscopy. Data were analyzed with dedicated software.

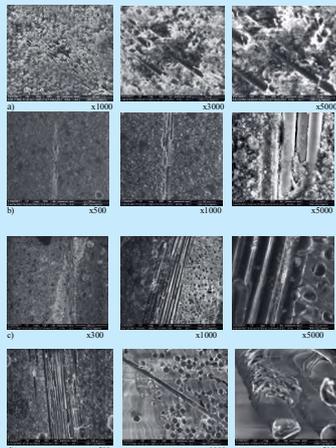


Figure 2. SEM images of fiber glass reinforced composite a) FRC1; b) FRC2; c) FRC3; d) FRC4

The following studies were performed:

- Design of FRC components for applications in CAD / CAM technology
- Formulation of a series of resins / glass fibers / coupling agent
- Study of the polymerization mechanisms of particulate composites using various initiation systems
- Preparation of a series of FRC using fiberglass with different architectures
- Structural characterization of the obtained material, at nanometric level
- Studies on the cytotoxicity of FRC components and material
- Development of the experimental model of FRC material for the CAD / CAM processing
- Manufacturing of experimental restorations from the tested FRC disks
- Testing the optical properties of FRC
- Validation of the system in laboratory conditions



Figure 3. Evolution of the homogeneity



Figure 4. Different E type fiber glass geometries

Type	Resin	Hybrid filling	Fiber glass geometry	Number of layers
FRC1	R1	U1	Veil	6
FRC2	R2	U2	Veil	10
FRC3	R2	U2	Twill	8
FRC4	R2	U2	Stratimat	4

### Results

Raman analysis showed a powerful interaction between the polymer and the fiber glass. SEM data revealed that the different fiber glass geometries were well incorporated inside the resin, resulting an acceptable homogeneity. The invention relates to a composition of fiber glass reinforced composite material based on thermo-baro-photopolymerizable composite resin and fiber glass fabric type E in the form of a veil and / or Stratimat, being indicated for obtaining a material to be used for prosthetic restorations using CAD / CAM technology. The material has superior mechanical properties and corresponding radiopacity. The dental product is presented in the form of a composite disc reinforced with solid fiberglass, with a diameter of 98.5 mm and a height of 10 mm, dimensions specific to dental CAD/CAM technology.

### Conclusions

Within the limitation of this study, it seems that it is possible to achieve a fiber glass reinforced composite for the use of CAD CAM technology. Further investigation must be done in order to test all the properties of the new material.

**Key words:** CAD CAM, composite, fiber glass

**Acknowledgement:** This work was supported by the Romanian National Authority for Scientific Research and Innovation, UEFISCDI, project PN-III-P2-2.1-PED-2016-1936

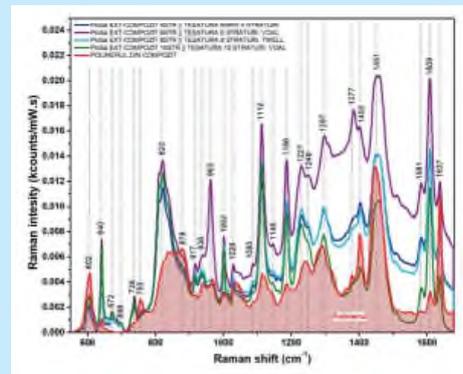


Figure 5. Raman spectra averages measured on the pure polymer, respectively on the 4 classes of FRC materials

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***“Ion Ionescu de la Brad” University of Agricultural Sciences  
and Veterinary Medicine of Iasi***



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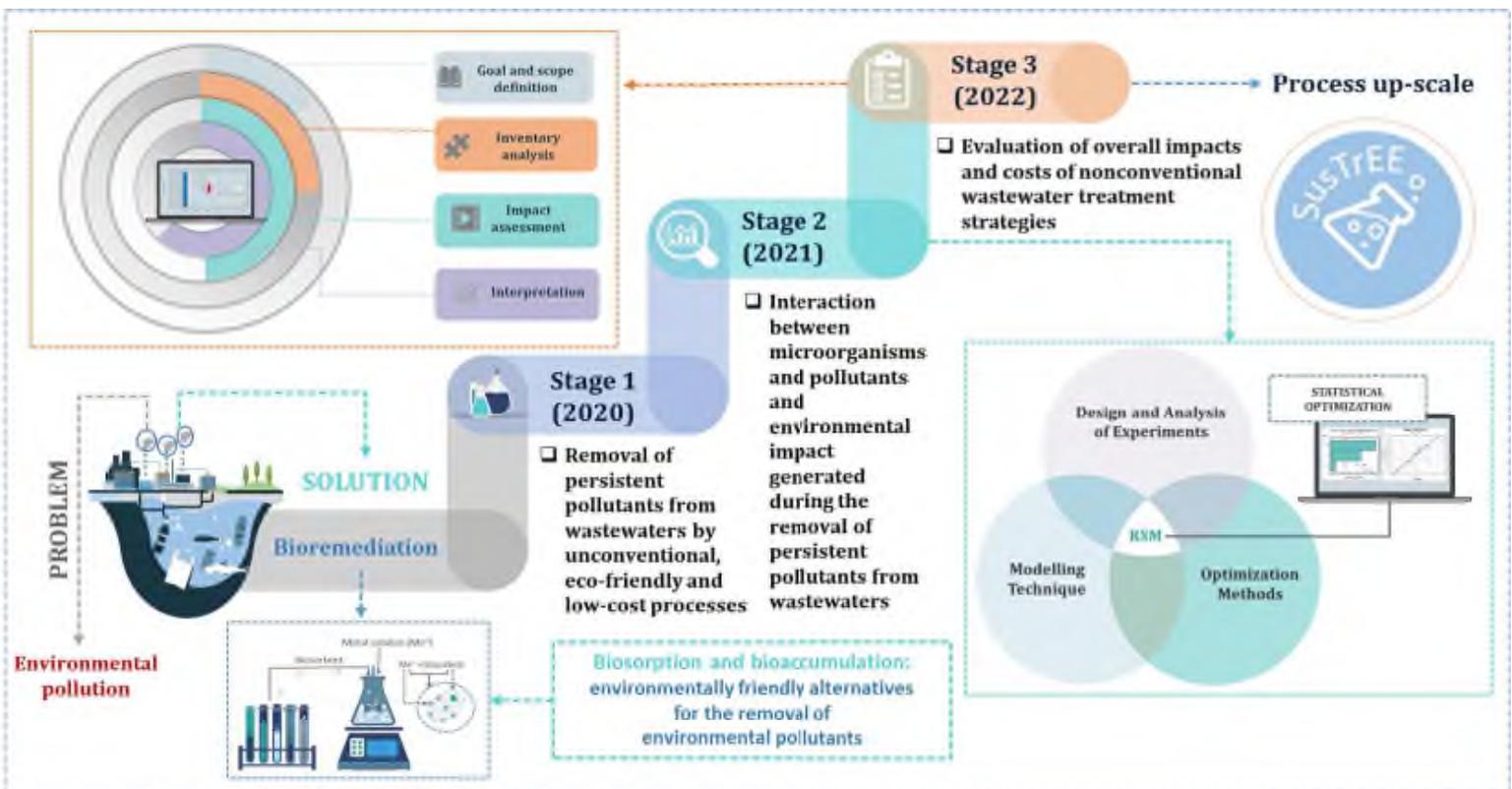
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## Evaluation of sustainability of eco-friendly processes used in wastewater treatment based on an integrated environmental and economic assessment approach (SusTrEE)

Research project number 439 PED / 2020, Code PN-III-P2-2.1-PED-2019-2430

Raluca Maria Hlihor, Maria Gavrilesu, Maria Apostol, Petronela Cozma,  
Isabela Maria Simion, Cătălina Filote, Mihaela Roșca



**Project Director:**  
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**Acknowledgments:** This work was supported by a grant of the Ministry of Research, Innovation and Digitization, CNCS/CCCDI – UEFISCDI, project number PN-III-P2-2.1-PED-2019-2430, contract no. 439 PED/2020, within PNCDI III.



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## Tailor-made human health risk assessment framework for evaluating the toxicity caused by heavy metals contamination of herbal based products used in phytotherapy and cosmetics (RiskToxPlants)

Research project number TE 120 / 2020, Code PN-III-P1-1.1-TE-2019-1200

Raluca Maria Hlihor, Maria Gavrilesu, Maria Apostol, Gabriel-Ciprian Teliban, Stavarache Mihai, Laura Hagiuzaleschi, Isabela Maria Simion, Dana Asiminicesei, Adrian-Ilie Nazare

*RiskToxPlants project has as fundamental objective the development of a human health risk assessment framework aiming to improve the quality of life by providing appropriate recommendations for safety levels of metals contained in medicinal plants used for phytotherapy and cosmetology.*

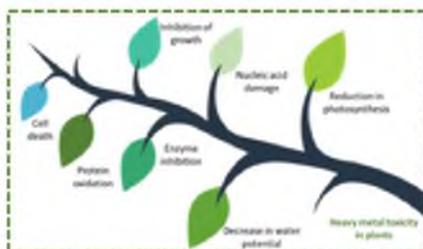


### RiskToxPlants novelty



□ RiskToxPlants is leading to a new vision that aims at developing a risk assessment framework used to provide appropriate recommendations for safety levels of metals contained in medicinal plants.

□ RiskToxPlants will be able to provide insights into the mechanisms by which plants take up metals and their detoxification/antioxidative pathways using biochemical and physiological studies and by identification of their histo-anatomical characters.



### Stage 1 (2020)

□ Detailed analysis of human health risks generated by the exposure to herbal plants contaminated with heavy metals used in phytotherapy and cosmetology according to the state of the art.

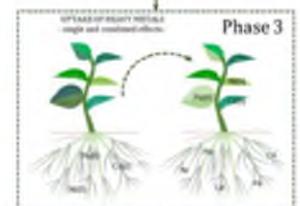
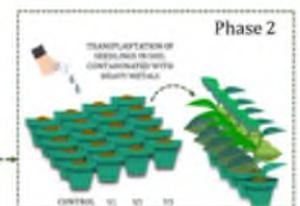
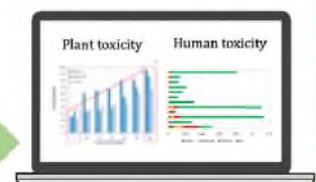


### Stage 2 (2021)

□ Investigation on the growth and development of herbal plants under heavy metal stress. Evaluation of herbal plants growth in stress caused by heavy metals presence in soils using biochemical and physiological studies and identification of their histo-anatomical characters.

### Stage 3 (2022)

□ Human health risk analysis based on the intake of heavy metals in different scenarios.



**Project Director:**  
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**ION IONESCU DE LA BRAD UNIVERSITY OF LIFE SCIENCES**



## INVENTION NAME

**Cerere brevet (Patent application) nr. OSIM A/00094/2020:**

**PROCEDURE AND INSTALLATION OF PLANT IRRIGATION WITH BIOSENSOR**

**Inventatori (Inventors):** Vasile Stoleru, Vlăduț Achitei, Mădălin Vasile Gheorghitoaie, Ilie Bodale, Vergil Marian Muraru

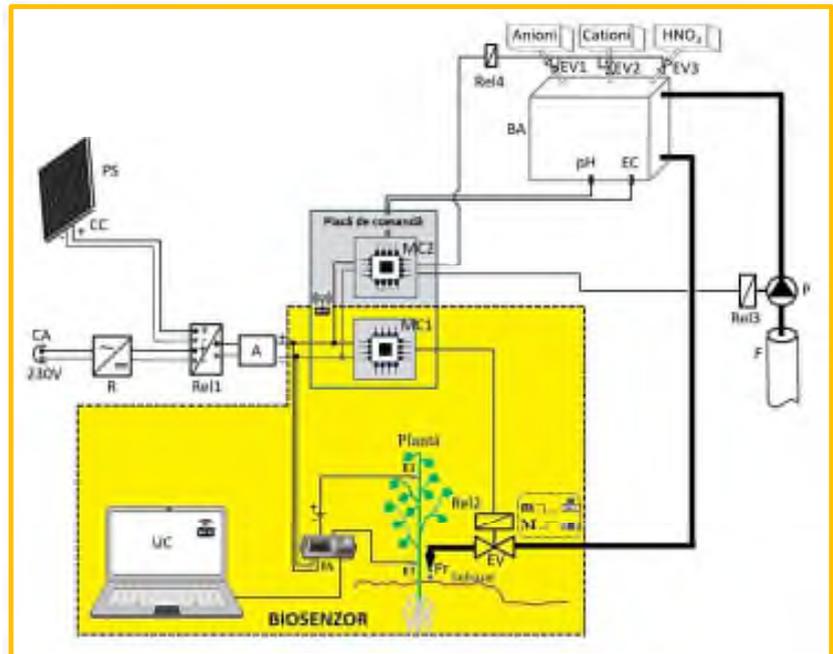
**Biosensor** is a smart control system of watering/fertilization of plants based on monitoring the electrical signal (ES) through plant stem. In plant, the ES is generated by the ions flow from xylems (yellow diagram from below figure).

### The element of novelty

Our invention use few plants to determine the time of watering and dose of nutrients according to the plants need.

### Operating principle

- The invention allows to control of the water and nutrients consumption, by monitoring the ES collected by two electrodes (E1, E2) inserted in stem of the plant.
- Electrodes have the role to collecting the low-intensity ES, which is the input for the smart system formed by microampermetre – computer - microcontroller assembly.
- The mixt of water and nutrient from water tank (BA) is controlled automatically by connecting the pH and electroconductivity sensors to the smart system of the installation. The assembly open or close the solenoid valves (EV) of the irrigation system.



**Advantages of the invention** The biosensor irrigation system has several advantages:

- ❑ **Physiological:** The plants determine the time of watering and the amount of water-nutrients to be supplied, which ensures favorable hydrological conditions for the vegetation period;
- ❑ **Economic:** The system works at low pressures, which ensures significant savings in water and electricity, which are needed in the climate change conditions;
- ❑ **Increased production:** Ensures increase of production, even in drought conditions;
- ❑ **Phytosanitary:** Reduces the incidence of fungal attacks by controlling soil moisture.
- ❑ **Adaptability:** The system can be used for all plants with an aerial stem greater than 10 cm.

**These advantages increase profit by reducing operating costs and increasing fruit production, as well as improving the quality of fruit grown in adverse weather conditions.**



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**INVENTION NAME**



**Cerere brevet (Patent application) nr. OSIM A/00122/2018:**

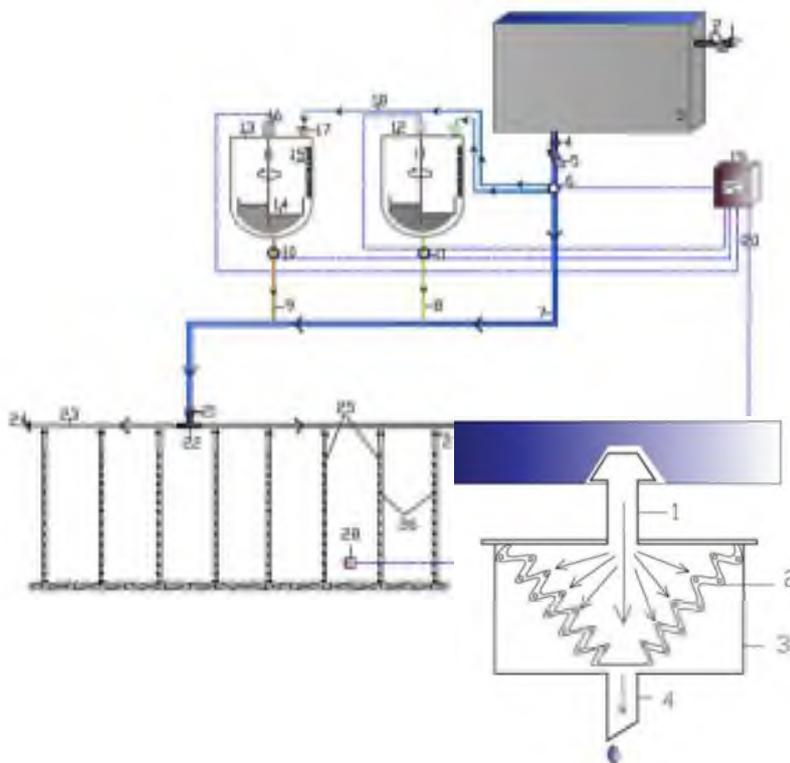
**Automatic installation for irrigation and hydrolyzing fertilization of crop plants in dual system**

**Inventors: Stoleru Vasile; Munteanu Neculai; Ţenu Ioan; Vîntu Vasile; Vitănescu Maricel; Teliban Gabriel**

Automatic installation for irrigation and hydrolyzing fertilization of crop plants, has dripping lines which perform uniform distribution of nutritive solution with microorganisms and chemical.

**The element of novelty** - The installation has the two tanks which are provided for a chemical solution and for a microorganism-based solution and are provided with a stirrer actuated by an electric motor. The two tanks are automatically opened by some dosing pumps controlled by a computer, depending on the substrate or soil humidity. The main and secondary pipes are configured to distribute the nutritive solution. The preset number of dripping lines is provided with a blind hose and some individual nozzles to perform the uniform distribution of the fertilizing solutions.

**Operating principle:** The installation consists of a water storage tank (3), a chemical solution tank (12) and a microorganism tank (13). The both basins are equipped with an individually operated rotary shaker (14). The level of the solution is constantly monitored using a graduated scale (15). The opening of the two basins is performed automatically by some dosing pumps (10, 11) controlled from a computer, depending on the soil moisture level (28). The main distribution line (7) and the secondary line for the nutrient solution (23) are common. Both the drip line (25) and the individual drippers (26) ensure a uniform distribution of the solution with microorganisms and/or chemical elements. The drip nozzles (26) are made of a main body and a housing that facilitates the passage of microorganisms through holes with a diameter of 1 mm.



**Advantages of the invention** The uniform distribution of the fertilizer solution is achieved with microorganisms and chemicals in the crop plants.

- Physiological:** efficient use in the nutrition process of soil ions;
- Economic:** These advantages increase profit by reducing operating costs and yield increasing, as well as improving the quality under adverse weather conditions;
- Increased production:** Ensures increase of production under abiotic stress conditions;
- Phytosanitary:** increasing plant resistance to biotic stress;
- Adaptability:** the system adapts to all horticultural crops

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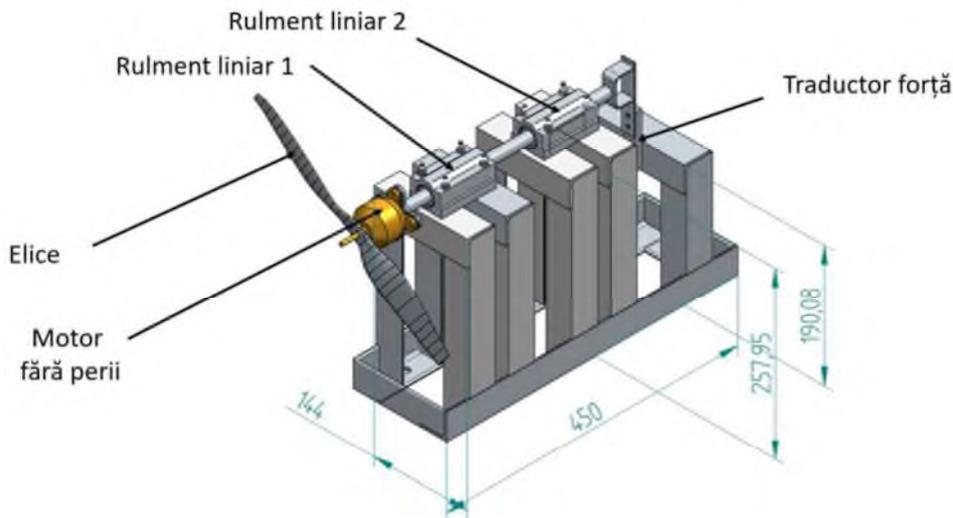
**Institutul Național de Cercetare-Dezvoltare Turbomotoare COMOTI**

## STAND DE TESTARE AUTOMATIZAT DESTINAT VEHICULELOR AERIENE FĂRĂ PILOT AVÂND PROPULSIE ELECTRICĂ CU ELICE

**Cerere brevet (Patent application): U2021\_00010**

**Inventatori (Inventors): Tiberius-Florian FRIGIOESCU, Teodor-Adrian BADEA, Mihaela-Raluca CONDRUZ, Alexandru PARASCHIV**

Stand de testare autonom, cu interfață software, a motoarelor fără perii cu elice destinate vehiculelor aeriene fără pilot, stand cu care se pot analiza performanțele unei configurații de motorizare. Standul este format din 2 computere, o structură metalică cu rulmenți liniari și o tijă pe care este montat motorul cu elice. Computerul R1 va controla turația motorului prin intermediul computerului R2 care totodată va afișa, înregistra, vectoriza și salva valorile forței, tensiunii, intensității, temperatura motorului și a sunetului. Interfața software permite introducerea procentului maxim de PWM, intensitate maximă, putere maximă și afișarea datelor procesate.

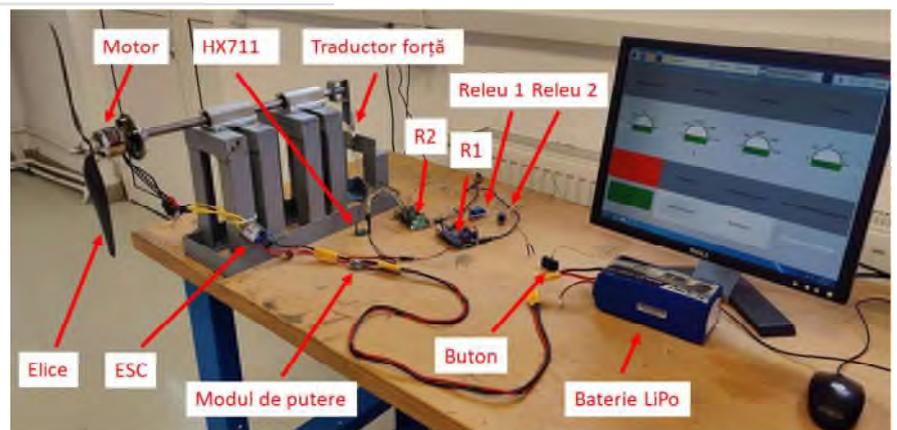


### Componente principale:

- Configurație de motorizare (acumulator-ESC-motor-elice)
- 2 computere Raspberry Pi 4
- 2 rele
- Schelet metalic stand de testare
- Traductor de forță cu cititorul HX711
- Modul de putere
- Buton oprire de urgență
- Senzori

### Facilități

- Testarea se realizează automat, turația motorului este crescută automat cu un pas de 1% PWM;
- Dotat cu buton de oprire manuală de urgență;
- Prezintă 4 sisteme de urgență: atingerea valorii maxime de forță, scăderea bruscă cu 30% a forței, depășirea intensității maxime, depășirea puterii maxime a motorului;
- Exportă datele automat într-un fișier de tip excel;



### Date de intrare

Operatorul introduce următoarele date:

- Procent maxim PWM
- Putere maximă motor
- Intensitate curent maximă ESC
- Forța maximă

### Rezultate în urma testării

În urma testării sunt exportați următorii parametri:

- Forța de propulsie
- Tensiune curent motor
- Turație elice
- Putere consumată de elice
- Intensitatea curentului
- Temperatura statorului motorului
- Sunetul produs de elice și motor



# International Exhibition of Inventions

## INVENTICA 2021

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**Institutul Național de Cercetare-Dezvoltare Turbomotoare COMOTI**

### **APARAT DE ZBOR FĂRĂ PILOT DE TIP QUADCOPTER CU ARIPI VARIABLE, MOTORIZARE VECTORIZATĂ ȘI METODĂ DE ZBOR LA PUNCT FIX ȘI ÎNAINȚARE**

**Brevet/Patent: RO 134896 A0**

**Inventatori (Inventors): Tiberius-Florian FRIGIOESCU, Mihaela-Raluca CONDRUZ, Teodor Adrian BADEA, Alexandru PARASCHIV**

Invenția se diferențiază față de un quadcopter clasic prin faptul că prezența celor 4 aripi cu unghi de incidență variabil și independent aduce o componentă de sustentație permițând motoarelor să fie vectorizate independent către direcția de deplasare aducând astfel ca avantaje principale creșterea vitezei maxime de zbor și a autonomiei de zbor.

<b>Dimensiuni:</b> 1109 x 1325 x 418 (L x l x h)	<b>4 motoare</b> de 1410 W cu 660 rpm/V (5S)
<b>Masa:</b> 12.5 Kg	<b>4 elice</b> 15x5.5
<b>MTOW:</b> 24 Kg	<b>2 acumulatori</b> 6S de 16 Ah cu 12C
<b>Sarcina utilă:</b> 10 Kg	Dispune de control manual cu <b>stabilizare automată</b> și <b>pilot automat</b> (realizate de 2 computere Raspberry Pi 4), <b>GPS</b> , <b>4 aripi cu reglare independentă a unghiului de incidență</b>

#### **Mod de zbor A**

Se menține forța de propulsie constantă în comparație cu modelul de quadcopter clasic aferent conceptului la intervenția aripilor și a vectorizării motoarelor

- Crește viteza maximă la înaintare cu 59%
- Scade consumul de energie cu 36% raportat la un traseu
- Se extinde distanța maximă de zbor cu 58%
- Modul de zbor **A** este optim pentru misiuni de transport, survolare rapidă, atac, specifice misiunilor cu necesitate de viteză mare



#### **Mod de zbor B**

Se menține accelerația constantă în comparație cu modelul de quadcopter clasic aferent conceptului la intervenția aripilor și a vectorizării motoarelor

- Creșterea vitezei maxime de zbor la înaintare, scăderea consumului de energie și extinderea distanței maxime de zbor depind de coeficientul de rezistență la înaintare (Ex: La un Cx de 0.4: 10%, 36% respectiv 57%, iar la un Cx de 0.7: 18.7%, 25%, respectiv 34%)
- Modul de zbor **B** este optim pentru misiuni de survolare, scanare, specifice misiunilor ce necesită un nivel de zgomot redus, autonomie mai mare și viteze reduse





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Inventica

Institutul Național de Cercetare-Dezvoltare Turbomotoare COMOTI

## INSTALAȚIE AUTOMATIZATĂ PENTRU TESTAREA LA ȘOC TERMIC, OXIDARE ȘI COROZIUNE A ACOPERIRILOR CU ROL DE BARIERĂ TERMICĂ

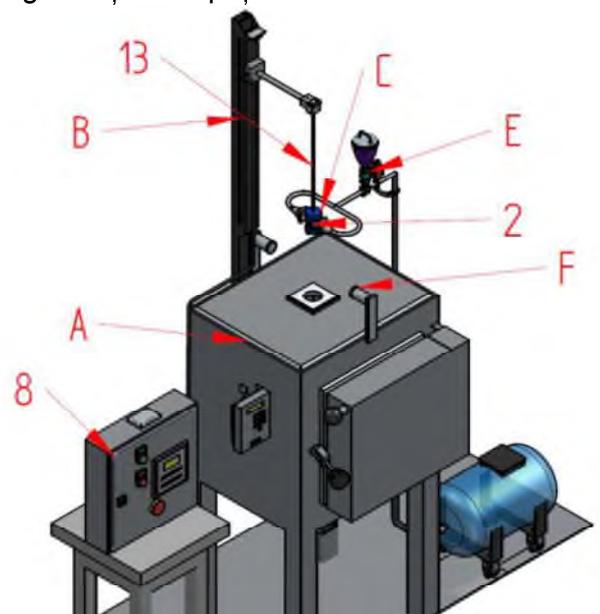
**Brevet/Patent: RO 134516 A0**

**Inventatori (Inventors): Alexandru PARASCHIV, Mihaela-Raluca CONDRUZ, Cristian PUȘCAȘU, Tiberius-Florian FRIGIOESCU**

Invenția se referă la o instalație de testare automatizată la cicluri de șoc termic, oxidare ciclică de lungă durată și/sau coroziune la cald a acoperirilor cu rol de barieră termică utilizate pentru protecția componentelor gazodinamice complexe din turbinele cu gaze utilizate în industria energetică și aerospațială.

### Rezumat

Instalația este alcătuită dintr-un sistem de încălzire (A), în incinta căruia sunt introduse simultan, cu ajutorul unor sisteme de deplasare (B) și prindere (C), două probe (2) aflate în contact direct cu un termocuplu (13), ciclurile de testare implicând răcirea probelor în condiții prestabilite, introduse în tabloul de comandă și control (8), iar testarea se realizează până când sistemul (F) de autodectare a degradării probelor identifică exfolierea a 20% din suprafața totală a acoperirii, instalația fiind prevăzută și cu un sistem (E) de dozare a agentului coroziv ce dozează în mod controlat și automatizat mici cantități de pulberi care se vor pulveriza spre probe în timpul procesului de răcire.



### Caracteristici

- Permite testare la temperaturi ridicate de tip șoc termic, oxidare, coroziune (pulverizare cu compuși corozivi) la temperaturi în intervalul 30-1400°C;
- Sistem de monitorizare video de înaltă rezoluție și sistem de autodectare a gradului de exfoliere a acoperirilor prin tehnica binarizării imaginilor;
- Răcirea poate fi lentă sau rapidă până la temperatura ambientală sau la temperaturi negative (răcire cu azot sau dioxid de carbon);
- Permite testarea simultană a două probe în aceleași condiții, indiferent de forma geometrică;
- Precizie ridicată de măsurare a temperaturii probelor și a celei din incinta de încălzire;
- Testare automatizată cu repetabilitate ridicată a pozițiilor probelor;
- Posibilitate de monitorizare și control de la distanță.

Această instalație a fost dezvoltată cu sprijinul financiar acordat în cadrul proiectului POC 114/09.09.2016, ID proiect P\_40\_422/105884, acronim „TRANSCUMAT”.



# International Exhibition of Inventions INVENTICA 2021 23.06.2021 – 25.06.2021



National Research and Development Institute for Gas Turbines COMOTI

## PROCESS AND INSTALLATION FOR MANUFACTURING HIGH PRESSURE FLEXIBLE ELEMENTS

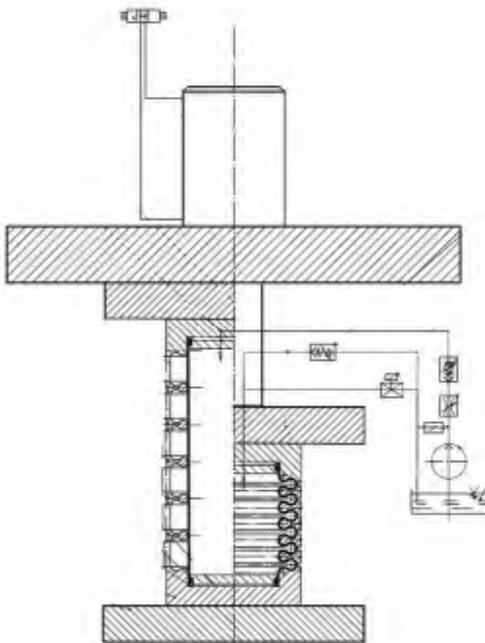
Patent:

RO 134308 A0

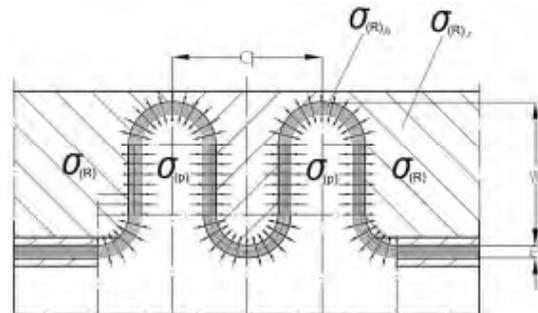
Authors:

SILIVESTRU VALENTIN [RO]; ENACHE MARIUS ȘTEFAN [RO]; GRIGORESCU MIHAI GHEORGHE [RO];  
 CÂRLĂNESCU CRISTIAN [RO]; GICA MIHAI [BE]; MANGRA ANDREEA CRISTINA [RO];  
 CÂRLĂNESCU RĂZVAN [RO]; GICA NICOLAE [RO]; PRISECARU TUDOR [RO]

The invention relates to a method and to an installation for the execution of high pressure flexible elements, intended to compensate for the expansions and stresses generated by the pressure inside the thick-walled tubular containers and apparatus.



Scheme of the installation



$$\sigma_{(R)} = \sigma_{(R)_b} + \sigma_{(R)_r} \geq \sigma_{(p)}$$

Vector diagram of the stresses generated by the internal pressure

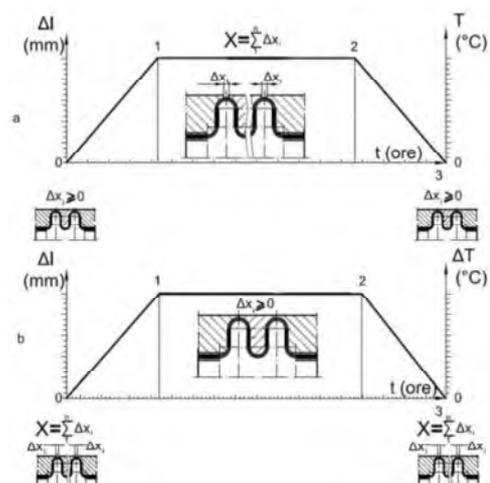


Diagram of an axial stress cycle



***The National Institute for Research & Development in Chemistry  
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<sup>1</sup>ICECHIM, Research Group "Evaluation and Conservation of Cultural Heritage" Bucharest, Romania; <sup>2</sup>Valahia University, Targoviste, Romania

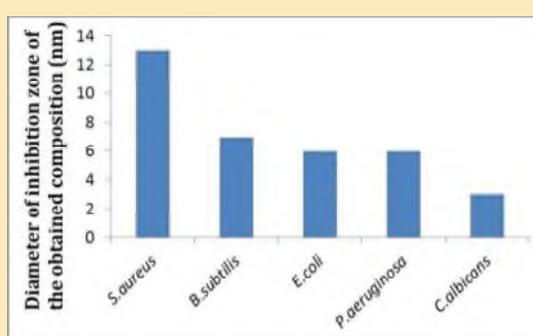
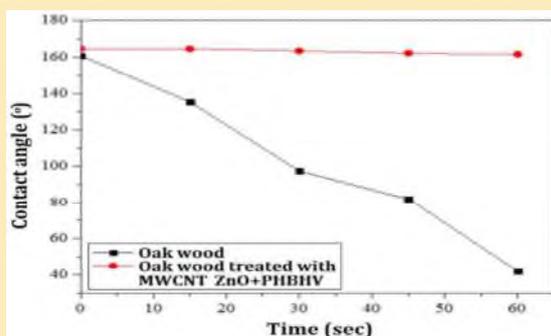
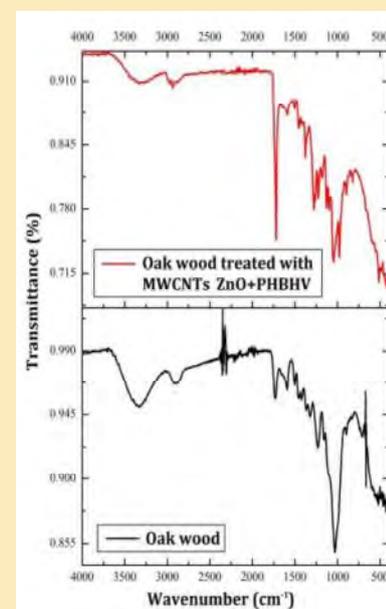
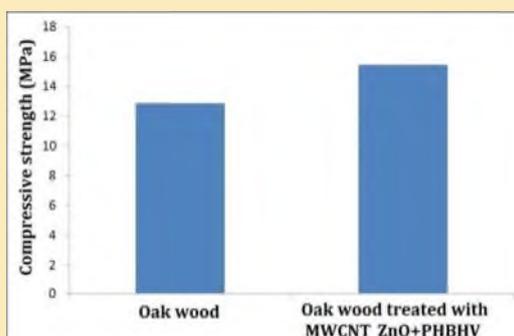
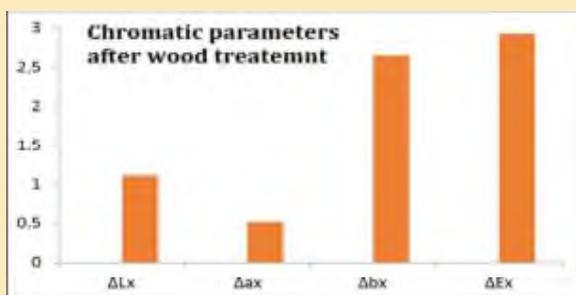
### ANTIMICROBIAL AND ANTIFUNGAL COMPOSITION FOR WOOD ARTIFACTS PRESERVATION AND PROCESS OF USE

**Patent Application: A 00140 / 29.03.2021**

**Madalina Elena David<sup>1,2</sup>, Rodica Mariana Ion<sup>1,2</sup>, Ramona Marina Grigorescu<sup>1</sup>, Lorena Iancu<sup>1</sup>, Mariana Calin<sup>1</sup>, Nelu Ion<sup>1</sup>**

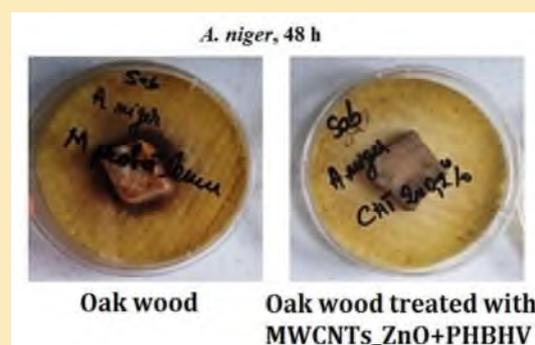
**Corresponding author: [madalina.e.david@gmail.com](mailto:madalina.e.david@gmail.com)**

The invention refers to an antimicrobial and antifungal composition made of multi-walled carbon nanotubes decorated with zinc oxide nanoparticles (MWCNTs\_ZnO), dispersed in a solution of poly (3-hydroxybutyrate-co-3-hydroxyvalerate) (PHBHV) which, applied to wood surface, preserves the chromatic characteristics, improves the surface hydrophobicity and the mechanical properties of wood materials, especially of oak wood, subjected to conservation / restoration processes.



The obtained **new solution** offers the following advantages:

- inhibits the action of the main factors leading to wood degradation (bacteria and fungi);
- preserves the chromatic characteristics of the wood;
- improves surface hydrophobicity of wood;
- enhances the mechanical properties of wood;
- environmentally friendly composition;
- easy to use by brushing directly on the wood surface.



**Acknowledgements:** This work was supported by a grant of the Romanian Ministry of Research and Innovation, CCCDI—UEFISCDI, project number PNIII-P1-1.2-PCCDI-2017-0476/51PCCDI/2018, within PNCDI III.

Patent RO 133306/2021



**ANTIMICROBIAL PULVERISABLE SOLUTION FOR TREATMENT, CONSOLIDATION AND PROTECTION OF INORGANIC SURFACES OF BUILDINGS AND/OR HISTORICAL MONUMENTS**

**Radu Claudiu Fierascu<sup>a</sup>, Irina Fierascu<sup>a</sup>, Adriana Moanta<sup>b</sup>, Ionela Petre<sup>b</sup>**  
<sup>a</sup>The National Institute for Research & Development in Chemistry and Petrochemistry—ICECHIM  
 Bucharest, Romania, [www.icechim.ro](http://www.icechim.ro)  
<sup>b</sup>CEPROCIM S.A., Bucharest, Romania, [www.ceprocim.ro](http://www.ceprocim.ro)



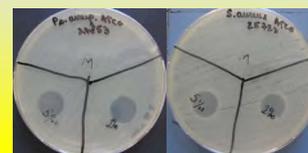
The invention relates to an antimicrobial composition for the treatment, consolidation and protection of inorganic surfaces of buildings and / or historical monuments. Antimicrobial suspensions are obtained by milling the solid material followed by dispersion in isopropyl alcohol solution, in varying concentrations, thus obtaining a pulverisable solution. Sprayable biocide solutions have an effect on both gram-positive strains and gram-negative strains.



Plaster material treated twice with solvent (left), solution S1 (center) and solution S2 (right), before (up) and after freezing / thawing tests.

Lime mortar material treated twice with solvent (left), solution S1 (center) and solution S2 (right), before (up) and after freezing/thawing tests.

Cement mortar material treated twice with solvent (left), solution S1 (center) and solution S2 (right), before (up) and after freezing / thawing tests.



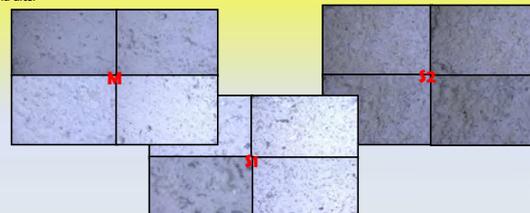
Appearance of microbial growth inhibition zones for suspensions (S1 - 2 %, S2 - 5 %) tested against *P. aeruginosa* and *S. aureus*. M - control (solvent).



Microscopical aspects on treatment of plaster surfaces; M- untreated; S1/S2- treated with the solutions



Microscopical aspects on treatment of cement mortar surfaces; M- untreated; S1/S2- treated with the solutions



Microscopical aspects on treatment of lime mortar surfaces; M- untreated; S1/S2- treated with the solutions

The present invention represents a result of the project "Innovative apatitic materials with enhanced antimicrobial activity for building materials and cultural heritage conservation" project PN-III-P2-2.1-PED-2016-0198, financed by the Romanian National Authority for Scientific Research and Innovation, CNCS/CCCDI—UEFISCDI, within PNCDI III.

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 Technical manager:  
[fierascu.radu@icechim.ro](mailto:fierascu.radu@icechim.ro)



Patent application A00251/2021

## ANTIMICROBIAL COMPOSITE MATERIAL WITH ROLE IN CONSOLIDATING WOODEN SURFACES WITH CULTURAL VALUE AND METHOD OF OBTAINING IT

Irina Fierascu<sup>1</sup>, Radu Claudiu Fierascu<sup>1</sup>, Roxana Ioana Brazdis<sup>1</sup>, Anda  
Maria Baroi<sup>1</sup>, Alina-Ruxandra-Eugenia Ortan<sup>2</sup>, Augusta Raluca Gabor<sup>1</sup>,  
Cristian-Andi Nicolae<sup>1</sup>

<sup>1</sup>The National Institute for Research & Development in Chemistry and Petrochemistry—ICECHIM  
Bucharest, Romania, [www.icechim.ro](http://www.icechim.ro)

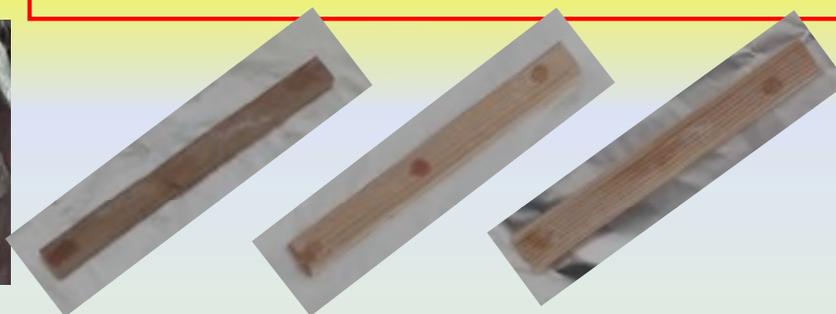
<sup>2</sup>University of Agronomic Sciences and Veterinary Medicine of Bucharest, [www.usamv.ro](http://www.usamv.ro)



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The present invention relates to a composite coating material with consolidating and antimicrobial properties, which provides protection for wood objects with cultural value, based on a solution composed of amorphous silica nanoparticles and an antimicrobial component (composed of hydroxyapatite type, in which calcium has been totally or partially displaced by strontium), dispersed in an aqueous solution of polyvinyl alcohol.



This work was supported by a grant of the Romanian National Authority for Scientific Research and Innovation, CNCS/CCCDI – UEFISCDI, project number PN-III-P1-1.2-PCCDI-2017-0413, contract 50 PCCDI/2018, within PNCDI III.

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Technical manager:  
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# International Exhibition of Inventions

## INVENTICA 2021

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**ICECHIM, Bucharest, Romania**

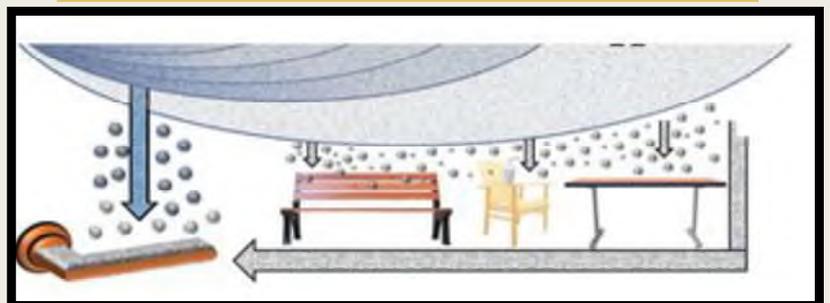
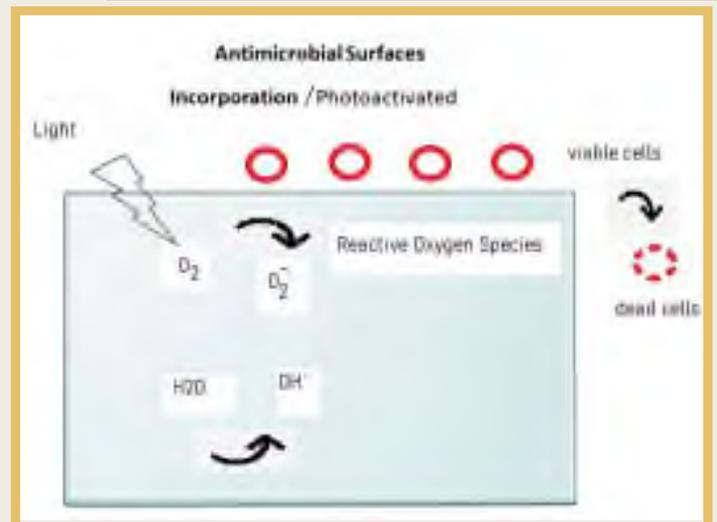
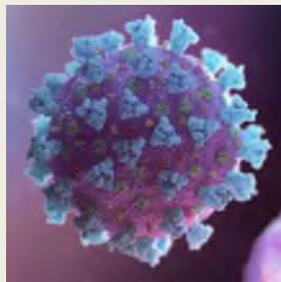
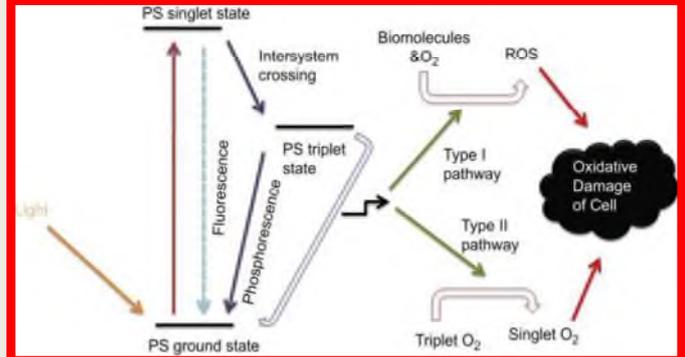
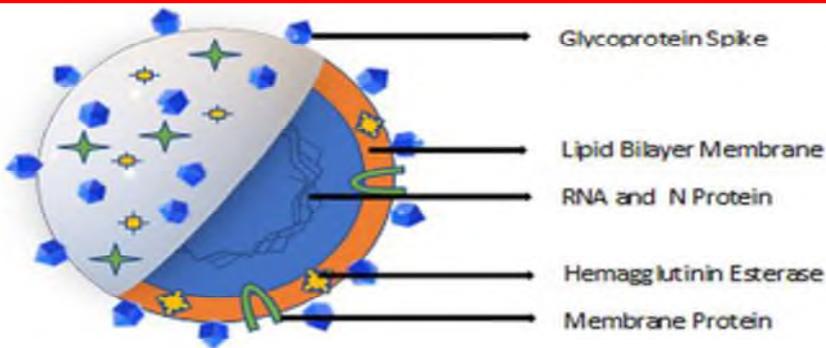


### MEDICAL DEVICE FOR HSV-1 / SARS-COV-2 / COVID-19 ANTI-VIRAL PHOTODYNAMIC INACTIVATION ON SURFACES, METHOD OF MAKING AND USING IT

**Cerere brevet / Patent application: A00121/18.03.2021**

**Inventori (Inventors): Rodica-Mariana ION**

The invention relates to the use of a sulfonated porphyrin for the production of a hydrogel type medical device used for the antiviral photodynamic inactivation of HSV-1 / SARS-CoV-2 / COVID-19 on surfaces such as: furniture, medical instruments, laboratory vessels, access, etc., from the health system, hospitals, pharmacies as well as in other spaces for staff protection. The device is based on a sulfonated porphyrin embedded in the hydrogel, used for the photodynamic inactivation of HSV-1 virus as a model for SARS-CoV-2 (COVID-19), which is exposed to low power laser radiation and a short irradiation distance, leads to the destruction of viruses.





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### NATIONAL INSTITUTE FOR RESEARCH AND DEVELOPMENT IN CHEMISTRY AND PETROCHEMISTRY – ICECHIM BUCHAREST

## ACOPERIRE CU STRUCTURA POLIURETANICA NANOCOMPOZITA SI PROPRIETATI ANTIUZURA SI ANTIALUNECARE SI PROCEDEUL SAU DE OBTINERE

Brevet/ 130245 Inventatori (Inventors/ authors): MARIN LAURENTIU, MARIN CATALINA

### THE DIRECTION OF THE RESEARCH

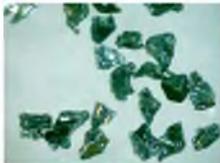
- To obtain polymeric composites, based on polyurethane nanocomposite. The polyurethane matrix will be modified with nano elements based on bentonite – phyllosilicates.
- At the surface polyurethane matrix will be modified with an abrasionproof element – carborundum SiC , electrocorindon Al<sub>2</sub>O<sub>3</sub>
- Polyurethane matrix will be modified with an burningproof element.

### RESEARCH RESULTS

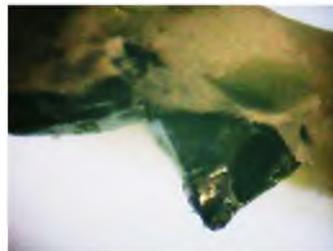
ELECTROCORINDON GRAINS X 20



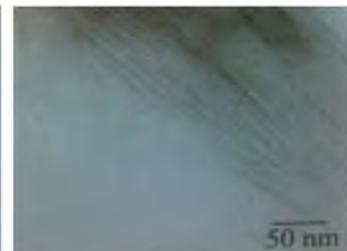
CARBORUNDUM GRAINS X 20



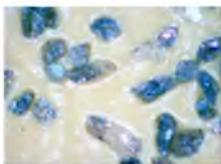
POLYURETHANE NANOCOMPOSITE FLOOR COAT WITH CARBORUNDUM SECTION X 20



POLYURETHANE NANOCOMPOSITE BENTONITE ELECTRONIC MICROSCOPI



POLYURETHANE NANOCOMPOSITE FLOOR COAT WITH ELECTROCORINDON X 20



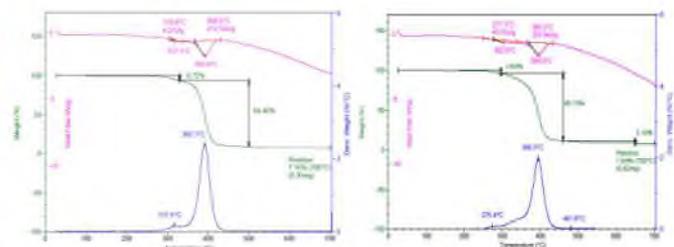
POLYURETHANE NANOCOMPOSITE FLOOR COAT WITH ELECTROCORINDON X 20



POLYURETHANE NANOCOMPOSITE FLOOR COAT WITH ELECTROCORINDON SECTION X 20



POLYURETHANE MATRIX NONMODIFIED



POLYURETHANE NANOCOMPOSITE FLOOR COAT WITH CARBORUNDUM X 20



POLYURETHANE NANOCOMPOSITE FLOOR COAT WITH CARBORUNDUM X 20



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# International Exhibition of Inventions INVENTICA 2021

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National Institute for Research & Development in  
Chemistry and Petrochemistry - ICECHIM



## *New biocompatible products shagaol and curcuminoid-like type used as adjuvantes in cancer radiotherapy*

### **CANRADIOPROTECT**



Research project: PN-III-P2-2.1-PED-2019-1471/363 PED



Implementation period: 23/10/2020-22/10/2022

Project Budget: 600.000 lei

The project refers to an interdisciplinary research field and aims to develop methods for synthesis and biological testing of new symmetrical  $\beta$ -di-ketone compounds and asymmetric mono or di-ketones. After morphostructural characterization, biocompatibility testing and structure-property relationship, biologically active products will be applied in the radiotherapy procedure to treat cancer. In this way, the new synthesized structures, analogues of shagaol and curcumin, have a higher antitumor activity than natural compounds and are used as adjuvants in cancer therapy.

### Objectives:

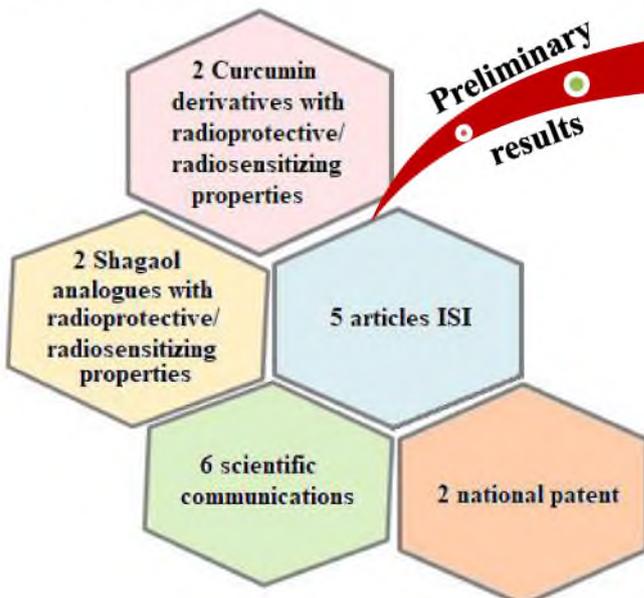
Selection of natural compounds and synthesis of biologically active chromogens (curcumin and shagaol) with free radical capture properties and choice of demonstrative experimental model.



The study of the radioprotective and radio sensitizing processes of the compounds selected after the biocompatibility tests.

The correlation of the intensity of the effect of radioprotection and radiosensitization with the structural characteristics of the selected compounds.  
The correlation of the intensity of the effect of radioprotection and radiosensitization with the structural characteristics of the selected compounds.

### Estimate results:



**Curcumin: Modern Applications for a Versatile Additive, Coatings, 2021, 11, 519. doi.org/10.3390/coatings11050519**



**Synthesis of asymmetric  $\beta$ -diketone derivatives and their complexation with lanthanides, the 23<sup>rd</sup> Frühjahrssymposium, Leipzig, Germany, 2021**



**Curcumin derivatives immobilized in silica matrices by sol-gel processes used as bioactive coatings, International Congress of "Apollonia" University from Iasi, 2021**



**In Vitro Study of Curcumin Derivatives with Potential Antitumor Activity, 1st International Electronic Conference on Biomedicine, 2021**

### Contact:

Project Manager: **dr.ing. Florentina Monica Raduly**

Tel. +40 21 316.30.62/118; Fax: +40 21 312.34.93

E-mail: [monica.raduly@icechim.ro](mailto:monica.raduly@icechim.ro)

Web: [www.icechim.ro/project/canradioprotect-ro](http://www.icechim.ro/project/canradioprotect-ro)

***„Petru Poni” Institute of Macromolecular Chemistry – ICMPP Iași***

The 25th International Exhibition of Inventions "INVENTICA 2021" Iași, România, June 23<sup>th</sup> – 25<sup>th</sup> 2021



## Innovative Electrospun Membranes based on Phosphorus-containing Polymers for Protective Clothing



**Dr. Serbezeanu Diana**

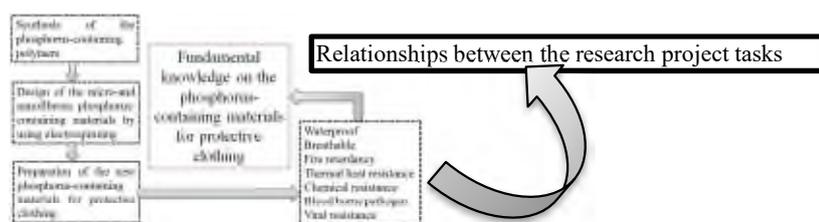
"Petru Poni" Institute of Macromolecular Chemistry, Aleea Grigore Ghica Voda, 41A, Iasi – 700487, Romania

**Research project number:**  
 PN-III-P1-1.1-TE-2019-0639/nr. TE  
 89/2020

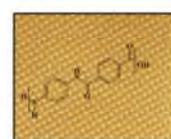
### Purpose

The main objective of the proposed project is to design new flame retarded micro- and nano- fibrous membranes based on phosphorus-containing polymer, by electrospinning process. These membranes are intended to be integrated into fireman protection equipment. The obtained micro and nano- fibrous architectures will be characterized from morphological and functional point of view. Innovative fundamental approaches will be applied to design phosphorous-containing membrane having high air permeability, high water vapor transport properties as well as high hydrostatic resistance, as a class of new materials with superior properties regarding the physiological comfort, recommended for development of improved fireman protective clothes.

The aim of this project is to investigate the feasibility of new developed protective textile materials that could present high protection performance and thermal comfort, using electrospinning.



### Protective clothing



**Advantages:**

- heat resistance
- very resistant to impact
- abrasion damage

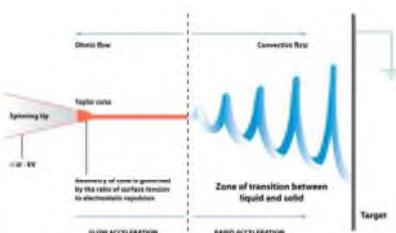
**Disadvantages:**

- absorb moisture
- tensile strength and modulus are high
- compressive properties are poor
- very difficult to cut

*In protective textile application laminated or coated electrospun fibers are preferred*

### Solution

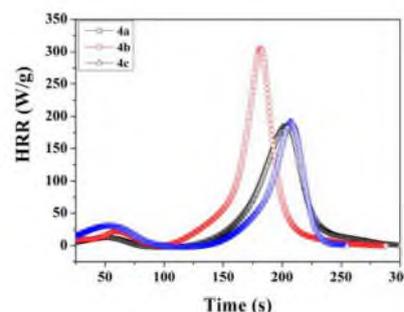
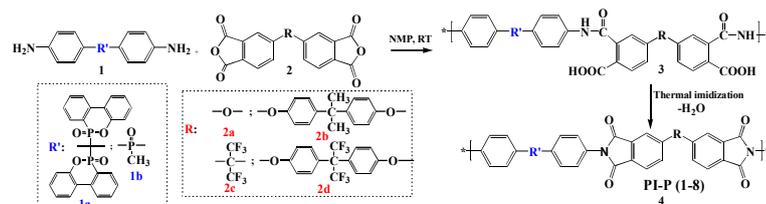
#### Electrospinning process



### Advantages

- ❖ It is a simple process
- ❖ It is easy to operate fine-tuned uniform fibers
- ❖ It can be applied on existing installations
- ❖ It is safe to operate
- ❖ It involves reduced number of technological steps
- ❖ The product is nontoxic and stable over time
- ❖ The product obtained is inexpensive and can be adapted to a wide range of biomedical applications.

#### Synthesis of phosphorus-containing polymers



The HRR curves for the phosphorus-containing polyimide 4

**Use:** The electrospun phosphorus-containing polymers membranes presents a great potential as heat and flame protection clothing, based on the good protection performance against fire and low level of air permeability even after prolonged high temperature exposure.

**Phase:** Laboratory

**Research project domains:** Textile products and technologies, confections and design

**New “green” technology for advanced water treatment based on functionalized polysulfones/ionic liquids membranes**

**Experimental-demonstrative project:  
 PN-III-P2-2.1-PED-2019-3013 / 310PED/2020 (GreenTechMembr)**

**Dr. Anca FILIMON<sup>1</sup>, Conf. dr. ing. Lavinia LUPA<sup>2</sup>**

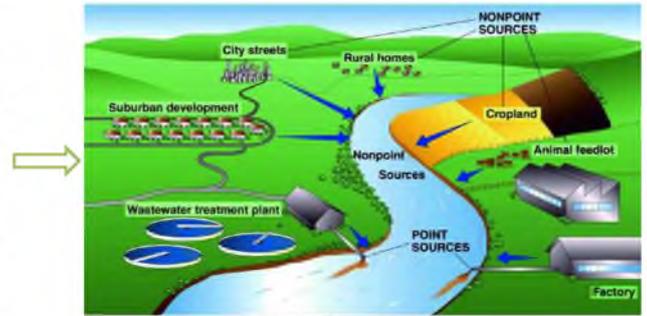
<sup>1</sup>*“Petru Poni” Institute of Macromolecular Chemistry, Grigore Ghica Voda Alley, 41A, Iasi, Romania, 700487*

<sup>2</sup>*Politehnica University of Timisoara, Faculty of Industrial Chemistry and Environmental Engineering, 6 Vasile Parvan Blv, Timisoara, Romania, 300223*

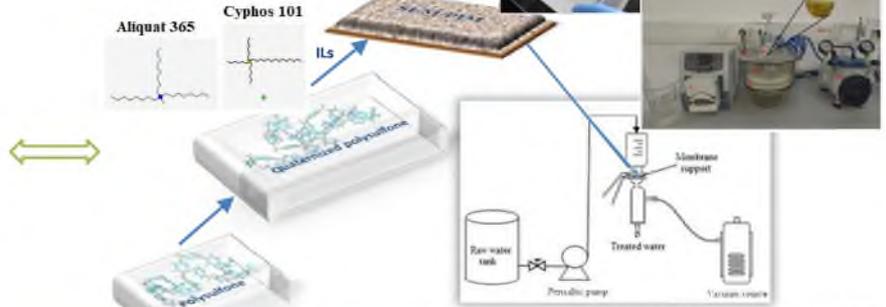
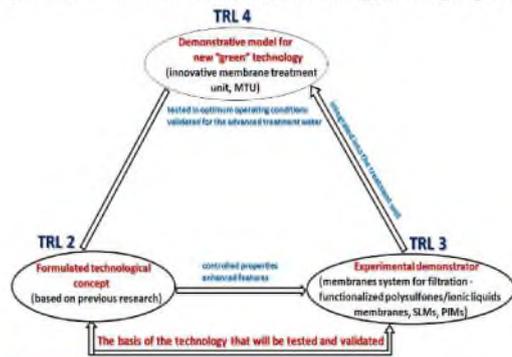
**Purpose**

The project scope is to develop new supported liquid membranes (SLMs) and polymer inclusion membranes (PIMs), used as selective barriers in an innovative membrane treatment unit (MTU), which will be tested and validated for the advanced treatment of water. In order to overcome the drawbacks of conventional membrane technologies, our approach propose:

- (1) Formulation and design of ionic liquids-based polysulfone membranes (SLMs, PIMs)
- (2) Optimization of properties in solution and solid state in order to obtain ionic liquids-based polysulfone membranes applicable in microfiltration process
- (3) Design and development of the membrane treatment unit (MTU) by integrating the optimized experimental demonstrator (SLMs, PIMs) into a final product
- (4) Validation of the laboratory technology through specific tests



**Solution**



**Advantages**

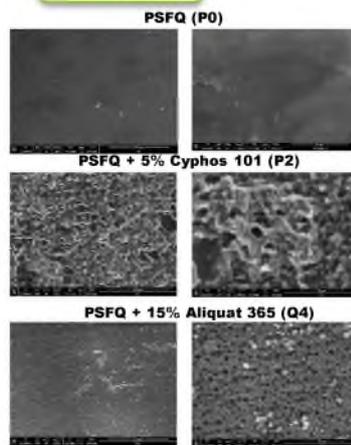
The new approach, regarding the obtaining of a new innovating membrane technology for water treatment, the research has the following advantages:

- investigates new materials to overcome the degradation and modifying the synthesis process to produce the membranes with a wide range of structures, chemistries, and performance characteristics;
- increases the selectivity and stability;
- compared with the conventional methods is a green, compact, and economical alternative system;
- separate organic and inorganic compounds from high fluxes with minimal energy consumptions, high selectivity and technical feasibility, and produces reduced volume of waste.

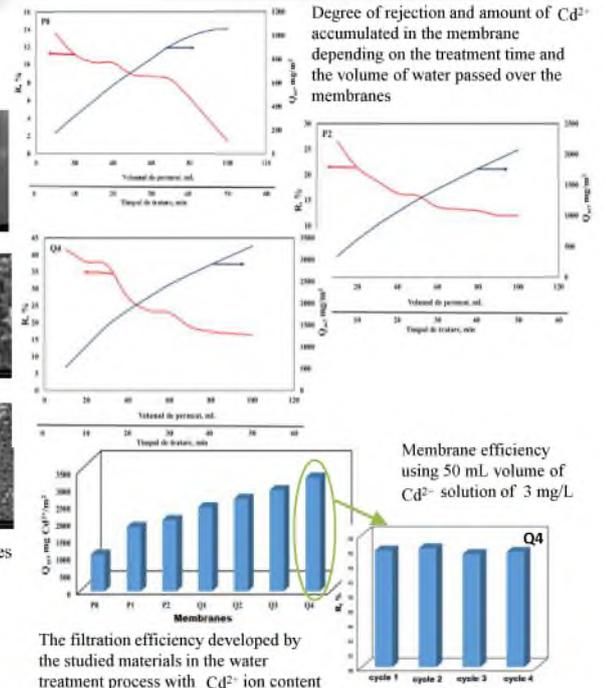
**Application**

The project will provide a new sustainable technology, high performance, tested and validated at the laboratory-scale, which will ensure the water depollution, and by thematic approach being connected to a main direction of international research, namely the main field Environment - Sustainable Development - Global Changes.

**Results**



SEM images obtained at different magnitudes



**Phase** Tested/validated at the laboratory-scale

**Project domain**

**Environment – ecology, ecological management, environmental protection and monitoring**



# International Exhibition of Inventions INVENTICA 2021 23.06.2021 – 25.06.2021

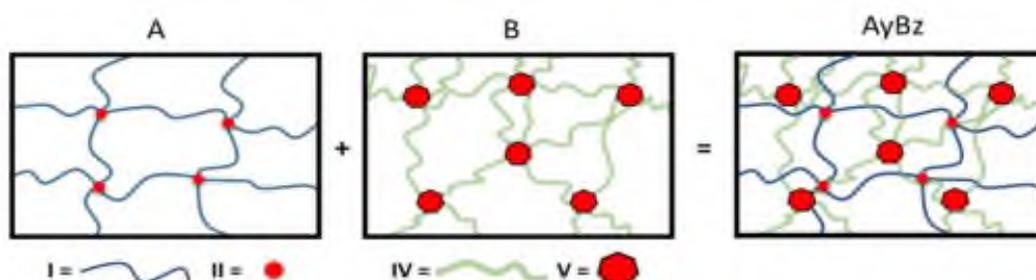


**INSTITUTUL DE CHIMIE MACROMOLECULARA "Petru Poni"**

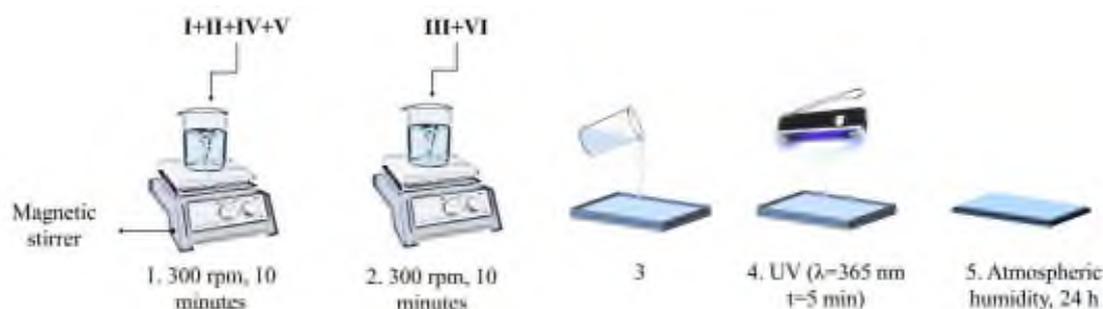
## Process for obtaining a two-component silicone rubber

**Patent application: 2858 / 8.VI.2021; Authors: Adrian Bele, Carmenuş Racleş, Dascălu Mihaela, George-Theodor Ştiubianu**

**Abstract:** The present invention relates to a process for obtaining a two-component silicone rubber for use in direct current polymer generators. For this purpose, the system consists of component A and B which are successively homogenized to obtain silicone rubbers with two separate polymer networks that intertwine after UV irradiation and atmospheric humidity crosslinking. The process allows the use of components (A and B) in different mass ratios so that silicone rubbers with elongation at break of up to 720%, modulus of elasticity of 1 MPa and absorbed elastic energy of 63 kJ/m<sup>3</sup> can be obtained, requirements necessary for their use to improve the conversion of mechanical energy directly into electricity.



Schematic representation of the full cross-linked silicone elastomer



The main steps used for manufacturing process

Dielectric and mechanical results for some mono\* and bicomponent silicone elastomers (SE)\*\*

Probă	Elongation at break [%]	Ultimate strength [MPa]	Young's modulus [MPa]	UTT [kJ/m <sup>3</sup> ]	Dielectric permittivity (10 <sup>3</sup> Hz)	Dielectric loss (10 <sup>3</sup> Hz)
A*	256	0.31	0.42	4	2.9	0.005
B*	100	0.15	0.41	1	3.1	0.003
A1B1**	520	1.00	0.60	30	3.6	0.003
A2B1**	720	1.50	1.00	63	3.8	0.041
A1B2**	320	0.60	0.45	11	3.9	0.005
Commercial SE* (Elastosil)	300	3.10	1.25	43	2.6	0.002



# International Exhibition of Inventions INVENTICA 2021 23.06.2021 – 25.06.2021



INSTITUTUL DE CHIMIE MACROMOLECULARA "Petru Poni"

## GREEN SILICONE-BASED INTERPENETRATED POLYMERIC "SPIDER WEBS" ENGINEERED FOR WAVE ENERGY HARVESTING

Research project: PN-III-P1-1.1-PD-2019-0148; Authors: Adrian Bele (Mentor: Anne L. Skov)

Renewable technologies began to develop rapidly after the 1973 oil crisis, converting various types of energy, such as wind and ocean into electricity. The most studied technologies regarding Ocean Energy Harvesting are wave energy converters (WEC). The WEC technology gained great attention and the research community developed different devices, like Oscillating Water Columns (OWC). To be able to convert Ocean Energy to useful electrical energy all WEC possess a power take-off (PTO) system. In the case of OWC is the air turbine, and difficulties encountered are the complexity of the mechanical parts, susceptibility to corrosion, high costs, deploying and maintaining. Ocean Energy Harvesting using Dielectric Elastomers (DE) as PTO systems is a relatively new technology with great potential aiming to reduce the main drawbacks of classic technologies. Silicone-based elastomers are the most studied class, due to their properties: high flexibility, low toxicity, resistance to weathering, good dielectric strength and operating on various temperatures (-120 to 200 °C). The polar nature of the siloxane bond is a premise for good dielectric properties, but the methyl groups hinder the Si-O dipoles to approach one each other, thus they possess a low dielectric permittivity, which is still the main disadvantage along with Yield strength. **The main aim** is to increase the conversion efficiency of silicone-based PTO by increasing the Yield strength and the dielectric permittivity of silicone elastomers in an original approach which consists in obtaining new full polar/non-polar interpenetrated polymer networks (IPNs) mimicking at a molecular level the spider webs due to the versatile chemistry of silicones.

**The operating principle**, briefly illustrated in Figure 1, can be described as follows: 1. as the wave approaches the chamber the air is compressed and inflates the polymeric-based PTO system, thus external mechanical free force is converted into potential spring energy; at the same time the capacitance of the variable capacitor increases and a voltage is applied; 2. when the polymeric-based PTO system is deflating, due to the release of the external tensile forces (retraction of the wave), the surface area of the variable capacitor is reduced, while the distance between the electrodes is increased, thus respective charge is increased; after complete deflating, in which a considerable amount of spring energy is converted into electrical energy, the electric charge is harvested. Harvested energy can be estimated from a cycle of operation (stretching and relaxing the variable capacitor) and depends on the difference between the total capacitance in stretch state,  $C_2$ , and relaxed state,  $C_1$  (equation 1 and 2, considering a constant volume of the elastomer,  $Az = v = \text{constant}$ ), and the square of the applied voltage,  $V$ , as described below

$$C = \epsilon_0 \epsilon' \frac{A}{z} = \epsilon_0 \epsilon' \frac{v}{z^2} \quad (1) \quad E = 0.5 C_2 V^2 \left( \frac{C_2}{C_1} - 1 \right) \quad (2)$$

where:  $C$  (1 – relaxed state, 2 – stretched state) and  $A$  is the electric capacitance and the active area of the variable capacitor (polymeric-based PTO);  $\epsilon'$  and  $z$  are the permittivity and the thickness of the dielectric elastomer;  $\epsilon_0$  is the permittivity of free space;  $V$  is the applied voltage

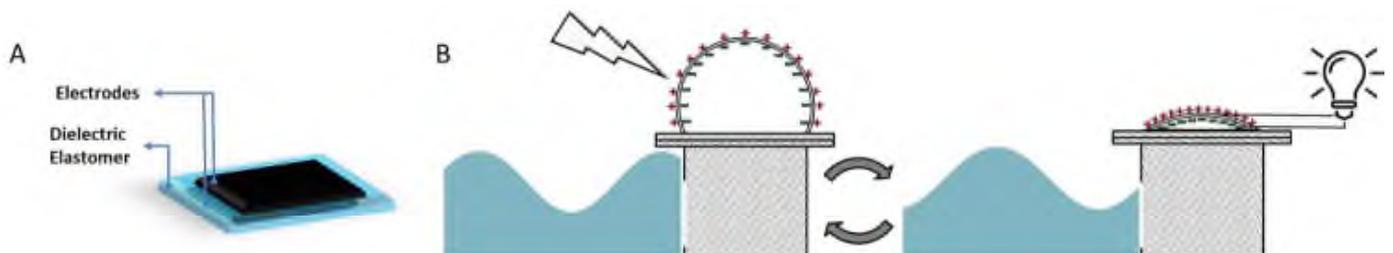


Figure 1. A – General components of the polymeric-based PTO system; B - Polymer-based Oscillating Water Column

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## Controlled Atmosphere for **STOR**age facilities of fruits and vegetables: a **Low-cost multidisciplinary solution (CASTOL)**

Bogdan-Catalin Serban, Octavian Buiu, Cristina Mihaela Nicolescu, Marius Bumbac, Robert Ropotan

### Scope:

Development of an innovative low-cost solution to preserve good quality of fresh food and vegetables in controlled atmosphere storage facilities.

### Original Approach:

The project aims at contributing to food waste levels decrease by merging multidisciplinary concepts and achievements (Internet of Things & Phytochemistry)

Data provided by the smart sensing platforms from monitoring the controlled atmosphere (CA) environments, together with data provided by the evaluation and monitoring procedures of fresh fruits/vegetables quality will emerge in a low-cost toolbox to be used in various storage spaces

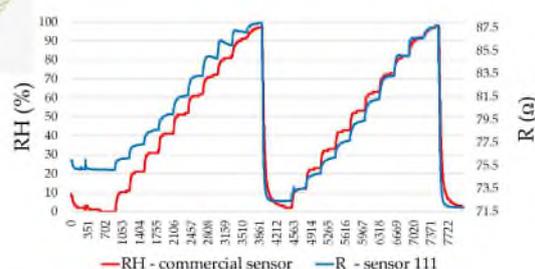
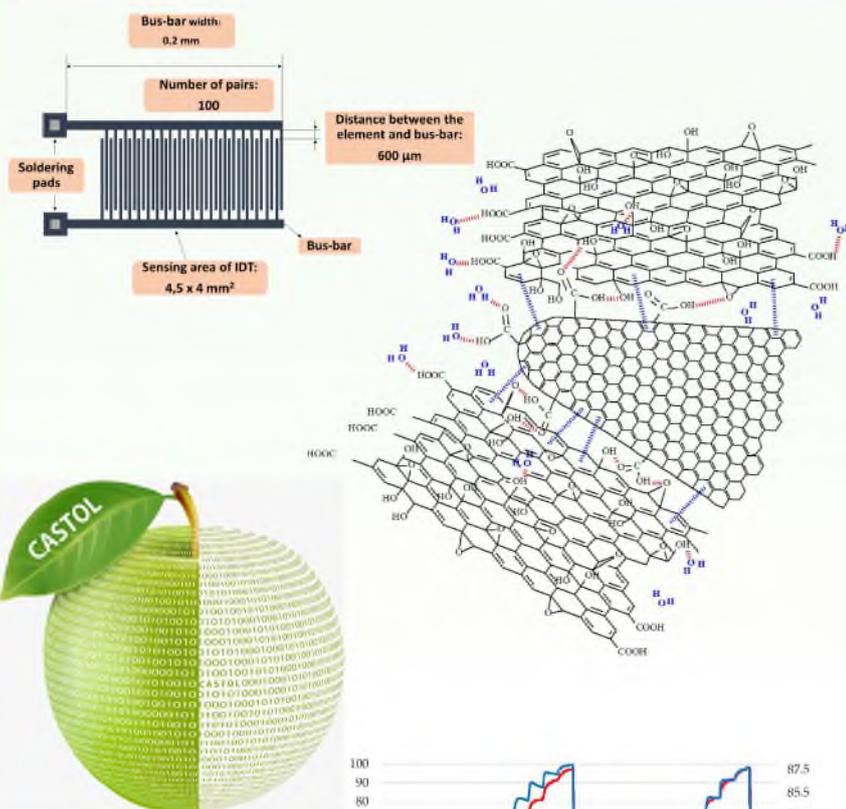
### Advantages of the device under development:

**versatility** – may be applied in various storage environments along the food distribution chain (production sites, transportation containers, distributors sites, supermarkets, etc.)

**affordability** - the device to be designed and tested is previewed as a low-cost solution, both the hardware (sensors array) for controlled atmosphere monitoring, and also the procedures for quality evaluation of stored fresh fruits & vegetables will be qualified based on a cost-efficiency analysis performed on different technical solutions

### Specific Objectives:

- smart sensing platform (RH, O<sub>2</sub>, CO<sub>2</sub>, VOC, temperature) for low-cost monitoring of CA storage facilities
- cost-efficient quality monitoring procedure for fresh fruits and vegetables (patterns of phytochemical characteristics, degree of ripening, senescence, alteration) during storage in CA facilities
- low-cost toolbox with CA hardware monitoring and decision methodology for fresh fruits/vegetables storage



### Partners:

National Institute for Research and Development in Microtechnology IMT-București  
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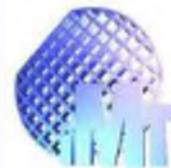
## CARBON DIOXIDE SENSOR WITH SURFACE ACOUSTIC WAVES

APPLICATION PATENT OSIM, ROMANIA, A/00474, 31.07.2020

ASSIGNEE: National Institute for Research and Development in

Microtechnologies - IMT Bucharest

Inventors: Bogdan-Catalin Serban, Octavian Buiu,  
 Cornel Cobianu, Roxana Marinescu



### FIELD OF INVENTION

- Carbon dioxide (CO<sub>2</sub>) detection is important in various sectors of domestic and industrial activity, such as indoor air quality control (air conditioning and ventilation systems), healthcare (monitoring of respiration, anaesthesia), agriculture (monitoring of CO<sub>2</sub> flow in soil), food technology (packaging processes, transport), alcoholic beverage industry.
- Along with optical, electrochemical and resistive sensors, gravimetric sensors are a solution for CO<sub>2</sub> monitoring.
- Drawback: Non-dispersive infrared (NDIR) structures, the most commonly used commercial devices used for CO<sub>2</sub> monitoring, have disadvantages, such as high cost, spectral interference and high detection limit.

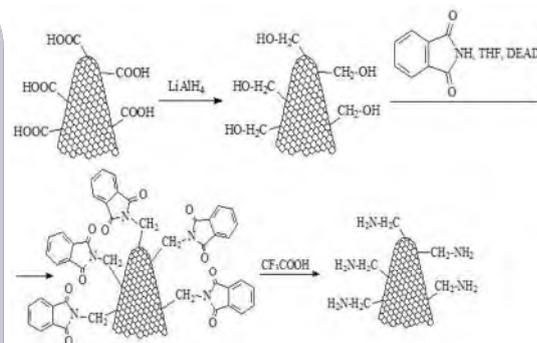


FIG 1 – Structure of CNH-CH<sub>2</sub>-NH<sub>2</sub>

### ORIGINAL APPROACH

- The invention includes the design and manufacturing processes for a new gravimetric CO<sub>2</sub> sensor, employing carbon nanohorns functionalized with aminomethyl groups (abbreviated as CNH-CH<sub>2</sub>-NH<sub>2</sub> – FIG 1) as sensing layer, deposited by spin coating, a quartz piezoelectric substrate and interdigital transducers.
- This type of functionalization confers selectivity to the nanohorn nanocarbon material by grafting aliphatic primary amine groups. Aliphatic amines, according to the HSAB theory, are hard bases and can interact reversibly, at RT, with CO<sub>2</sub> (hard acid) to form carbamates. The sensing structure used is of the "delay line" type, having a double delay line in order to compensate the thermal drift.
- One of the delay lines is coated with CNH-CH<sub>2</sub>-NH<sub>2</sub>, the second delay line being the piezoelectric substrate without a sensitive layer. To obtain a signal due exclusively to the chemical interaction between CNH-CH<sub>2</sub>-NH<sub>2</sub> and CO<sub>2</sub>, the signal associated with the second delay line can be subtracted from the signal of the first delay line (FIG 2).

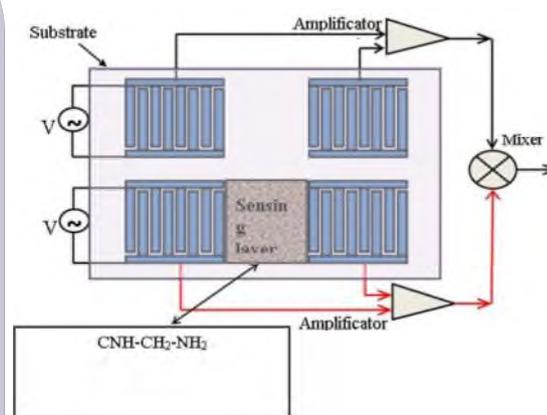


FIG 2 – Structure of the CO<sub>2</sub> sensor

### SYNTHESIS OF THE SENSING LAYER

- Oxidized carbon nanohorns (40 mg), purchased from Sigma Aldrich, are dispersed in anhydrous tetrahydrofuran and subjected to ultra sonication for 90 minutes. 4 mg of LiAlH<sub>4</sub> are then added, the new mixture being ultrasonicated for two hours. The reaction mixture is dispersed in 250 ml of ethanol and filtered. The solid product is dried in the oven at 70°C for three hours.
- The reduced nanohorns are dispersed in tetrahydrofuran and ultrasonicated for 60 mins. 20 mg phthalimide and 4 mg ethyl azodicarboxylate (DEAD) are added. The solution is ultrasonicated for 4 hours, then the mixture is diluted with 300 ml of methanol and filtered. The solid product is dried in the oven at 90°C for three hours. The product obtained is treated with 20 mL trifluoroacetic acid, ultrasonicated for 3 hours and filtered.
- The CNH-CH<sub>2</sub>-NH<sub>2</sub> is dried at 100°C under vacuum for 2 hours and then washed with ethanol, acetone and deionized water. A solution of CNH-CH<sub>2</sub>-NH<sub>2</sub> (5 mg) in 50 mL dimethylformamide is ultrasonicated at RT for 10 hours. The obtained solution is deposited by the spin coating method on the quartz substrate (3000 rpm, for 60 s). The film is heated to 100°C for 90 mins. The obtained film is subject to a final heat treatment, at 200°C, for 10 mins.

### ADVANTAGES OF THE PROPOSED SENSING LAYERS

- Improved mechanical properties, better processability, fast response, detection at RT, fast response, increased selectivity
- High specific area / volume ratio, affinity for CO<sub>2</sub> molecules through HSAB-type interactions ("mass loading"), as well as a variation of its resistance in contact with CO<sub>2</sub> molecules ("electric loading")

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**QUATERNARY HYDROPHILIC NANOHYBRID COMPOSITION FOR RESISTIVE HUMIDITY SENSORS**

EUROPEAN PATENT APPLICATION 20 465 580.7 /3.11.2020

**ASSIGNEE: National Institute for Research and Development in Microtechnologies - IMT Bucharest**

**Inventors: BOGDAN- CATALIN SERBAN, OCTAVIAN BUIU, CORNEL COBIANU, VIOREL AVRAMESCU, NICULAE DUMBRAVESCU**



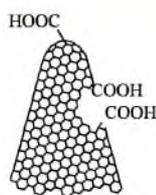
**INTRODUCTION**

• Many principles and methods were described in literature for measuring relative humidity (RH) and several types of materials were employed as RH sensing layers. The present invention relates to the RH sensing response of a resistive sensor employing a sensing layer based on a quaternary nanohybrid composition comprising or consisting of CNH<sub>ox</sub> (FIG 1)/GO/SnO<sub>2</sub>/PVP at 1/1/1/1 to 0.75/0.75/1/1 w/w ratio. The quaternary hydrophilic nanohybrid compositions exhibit several significant advantages, when employed as RH sensitive layers:

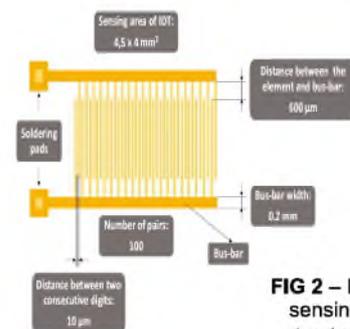
- both oxidized carbon nanohorns (CNH<sub>ox</sub>) and graphene oxide (GO) are nanocarbonic materials with high specific surface area (SSA)/volume ratio, affinity for water molecules, and exhibit rapid variation of the electrical resistance in contact with water molecules, when varying RH from 0% to 90%;
- nanometric tin (IV) oxide (SnO<sub>2</sub>) powder exhibits good RH sensitivity;
- PVP is a hydrophilic polymer with excellent binding properties;
- detection at room temperature;
- low response time;
- low cost, small size, and simplicity in manufacturing

**MATERIALS, METHODS, RESULTS**

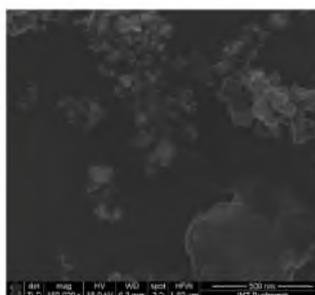
- The interdigitated (IDT) sensing structure (FIG 2) was manufactured on a Si substrate (470 μm thickness), covered by a SiO<sub>2</sub> layer (1 μm thickness). The metal stripes of IDT comprised a Cr (10 nm thickness) and Au (100 nm thickness) stack, having 200 μm width. 6 mm was the distance between the electrodes. A dispersion formed in isopropyl alcohol of a quaternary nanohybrid composition described above, at different ratios, was deposited on the IDT structure using the drop casting method (FIG 3).
- The RH monitoring capability of the sensitive layers was investigated by applying a current between the two electrodes and measuring the voltage at different RH values
- Measurements were performed in humid N<sub>2</sub> at room temperature, and compared with the response of a commercial, industrial grade, capacitive RH Sensirion RH sensor, provided with signal-processing and signal-amplifying electronics (FIG 4 and FIG 5).
- It was demonstrated that the resistance of the sensitive layer this patent proposes varies with RH.



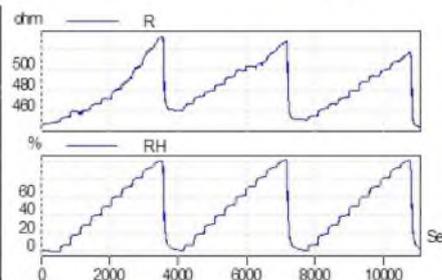
**FIG 1 – Structure of oxidized carbon nanohorns (CNH<sub>ox</sub>)**



**FIG 2 – IDT sensing structure**



**FIG 3 - SEM image for CNH<sub>ox</sub>/GO/SnO<sub>2</sub>/PVP (0.75/0.75/1/1) nanohybrid composition**



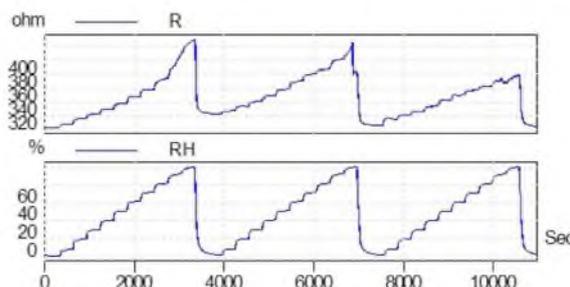
**FIG 4 – R Curve: Response of the sensor employing GO/SnO<sub>2</sub>/PVP at 0.75/0.75/1/1 as sensing layer  
 RH Curve: Response of Sensirion RH sensor**

**CONCLUSIONS**

- The IDT sensing structure presented in this work exhibits a linear response and good RH sensitivity when varying RH from 0% up to 90% in humid N<sub>2</sub> environment.
- The sensor response time and stability are comparable to that exhibited by a commercially available Sensirion RH sensor.

**ACKNOWLEDGMENT**

This work was funded by the Romanian Ministry for Research and Innovation, through the PN 1916/2019 - MICRO-NANO-SIS PLUS / 08.02.2019 Program



**FIG 5 – R Curve: Response of the sensor employing GO/SnO<sub>2</sub>/PVP at 1/1/1/1 as sensing layer  
 RH Curve: Response of Sensirion RH sensor**

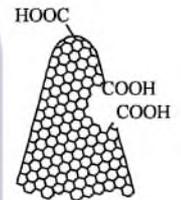
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**TERNARY SENSITIVE LAYER FOR ETHANOL RESISTIVE SENSOR**  
ROMANIAN PATENT APPLICATION A/00477, 31.07.2020  
**ASSIGNEE: National Institute for Research and Development in Microtechnologies - IMT Bucharest**  
**Inventors: BOGDAN-CATALIN SERBAN, OCTAVIAN BUIU, CORNEL COBIANU, NICULAE DUMBRAVESCU, VIOREL MARIAN AVRAMESCU**



## INTRODUCTION

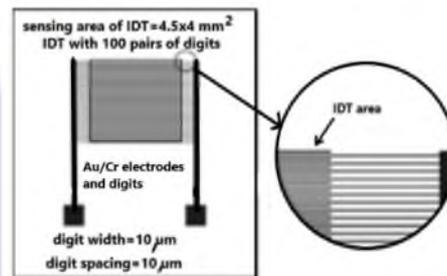
- The technical problem solved by the present invention consists of designing new sensitive layers for low concentration levels of ethanol vapor, employed in the design of resistive sensor. The sensitive layers are ternary nanocomposites comprising oxidized carbon nanohorns (CNH<sub>OX</sub>) / SnO<sub>2</sub> / polyvinylpyrrolidone (PVP) with stoichiometry 1/1/1 and 2/1/1 w/w ratios. The use of ternary nanocomposites for ethanol vapors detection has several significant advantages:
- Both CNH<sub>OX</sub> (**FIG 1**) and SnO<sub>2</sub> have high specific area / volume and affinity ratio for ethanol molecules;
- The two semiconducting materials, p-type (CNH<sub>OX</sub>) and n-type (SnO<sub>2</sub>), ensure a variation of the resistance of the sensitive layer to contact with ethanol vapors;
- PVP is hydrophilic polymer with excellent film forming properties;
- RT detection, low power consumption (below 2 mW), high sensitivity.



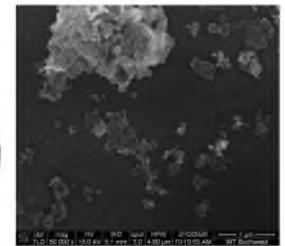
**FIG 1 –**  
 Structure of oxidized carbon nanohorns (CNH<sub>OX</sub>)

## MATERIALS, METHODS, RESULTS

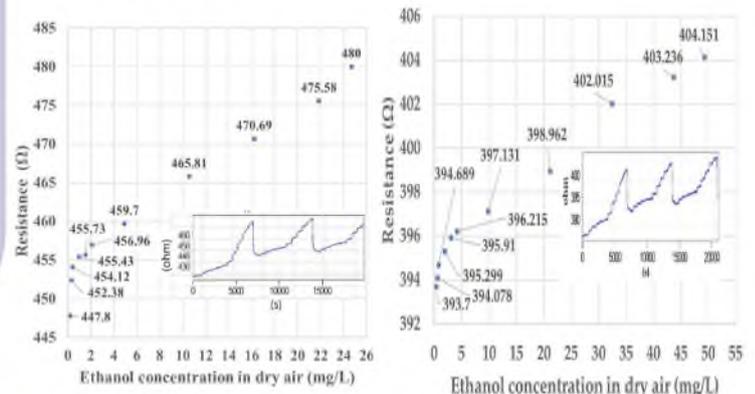
- The test structure consisted of a dual comb interdigitated transducer (IDT) structure with 100 pairs of Au/Cr fingers, each with a width of 10 μm and 10 μm spacing between two consecutive fingers (**FIG 2**).
- A dispersion formed in isopropyl alcohol of the sensing layer described above, at different w/w ratios, was deposited on the IDT structure by the drop casting method (**FIG 3**)
- The sensing capacity to ethanol was investigated by applying a constant current between the two electrodes and measuring the voltage at different values of ethanol vapor concentration (in the range 0- 50 mg/L in dry air – **FIG 4**)
- The sensing mechanism is explained in terms of the overall response of the p-type semiconductor (CNH<sub>OX</sub> percolated between electrodes of the sensor) shunting the heterojunction between n-type SnO<sub>2</sub> and p-type CNH<sub>OX</sub>. The HSAB principle is also involved in the sensing mechanism.



**FIG 2 –** Schematic layout of the Si chip containing dual-comb IDT transducer. The sensing layer is deposited on the rectangle area of 4.5 x 4 mm<sup>2</sup>



**FIG 3 -** SEM image for CNH<sub>OX</sub>/SnO<sub>2</sub>/PVP at 2/1/1 nanohybrid composition



**FIG 4 –** RT transfer functions of the chemiresistive ethanol sensors employing as sensing layers (left) ox-SWCNH/SnO<sub>2</sub>/PVP=1/1/1 (mass ratio) and (right) ox-SWCNH/SnO<sub>2</sub>/PVP=2/1/1. For both cases, the flow rate of air passing through liquid ethanol was varied, while the total flow rate was kept at 1 L/min. The inset shows the automatic recording of the sensor resistance as a function of time and ethanol vapor concentration

## CONCLUSIONS

- Both types of sensing film investigate showed increased RT sensitivity for ethanol vapor concentrations in dry air below 1 mg/L, as well as in the range of 25-50 mg/L, power consumption < 2 mW (> 300 x smaller than that of commercial sensors), response time = 30 s, recovery time = 50 s, and a good reversibility/reusability.
- These impressive performance open new pathways for future VOC monitoring applications related to wireless sensor networks, where data can be collected from static samplers every minute and can accurately determine the ethanol concentration changes in the ambient air.

## ACKNOWLEDGMENT

This work was funded by the Romanian Ministry for Research and Innovation, through the PN 1916/2019 - MICRO-NANO-SIS PLUS / 08.02.2019 Program

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**QUATERNARY OXIDIZED CARBON NANOHORNS - BASED NANOHYBRID  
 FOR RESISTIVE HUMIDITY SENSOR**

EUROPEAN PATENT APPLICATION 20 465 581.5 /3.11.2020

**ASSIGNEE: National Institute for Research and Development in Microtechnologies -  
 IMT Bucharest**

**Inventors: BOGDAN- CATALIN SERBAN, OCTAVIAN BUIU, CORNEL COBIANU,  
 VIOREL AVRAMESCU, NICULAE DUMBRAVESCU**



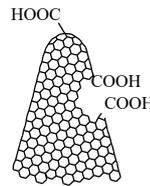
**INTRODUCTION**

- The present invention relates to the RH sensing response of a resistive sensor employing a sensing layer based on quaternary nanohybrid composition comprising or consisting of  $CNH_{Ox}/SnO_2/ZnO/PVP$  at 1.5/1/1/1 w/w ratio to 3/1/1/1 w/w ratio. When employed as RH sensing layers, these quaternary nanohybrid compositions exhibit several significant advantages:
- Oxidized carbon nanohorns ( $CNH_{Ox}$ ) (**FIG 1**) have high specific surface area/volume ratio, water molecules affinity and show rapid electrical resistance variation when RH varies from 0% to 90%.
- The nanometric tin (IV) oxide ( $SnO_2$ ) nanopowder exhibits good RH sensitivity.  $CNH_{Ox}$  have p-type electrical conduction (through holes), while  $SnO_2$  is a n-type metallic oxide semiconductor (through electrons). By adding  $SnO_2$  to  $CNH_{Ox}$ , one will obtain islands of p-n semiconductor heterojunctions embedded in PVP (a dielectric material) that increase the sensitivity of the sensitive layer.
- Zinc oxide ( $ZnO$ ) nanopowder exhibits good RH sensitivity. Both  $ZnO$  and  $SnO_2$  are n-type electrical conductors. The  $ZnO - SnO_2$  nanocomposite has sensing properties superior to each of the single oxides, because each of the oxides interacts differently with the oxidized carbon nanohorns, leading to alterations in the pore distribution, which increase the specific surface area;
- Polyvinylpyrrolidone (PVP) is a hydrophilic polymer with excellent binding properties, which enables its use in sensing structures with either flexible or rigid substrate;
- Detection at room temperature, low response time, low cost, small size, simplicity in manufacture.

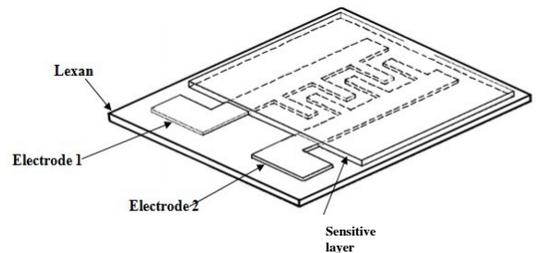
**MATERIALS, METHODS, RESULTS**

The interdigitated (IDT) sensing structure (**FIG 2**) can be manufactured on Lexan, Kapton, or glass. The dielectric substrate may have a thickness from 5 to 50  $\mu m$ . The electrodes can be made from the same material or can be formed of different materials, including conductive materials such as gold and chromium. A dispersion formed in isopropyl alcohol of a nanohybrid sensing layer described above, at different w/w ratios, was deposited on the IDT structure using the drop casting method (**FIG 3**).

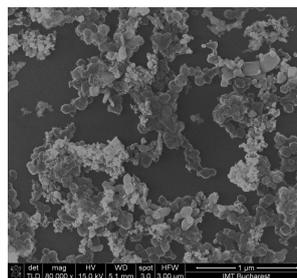
- The RH sensing capability of the sensitive layers was investigated by applying a current between the two electrodes and measuring the voltage at different RH values.
- Measurements were performed in humid  $N_2$ , at RT and compared with the response of a commercial capacitive RH humidity sensor, provided with signal-processing and signal-amplifying electronics (**FIG 4** and **FIG 5**). From the detection principle point of view, the resistance of the sensitive layer varies with the RH level.



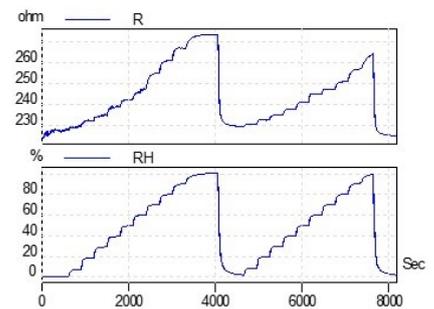
**FIG 1 – Structure of oxidized carbon nanohorns ( $CNH_{Ox}$ )**



**FIG 2 – IDT sensing structure**



**FIG 3 - SEM image for  $CNH_{Ox}/SnO_2/ZnO/PVP$  at 1.5/1/1/1 nanohybrid composition**



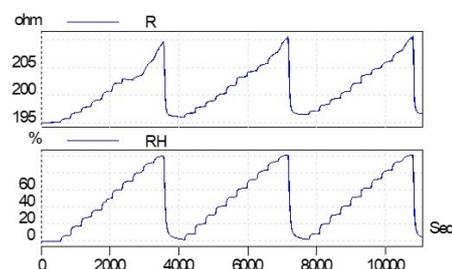
**FIG 4 – R Curve: Response of the sensor employing  $CNH_{Ox}/SnO_2/ZnO/PVP$  at 1.5/1/1/1 as sensing layer  
 RH Curve: Response of Sensirion RH sensor**

**CONCLUSIONS**

The IDT sensing structure presented in this work exhibits a linear response and good RH sensitivity when varying RH from 0% up to 90% in humid  $N_2$  environment. The sensor response time and stability are comparable to that of a commercially available RH sensor.

**ACKNOWLEDGMENT**

This work was funded by the Romanian Ministry for Research and Innovation, through the PN 1916/2019 - MICRO-NANO-SIS PLUS / 08.02.2019 Program



**FIG 5 – R Curve: Response of the sensor employing  $CNH_{Ox}/SnO_2/ZnO/PVP$  at 3/1/1/1 as sensing layer  
 RH Curve: Response of Sensirion RH sensor**

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**HYDROGEN SULPHIDE SENSOR WITH SURFACE ACOUSTIC WAVES**  
APPLICATION PATENT OSIM, ROMANIA, A/00469, 31.07.2020  
**ASSIGNEE: National Institute for Research and Development in  
 Microtechnologies - IMT Bucharest**  
**Inventors: Bogdan-Catalin Serban, Octavian Buiu, Cornel Cobianu,  
 Roxana Marinescu**



### FIELD OF INVENTION

• The invention includes the design and manufacturing processes for a new gravimetric hydrogen sulphide ( $H_2S$ ) sensor, employing carbon nanohorns functionalized with mercapto groups (-SH) and carbonothioyl (-C=S) groups (abbreviated as CNH-SH, FIG 1).

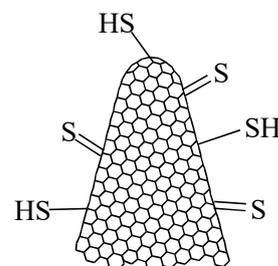


FIG 1 – Structure of CNH-SH

### ORIGINAL APPROACH

- The  $H_2S$  sensor includes a quartz piezoelectric substrate, interdigital transducers and a sensing layer deposited via spin coating (FIG 2).
- The sensing layers described in this invention are based on carbon nanohorns subjected to  $H_2S$  / He plasma treatment. This type of functionalization ensures the selectivity of nanohorns towards  $H_2S$  molecules by grafting sulphur-based groups, such as SH and C = S. At the same time, the optimal degree of derivatization of carbon nanohorns, in order to obtain high sensitivities, can be tuned by changing the plasma power, as well as the exposure time.
- Sensitive layers of the  $H_2S$  / He plasma-functionalized nanohorns type interact with the  $H_2S$  molecules. The adsorption of the  $H_2S$  molecules alter the mechanical and electrical properties of the sensing layer, leading to changes of the propagation rate and frequency of the surface acoustic wave.

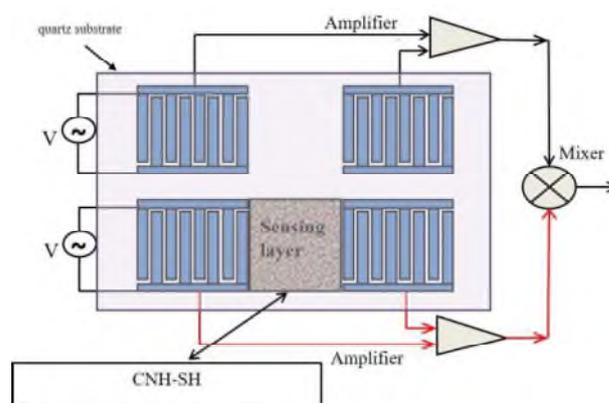


FIG 2 – Structure of the  $H_2S$  sensor

### SYNTHESIS OF THE SENSING LAYER

The process steps for synthesising the solid-state sensing films based on CNH-SH are shown below:

- Carbon nanohorns, purchased from Sigma Aldrich, are functionalized in  $H_2S$  / He plasma (60-40 v/v), with a plasma power of 30 W, at an exposure time of 5 minutes.
- The synthesized CNH-SH is washed with ethanol, acetone and deionized water.
- A dispersion of CNH-SH (10 mg) in 100 mL dimethylformamide is subjected to ultrasonication RT for 12 hours.
- The obtained dispersion is deposited by the spin coating method on the quartz substrate (2000 rpm, for 60 s).
- The obtained film is heated at 120°C for 30 minutes.
- Steps 4 and 5 are repeated.
- The obtained film is subjected to a final heat treatment, at 200°C, for 10 minutes.

### ADVANTAGES OF THE PROPOSED SENSING LAYERS

- Improved mechanical properties and better processability
- High specific area / volume ratio, affinity for  $H_2S$  molecules through van der Waals-type interactions ("mass loading"), as well as a variation of its resistance in contact with  $H_2S$  molecules ("electric loading")

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**INVENTICA 2021**  
 23.06.2021 –  
 25.06.2021 IAȘI,  
 ROMANIA

**RESISTIVE OXYGEN SENSOR AND METHOD OF MANUFACTURING IT**

APPLICATION PATENT OSIM, ROMANIA, A/00470, 31.07.2020

**ASSIGNEE: National Institute for Research and Development in**

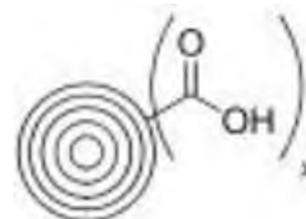
**Microtechnologies - IMT Bucharest**

**Inventors: Bogdan-Catalin Serban, Octavian Buiu,  
 Cornel Cobianu, Roxana Marinescu**



**FIELD OF INVENTION**

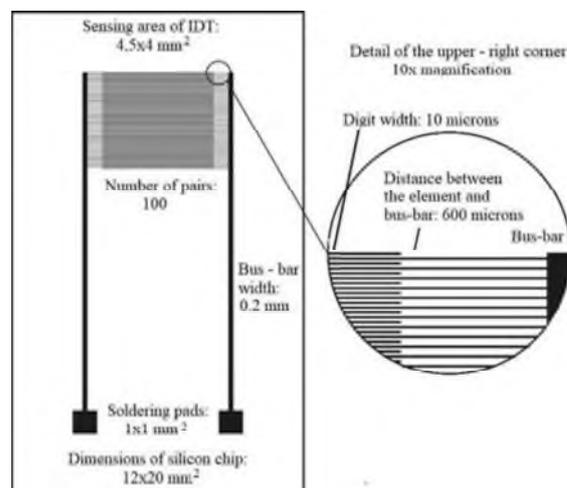
- Oxygen concentration monitoring is a process of cardinal importance in various sectors, such as indoor air quality control (air conditioning and ventilation systems), combustion monitoring in industrial boilers, healthcare (breathing monitoring, incubators), automotive (lambda probe), food technology, etc..
- Along with electrochemical, optical and paramagnetic structures, resistive structures  $O_2$  are a viable solution for  $O_2$  monitoring. Drawback: chemiresistive sensors typically require high operating temperature.



**FIG 1 – Structure of oxidized carbon nano-onions (CNOs-ox)**

**ORIGINAL APPROACH**

- The invention includes the design and manufacturing process for a new resistive, RT  $O_2$  sensor, employing as sensing layer organic - inorganic halide perovskites ( $CH_3NH_3PbI_{3-x}Cl_x$ ) - oxidized carbon nano-onions (CNOs-ox, **FIG 1**). The  $O_2$  sensor includes a Si/SiO<sub>2</sub> substrate, interdigitated (IDT) electrodes and the sensing layer, deposited via spin coating (**FIG 2**).
- The  $O_2$  monitoring capability was investigated by applying a current between the two electrodes and measuring the voltage at different  $O_2$  concentration levels. The resistance of the sensitive layer varies with  $O_2$  concentration.



**FIG 2 – Structure of the  $O_2$  sensor**

**SYNTHESIS OF THE SENSING LAYER**

- The Si / SiO<sub>2</sub> substrate is cleaned for 10 minutes in the ultrasonic bath using sequentially equal volumes of acetone, ethanol and finally deionized water.
- Carbon nano-onions (CNOs) are synthesized from nanodiamonds, by heating at 1650°C, in a helium atmosphere. The synthesis of CNOs-ox is performed by reaction with nitric acid, 3 M, at reflux, for 48 h. The product obtained is washed with deionized water, acetone and deionized water.
- A dispersion of CNOs-ox (0.15 mg / mL) in isopropyl alcohol is prepared and subjected to ultrasonication for 2 h. The obtained dispersion is deposited by the "spin coating" method (1000 rpm for 20 seconds) on the Si / SiO<sub>2</sub> substrate employing liner or interdigitated electrodes (after previously masking the contact area).
- A solution of 0.8425 g of methylammonium iodide and 485 mg PbCl<sub>2</sub> in 10 mL dimethylformamide is prepared, to which 20 μL of HCl (concentration 36.5%) are added. The obtained solution is deposited by the "spin coating" method (1000 rpm for 15 sec; 3000 rpm for 40 sec) over the initially deposited CNOs-ox film.
- The obtained layer is heated at 100°C for 30 minutes. Halogenated perovskite penetrates the nanocarbon structure, forming a hybrid structure:  $CH_3NH_3PbI_3 - xCl_x / CNOs-ox$ .

**ADVANTAGES OF THE PROPOSED SENSING LAYERS**

- The presence of CNOs-ox ensures a high specific surface area / volume ratio, as well as a pronounced affinity for  $O_2$  molecules;
- Detection over a wide temperature range;
- Fast response;
- Reversibility.

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## RELATIVE HUMIDITY SENSOR AND METHOD

EP 3,078,964 B1, Issued May 24, 2017

Proprietor: Honeywell International Inc. Morris Plains, NJ 07950 (US)

Inventors: Bogdan-Catalin Serban, Cornel Cobianu, Mihai Brezeanu,  
 Octavian Buiu, Cazimir Bostan, Alisa Stratulat

### FIELD OF INVENTION

- Among the various RH sensing structures reported in literature, capacitive sensors are an attractive solution due to their highly linear response.
- The main drawback of capacitive RH sensors is the fact that they exhibit hysteresis.
- A way to reduce the hysteresis is by increasing the sensor hydrophobicity. This can be done by the impregnation of the polymeric film with either a hydrophobic and dense inorganic material (such as carbon black) or with an organic material (such as lignin).

### ORIGINAL APPROACH

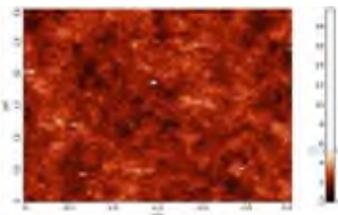
- Novel pathway for reducing the hysteresis of polyimide-based capacitive RH sensor: impregnating its polymeric sensing layer (polyimide) with talc → the number and size of the voids in the polymeric sensing film decreases
- A direct and simple mean to evaluate the hysteresis of the polymeric sensing layer employed by a capacitive RH sensor is by depositing it on a quartz crystal microbalance (QCM) substrate.

### MATERIAL SYNTHESIS AND CHARACTERIZATION

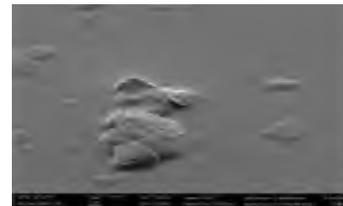
- Talc slurry (1%) was prepared from talc powder (average particle size < 10 μm) and DMF, ultrasonically stirred (at RT, for 6 hours), then mixed with simple polyimide and again ultrasonically stirred (at RT, for 24 hours) for full dispersion.
- The sensing solution was spin-coated (6.000 rpm) on QCMs and placed in an oven, for the curing process: at 85°C for 30 mins, at 150°C for 30 mins, at 300°C for 30 mins, at 400°C for 30 mins.
- AFM analysis performed on the sensing layers (**Figs. 1-2**) show that the talc-impregnated polyimide layer has increased roughness.
- Microscopy (SEM) image (**Fig. 3**) indicates that, while some talc particles are incorporated in the polyimide layer, others are to be found at its surface.



**FIG 1** - AFM of simple polyimide layer



**FIG 2** - AFM of talc-impregnated polyimide layer

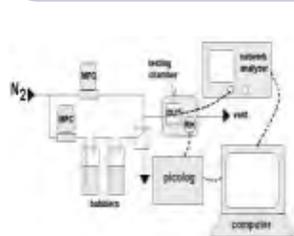


**FIG 3** - SEM of talc-impregnated polyimide layer

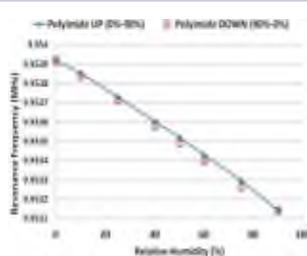
Ref:  
 B Serban et al,  
 IEEE CAS 2015,  
 Proceeding pp  
 109-112.

### MEASUREMENTS & CONCLUSIONS

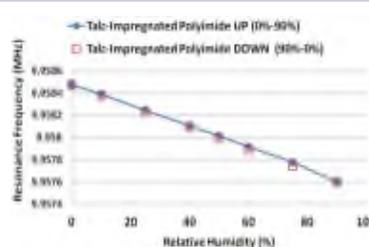
- Employing the experimental set-up in **Fig 4**, hysteresis was measured for 7 RH values between 0% and 75% (**Figs. 5-6**), improvement up to 38% was obtained with talc-impregnated polyimide sensing layers compared to simple polyimide-based ones (**Fig. 7**).



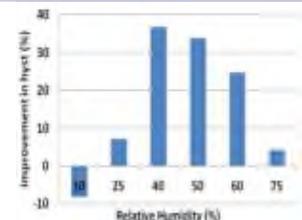
**FIG 4** - Experimental set-up



**FIG 5** - Simple polyimide-based QCM response



**FIG 6** – Talc-polyimide-based QCM response



**FIG 7** – Improvement in RH hysteresis obtained with talc-impregnated polyimide

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## Relative humidity sensor and method of forming relative humidity sensor

EP 3,150,999 B1, Issued December 13, 2017

Proprietor: Honeywell International Inc. Morris Plains, NJ 07950 (US)

Inventors: Bogdan-Catalin Serban, Viorel-Georgel Dumitru, Octavian Buiu, Mihai Brezeanu

### FIELD OF INVENTION

- Relative humidity (RH) sensing, control and monitoring are of paramount importance in many domestic and industrial applications
- Doped polyaniline-based chemiresistive RH sensors are an attractive option due to their excellent linear response and simplicity
- Drawbacks: de-doping risk and poor mechanical stability of polyanilines, hydrophobic properties of the sensing layer

### ORIGINAL APPROACH

- The invention relates to the design and manufacturing process of a new chemiresistive RH sensor employing conductive polyanilines nanofibers as sensing layer. The RH sensor includes a dielectric substrate, two electrodes disposed above a dielectric substrate and a sensing layer
- By doping emeraldine (**FIG. 1**) with calconcarboxylic acid (HA) (**FIG. 2**), the synthesis of new conductive polyanilines nanofibers, sensitive to RH variation, is performed (**FIG. 3**).
- The selected dopants lead to important benefits: the mechanical properties and processability of the sensing layer are improved, polyanilines are less susceptible to de-doping process, the response of the sensor improves.

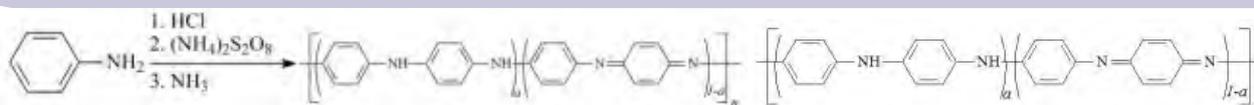


FIG 1 - Synthesis of emeraldine

FIG 2 - structure of calconcarboxylic acid (HA)

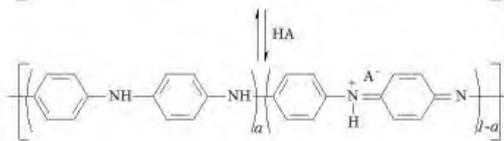
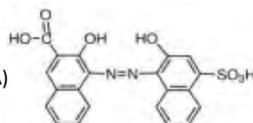


FIG 3 - Doping of emeraldine with HA

### SENSING STRUCTURE & EXPERIMENTAL RESULTS

- The dielectric substrate (50μm – 5 mm thick) can be formed from plastic (Ex: polyethylene terephthalate), glass, or composite materials (Ex: FR4 employed for PCB)
- Electrodes (Al, Cu, etc.) can be deposited onto the surface of the dielectric substrate by using different methods, such as sputtering, direct printing and evaporation. Electrodes can be linear, planar (**FIG 4**) or can have interdigitated configuration (**FIG 5**)
- Sensing layer can be deposited by electrospinning
- RH detection capability is investigated by applying a voltage between the two electrodes and measuring the electrical current flowing through the sensitive layer at various RH levels. The calconcarboxylic acid doped polyaniline polymer absorbs water and the changed geometry of the polymer increases the charge transfer across the polymer chain. RH response is very fast, the current through the sensor changing almost simultaneously with the RH variation (**FIG 6**)

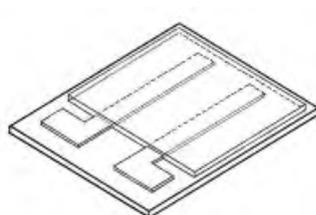


FIG 4 – Sensor with planar electrodes

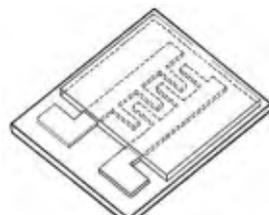


FIG 5 - Sensor with interdigitated electrodes

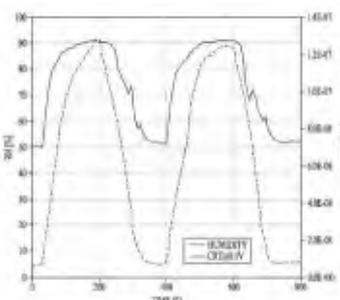


FIG 6 – Sensor RH response

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## SENSING LAYER FOR OXYGEN DETECTION

**EP 2,848,927 B1, Granted September 9, 2015**

**Proprietor: Honeywell Romania S.R.L. 014459 Bucharest (RO)**  
**Inventors: Bogdan-Catalin Serban, Cornel Cobianu, Mihai Brezeanu, Viorel Avramescu, Octavian Buiu, Viorel-Georgel Dumitru, Mihai Mihaila, Cazimir Bostan**

### FIELD OF INVENTION

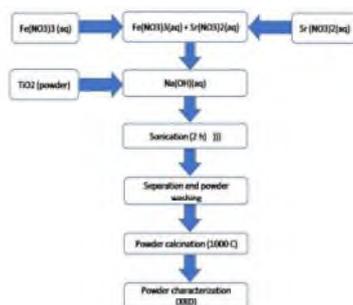
- In harsh environment applications, especially at high RH and high ambient temperature, metal oxide-based resistive oxygen sensors are an inexpensive alternative to the well-known potentiometric zirconia oxygen detectors.
- Typical drawback of solution: selectivity issues, high power consumption, drift, material degradation, slow response time.

### ORIGINAL APPROACH

- This study employs a novel nanocomposite sensing layer based on Sono-STFO40 & CNTs (sono-chemically synthesized  $\text{SrTi}_{0.6}\text{Fe}_{0.4}\text{O}_{2.8}$  mixed with carbon nanotubes) exhibiting high sensitivity, fast response time, small drift and improved thermal and mechanical stability

### NOVEL SENSING LAYER SYNTHESIS AND CHARACTERIZATION

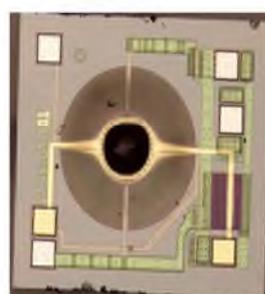
- A Sono-STFO40 & SWCNTs matrix nanocomposite slurry was synthesized by mixing sono-STFO40 (powder, 50% w/w), single-wall CNTs (5%), terpeneol (solvent, 35% w/w), hydroxypropyl cellulose (HPC)(binder, 5% w/w) and capric acid / caprylic acid (equimolecular mixture, surfactant, 5% w/w).
- Sono-STFO40 and sono-STFO40 & SWCNTs matrix nanocomposite were deposited on SOI-based micro-hotplate membranes using a dip pen nanolithography (DPN) system



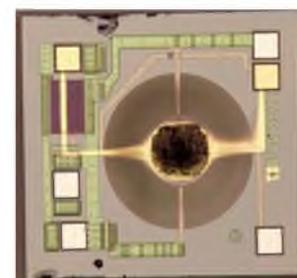
**FIG 1 –** Route for the synthesis of sono-STFO40



**FIG 2 -** Argon set-up for sono-STFO40 synthesis



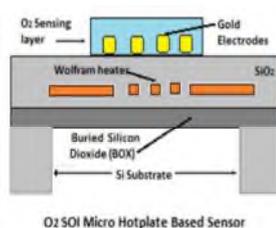
**FIG 3 -** Top-view of the resistive SOI micro-hotplate-employing sono-STFO40 as  $\text{O}_2$  sensing layer



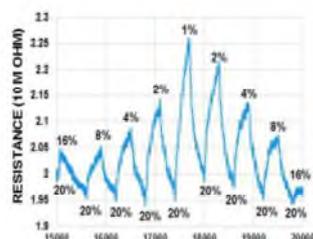
**FIG 4 -** Top-view of the SOI micro-hotplate employing sono-STFO40 & SWCNTs as  $\text{O}_2$  sensing layer

### MEASUREMENTS & CONCLUSIONS

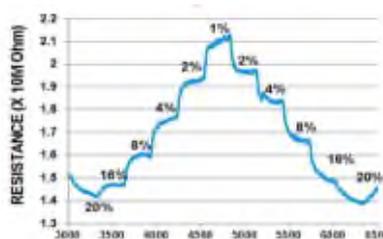
- $\text{O}_2$  detection tests (**Figs. 6-7**) on SOI-based micro-hotplates (**Fig. 5**) showed that the presence of the SWCNTs enhances the  $\text{O}_2$  response up to 35% for  $\text{O}_2$  concentration levels lower than 4% (**Fig. 8**).



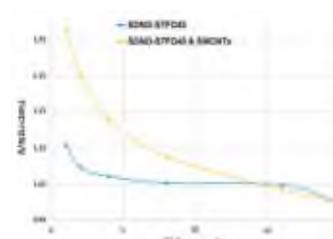
**FIG 5 –** Tungsten was employed as heater within the SOI micro-hotplate (its temperature was set at 650°C)



**FIG 6 –** SOI micro-hotplate-based  $\text{O}_2$  resistive sensor response employing sono-STFO40 as sensing layer



**FIG 7 –** SOI micro-hotplate-based  $\text{O}_2$  resistive sensor response employing sono-STFO40 & SWCNTs as sensing layer



**FIG 8 –** Comparison of the  $\text{O}_2$  response of the 2 sensing layers discussed in this study

***National Institute For Research And Development For Cryogenic  
And Isotopic Technologies - ICSI Rm.Valcea***



# International Exhibition of Inventions INVENTICA 2021

23.06.2021 – 25.06.2021

NATIONAL RESEARCH INSTITUTE OF CRYOGENICS & ISOTOPIC TECHNOLOGIES  
ICSI RM. VÂLCEA, ROMANIA



## PROCESS OF CATALYTIC PYROLYSIS OF BIOMASS TO OBTAIN FUELS

Patent application/A 00743/14.11.2019; Patent granting decision no.37/ 30.03.2021

Inventors : E.David, A.Armeanu

### Description

The invention relates to a process for the conversion of biomass into a majority liquid fraction consisting of compounds with low oxygen content, which can be further converted into liquid fuel (bio-oil) and a gaseous product with a high hydrogen content. The process is based on a catalytic pyrolysis process in which the catalyst is engaged in the de-oxygenation reactions that take place when the biomass is subjected in the reactor to specific conditions of the pyrolysis process. The resulting bio-oil has a low oxygen content in the composition and it is separated from the liquid fraction by condensation and settling processes.

### Novelty

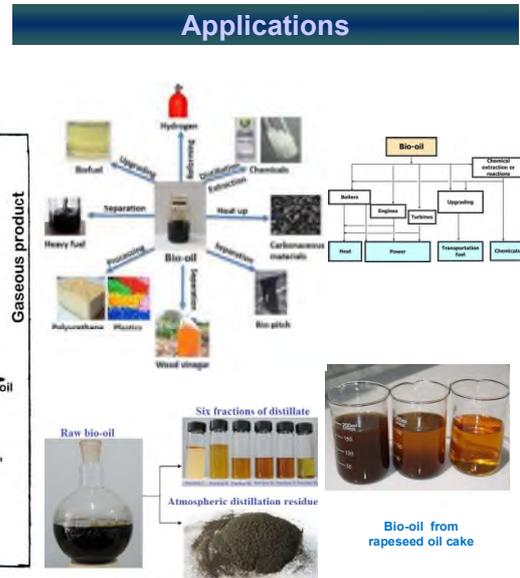
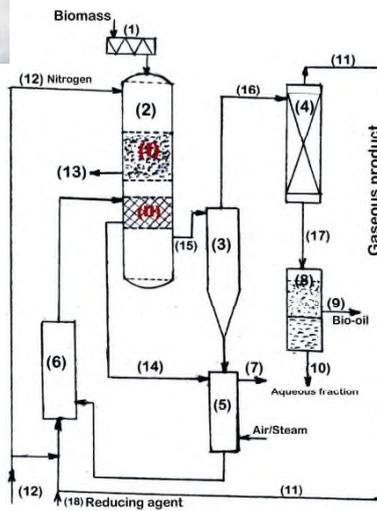
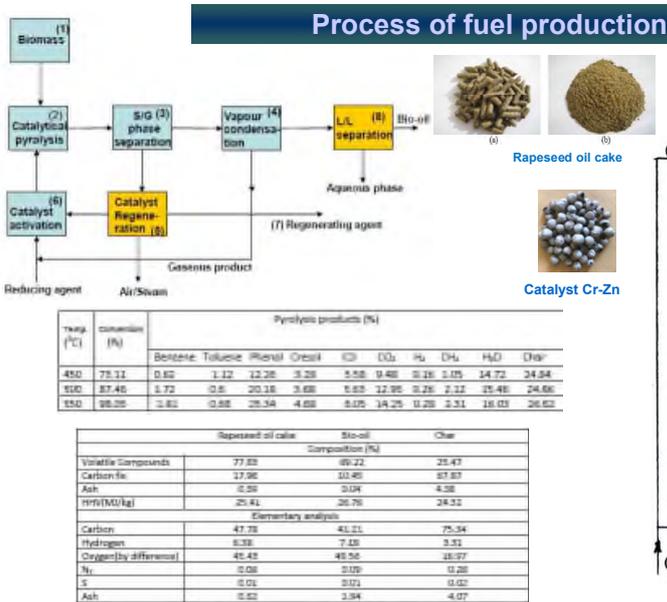
The way of placing the catalyst layer in the reactor, a catalyst that ensures the catalytic pyrolysis of the vapors resulting from the biomass pyrolysis process, and does not intervene in the initial biomass pyrolysis process used as raw material; The catalyst used consists of ZnO-Cr<sub>2</sub>O<sub>3</sub> (in the Zn: Cr ratio of 10: 1) deposited on an oxide, in particular aluminum oxide (Al<sub>2</sub>O<sub>3</sub>); The raw material used consists of rapeseed oil cake, a waste with a high content of oxygenated organic compounds which results in a bio-oil also high in oxygen content, which by its catalytic pyrolysis in the vapor state is considerably reduced, improving characteristics of the resulting bio-oil.

### Advantages

The catalyst has a better stability and resistance to the formation of coke and a higher selectivity to the formation of bio-oil; The liquid product (pyrolysis bio-oil) is rich in hydrocarbons and with a lower oxygen content; The catalyst is a bifunctional one and can convert water vapor formed during the pyrolysis of biomass into hydrogen;

### Applications

Production of clean energy ;Development of new technologies; Waste recycling; Environmental protection; Production of selective materials ; Gas separation and purification technologies;



- > A new catalyst is used, with a better stability and resistance to the formation of coke and a higher selectivity to the formation of bio-oil;
- > To obtain high conversion efficiency, a process of catalytic pyrolysis of biomass is used, which selectively deoxygenates the oxygenated compounds from the biomass composition, with minimal losses of hydrogen and carbon;
- > The developed process of catalytic pyrolysis of biomass ensures the formation of a liquid product (pyrolysis bio-oil) rich in hydrocarbons and with a low oxygen content;
- > The low oxygen content makes the bio-oil to be of superior quality by the fact that it is much more thermally stable than the product resulting from classical pyrolysis;
- > The low oxygen content in the prepared bio-oil, according to the present invention, ensures the immediate transition to refining to prepare biofuels, without the need for intermediate steps, such as deoxygenation or stabilization by hydrotreating;
- > The catalyst used is a material that promotes the deoxygenation of the pyrolysis products before the reaction products leave the catalyst bed;
- > The catalyst is a bifunctional one and can convert water vapor formed during the pyrolysis of biomass into hydrogen to provide a reactive medium for the hydrogenation reaction and selectively for the removal of oxygen from the pyrolysis vapors.



# International Exhibition of Inventions

## INVENTICA 2021

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INSTITUTUL DE CERCETARE DEZVOLTARE PENTRU TEHNOLOGII CRIOGENICE SI IZOTOPICE

### PROCEDEU DE OBTINERE MATERIALE GRAFENICE DOPATE CU AUR

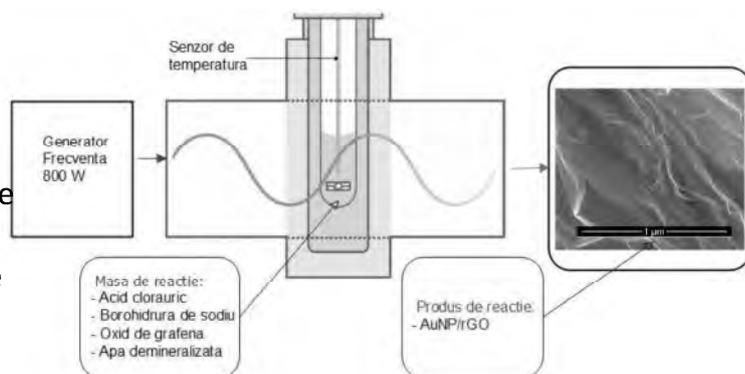
A 00536/2020/ PN 19 11 02 01

**Inventatori:** Marinoiu Teodora Adriana, Carcadea Elena, Raceanu Mircea, Capris Ioan Catalin, Varlam Mihai

**Invenția** se referă la un procedeu de obținere materiale grafenice dopate cu nanoparticule de aur, compozite care, datorită stabilității chimice și electrochimice ridicate, au numeroase aplicații în producerea de electrozi pentru diverse dispozitive electrochimice de tipul pilelor de combustibil, bateriilor, senzorilor, celulelor solare.

**Procedeu**, conform invenției, utilizează sinteza într-o singură etapă de reacție, iar această cale oferă un mare potențial tehnic, ce poate fi optimizat, astfel încât să poată fi transpus pentru obținerea grafenelor decorate cu nanoparticule de aur la scară superioară de producție, utilizând un protocol ieftin, rapid și eficient.

**Problema tehnică pe care o rezolvă invenția** constă în obținerea unui material nanocompozit de tipul grafene dopate cu nanoparticule de aur în câmp de microunde, printr-un procedeu într-o singură etapă, care nu necesită presiuni ori temperaturi ridicate, conform schemei



**Materialul grafenă dopată cu aur**, conform invenției, constă în aceea că se obține pornind de la oxid de grafenă comercial, printr-un procedeu într-o singură etapă, în condiții blânde de reacție în câmp de microunde (40-100 C, 800 W)

Conform prezentei invenții, procedeu de preparare a grafenelor dopate cu aur este simplu, nu prezintă dificultăți tehnologice de sinteză, activitățile de operare, exploatare și control sunt ușor de executat, procedeu e economic, iar reactivii și materialele folosite sunt ușor accesibile și nepoluante comparativ cu metodele actuale de preparare a grafenelor dopate cu metale. Procesul se bazează pe co-reducerea *in-situ* a oxidului de grafenă (rGO) cu borohidruza de sodiu ( $\text{NaBH}_4$ ) în prezența precursorului de Au (de exemplu, acid clorauric)

Proba	Compoziție chimică (at%)			Compoziție chimică (wt%)			Suprafața specifică ( $\text{m}^2 \text{g}^{-1}$ )	Rază pori (nm)	Volum pori ( $\text{cm}^3 \text{g}^{-1}$ )
	C	O	Au	C	O	Au			
Material grafenic dopat cu aur	83.61	16.06	0.33	75.7	19.38	4.92	183	1.9659	1.163

Exemplu de material obținut prin prezenta invenție-Proprietăți fizice și chimice

**Avantajul tehnic** pe care îl aduce această invenție constă în aceea că, pornind de la un material accesibil comercial – oxidul de grafenă, printr-un procedeu special conceput de sinteză chimică în câmp de microunde, se pot obține materiale grafenice dopate cu aur cu proprietăți morfologice și structurale specifice utilizării drept catalizatori și/sau electrocatalizatori.

***National Institute For Research And Development In Mine Safety  
And Protection To Explosion - INSEMEX Petroşani***



# International Exhibition of Inventions INVENTICA 2021 23.06.2021 – 25.06.2021



**NATIONAL INSTITUTE FOR RESEARCH AND DEVELOPMENT  
IN MINE SAFETY AND PROTECTION TO EXPLOSION – INSEMEX PETROȘANI**

## SPECIALIZED SCALABLE SYSTEM FOR CHECKING THE OPERATING PARAMETERS FOR PYROTECHNIC ARTICLES FOR PROFESSIONAL USE - CATEGORY F4

**PATENT REQUEST NO. OSIM A 2020 00687**

**Inventors: Vasilescu Gabriel-Dragoș – PhD.Habil.Eng., Ghicioi Emilian – PhD.Eng., Găman George-Artur – PhD.Eng., Laszlo Robert – Stud. PhD.Eng., Kovacs Attila – PhD.Eng., Gheorghiosu Edward-Jan – PhD.Eng., Rus Daniela-Carmen – PhD.Eng., Rădeanu Cristian – PhD.Eng., Garaliu Bușoi Bogdan – Stud. PhD.Eng., Ilici Ștefan – Eng., Miron Claudia – Eng.**

The invention relates to a specialized scalable system, intended for determining the operating parameters for pyrotechnic articles for professional use - category F4, which allows image processing for scalable determination, based on the assignment of a known size, expressed in the unit of measurement - the meter, a reference mark with a certain number of pixels, as well as by using a calculation algorithm, for determining and monitoring the main specific functional parameters, such as: trajectory - ascending height, deviation from the vertical in two perpendicular planes, the dimensions of the main and side effects.

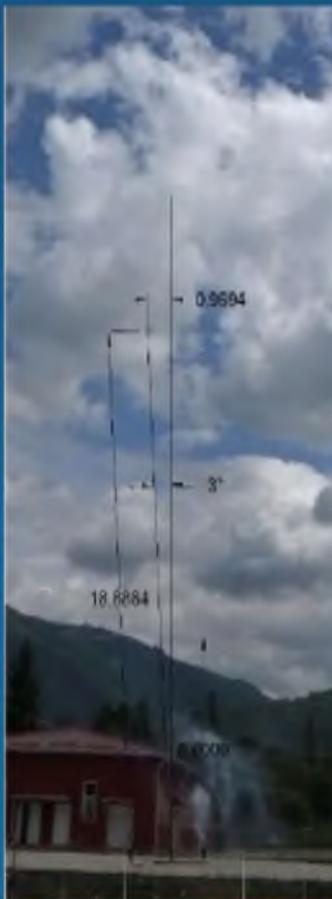


Fig.1 Operation of the pyrotechnic article (F4) captured by the ultra-fast video camera no. 1

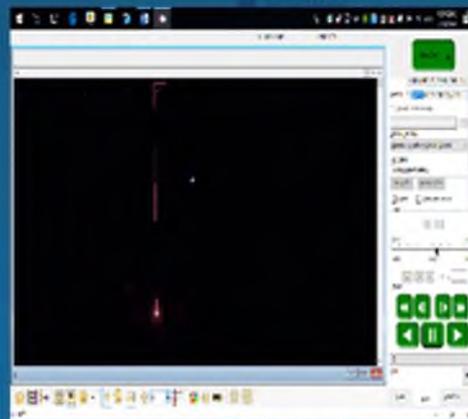


Fig.2-Visual result of the breaking height of the effect (A) recorded by the ultra-fast camera no.1

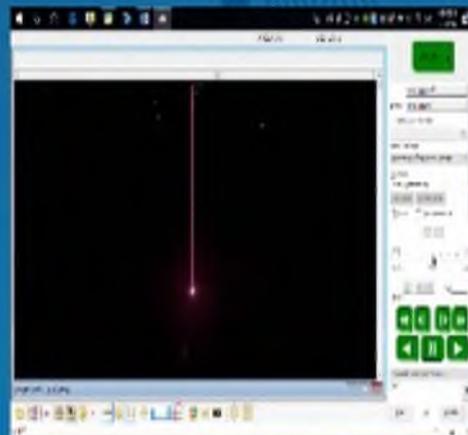


Fig.3-Visual result of the breaking height of the effect (A) recorded by the ultrafast camera no.2



Fig.4. Operation of the pyrotechnic article (F4) captured by the ultra-fast video camera no. 2

The specialized scalable system is realized as a complex assembly, equipped with dual optical system with high frequency frame recording, which allows image processing for scalable determination, based on the assignment of a known size, expressed in the unit of measurement - the meter, to a reference landmark with a certain number of pixels, as well as by using a calculation algorithm, for determining and monitoring the main spatial functional parameters, specific to pyrotechnic articles for professional use - category F4, such as: trajectory- ascending height, deviation from the vertical in two perpendicular planes, the dimensions of the main and side effects, the height of fall, the safety distance. Thus, the system allows the determination of the explosion height and the ascending angle, the determination of the dimensions of the light effects: burst height, effect height, effect width, fall height, deviation angle from the vertical, based on them can be established, both compliance of these products with the security quality requirements that they must meet, as well as their classification in the related category -F4.

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**NATIONAL INSTITUTE FOR RESEARCH AND DEVELOPMENT  
IN MINE SAFETY AND PROTECTION TO EXPLOSION – INSEMEX PETROȘANI**



**COMPUTER STAND FOR THE PREPARATION OF A  
MIXTURE OF FLAMMABLE/TOXIC/EXPLOSIVE GASES**

**PATENT REQUEST NO. OSIM A 2019 00807**

**Inventors: Șimon Marinică Adrian Bogdan – Stud.PhD., Găman George Artur – PhD.Eng., Ghicioi Emilian – PhD. Eng., Pupăzan Gheorghe Daniel – PhD.Eng., Călămar Angelica-Nicoleta – PhD.Eng., Păsculescu Vlad Mihai – PhD. Eng., Vlasin Nicolae-Ioan – PhD.Eng., Laszlo Robert – Stud.PhD.Eng., Burian Constantin Sorin – PhD.Eng., Florea Gheorghe-Daniel – Eng., Prodan Maria – PhD. Chem., Cioclea Doru – PhD.Eng., Șuvar Marius Cornel – PhD.Eng., Vass Zoltan – Eng., Moldovan Lucian – PhD.Eng., Simion Alexandru Florin – PhD. Eng.**

The invention relates to a computerized stand for the preparation of a mixture of flammable/toxic/asphyxiating gases, with the purpose of obtaining gas mixtures at concentrations in the explosive range, the operating principle of the stand is based on mixing two volumetric flows, controlled by programmable microprocessors, at which the gases are stored and circulated at atmospheric pressure with the aid of cylindrical injectors, driven by stepper motors so that the gas circuit does not require valves and at the outlet there is a homogenization chamber with agitator and dedicated flammable/toxic/explosive sensor to confirm the programmed concentration.

**LEGEND:**

- [1] Storage cylinders
- [2] Gas flow
- [3] Mixing chamber
- [4] Propeller
- [5] Electric motor
- [6] Outlet nozzle
- [7] Gas sensor
- [8] Gas concentration diagram
- [9] PC
- [10] Microprocessors
- [11] Multiple power supply
- [12] Stepper motor drivers
- [13] Stepper motors
- [14] Mechanical couplings
- [15] Mechanical assembly
- [16] Pistons

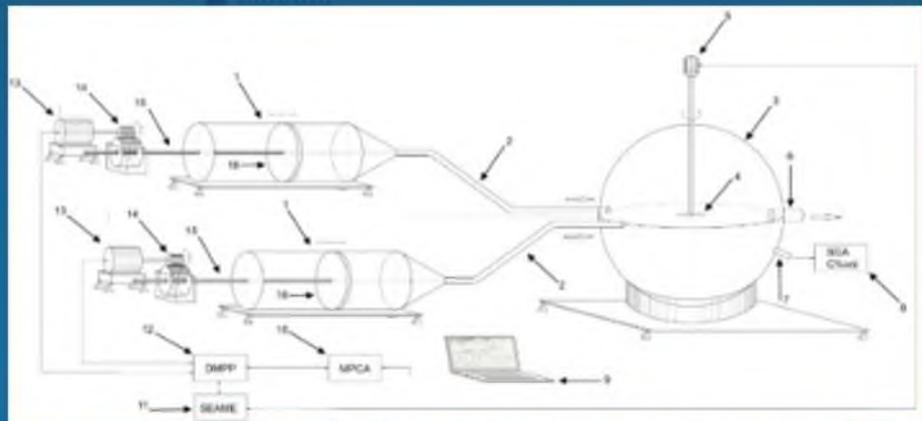


Fig. no. 1. Computer stand for the preparation of a mixture of flammable/toxic/explosive gases



Fig. no. 2. Hardware used in the computer stand

Stoichiometric mixture of gases are achieved using the computer stand, which is in continuous development and essential for gas mixtures experiments, based on two stepper motors that precisely control the gas flows, into a direct realization of a mixture (explosive atmospheres). The hardware used to develop the gas mixture system, consists in two stepper motors (Nema 17), two controller boards that host the logical part required to achieve the desired concentration of a gas mixture and two stepper drivers that ensure a proper operation of those two stepper motors

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IN MINE SAFETY AND PROTECTION TO EXPLOSION – INSEMEX PETROȘANI**

## CONTINUOUS INVASIVE DETERMINATION METHOD OF AIR VELOCITY

**PATENT REQUEST NO. OSIM A 2020 00338**

**Inventors:** Cioclea Doru – PhD. Ing., Emeric Chiuzan – PhD. Ing., Găman George Artur – PhD. Ing., Ghiciei Emilian – PhD. Ing., Gherghe Ion – PhD. Ing., Rădoi Gheorghe Florin – PhD. Ing., Boantă Corneliu Dănuț – PhD. Ing., Ianc Nicolae – PhD. Ing., Tomescu Cristian – PhD. Ing., Morar Marius Simion – PhD. Ing., Matei Adrian – PhD. Ing., Drăgoescu Răzvan – PhD. Ing.

The invention relates to the continuous invasive determination method of air velocity. The method shall take into account the entire measuring section, the location and the measuring surface are chosen and the air parameters, the equivalent surfaces and centers of gravity within the measuring surface are determined, the system for the continuous determination of the static, dynamic, and total average air pressure is set up and installed at the measuring point, and the system for continuous determination of the mean pressure is connected, the data resulting from the continuous measurements are collected, finally the average speed at the level of the measuring surface is established indirectly.

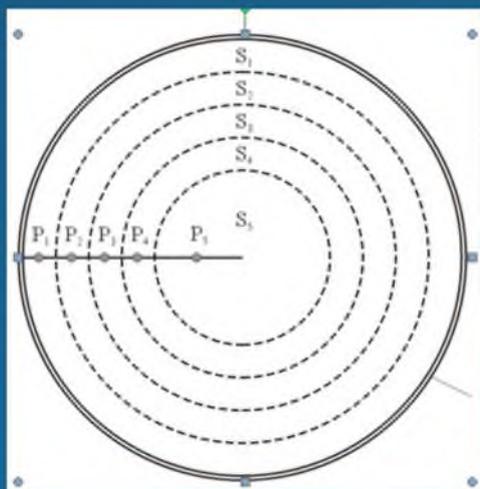


Fig. no. 1. Establishment of measuring points at the level of a circular ventilation duct

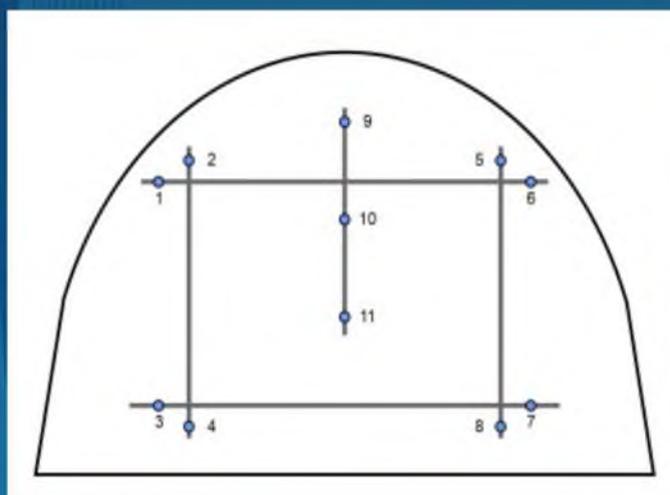


Fig. no. 2. Establishing measurement points at a gallery level

The method of continuous invasive determination of air velocity consists in going through several stages as follows: Choosing the place of measurement; - Determination of the measuring surface - Determination of air condition parameters; - Establishment of equivalent areas; - Determination of centers of weight; - Configuring the system for continuous determination of the static, dynamic, and total average air pressure; - Initial installation of the system for continuous determination of the static, dynamic and total average air pressure; - Installation at the place of measurement of the system for continuous determination of the average static, dynamic and total air pressure; - Connecting the system for continuous determination of the average pressure; - Collection of data resulting from continuous measurements; - Indirect determination of the average speed at the level of the measuring surface.

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## **NATIONAL INSTITUTE FOR RESEARCH AND DEVELOPMENT IN MINE SAFETY AND PROTECTION TO EXPLOSION – INSEMEX PETROȘANI CONTINUOUS AIR SPEED DETERMINATION SYSTEM**

**PATENT REQUEST NO.OSIM A 2020 00369**

**Inventors: Cioclea Doru – PhD. Ing., Emeric Chiuzan – PhD. Ing., Găman George Artur – PhD. Ing., Ghicioi Emilian – PhD. Ing., Gherghe Ion – PhD. Ing., Rădoi Gheorghe Florin – PhD. Ing., Boantă Corneliu Dănuț – PhD. Ing., Ianc Nicolae – PhD. Ing., Tomescu Cristian – PhD. Ing., Morar Marius Simion – PhD. Ing., Matei Adrian – PhD. Ing., Drăgoescu Răzvan – PhD. Ing.**

The system for the continuous determination of the air speed, uses rectangular profiles that can be structured from cross type components, with connecting elements made of linear rectangular profiles, screw-type stiffening elements, Pitot-Prandtl tubes, primary connecting hoses connected to the pressure sockets, two barrels equipped with several connecting elements, each connecting element is provided with a shut-off valve / opening, secondary connecting hoses connected to the barrels, respectively a pressure measuring device, the data resulting from the continuous measurements are collected, finally the average speed at the level of the measuring surface is established indirectly.

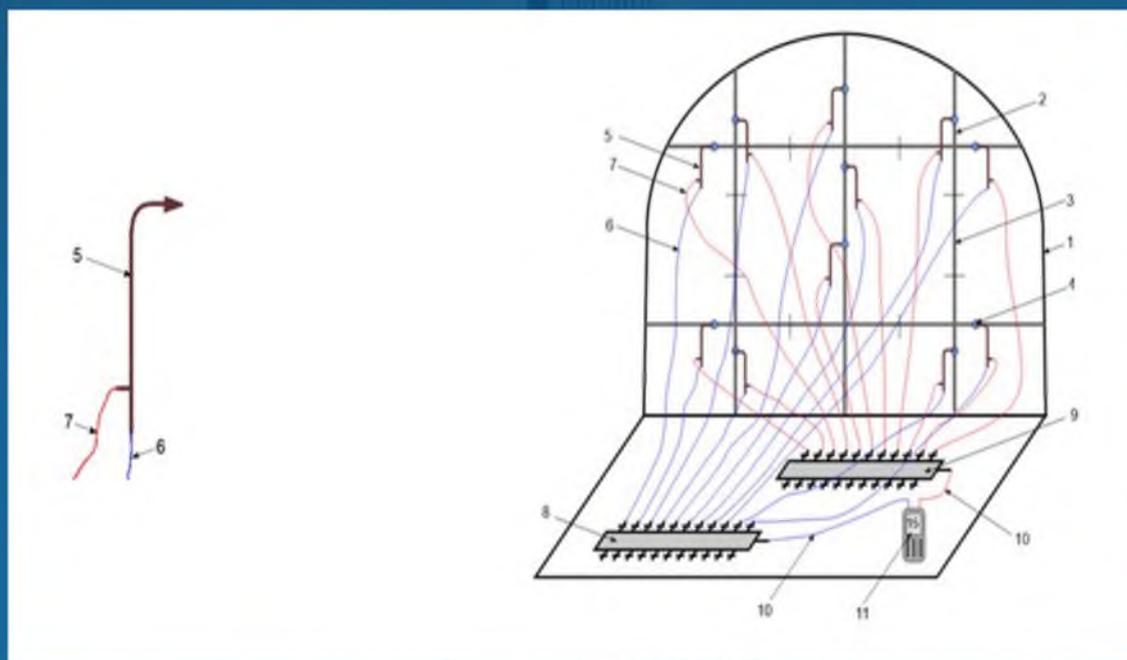


Fig. no. 1. Determining the average air speed system

The system for the continuous determination of air velocity consists in the interconnection of several component parts as follows:

1. The framework of the system for determining the average air speed.
2. Pitot-Prandtl tubes.
3. Barrels.
4. Connecting hoses.
5. Pressure gauge.
6. Indirect determination of the average speed at the level of the measuring surface.

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## PROTEIN HYDROLYSATE FROM KERATINOUS PROTEIN MATERIALS AND PREPARATION PROCEDURE ACCORDING TO THE ALKALINE METHOD

**Patent application: No. A/00602**

**Inventors: Coța Constantin, Nagy Elena Mihaela, Cioica Nicolae, Jurcă Mihnea, Drăgan Simion, Miclăuș Vasile, Miclăuș Adina**

### DESCRIPTION:

The invention relates to the composition of a protein hydrolysate from keratinous protein materials intended for use as an additive in inorganic fertilizers for agriculture. The composition of protein hydrolysate with improved biological activity contains, in addition to free amino acids, peptides and polypeptides, and microelements essential for plant development ( $\text{Cu}^{2+}$ ,  $\text{Co}^{2+}$ ,  $\text{Mn}^{2+}$ ,  $\text{Fe}^{3+}$ ,  $\text{Zn}^{2+}$ ) in form of organometallic compounds water-soluble and easily assimilated by plants.

According to the invention, the hydrolysis is performed in two steps: step I in a reducing medium, at a temperature of 55-65 °C and pressure  $p = 1$  bar; step II at a temperature of 100-135 °C, pressure  $p = 1-3$  bar and  $\text{pH} = 10.5-12.5$ .

### RESULTS

Free amino acids, peptides and polypeptides.... 5-18 %

Microelements:  $\text{Cu}^{2+}$ ,  $\text{Ca/Mg}$ ,  $\text{Co}^{2+}$ ,  $\text{Mn}^{2+}$ ,  
 $\text{Fe}^{2+}$ ,  $\text{Zn}^{2+}$ ..... 0.5-7.5 %

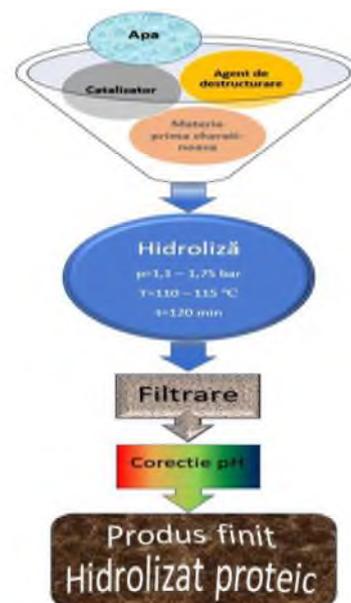
pH..... 5-6.5

Density..... 1.06-1.15 g/cm<sup>3</sup>

Solubility..... 100%

Yield..... 97-98%

### MATERIAL AND METHOD USED



### CONCLUSION

Allows recovery of large quantities of wool waste in form of products with high biological activity in the fertilization process;

Solving environmental problems caused by the storage and neutralization of keratinous waste, including poor quality wool;

Amino acids, peptides and polypeptides found in the composition of protein hydrolyzate, used as an additive to inorganic fertilizers for agriculture, play an essential role in enzymatic and bacterial processes that occur in both soil and plants, while contributing to the degradation of pesticides and toxins.



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### **SISTEM INTEGRAT DE RECUPERARE A ENERGIEI TERMICE SOLARE SI DIN PROCESUL DE COMPOSTARE**

**INTEGRATED SYSTEM FOR RECOVERY OF SOLAR THERMAL ENERGY  
AND FROM THE COMPOSTING PROCESS**

**Patent Application No.: A-00722 / 2020**

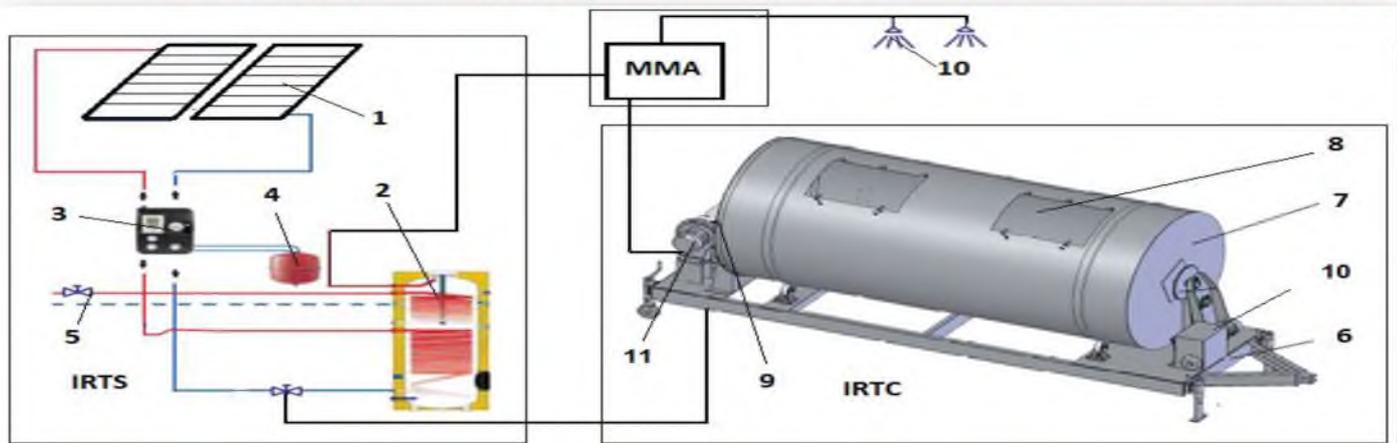
**Inventors: CIUPERCĂ Radu, ZAICA Ana, NEDELICU Anuța**

#### **DESCRIERE:**

Invenția se referă la un sistem integrat de recuperare a energiei termice solare și din procesul de compostare a deșeurilor biodegradabile, pe care o transferă unei instalații pentru producerea de apă caldă menajeră, destinat fermelor mici și gospodăriilor individuale.

#### **DESCRIPTION:**

The invention refers to an integrated system for the recovery of thermal energy both solar and from the composting process of biodegradable waste, which it transfers to an installation for the production of domestic hot water, intended for small farms and private households.



The system consists of a Solar Thermal Energy Recovery (IRTS) Installation, consisting of solar collectors (1), a storage tank (2), hydraulic equipment (3), expansion vessel (4), water circuits (5), a Thermal Energy Recovery Plant resulting from the Composting process (IRTC), consisting of a frame (6), composting cylinder (7) with two doors for loading / unloading, a back cover (9), equipped with steam intake / discharge vents, a geared transmission and chain wheels (10) for rotating the composting cylinder, a heat recovery and transfer system for the production of hot water (11), a thermometer for measuring the temperature of the compost and a Monitoring and Automation Module of the entire heat recovery process (MMA).

#### **ADVANTAGES:**

- easy use and maintenance, without the need for trained or specialized personnel;
- allows the regulation of the absorbed air flow, with impact on the temperature of the domestic hot water produced;
- the integrated system ensures the recovery of thermal energy and its reuse for the production of hot water, throughout the day and in any weather conditions, throughout the year.



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## **STRUCTURĂ PORTANTĂ MODULATĂ PENTRU UTILAJE AGRICOLE** **MODULATED LOAD-BEARING STRUCTURE FOR AGRICULTURAL MACHINERY**

**Patent Application No.: A-00658 / 2020**

**Authors: MURARU Vergil Marian, CÂRDEI Petru, MURARU Sebastian Lucian,  
MURARU-IONEL Cornelia, CONDRUZ Paula**

### **DESCRIERE:**

Invenția se referă la o structură portantă modulată cu aplicații multiple destinată mașinilor de lucrat solul pe care se montează organe active în diferite variante de lucru, în vederea extinderii perioadei de utilizare în funcție de mărimea exploatațiilor agricole și puterea tractorului.

### **DESCRIPTION:**

The invention relates to a modulated load-bearing structure with multiple applications for tillage machines on which active parts are mounted in different working variants in order to extend the period of use depending on the size of agricultural exploitations and the power of the tractor.

### **MATERIALS AND METHOD USED:**

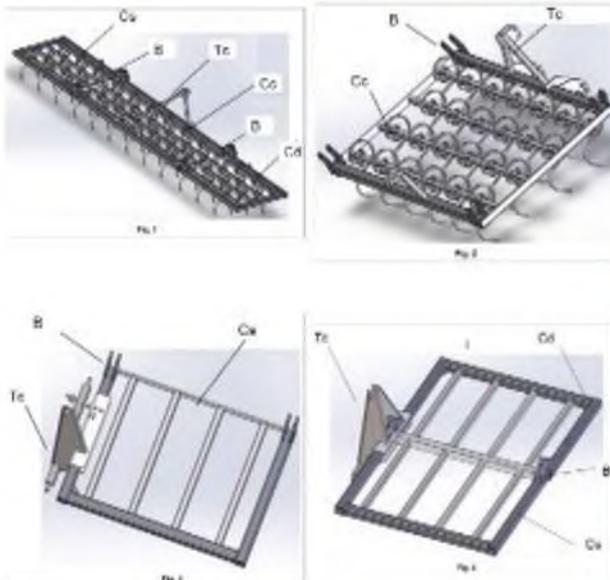
The technical problem solved by the invention consists of the realization of a modulated load-bearing structure for the variation of the working width of the basic structure, in order to increase the utility of the equipment and to extend the period of use depending on the size of the agricultural exploitations and the tractor power. The modulated load-bearing structure for agricultural machinery according to the invention comprises a central frame supported by working depth limiting wheels, equipped with a central coupling triangle, to which they can be attached, by means of a system of hinges and hydraulic folding cylinders coupled to the hydraulic system of the tractor, two other left - right side frames, also provided with an additional coupling triangle, frames on which the active parts are mounted in different working schemes.

### **RESULTS:**

The modulated load-bearing structure for agricultural machinery consists of the central frame (Cc) supported by the working depth limiting wheels, equipped with the central coupling triangle (Tc), to which they can be attached, through a system of hinges (B) and hydraulic folding cylinders coupled to the hydraulic system of the tractor, two other side frames left (Cs), respectively right (Cd) also provided with additional coupling triangle (Ts), frames on which the active parts are mounted in different working schemes. During work depending on the working variant, either all three frames (Cc), (Cs) and (Cd) for the maximum width can be easily mounted through the hinge system, using the central triangle (Tc), or the central frame (Cc) for the intermediate width, or only the side frames (Cs) or (Cd) using the additional triangle (Ts) for the minimum width, or both side frames (Cs) and (Cd) using the additional triangle (Ts) for another intermediate working width.

### **CONCLUSIONS:**

From the researches carried out in the specialized literature on some patented elements, prospectuses, etc. it results the fact that, there are agricultural equipments that have load-bearing structures on which working parts are mounted with different working widths (eg SANDOKAN or GRATOR model manufactured by Maschio Gaspardo company; KOMPACTOR or ZIRKON models manufactured by Lemken company; models C3.9 or C6. 5 manufactured in Romania etc). The disadvantages of this equipment are that, the load-bearing structures are not modulated and do not allow obtaining other working widths (lower than the basic one). Another disadvantage is the limitation of the working period being related to the size of the power of the tractors and of the agricultural exploitations on which it is used. The invention has the following advantages: - the possibility of working with maximum width having in composition the load-bearing structure with the three frames; - the possibility of working with intermediate width having in composition the load-bearing structure with the central frame; - the possibility of working with minimum width having in composition the load-bearing structure with the lateral frame; - the possibility of working with intermediate width having in composition the load-bearing structure with two lateral frames joined by the hinges of the basic structure and towed with the additional triangle.





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## **EQUIPMENT WITH INTERCHANGEABLE ACTIVE PARTS FOR HARVESTING MEDICINAL PLANTS**

**Patent Application No. A-00415 / 2020**

**MUSCALU Adriana, TUDORA Cătălina, BÎRSAN Mariana, GANEA-CHRISTU Ioan**

### **Descriere:**

Invenția se referă la un echipament tractat destinat recoltării plantelor medicinale cu diferite tipuri de inflorescențe folosind organe active de tipul cositoare cu lame drepte, respectiv curbe, cu posibilități de interschimbabilitate.

### **Description:**

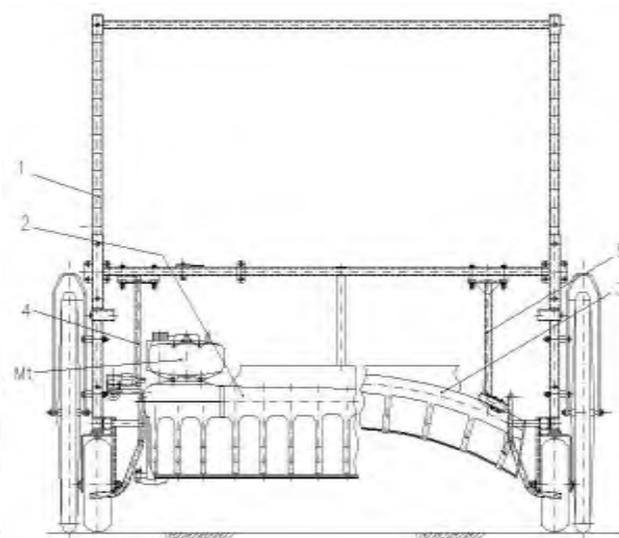
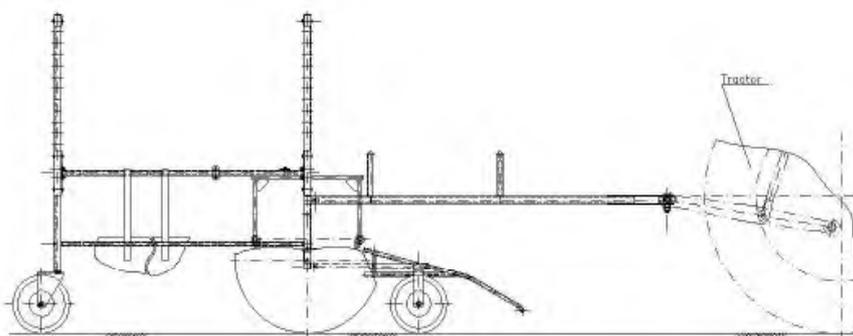
The invention relates to a trailed equipment intended for harvesting medicinal plants with different types of inflorescences using active parts such as mowers with straight or curved blades, respectively, with interchangeability possibilities.

### **Structure:**

The equipment is composed of a movable metal frame (1), provided with elements that allow the adjustment of the working height by sliding on the supports of the pivoting rear wheel pairs, as well as by aggregation with a low power tractor, with the front wheels of the equipment not being positioned, on which the mower (2) with curved blades is mounted by means of the support (4), with removable elements, respectively the mower (3) with straight blades, by means of the support (5), each of the mowers having a heat engine (Mt), the mowers (2) and (3) can be changed depending on the culture, characterized by a certain type of inflorescence.

### **Advantages:**

- obtaining a higher yield at harvest;
- constructive versatility;
- reduced cost;
- possibility of adjusting in a wide range the working height;
- possibility of quick disassembly;
- possibility of interchangeability of active parts by simple operations;
- possibility of use on medium and small plots - an advantage for small farmers.





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## INSTALAȚIE PENTRU AFÂNARE BIOCOMPOST

## INSTALLATION FOR BIOCOMPOST LOOSENING

Patent Application No. A-00402/ 2020

Inventors: PĂUN Anișoara, GANEA-CHRISTU Ioan, MATACHE Mihai, CABA Ioan, LAZA Evelin

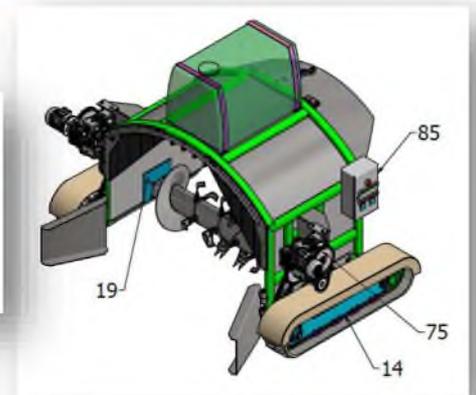
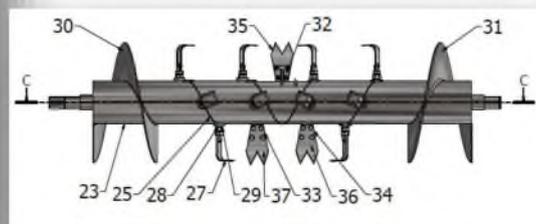
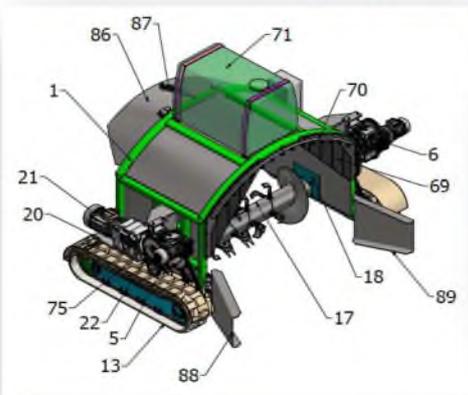
### DESCRIERE:

Invenția se referă la un echipament mobil cu acționare electromecanică destinat aerării și amestecării biocompostului în unități agricole, pentru valorificarea acestuia ca îngrășământ pentru legumicultură și alte sectoare agricole.

### DESCRIPTION:

*The invention relates to a mobile equipment with electromechanical actuation intended for biocompost aeration and mixing in agricultural units to capitalize it as fertilizer for vegetable growing and other sectors.*

The installation for biocompost loosening, according to the invention, consists of a central support (1) made of a rectangular pipe and plated with zinc coated sheet (2) on which are mounted two plates (3 and 4) for double-worm gear motors (5 and 6), which by means of two chain drives (7 and 8) will drive the chain pulleys (9 and 10) mounted on the axles (11 and 12) of two travel subassemblies with rubber tracks (13 and 14). On the central support (1) are mounted two supports with mounting holes and open channels (15 and 16) in which the central drum with knives (17) is mounted by means of two bearings (18 and 19). Also on the central support (1) is mounted a special support (20) for a conical-cylindrical gear motor (21), which by means of a Gall chain transmission (22) will drive the central drum with knives (17).



### ADVANTAGES:

- the main advantage is the increase of the loosening degree, by the fact that the drum with knives has mounted on the central side three knives of a special shape that will throw the material, and on the sides it has mounted a set of curved knives, mounted on a helical spiral and rotated at a certain angle;
- it has an autonomous operating system;
- it achieves different travel speeds for the technological phase of work and the phase of travel and turns.



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## **BIOREACTOR FOR PROCESSING SLUDGE FROM WASTEWATER PRETREATMENT PLANTS**

**Patent Application No. A-00397 / 2020**

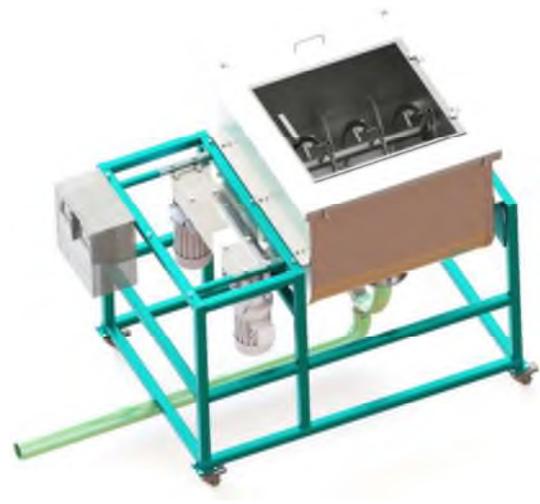
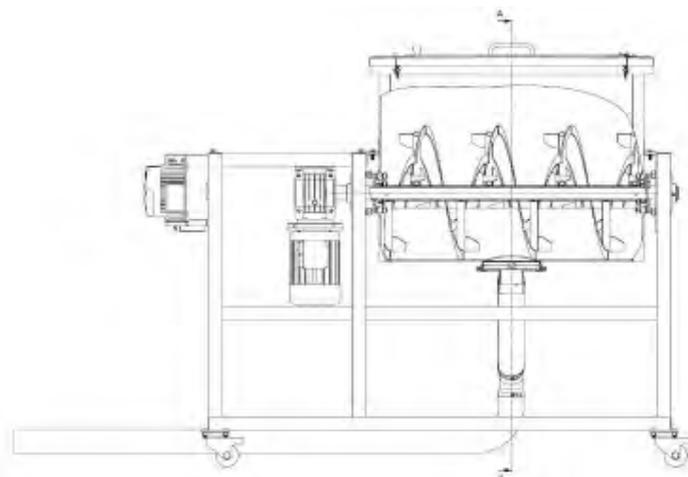
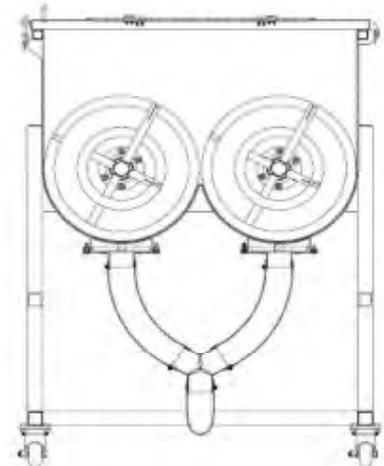
**Authors: Iuliana Găgeanu, Eugen Marin, Iulian Voicea**

### **DESCRIPTION:**

*The invention relates to a bioreactor for processing sludge from wastewater pretreatment plants intended for anaerobic treatment by homogeneous cold mixing in different proportions of components of sewage sludge, compost and soil to obtain a composition with agronomic properties useful for recovery in agriculture.*

### **COMPONENTS:**

The bioreactor for the processing of sludge from wastewater treatment plants consists of a mobile frame, a tank provided with a hinged lid, transparent visitation window, bearings, shafts, two helical spires (with inner coil, brackets, outer blades, brackets and inner blades) with reverse direction of rotation for improved mixing, drain system for the evacuation of mixed product, two electric motors with reducers and frequency converters for adjusting the mixing speed depending on the sludge – compost – soil proportions used for the mix.





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## ECHIPAMENT PENTRU DETAȘAREA FRUCTELOR DE CĂȚINĂ CONGELATE DE PE CRENGI EQUIPMENT FOR DETACHING FROZEN SEA-BUCKTHORN FRUIT FROM BRANCHES

Patent application No.: A-00398 / 2020

Inventors: MILEA Dumitru, CIUPERCĂ Radu, VIȘAN Alexandra

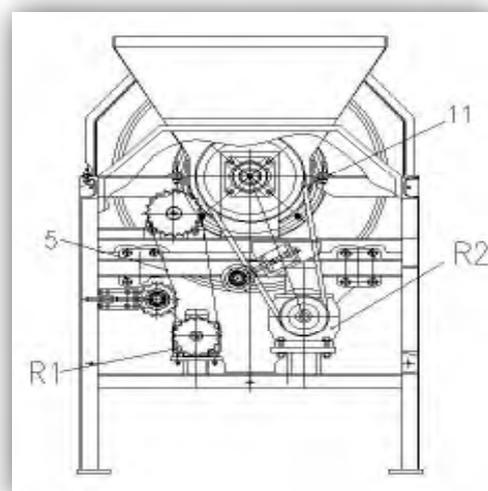
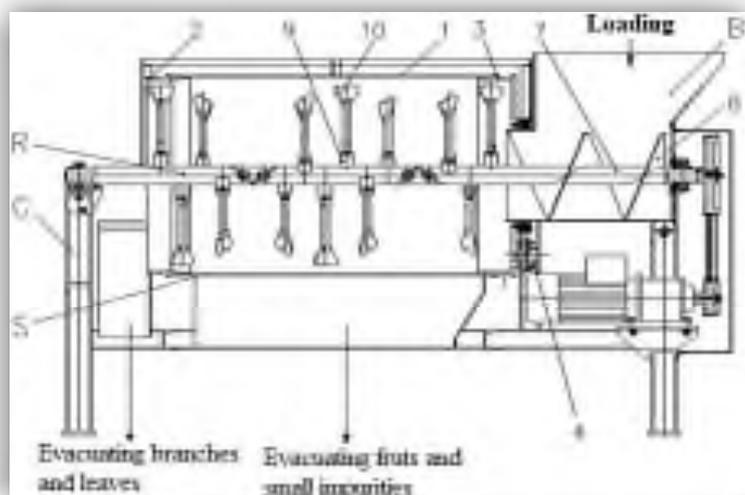
### DESCRIERE:

Invenția se referă la un echipament destinat detașării fructelor de cătină de pe crengile recoltate și congelate în prealabil, separării și evacuării celor două fracții rezultate - crengi și frunze, respectiv fructe și impurități mici.

### DESCRIPTION:

The invention relates to the equipment for detaching sea buckthorn fruit from previously harvested and frozen branches, separating and evacuating the two resulting fractions – branches and leaves, respectively fruits and small impurities.

The equipment consists of the frame (C) made of metal profiles, feed hopper (B), cylindrical sieve made of stainless steel (S), composed of interchangeable sieve (1) mounted on the discharge drum (2) and on the feed drum (3) provided with a toothed ring (4), engaging a pinion receiving motion by a chain drive (5) from a gear motor (R1) with adjustable speed, from the rotor (R), driven by a gear motor (R2) by the belt drive (11), composed of a tubular shaft (7) provided with a coil (8) made of stainless steel sheet, mounted inside the hopper (B), and on the other side of the shaft internally threaded bushings (9) are welded, arranged in two diametrically opposed rows along a helical curve, in which the adjustable paddle impactors (10) are mounted, which ensure the modification of the working diameter of the shaft (7) as well as the speed of movement of the branches inside the cylindrical sieve, depending on the requirements of the working process, the actuation of the rotary sieve and of the drum being made from an electrical motor and a control installation.



### ADVANTAGES:

- reduced degree of damage to shaken fruits;
- reduced percentage of losses in the detachment process;
- possibility to establish the optimal working regime;
- reduced complexity being able to operate independently or integrated in technological flows.



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## INTEGRATED SYSTEM AND METHOD FOR OBTAINING BIOACTIVE SUBSTANCES FROM MEDICINAL PLANTS

**Patent application OSIM A-00288/26.05.2020 / Research project ADER 25.4.1.**

**Dr. ing. VOICEA Iulian, Dr. ing. MATACHE Mihai**

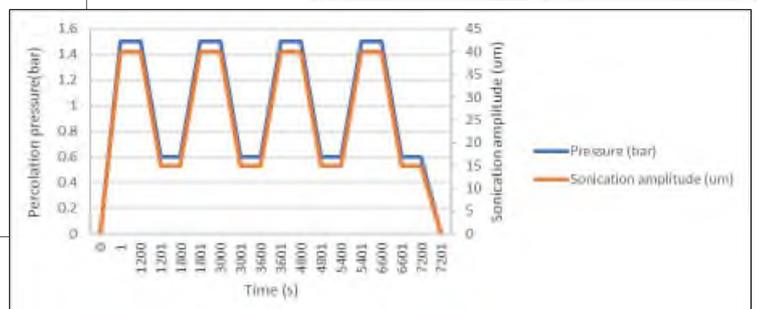
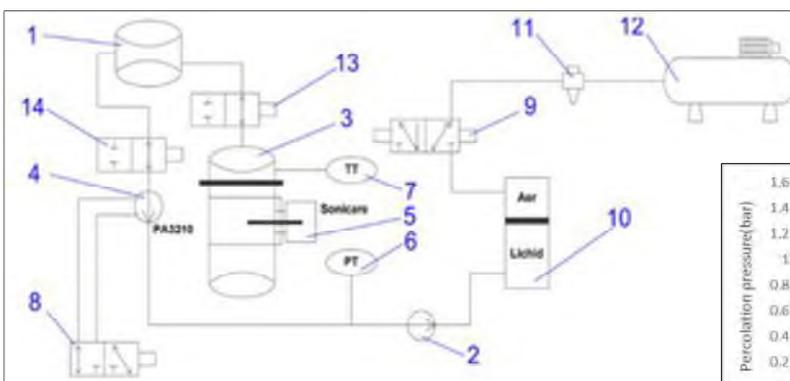
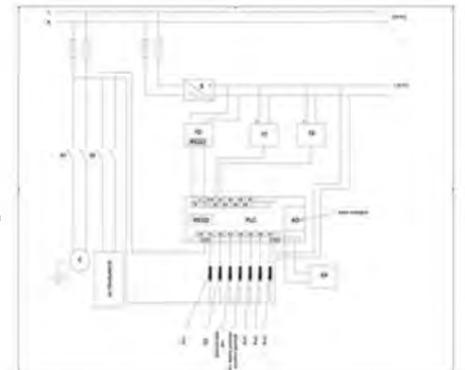
The invention relates to an integrated system and method for obtaining bioactive substances from medicinal and aromatic plants by simultaneous ultrasonic extraction and percolation processes for the agri-food sector using organic biofertilizers / bioinsecticides.

The technical problem solved by the invention consists in the realization of a combined system that integrates two simultaneous extraction processes: percolation - extraction with the help of pressure factor and ultrasonication - ultrasound field extraction that allows almost total extraction of bioactive substances from medicinal and aromatic plant cells.

The *integrated system and method for obtaining bioactive substances from medicinal and aromatic plants* is composed of the loading vessel **1** - solvent discharge, pumps **2** and **4** loading the extraction vessel **3**, the ultrasonic generator **5** which produces a high, respectively low amplitude sonic field, the solenoid valves **8, 9, 13, 14** actuating the hydro-pneumatic cylinder **10**, the compressed air system **12**, the pneumatic distributor **11** provided with a pressure regulator, the pressure sensor **6** and the temperature sensor **7** which allow the monitoring of the extraction process, the input data being available on a touchscreen operating terminal, the combination of simultaneous extraction through the two methods leading to higher yields and quality of the resulting bioactive substances.

The *integrated system and method for obtaining bioactive substances from medicinal and aromatic plants* is **characterized by the fact that** the extraction method, applicable by the integrated system of simultaneous ultrasonic and percolation extraction, described above, has the following characteristics:

- extraction time: 7200 seconds; high extraction percolation pressure: 1.2-1.5 bar;
- low extraction percolation pressure: 0.2 – 0.6 bar; number of high pressure cycles: 4 cycles;
- number of low pressure cycles with quasi-dynamic pressure variation between 0.2 and 0.6 bar: 4 cycles;
- high pressure cycle time: 1200 seconds; 600 seconds with a quasi-dynamic cycle time of 60 seconds, a pause of 60 seconds before and after the high pressure cycle and the pause being 60 seconds between the low pressure quasi-dynamic cycles;
- extraction temperature: 20-25°C;
- ultrasonic field amplitude: 0-46  $\mu\text{m}$ ;
- time of 0-15  $\mu\text{m}$  low amplitude: 600 seconds;
- time of 20-40  $\mu\text{m}$  high amplitude: 600 seconds;
- ultrasonic probe immersion in the solvent: 35-45 mm;
- ultrasonic probe radiant surface: 5.4  $\text{cm}^2$





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### ECHIPAMENT DE REALIZAT BRAZDE COMPARTIMENTATE

### EQUIPMENT FOR MAKING INTERRUPTED FURROWS

Patent Application No. A-00733 / 2019

Inventors: OPRESCU Remus, GANEA-CHRISTU Ioan, VLĂDUȚ Valentin, VOICEA Iulian

#### DESCRIERE:

Invenția se referă la un echipament de deschis brazde compartimentate destinat lucrărilor agricole de udare prin brazde discontinue în vederea eficientizării folosirii apei din precipitații pe terenuri cu pante mai mici de 6 grade.

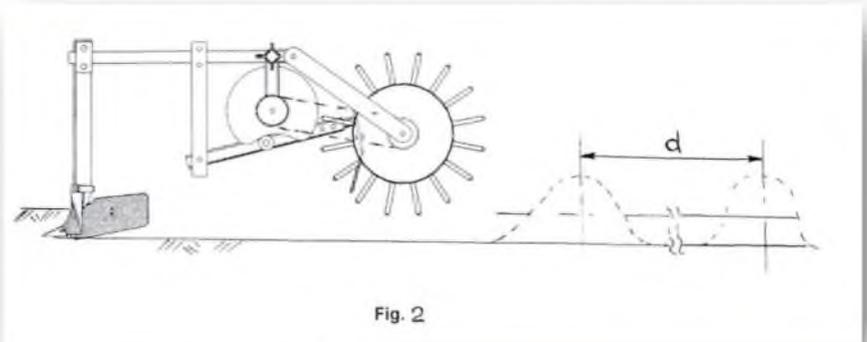
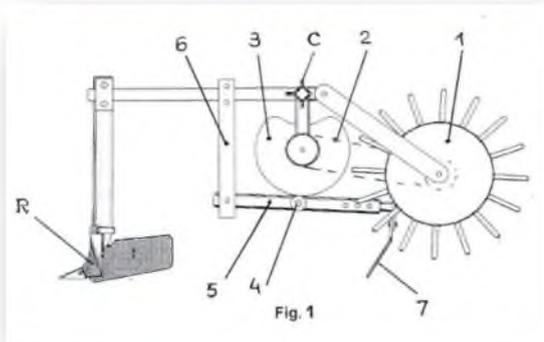
#### DESCRIPTION:

*The invention relates to the equipment for making interrupted furrows intended for agricultural watering works through discontinuous furrows in order to make more efficient the use of rainwater on lands with slopes of less than 6 degrees.*

#### COMPONENTS:

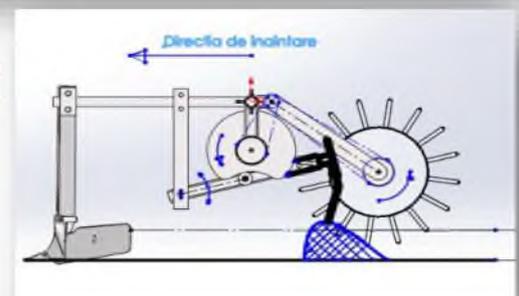
The equipment for making interrupted furrows consists of a unit mounted on the (C) frame of a channel opening machine which may be a ridge plough (R), unit composed of a copying wheel (1) from the shaft of which the movement is transmitted through the chain (2) to the cam (3) on which rolls the roller (4) of the cam follower (5) on which hoe (7) is mounted and which is placed on the support (6).

During work, the equipment opens the watering channel by means of the ridge plough (R), behind which is placed the hoe (7) which performs shaping and compartmentalization (interruption of the furrow) at distances (d) predetermined depending on the characteristics of the land by operating the cam (3), which moves the cam follower (5) causing the hoe (7) to rise, thus the furrow being interrupted from place to place at equal distances.



#### ADVANTAGES:

- the quality of the furrows, the shape and size of the plugs with high precision lead to an increase in production per hectare by 20% for agricultural crops, where interrupted furrows are made;
- high precision in making the plugs in terms of plug spacing;
- constructive simplicity compared to similar hydraulically operated equipment;
- low cost price;
- low energy consumption.





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## DISPOZITIV DE CONDUCERE A PLATFORMELOR DE SCANARE A PROPRIETĂȚILOR SOLULUI

## DEVICE FOR DRIVING SOIL PROPERTIES SCANNING PLATFORMS

Patent Application No.: A-00734 / 2019

Authors: MURARU Sebastian Lucian, CONSTANTINESCU Oana-Mihaela

### DESCRIERE:

Invenția se referă la un dispozitiv electronic inteligent de comandă și control destinat platformelor optoelectronice de scanare a proprietăților solului (DEC).

### DESCRIPTION:

The invention relates to an intelligent electronic command and control device designed for optoelectronic soil properties scanning (DEC) platforms.

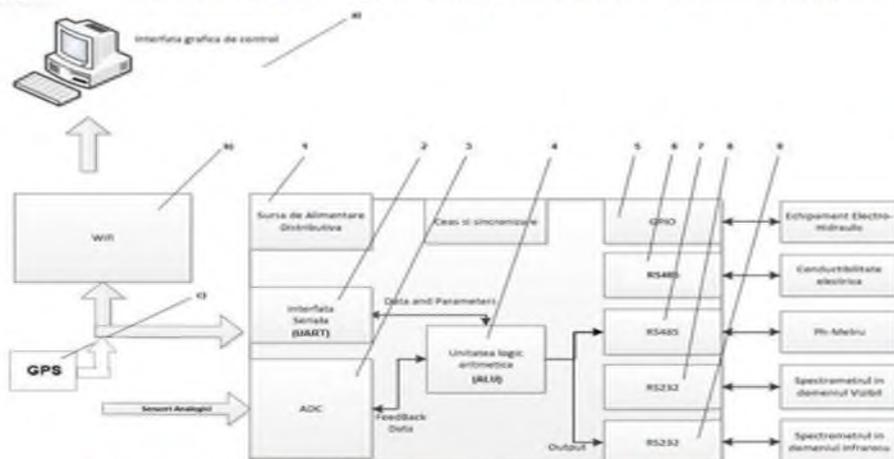
### MATERIALS AND METHOD USED:

The technical problem solved by the proposed solution consists of the realization of an intelligent electronic device for command and control of mobile optoelectronic platforms for scanning the soil properties. It has a structure that allows the realization of the necessary functions for the platform, based on a series of inputs, outputs and communication ports grouped as follows:

- Analog and digital inputs and outputs:
  - (analogical) control of the piston movement of the hydraulic servomechanism that takes the analyzed soil sample;
  - control of the washing circuit of the pH sensor between measurements.
- Communications: a) RS-232 interface for controlling and collecting data from the spectrometer covering the infrared range; b) RS-232 interface for controlling and collecting data from the spectrometer covering the visible range; c) RS-485 interface for controlling and reading the results from the pH-meter, d) RS-485 interface for reading the electro-conductivity sensor measurements; e) Wi-Fi connection to the operator control panel (tablet with graphical interface).

### RESULTS:

Device for controlling soil property scanning platforms, characterized in that it consists of a distributive power supply module (1) for powering device components, a serial interface UART (2) for communication with the GPS module (c) and the Wi-Fi module (b) that communicates with graphical control interface (a) (laptop, tablet, etc.), analog-to-digital converter ADC (3), logic-arithmetic unit (4), GPIO relay control module for inputs and outputs of electrohydraulic equipment (5), RS485 serial interface (6) for reading sensor measurements of electro-conductivity, the RS485 (7) interface for controlling and reading the results from the pH meter, the RS232 (8) interface for controlling and retrieving data from the infrared spectrometer, the RS232 (9) interface for controlling and processing data from the spectrometer in the visible range.



### CONCLUSIONS:

The device controls the hydraulic circuit for actuating and washing the pH measuring system, the spectrometers necessary to determine the soil spectra, the electrical conductivity of the soil and the correlation of the data obtained with the position of the platform, provided by a GPS module. Thus, the data obtained can be presented in GIS maps made with the help of the specialized programs (ArcGis, Google Earth, etc.).

Device for driving soil scanning platforms - principle general scheme



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### **METODĂ DE ÎMBUNĂTĂȚIRE A SOLURILOR AGRICOLE CONTAMINATE CU METALE GRELE**

### **METHOD FOR IMPROVING AGRICULTURAL SOILS CONTAMINATED WITH HEAVY METALS**

**Patent Application No. A-00677/ 2019**

**Inventors: PRUTEANU Augustina, VLĂDUȚ Valentin, VOICEA Iulian, BORDEAN Despina**

#### **DESCRIERE:**

Invenția se referă la o metodă de îmbunătățire a solurilor agricole contaminate cu metale grele (cupru, plumb și zinc) în vederea ameliorării rapide prin fitoremedierea indusă cu agent de chelare. Invenția combină remedierea solurilor cu plantă-muștar (*Brassica juncea*) și îmbunătățită rapid cu agent de chelare - acidul etilen-diamino-tetraacetic (EDTA) în doze multiple, realizând cu ușurință într-un timp scurt bioremedierea solului fără a provoca poluarea secundară a acestuia.

#### **DESCRIPTION:**

The invention refers to a method for improving agricultural soils contaminated with heavy metals (copper, lead and zinc) for rapid improvement through chelating agent-induced phytoremediation. The invention combines soil remediation with mustard plant (*Brassica juncea*) and rapidly improved with chelating agent - Ethylenediaminetetraacetic acid (EDTA) in multiple doses, easily achieving in a short time soil bioremediation without causing its secondary pollution.

#### **The Stages of the Soil Improvement Method:**

- Identification of soil characteristics and contaminants;
- Choice of hyperaccumulating plant and chemical chelating agent;
- Sowing of mustard seeds;
- Washing the plant with a mixture of water and chelating agent;
- Absorption of the complex metal-chelate from soil to roots;
- Translocation in ascending flow of the metal-chelate complex through xylem from roots to stem;
- Capturing, accumulation and storage metals in the leaves;
- Harvesting the plant at the end of the growing season.





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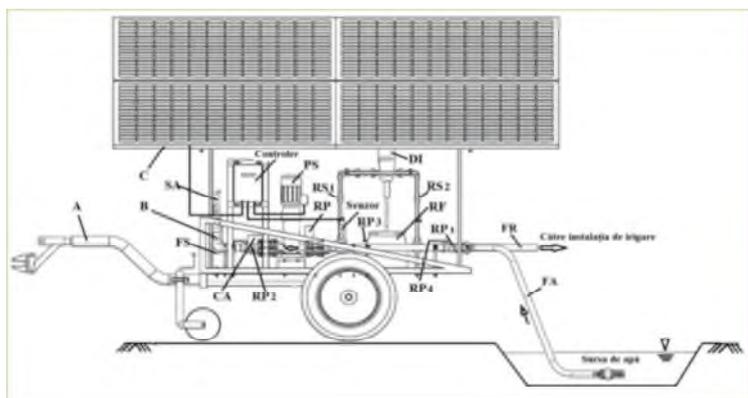
## MOBILE PUMPING GROUP FOR WATER SUPPLY OF IRRIGATION INSTALLATIONS

Patent Application No. A – 00586 / 2019

Inventors: Manea Dragoș, Murgescu Ion, Șovăială Gheorghe, Tociu Carmen, Ungureanu Nicoleta, Manole Emilia Sofia, Gîdea Mihai

**DESCRIPTION:** The invention relates to a mobile pumping group intended for the supply of pressurized water and liquid fertilizers for irrigation and fertilization of agricultural crops.

**STRUCTURE:** The pumping group consists of the mobile platform A on which the pumping and fertigation system B and the solar generator C are located. Platform A is of the towed trailer type, made of a metal structure frame provided with a coupling system to the tractor, a rolling system with single axle and tyre wheels, a support wheel pivoting when decoupling. The pumping and fertigation system B is composed of solar pump PS, air-release valve SA, sieve filter FS, water meter CA, pressure regulator RP with manometer, DI device for liquid fertilizer injection, liquid fertilizer tank RF, four main valves RP1 ... RP4 located on different sections of the system, pipes and fittings for connecting these components, the suction hose FA with suction at one end and quick coupling at the other end and the discharge hose FR with quick couplings at both ends. The pump PS with electric speed control is connected to the solar generator C via a controller. When traveling in the field between irrigation systems, the suction hose FA and the discharge hose FR are stored on the platform in the form of a coil. Solar generator C consists of a number of photovoltaic panels that are mounted on metal supports fixed to the platform, above the pumping and fertigation system B.



### ADVANTAGES:

- It can be moved quickly in the field to different irrigation installations located at great distances from each other;
- It has a high autonomy of operation, the pump of the irrigation and fertigation system being supplied with energy from renewable sources.



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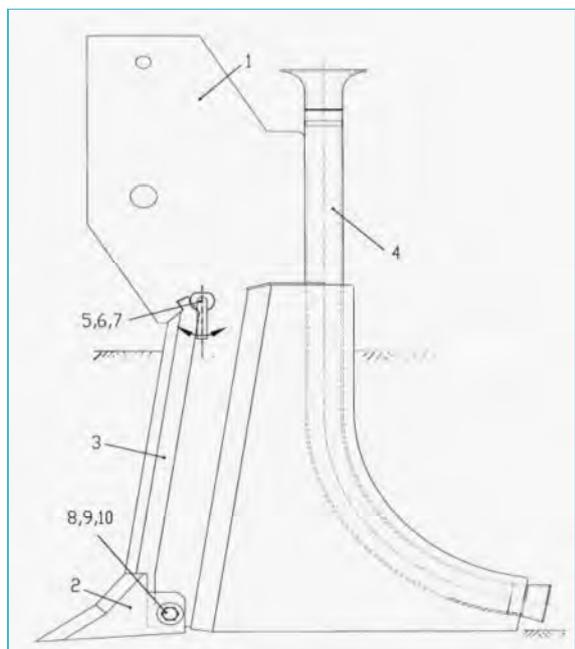
## SYSTEM FOR QUICK REPLACEMENT OF FURROW OPENING WORKING PART TO BURY DRIP IRRIGATION TUBING / TAPES

Patent Application No. A-00577 / 2019

Inventors: Dumitrașcu Andrei, Marin Eugen, Manea Dragoș, Ganea-Christu Ioan, Popa Vlad

**DESCRIPTION:** The invention relates to a system for rapid change of the active member such as a blade and blade support for opening gutters, intended for equipment for burying pipes or continuous strips for irrigation by underground drip in agricultural crops.

**STRUCTURE:** The system consists of a support 1 containing the guide 4 through which pass the tubes, respectively the drip tapes, and on which is mounted the active part composed of the removably mounted knife 2, with screw, washer and nut, positions 8, 9 and 10, on the support 1 which has a special cut to shape for mounting the upper part of the blade 3 and a hole for locking it in the working position by means of the bevelled handle and collar bolt 5, the flat washer 6 and the split pin 7, the blade 3 being mounted at the bottom in the fork of the knife 2, the change can be made, depending on the degree of wear, either by quickly removing and replacing the knife 2, or by changing the blade 3, by rotating the handle of the bolt 5 in the unlock position, or by replacing both elements.



The technical problem solved by the proposed solution is the mounting system of the active part, which facilitates the rapid change in the field, either of the knife, or of the blade, or of the knife-blade assembly, depending on their degree of wear.

### ADVANTAGES:

- It can be used on any agricultural equipment for laying the drip tubing, with minimal adaptations;
- It ensures a controlled unwinding of the drip tubing, both when it is laid on the ground surface and when it is buried in the ground.



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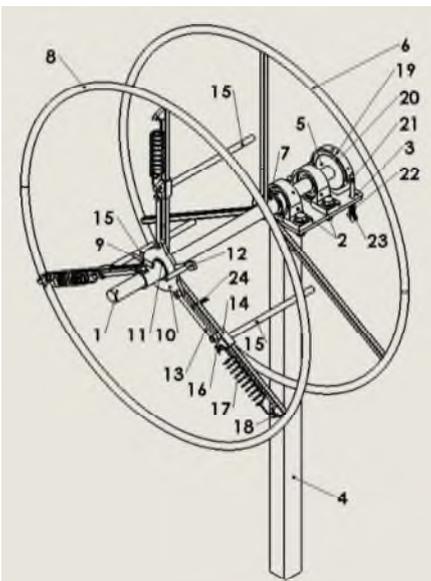
### DRUM FOR DRIP IRRIGATION TUBING

**Patent Application No. A-00497 / 2019**

**Inventors: Manea Dragoş, Popa Radu**

**DESCRIPTION:** The invention relates to a drum on which the drip irrigation tube is fixed, in the form of a coil, a drum intended for agricultural machinery for laying the drip tube on the soil surface for surface irrigation or for burying the drip tube for underground irrigation.

**STRUCTURE:** The drum is composed of the shaft 1, which rotates in the bearing housings 2 fixed on the horizontal plate 3 welded on a vertical rectangular pipe 4, at one end of the shaft 1 being welded the disc 5, the spoke wheel 6 fixed on the shaft 1 with the catch pin 7, another spoke wheel 8 which can move axially on the shaft 1 and which can be locked with the handle screw 9, the part 10 which is mounted on the wheel hub 8 with the possibility of rotating vertically, being fixed axially with the elastic ring 11 and provided with the handle 12, the rods 13 articulated at the lower end with the part 10 and at the upper end with the slideways 14 which can move along the spokes of the wheel 8 and on which are welded the arms 15 and the rings 16 into which one of the ends of the tension springs 17 enters, the other end entering the rings 18 welded to the spokes of the wheel 8, the semi-circular piece 19 inside which is fixed the ferodo tape 20 and which at one end is articulated on the plate 3, the threaded rod 21 welded at the upper end to the part 19 and passing through a hole drilled in the plate 3, the compression spring 22 inserted on the threaded rod 21 and pre-compressed between the plate 3 and the wingnut 23, the elastic safety 24 for locking the handle 12.



#### ADVANTAGES:

- It can be used on any agricultural equipment for laying the drip tubing, with minimal adaptations;
- It ensures a controlled unwinding of the drip tubing, both when it is laid on the ground surface and when it is buried in the ground.



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## REACTIV EXTRUSION PROCESSING OF NUTRIENT-ENRICHED BIOSOLIDS

**Research project: Project Sectorial Programe MADR – ADER 7.3.10.**

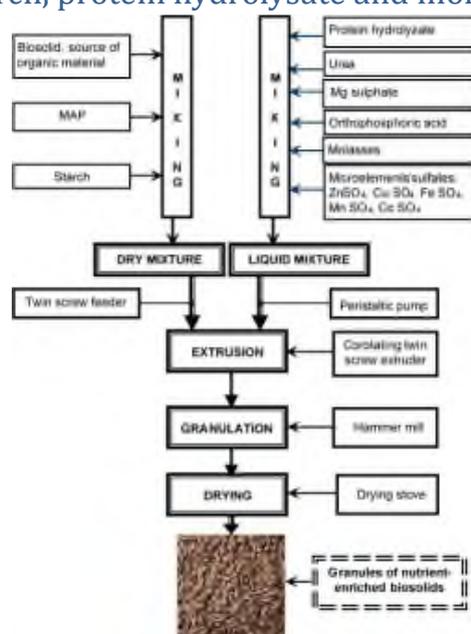
**Authors: Cioica Nicolae, Coța Constantin, Nagy Elena Mihaela, Gyorgy Zoltan**

### DESCRIPTION:

Biosolids are organic solids obtained by digestion and stabilization of raw sewage sludge and contain organic matter and nutrients. The low content of nutrients in biosolids means that for production of high-performance organo-mineral fertilizers it is necessary to introduce in their manufacturing formula, in addition to biosolids, fertilizers and mineral compounds. The thermo-mechanical processing by reactive extrusion takes place in a reactor extruder with two corotating screws that ensures, through a very good mixing at the molecular level, the development of chemical reactions between components and, through all this, a structure physical and chemical homogeneous of the granules.

Were used: monoammonium phosphate (MAP), as source of phosphorus and nitrogen (12% N, 61% P), urea as source of nitrogen (46% N) and potassium nitrate as source of potassium and nitrogen (13.7% N and 38.4% K). The microelements - cobalt, zinc, copper, iron and manganese were introduced in the formula in the form of sulfates, because they are completely water soluble. The components introduced in the formula to ensure the matrix that will make possible processing by reactive extrusion have been starch, protein hydrolysate and molasses.

### Technological process



### RESULTS

Characteristics	U.M	Value	
		Formula I	Formula II
Organic matter	% s.u.	43	43
C.organic/N	-	14	14
Nitrogen, N	%	8.38	8.56
Phosphorus, P	%	6.68	6.82
Potassium, K	%	8.38	8.69
pH	pH units	5.6	5.4
Granule structure:	-	homogeneous	homogeneous
Moisture content	%	3.2	3.6
Color		dark brown	dark brown



### Equipment used for experiments

1-extruder ZK 25x30; 2-twin screw feeder; 3-cooling-heating system; 4-peristaltic pump

The complexity of the phenomena, including the chemical reactions that take place between the components along their path in the extruder due to the fluid state at high temperature and intense mixing, especially in the pressure zone, make that variation of nutrient intake in the formula components to influence differently the variation percentage of them in the final product.



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## NOVEL TECHNOLOGIES FOR OBTAINING BIOETHANOL FROM ENERGY PLANTS AND FRUIT WASTES

Patent application / Research project: **Project: PN-III-P1-1.2-PCCDI-2017-0566**

**Inventors/ authors:** Nenciu Florin \*<sup>1</sup>, Nae Gabriel <sup>1</sup>, Vlăduț Valentin <sup>1</sup>, Voicea Iulian <sup>1</sup>, Dumitru Iulian <sup>1</sup>, Mircea Costin <sup>1</sup>, Matei Gheorghe <sup>2</sup>, Popa Diana <sup>3</sup>, Isticioaia Simona <sup>4</sup>, Apostol Livia <sup>5</sup>, Ungureanu Nicoleta <sup>6</sup>

<sup>1</sup>INMA București; <sup>2</sup>Universitatea Craiova; <sup>3</sup>SCDA Secuieni; <sup>4</sup>SCDA Caracal; <sup>5</sup>IBA București; <sup>6</sup>UPB-ISB București

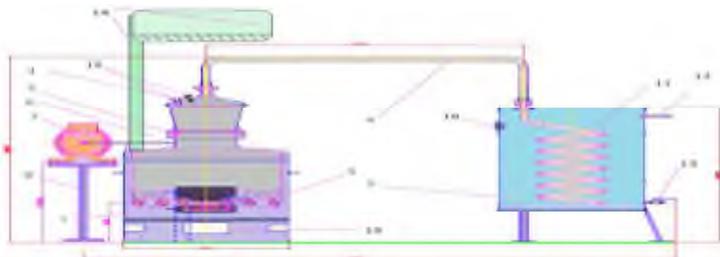
Medium and long term international objectives aim to produce high-quality biofuels, but to minimize as much as possible the cultivated areas and to avoid depleting the soil of nutrients. There are several technical plants that have the capacity to produce bioethanol, such as Jerusalem artichoke or Sweet sorghum, which are known to produce smaller negative effects on soils. These species however have some peculiarities, creating several difficulties in the alcohol production processes.

This project aimed to evaluate novel technologies for producing bioethanol from several technical plants and agricultural wastes highlighting:

- A. Development of a technological flow and a novel distillation equipment, that has the potential to produce high quality bioethanol from technical plants and fruit wastes
- B. Development of an improved bioethanol production system through multidisciplinary research (development of hybrids, development of equipment and processing technologies, etc.)

### A. Development of a technological flow and a novel distillation equipment, that has the potential to produce high quality bioethanol from technical plants.

The equipment designed for obtaining bioethanol from technical plants consists of the special constructed furnace (1), which includes the technological vessel (2), above having placed the expansion vessel (3). The alcohol vapors are being taken by the steam column (4), and led to the water condenser (5). The technological vessel is provided with a stirring system (for homogenizing the temperature), which is driven through the shaft (6) by the motor (7), that is positioned on the support (8). The motor is provided with a speed variator, so that the speed can be adjusted according to the density of the processed material. The combustion in the furnace is made through the adjustable gas burner (9), the air is entering the furnace through the vents (10). The gas burner is also improved, being able to adjust the temperature in the furnace very precisely, by means of 3 valves. In the cooling tank, in order to increase the contact surface with the coolant, the steam column takes a helical shape (11). The cooling vessel is provided with an overflow (12) and a drain valve (13). The toxic gases are evacuated through the exhaust pipe and the evacuation hood (14). The technological vessel is provided with pressure and temperature sensors (15), while the cooling vessel has a temperature sensor (16).



- |                         |                  |                                   |   |
|-------------------------|------------------|-----------------------------------|---|
| 1. Furnace              | 5. Cooling tank  | 9. Gas burner                     | 13. Draining valve  |
| 2. Technological vessel | 6. Shaft         | 10. Vents to ensure air supply    | 14. Exhaust pipe and the evacuation hood                          |
| 3. Expansion vessel     | 7. Motor         | 11. Steam column in helical shape | 15. Pressure and temperature sensors for the technological vessel |
| 4. Column for steam     | 8. Motor support | 12. Overflow for coolant          | 16. Temperature sensor for the cooling tank                       |

### B. Development of an improved bioethanol production system through multidisciplinary research (development of new hybrids, development of equipment and processing technologies, etc.)

The multidisciplinary consortium of partners had complementary activities consisting in:

- Improving energy plant varieties and hybrids to maximize the amount of sugars produced by crops;
- Improving cultivation technologies and crop maintenance;
- Adoption of new crop monitoring systems using sensors and drones for crop mapping and evaluation
- Increasing processing yields by developing new equipment and technologies;
- Use new modified enzymes, mechanics and technologies to improve biochemical processes.
- Use the generated wastes in improved composting to promote green agriculture and the circular economy
- Improve decision making, as well as strategies of optimization and control of bioprocesses

### CONCLUSIONS

1. The tested hybrids and varieties showed very good yields of bioethanol production, as well as improved characteristics of resistance to drought, heat and development difficult soils.
2. More efficient equipment and procedures for cultivation, crop maintenance, harvesting have been developed.
3. The advanced monitoring systems that use sensors and drones have reduced crop management costs and protected the environment by optimizing the amount of chemicals applied to soils.
4. The proposed technological flow, the novel distillation equipment and the use of the new techniques that use enzymes has contributed to improving the yields of biofuels obtained.

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## MECHANICAL BEHAVIOUR OF SELF COMPACTING CONCRETE WITH DIFFERENT MIX DESIGN

Aurelia BRADU, Adrian CIOBANU, Monica CHERECHEȘ, Florina FILIP, Marius MĂRȚ

### INTRODUCTION

Self compacting concrete (SCC) is a relatively new material, with high fluidity and ability to spread into place under its own weight. Contrasted with mix design of traditional concrete, which has a well-developed sizing method, the establishment of the self-compacting concrete recipe is guided only by the international recommendations. SCC constituents are similar to conventionally vibrated concrete, but the dosage differs significantly. Its composition allows a few combinations in terms of component materials and dosages used. This situation increases the degree of difficulty to design recipes due to the large number of variables which should be taken into account.

In order to evaluate the influence of mix design on the mechanical characteristics of SCC were studied 3 different classes made by same constituent material and designed in 2 different ways.

Table 1 Mix details of the concretes

Const.	Units	SCC1	SCC1-A	SCC2	SCC2-A	SCC3	SCC3-A	European Guidelines	ACI	JSCE
Cement	kg/m <sup>3</sup>	320	320	340	340	360	360	-	-	-
Powder content	kg/m <sup>3</sup>	480	470	490	480	490	480	380-600	>458	-
	l/m <sup>3</sup>	165	161	160	164	166	162	-	-	160-190
Paste	l/m <sup>3</sup>	359	346	373	359	381	368	300-380	340-400	-
Water	l/m <sup>3</sup>	170	160	180	170	190	180	150-210	-	155-175
Coarse aggr.	kg/m <sup>3</sup>	881	883	876	876	883	809	750-1000	-	-
	l/m <sup>3</sup>	333	327	327	316	327	316	270-360	280-320	280-350
Sand	kg/m <sup>3</sup>	814	883	809	876	883	809	-	-	-
	% G <sub>60</sub>	48	50	48	50	50	48	48-55	-	-
W/p	kg/m <sup>3</sup>	0,35	0,34	0,33	0,33	0,38	0,38	-	0,32-0,45	0,28-0,37
	l/m <sup>3</sup>	1,03	0,99	1,01	1,04	1,1	1,1	0,85-1,10	-	0,85-1,15



Fig.1 Testing SCC workability

### RESULTS

The properties of fresh SCC mixtures were similar, the workability was evaluated according The European Guidelines for Self Compacting Concrete being assigned the following classes: Flowability – SF2, Viscosity – VF2, Passing ability – PA2.

#### Compressive strength

The failure mode of the SCC specimens corresponds to pure uniaxial compression loading, the lateral shear stresses completely disintegrated the cube sides, leaving a relatively undamaged central core.

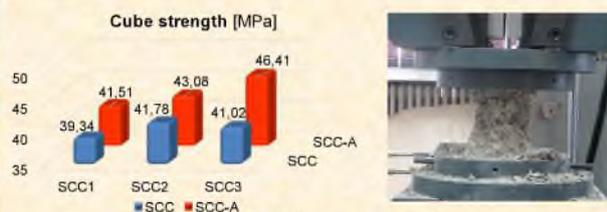


Fig.2 Cube compressive test

The mean cube compressive strength of SCC-A showed an improved values comparative to SCC with 5,52%, 3,11%, respectively 13,14%.

The relationship stress – strain developed in cylindrical concrete specimen is similar to that existing in structural compression members, hence, tests of cylindrical specimens are more realistic.

SCC-A specimen proved increased cylindrical strength with 19,43%, 13,82%, respectively 11,77%.



Fig.3 Cylindrical compressive test

#### Tensile strength

The knowledge of tensile strength is necessary for: considerations of cracking, shear, punching shear, bond and anchorage drawing moment-curvature diagrams and in the calculation of deflection.

The difference between the tensile strength values between series is insignificant: 0,99%, 1,39% and 2,82%.

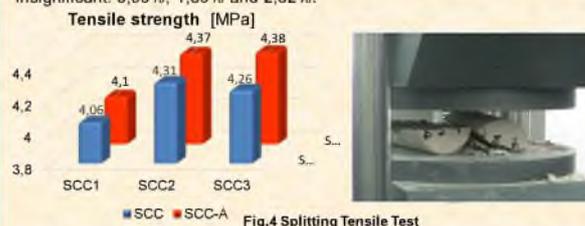


Fig.4 Splitting Tensile Test

#### Modulus of elasticity

The modulus of elasticity is used in the elastic calculation of deflection, often the controlling parameter in slab design, and of pre or post tensioned elements. E-value of the SCC mixtures were lower than that of SCC-A with 11,64%, 5,18% and 0,91 %.

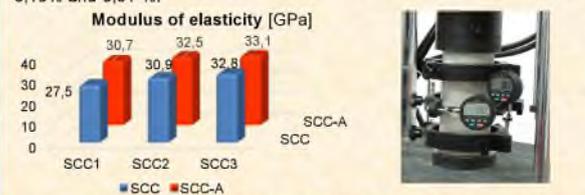


Fig.5 Determination of the secant modulus of elasticity in compression

### CONCLUSION

The addition of powder improve the workability but is also diluting the cement particle system, affecting the ordinary distance between them and modifying the water quantity available for the hydration process. The optimization of the mix design for SCC-A has contributed to the improvement of the mechanical characteristics.

## RESEARCH AND APPLICATIONS IN CLIMATE CONDITIONS AND DYNAMIC ACTIONS - ADAPTIVE METHODS IN A CHANGING SYSTEM

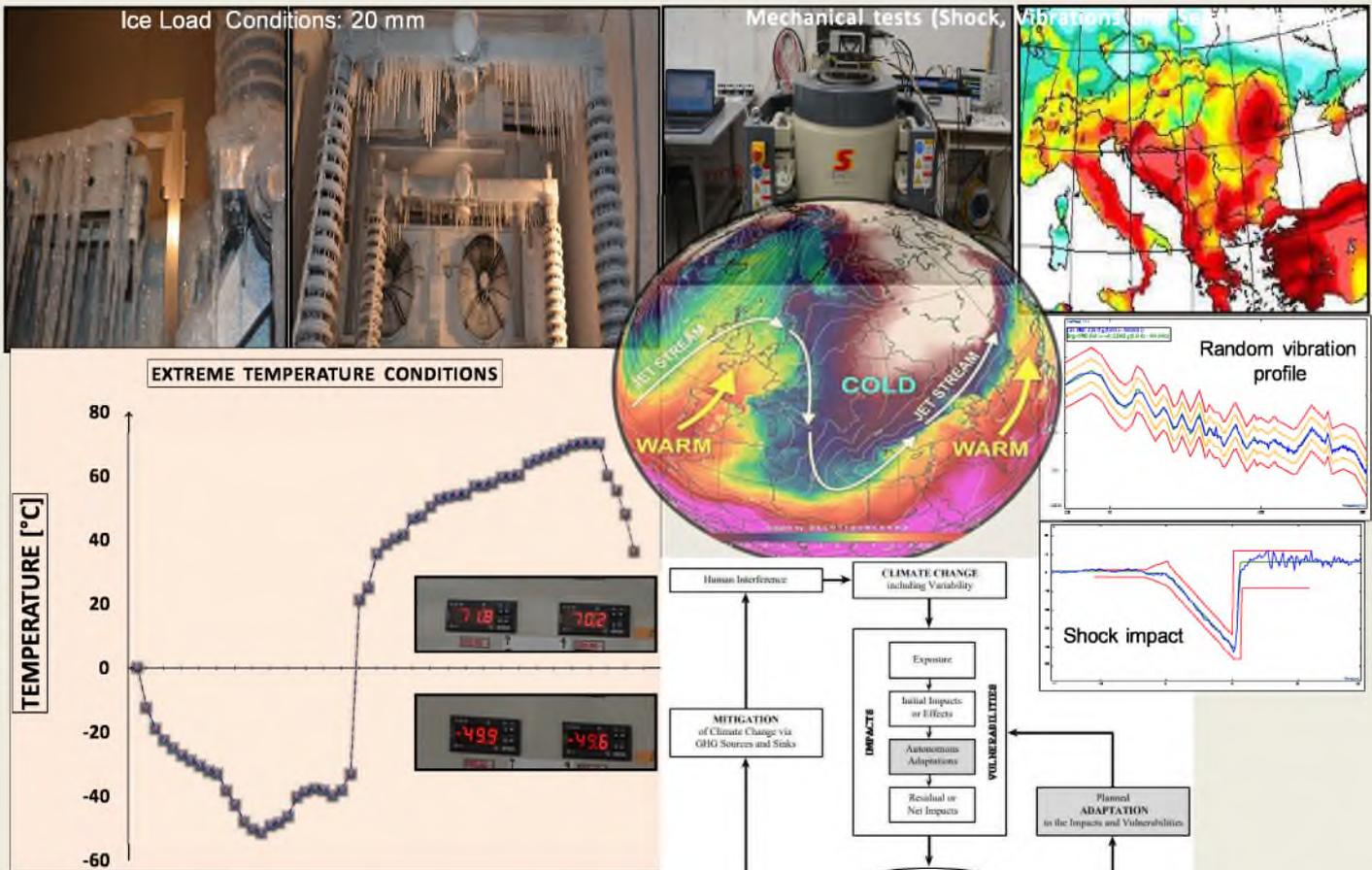
**Florina FILIP, Adrian CIOBANU, Monica CHERECHEȘ, Aurelia BRADU,  
 Ionel PUSCAȘU, Marius MĂRȚ**

### Description:

For a sustainable global future we must prepare with new test methods related to system-system interactions that can spread rapidly in the value chain, in the construction sector (structural and functional safety, medical units, emergency systems, support infrastructures for energy sources and security of energy supply, etc). Estimates of likely future adaptations are an essential ingredient in impact and vulnerability assessments. Adaptations vary according to the system in which they occur, who undertakes them, the climatic stimuli that prompts them, and their timing, functions, forms, and effects.

The implementation of a test program/ research study, explores the links between climate change and construction at the global level and the implications at the regional level, and examines the main climate and dynamic exposures and how they can be reproduced in the laboratory in different ways, in a range relatively short time compared to natural climate change and dynamic actions.

Such an analysis framework with a direct impact on the performance of existing and new constructions, as well for the related installations, represents an area in which NIRD URBAN - INCERC has special competencies and attributions.



### Acknowledgment:

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### Bibliography:

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[https://www.researchgate.net/publication/228955981\\_Perspectives\\_of\\_innovative\\_approaches\\_in\\_seismic\\_hazard\\_evaluation/figures?lo=1](https://www.researchgate.net/publication/228955981_Perspectives_of_innovative_approaches_in_seismic_hazard_evaluation/figures?lo=1); Smith, B., I. Burton, R.J.T. Klein, and R. Street, 1999: The science of adaptation: a framework for assessment. Mitigation and Adaptation Strategies for Global Change, 4, 199–213.

The purpose of the program for testing the effect of environmental and dynamic actions on buildings, is to artificially replicate the conditions which machinery, materials, devices or components might be exposed to and accelerate the effects of exposure to the environment, sometimes at conditions not actually expected.

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***National Institute For Research And Development In Constructions,  
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Bucharest Branch***

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## EXPERIMENTAL STAND FOR FIRE TESTING OF EXTERIOR CLADDING SYSTEMS OF BUILDINGS

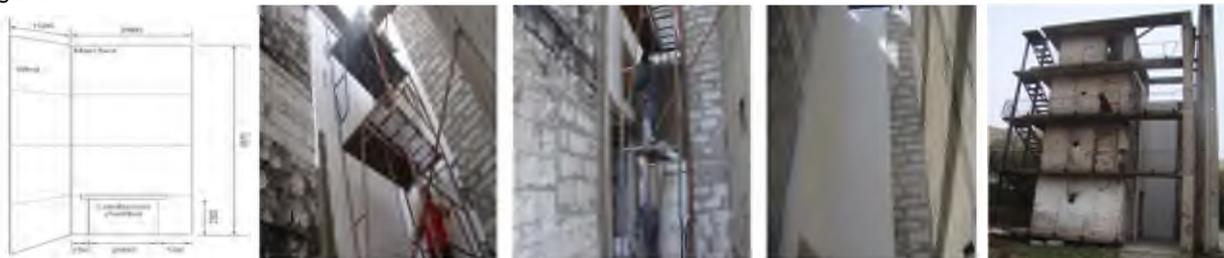
Adrian SIMION, Daniela STOICA

### General presentation

In the last period of time, in order to reduce energy consumption and environmental protection, in Romania the outdoor thermal insulation technology of buildings with wet facade systems (ETICS) is widely used. With the implementation of the concept of exterior insulation of buildings with this type of thermal insulation, began to appear a number of problems related to the fire behavior of the materials that make up ETICS systems. The team of researchers from INCERC Bucharest, after an analysis of the fire testing concepts of ETICS systems at European level, designed and built a fire resistance test stand for ETICS systems. The test stand has similar characteristics to the test stand in the British standard BS 8414, with the difference that in the continuation of the side wing and 2 m opposite the combustion chamber, there is also a reinforced concrete diaphragm on the entire height of the stand. (approx. 9 m), which serves both to accentuate the chimney effect during the tests and to protect the combustion phenomenon from possible wind gusts.

### Experimental program

The team of researchers from INCERC Bucharest, after an analysis of the fire testing concepts of ETICS systems at European level, designed and built a fire resistance test stand for ETICS systems. The test stand has similar characteristics to the test stand in the British standard BS 8414, with the difference that in the continuation of the side wing and 2 m opposite the combustion chamber, there is also a reinforced concrete diaphragm on the entire height of the stand. (approx. 9 m), which serves both to accentuate the chimney effect during the tests and to protect the combustion phenomenon from possible wind gusts.



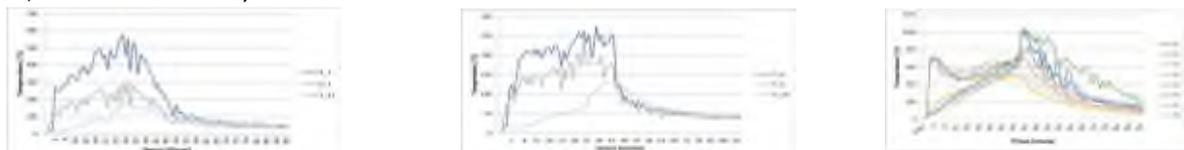
Construction within INCERC Bucharest made of reinforced concrete, proposed for natural scale testing of exterior cladding systems



Ignition of the thermal load and the phenomenon of fire propagation at height

### Experimental results

During the fire resistance testing experiments of ETICS systems, researchers from INCERC Bucharest measured a series of parameters in order to evaluate the response of the construction materials of which ETICS systems were composed, to the spread of fire at height. These parameters are: the ignition of the system, the variation of temperatures in the fire compartment and on the height of the facade, the variation of the thermal load mass, the height of the flames, detachments of the elements from the system, losses of local stability and the amount of smoke.



Variation of maximum temperatures on the facade of the ETICS system at floors 1, 2 and inside the fire chamber

### Conclusions

Based on the experimental research carried out during the national research project, unique data were obtained in Romania on the development of fire on facades, with results that can be transposed to the normative level, applicable from the design phases of buildings.

### Benefits

Researchers from INCERC Bucharest have made a unique stand in Romania for conducting experimental research on fire resistance of exterior cladding elements of buildings, open to both academia and economics. In this way, INCD URBAN-INCERC has contributed to the development of the database to support the establishment of criteria and performance levels for exterior cladding systems used in construction, so that they have a high degree of security at fire.

**Acknowledgements:** Results are part of the project "Vulnerability of buildings facades systems to fires actions" (PN 19.33.02.01).

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## ASSESSMENT OF NON-HAZARDOUS INDUSTRIAL BY-PRODUCTS AS SUSTAINABLE MATERIALS IN ENGINEERING APPLICATIONS

**Cornelia - Florentina DOBRESCU**

Numerous scientific studies are focused on finding alternative ecological binders, with low carbon footprint, using industrial by-products such as fly ash and slag to produce new green cement materials. This solution can provide an environmentally friendly and efficient soil improvement option. Due to the urban expansion and large areas with unstable soils, there is an increasing demand for soil improvement projects. For this reason, new method and techniques for deep soil improvement are widespread implemented, one example being deep mixing method (DSM).

### Experimental program

The experimental applications were focused on assessing the geotechnical characteristics and the behavior of native soil mixtures with different types of non-hazardous industrial by-products. The laboratory tests have allowed both the quantification of the feasibility of industrial waste reuse as geo-materials in fulfilling adequate technical requirements, as well as the identification of benefits in geotechnical applications. Details regarding the composition of mixtures and curing periods are presented in Table. The compressive strength was determined on samples at different curing time of 3, 7, 14 and 28 days.

Mixture of soil with industrial by-products	Curing period (days)
AP+20%FA	3, 7, 14, 28
AP+15%FA+5%S	
AP+10%FA+10%S	
AP+5%FA+15%S	
AP+20%S	

### Conclusions

The minimum value of UCS at 28 days recommended by Puppala et al. (2008), i.e. 1034 kPa, for cement-soil mixtures using deep mixing method is presented by comparison. A significant increase of UCS value was observed with the increasing of about 15% addition blast furnace slag, a consistent increase starting from 10% to 15% slag waste addition, with a lower increase rate thereafter.

□ The aim of the performed studies was to assess the variability of the compressive strength on soft clay samples mixed with industrial by-products as fly ash (FA) and slag (S) and activated with three different liquid alkaline binders, in laboratory conditions.

□ The methodological approach was focused on the identification of a sustainable binder as alternative to the conventional ones, such as non-environmentally friendly Portland cement, in order to be used for soil improvement, respectively in deep mixing method (DSM).

□ The results of experimental tests have pointed out that the binder type used for activation has a high influence in increasing the compressive strength of the mixtures. It has been demonstrated that the sodium-based binder is more effective than the potassium-based one.

- The application of efficient and facile techniques for reusing industrial waste in the sustainable construction works are considered key tools in achieving the targets proposed by the national strategy for sustainable development and implicitly the global objectives of 2030 Agenda.

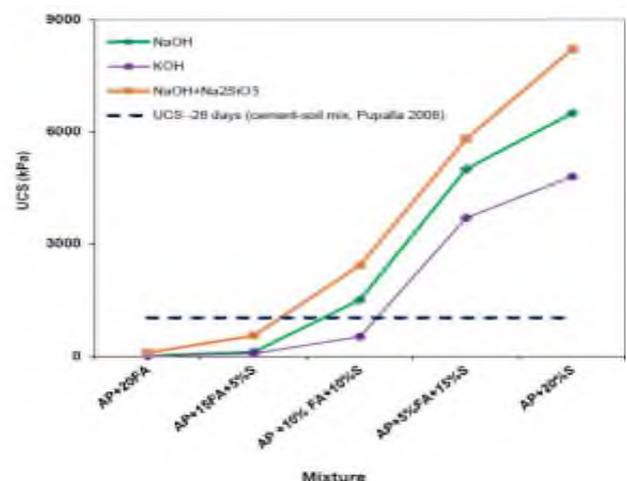
**Acknowledgements:** The authors acknowledge the financial support from The Ministry of Research and Innovation through the project PN 19 33 04 02: "Sustainable solutions to ensure the health and safety of population in concept of open innovation and environmental protection"

For the experimental tests, soft clay with high plasticity was used. Tests results have determined the grain size distribution and plasticity limits are presented in Table below .

Soil parameters	Determined values
Clay (A)	33%
Silt (P)	57%
Sand (N)	10%
Moisture content (w)	40%
Liquid limit (wL)	50%
Plastic limit (wp)	23%
Plasticity index (Ip)	27%
Consistency index (I <sub>c</sub> )	0,435
pH	7,7
Organic content	4,4%

### Experimental results

Compressive strength values obtained after 28 days curing time for the mixture sets prepared with three types of activating binders are represented in Figure below.



## DIGITAL IMPLEMENTATION OF STRUCTURAL HEALTH MONITORING: SEISMIC SENSORS, DATA ACQUISITION AND PROCESSING, ANALYTICAL MODELS, INTEGRATED SYSTEM

Claudiu-Sorin DRAGOMIR, Iolanda-Gabriela CRAIFALEANU, Vasile MEIȚĂ, Daniela DOBRE,  
 Emil-Sever GEORGESCU, Mihaela SANDU, Adelin CIȘMELARU

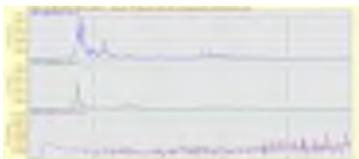
### General presentation

Within the National Network for the Seismic Monitoring and Protection of Building Stock from INCD URBAN-INCERC, research studies are currently being conducted in the field of the **digitalization of structural health and seismic monitoring of buildings**, directly applied to real buildings, seismically instrumented with modern equipment. The presented research will lead to the development of a large monitoring system, capable, in the future, to allow the remote identification, short time after a seismic event, of possible dangerous changes in the state of the monitored building. The digitalization of structural health and seismic monitoring of buildings are active research approaches, and damage detection could be also possible using a specialized software. All financial investments in this area will lead to a dense sensor network, providing useful information on the behavior of buildings and making possible the adoption of **measures to increase urban resilience**.

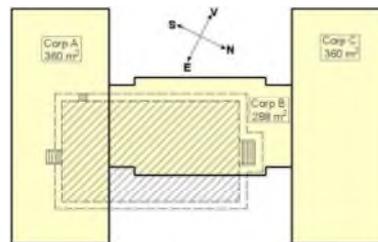
### Experimental program

By using the state-of-the-art equipment available at INCD "URBAN-INCERC", a large number of buildings can be remotely monitored and data can be directly sent to end users or to research institutes in the field through a real-time transmission system (wireless smart sensor networks, within a frequency range between 0 and 100 Hz).

### Experimental results, vibration records



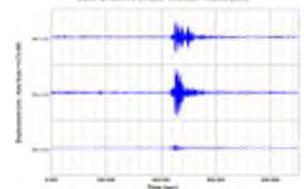
**The H-shaped IGSU building (30 m-high) has 7 floors and consists of three distinct wings, divided by separation joints**



Double symmetry with respect to vertical planes. Total built area: 1008 m<sup>2</sup>, developed area: approx. 8784 m<sup>2</sup>



ETNA 2 seismic equipment installed in the buildings of the General Inspectorate for Emergency Situations (IGSU) and Ministry of Research, Innovation and



### Records and signal processing for the Vrancea earthquake of April 9<sup>th</sup>, 2021, IGSU building (top)



Vibration frequencies are  $f_1 = 1.60$  Hz and  $f_2 = 1.50$  Hz. Similar values were obtained from computer analysis, microvibration records and records from the Vrancea earthquake of April 9<sup>th</sup>, 2021

### Conclusions

Research conducted at INCD URBAN-INCERC converges towards the development of a **large monitoring system** capable, in the future, to allow remote identification, shortly after a seismic event, of possible dangerous modifications in the condition of the instrumented/monitored buildings. After the completion of the recording and processing of data coming from the sites where seismic sensors were installed (in free-field or in buildings), specific analyses will be performed, considering the various soil and soil-structure interaction conditions, as well as seismic forces used in building design.

### Benefits

**Digitalization of structural health and seismic monitoring of buildings** are active research approaches, based on which damage detection could be possible using a specialized software. All financial and logistical investments in this field will lead to a dense sensor network from which useful information related to the behavior of structural systems could substantiate **the adoption of measures to increase urban resilience**.

In the future phases of the project, **INCD URBAN-INCERC**, through its specialists, will continue with the **digitalization of structural health and seismic monitoring of buildings for the entire network of national research institutes in Romania**.

**Acknowledgements:** Results are part of the project "Research on the implementation of an integrated system for ensuring the security of the constructed space, with semi-automatic generation of PGA maps provided by seismic actions or other vibratory sources and quick evaluation of vulnerability of instrumented buildings" (PN 19 33 01 01).

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## THERMO-INSULATING AND DECORATIVE COATINGS WITH SUNFLOWER SEED HUSKS

IRINA POPA, CRISTIAN PETCU, ALEXANDRINA MUREȘANU

### General presentation

The work presents aspects of an experimental research in which basic recipes have been designed in order to obtain innovative products intended to be used in construction as finishings. Starting from products with sunflower seed husks, a vegetal waste resulting from the industry of edible sunflower oil, were obtained multi-layered coatings with thermal isolation and decorative characteristics.

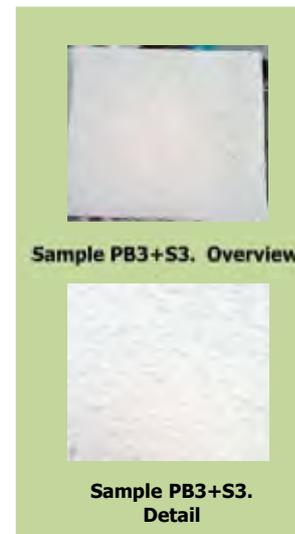
### Experimental program. Experimental results

There were developed three recipes/products, each one having two components: a continuous one (binders L - L1, L2, L3,  $x > y > z$ , being acrylic film product finishings) and a discontinuous one (three mixtures of three sorts of sunflower seed husks waste, having maximum dimensions of 4 mm, 6 mm and 8 mm, with  $A > B > C > D$ ). The primer, noted with *a*, and the products P1, P2, P3, applied in three and four-layered systems (S1, S2, S3) on gypsum board surfaces (PB1, PB2, PB3), generated three plasterboard samples whose coatings were further studied as thickness, adherence to the drywall and thermal insulation properties.

Product	Basic recipe of the product	System (number and type of layers)
P1	$x \text{ g L1} + (A \text{ g } \phi 4 + A \text{ g } \phi 6)$	S1 (1 layer <i>a</i> + 3 layers P1)
P2	$y \text{ g L2} + (B \text{ g } \phi 4 + B \text{ g } \phi 6 + C \text{ g } \phi 8)$	S2 (1 layer <i>a</i> + 2 layers P2)
P3	$y \text{ g L3} + (A \text{ g } \phi 4 + B \text{ g } A \phi 6)$	S3 (1 layer <i>a</i> + 3 layers P3)
a	$z \text{ g L} + D \text{ g } \phi 4$	

Plasterboard sample notation	Adherence to the plasterboard sample, (MPa)	Thickness of each system applied on one side of a plasterboard sample, (mm)	$R_{\text{system}}$ ( $\text{m}^2\text{K/W}$ )	$\lambda_{\text{system}}$ ( $\text{W/m.K}$ )
PB1 PB2 PB3	-	-	0,062* 0,062* 0,068*	0,202* 0,202* 0,185*
PB1 + S1	1,31	5,11	0,156	<b>0,108</b>
PB2 + S2	1,29	6,25	0,134	<b>0,104</b>
PB3 + S3	1,30	3,15	0,126	<b>0,172</b>

\* = Thermal resistance and thermal conductivity of the plasterboard uncovered samples



### Discutions

- Due to the specific properties, shape and dimensions of the vegetal waste used and of the aerated structure of the innovative products, the resulting multi-layered coatings, having an approximate total thickness of only 3,15 – 6,25 mm, are defined by their thermal conductivity from 0,172W/m.K to 0,104 W/m.K and good adherence to gypsum surface, between 1,29 MPa and 1,31 MPa.
- The presence of the waste of 8 mm gives the coating, at lower number of layers, better thermal isolating properties and higher thickness, even so much thinner than that of traditional thermal isolating materials.
- The mixture of the three dimensional fractions of waste also confers a textured, original decorative appearance to this type of coating.

### Advantages

- > Obtaining innovative decorating coatings, with a certain contribution to the thermal insulation performance of the support on which it is applied;
- > Efficient production, acquisition and putting into operation costs for this type of innovative product and for the double-function coating respectively;
- > A new method for integrating this kind of industrial vegetal waste in construction, generating products with high added-value.

**Acknowledgements:** The authors acknowledge the financial support from The Ministry of Research and Digitalization through the project PN 19 33 04 02: "Sustainable solutions to ensure the health and safety of population in concept of open innovation and environmental protection"

## Contributions regarding the development of LCA type cost analyzes in the construction materials sector Author – researcher Silviu Lambrache

**Context.** Life cycle cost analyzes in the construction activity have become an essential component of determining the feasibility and timeliness of construction works both in terms of choosing the raw materials, materials used and the chosen construction options.

**Methodology.** A complete life-cycle cost analysis for a construction material takes into account the lifetime costs for the material used, namely manufacturing, installation, use, maintenance and replacement costs due to physical wear and tear. Before calculating the lifetime

cost/use of the material, future lifetime costs for specific time and annual periods must be converted to a certain set time period (present value) so that comparability and aggregation of costs can be achieved, being done by using the discount rate.

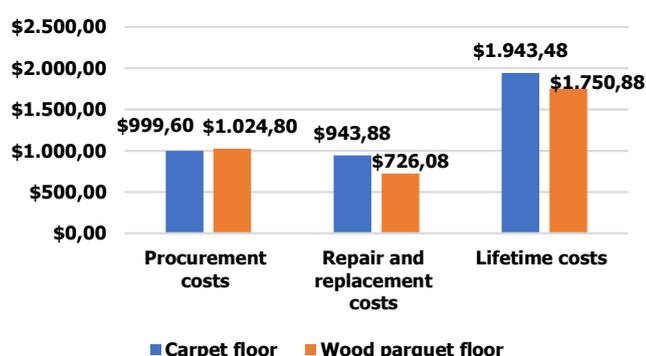


Fig. 1 Life cycle cost analysis results

**Results.** To exemplify the methodology and the results obtained, an analysis model will be detailed for two constructive variants in order to select the variant that has an optimal cost during use. The duration of use of the considered materials is 40 years, and the discount rate is 2.70%

Table 1. Analysis of intervention activities and related costs for repairs and replacements during the lifetime of materials

Material type	Duration of use (years)	Year of intervention (repairs, replacements)	Weight cost of the intervention (%)	Repair and replacement costs* $\sum P_c \cdot x \frac{1}{(1+r)^t} \cdot xW$
Carpet floor	40	7	15	\$ 124,43
		14	15	\$ 100,26
		21	15	\$ 85,69
		25	100	\$ 513,53
		32	15	\$ 63,92
Wood parquet floor	40	39	15	\$ 53,05
		10	10	\$ 78,51
		20	100	\$ 601,49
		30	10	\$ 46,08

\*  $P_c$  – purchase cost;  $r$  – discount rate;  $t$  – current year;  $W$  – weight cost.

**Conclusions.** In order to make construction investment projects more efficient, great importance must be given to optimizing the cost of construction materials (costs for repairs and replacements) due to their high share in the total cost, that contribute to a large extent of the formation for life-cycle cost, mainly due to the long duration of their use.

### ACKNOWLEDGEMENTS

The authors acknowledge the financial support from The Ministry of Education and Research through the project PN 19 33 04 02: "Sustainable solutions to ensure the health and safety of population in concept of open innovation and environmental protection".

## Effects of confinement measures imposed at the beginning of the COVID-19 pandemic on outdoor air quality

Vasilica Vasile, Cristian Petcu, Alina Dima, Mihaela Ion, Cora Stamate, Mariana Cioncu-Puenea

### Context

Air pollution causes deteriorating health, environmental degradation, and climate change. Restrictive measures imposed at the beginning of the COVID-19 epidemic, have contributed to reductions in the concentrations of nitrogen dioxide (NO<sub>2</sub>) - one of the main air pollutants - reported in urban areas: 60% in New Delhi, 49% in Las Vegas, 40% in New York and 78% in Mumbai.

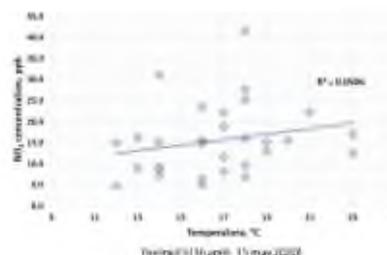
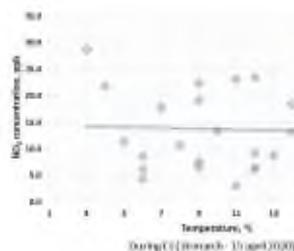
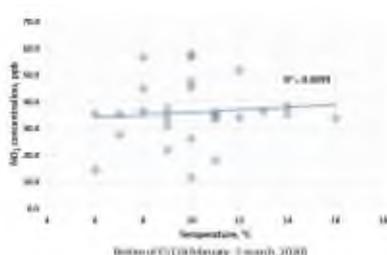
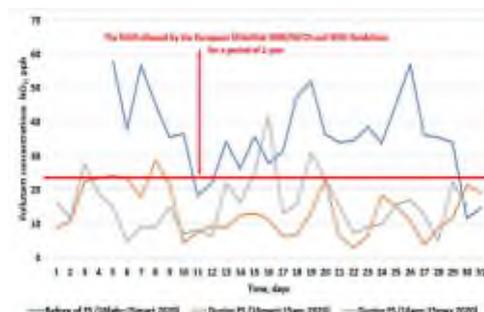
The purpose of our study was to perform a comparative analysis of the experimental results on outdoor air quality in Bucharest, before and during the implementation of the measures specified in Decree no. 195/2020 and Decree no. 240/2020, regarding the establishment, respectively the extension of the state of sanitary emergency (ES) on the Romanian territory.

### Methodology

HAZ-SCANNER EPAS equipment (fig.1), manufacturer SKC - UK, was used to monitor the air quality parameters in the atmospheric environment, equipped with sensors (PID or electrochemical) for measuring many parameters, at an interval of 1 minute, including nitrogen dioxide (NO<sub>2</sub>) in the range of concentrations: 0 - 5000 ppb.



Fig.1 HAZ-SCANNER EPAS equipment installed on NIRD URBAN-INCERC research platform



### Results and discussions

The values of the NO<sub>2</sub> concentration, registered in the period before ES, varied between 21.8-108.9 μg/m<sup>3</sup>, in the first month of the ES, between 5.6-54.0 μg/m<sup>3</sup>, and in the second month, between 8.8-78.4 μg/m<sup>3</sup>. The findings are similar to those reported in other studies conducted in major European cities, such as Barcelona or London, with reductions by 51%

in NO<sub>2</sub> concentrations (Tobias et al., 2020) and 40%, respectively (Brown et al., 2021), and Milan, with 64.7% (Zoran et al., 2020). It can be observed that the monitored concentrations are higher, before ES, than the limit allowed by the European Directive and WHO Guideline, and the temperature has a weak influence on NO<sub>2</sub> concentration.

### Conclusions

Because air pollution affects millions people worldwide each year, air quality remains an issue that requires long-term attention from communities, although the findings on declining concentrations of one of the major outdoor pollutants may seem positive.

**Acknowledgements:** The authors acknowledge the financial support from The Ministry of Research and Digitalization through the project PN 19 33 04 02: "Sustainable solutions to ensure the health and safety of population in concept of open innovation and environmental protection".

**ACOUSTIC INSULATION FOR GLASS DOOR AND WINDOWS, INFLUENCE  
 DEPENDING ON THE DIFFERENT DEGREES OF THEIR OPENING**

Marta Cristina ZAHARIA Ph.D.Dipl.Eng.,  
 Ioana Mihaela ALEXE Ph.D.Dipl.Eng., Ciprian ENE Dipl.eng.

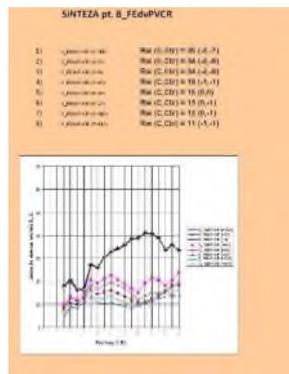
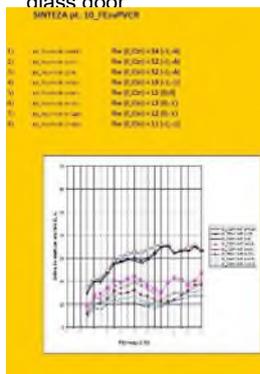
In Romania, there were made researches about the acoustic insulation, considering different degrees of opening positions, for a type of glass door and for some windows and there were conducted during 2020, in project Romania, there were made PN 19 33.03.01 concluded with MEC and in project 87PED - ACOUPERM/2017-2018.

Civil buildings have, usually, the facade walls made of opaque construction elements and glazed building elements. The studies performed about the fact that when there are facade walls with doors and windows on it, the acoustic insulation made by them depends very much of the materials from which they are manufactured, on the type of configuration of glasses and frames and the dimensional characteristics, as well as the degree of sealing on the contour, respectively the degree of opening of them when there are open.

Studies were made with acoustics laboratory experiments in the airborne sound insulation stand of Building Acoustics Laboratory of INCDC URBAN-INCERC, INCERC Bucharest Branch.

We analyzed the results of the acoustical measurements comparing the values of  $R_w$  ( $C, C_{tr}$ ) for the types of the analyzed windows and the glass door, each of them with many (8 for a window and 7 for glass door) different opening positions, in total almost 40 different opening positions, and studied graphical forms of  $R$ , in one third octave frequency band.

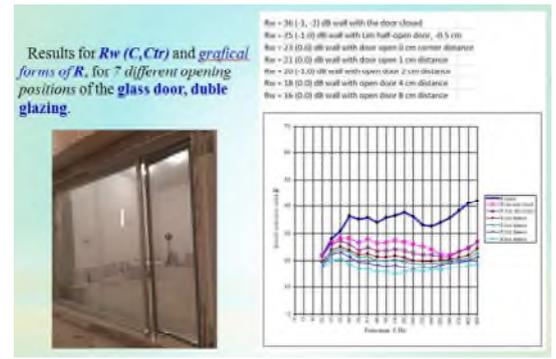
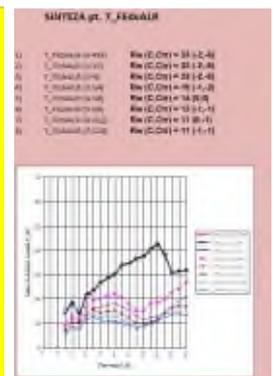
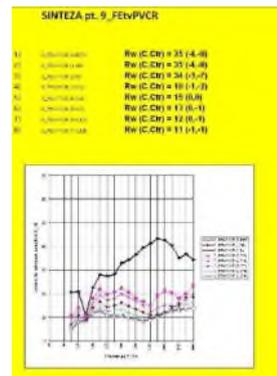
**Experimental results** Here are presented comparative studies, between the results of the acoustic insulation of windows and the glass door



Results for  $R_w$  ( $C, C_{tr}$ ) and graphical forms of  $R$ , for 8 different opening positions of the PVC (Polyvinyl chloride) windows, with simple, double and triple glazing, Aluminium window with double glazing.



The windows analyzed were made using different materials and products, like: PVC (Polyvinyl chloride) windows frames, with structures of glass: double glazing, triple glazing, simple glazing sheets of glazed materials, and also aluminium window frame, with structures of glass: double glazing. The windows were mounted in a brick standardized wall. The glass door analyzed was made using materials and products, like: aluminium door frame, with double glazing sheets. The door was mounted and is part of a glass wall.



**Conclusion:** Considering the results of the acoustic measurements, we can conclude that the acoustic insulation of windows and the glass door, the airborne sound insulation index,  $R_w$ , decreases from max.36 dB (for closed door) and max 32 dB (for the most sealed and closed windows) to min.9 dB (for the most bigger degree of opening that was tested), depending on the type of door or window configuration. Also the acoustical results show that for all analyzed windows and door, the resonance areas, in the graphs of  $R$  indices, occur when the wavelength dimensions of the resonant frequencies are in accordance with the size of the air space of the opening and the spacing between the glass sheets of the window and of the door.

**Acknowledgements:** The authors acknowledge the financial support from The Ministry of Education and Research (MEC) through the project PN 19 33 03 01, "Researches to achieve the acoustic and thermal comfort inside the buildings, using an innovative tool for choosing the optimum structures of construction elements, from classical versus modern materials" and project 87PED - ACOUPERM / 2017-2018.

***National Institute For Research And Development In Constructions,  
Urbanism And Sustainable Spatial Development - "URBAN-INCERC", Cluj  
Branch***



# International Exhibition of Inventions

## INVENTICA 2021

23.06.2021 – 25.06.2021



NATIONAL INSTITUTE OF INVENTICS, IASI, ROMANIA

URBAN  
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MINISTRY OF RESEARCH, INNOVATION AND DIGITIZATION

National Institute for Research and Development in Construction,  
Urban Planning and Sustainable Spatial Development "URBAN-INCERC"



## PROCESS FOR PRODUCING WHITE PORTLAND CEMENT-BASED CEMENTITIOUS TILING MATERIALS, WITH SELF-CLEANING CAPACITY

Patent application No. A/00117 / 17.03.2021

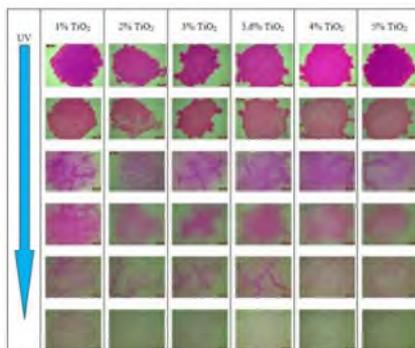
Inventors: **Andreea HEGYI, Elvira GREBENIȘAN, Adrian-Victor LĂZĂRESCU, Henriette SZILAGYI, Vasile MEIȚĂ, Mihaela SANDU, Cornelia BAERĂ**

Claim 1: Process of producing cementitious composites based on white Portland cement, respectively tiling elements, with self-cleaning capacity.

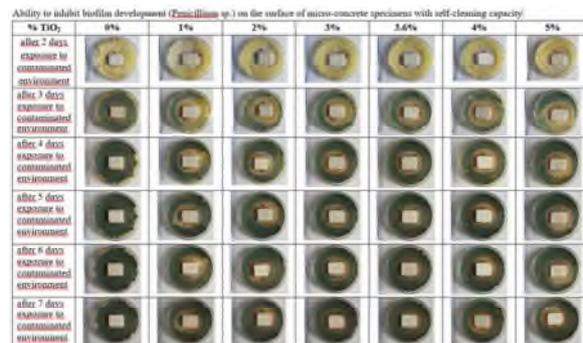
Claim 2: Self-cleaning mortar based on white Portland cement.

Claim 3: Micro-concrete with self-cleaning capacity, based on white Portland cement.

Claim 4: Micro-concrete tiling elements based on white Portland cement, with self-cleaning ability.



Recovery of the degree of whiteness-  
self-cleaning effect in the situation of  
staining with Rhodamine B



Ability to inhibit biofilm development  
(*Penicillium* sp.) on the surface of micro-concrete  
specimens with self-cleaning capacity

### Innovativeness:

- capitalizing on local potential by developing new compositions of cementitious materials and prefabricated elements.
- self-cleaning ability, under the effect of solar light radiation or artificial UV radiation.
- long-term preservation of the aesthetic appearance of buildings.
- making surfaces safe for the population ensuring a low degree of contamination with microorganisms.
- the ability to contribute to the reduction of air pollution by reducing the concentration of oxides of type NO<sub>x</sub>, SO<sub>x</sub>
- the ability to contribute to the reduction of water and soil pollution by substantially reducing the need for the use of substances intended for cleaning, maintenance and maintenance of construction surfaces.



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NATIONAL INSTITUTE OF INVENTICS, IASI, ROMANIA

MINISTRY OF RESEARCH, INNOVATION AND DIGITIZATION  
National Institute for Research and Development in Construction,  
Urban Planning and Sustainable Spatial Development "URBAN-INCERC"



&



### ECOLOGICAL ALTERNATIVE TO CLASSIC THERMAL INSULATION PRODUCTS, BY RECYCLING WITH WASTE ENERGY RECOVERY OF POST-INDUSTRIAL TEXTILE WASTE AND THE USE OF VEGETAL AND SHEEP WOOL FIBRES

**Project number PN-III-P2-2.1-PED-2019-0463**

**Andreea Hegyi, Cezar Bulacu, Henriette Szilagyi, Adrian - Victor Lăzărescu, Vasile Meişă, Mihaela Sandu**

The aim of the project is to integrate and fully capitalize the postindustrial textile waste, natural plant fibers and sheep wool, by identifying, designing and developing eco-biocomposite thermo-insulating products of non-woven type, as an ecological alternative to classical thermo-insulating products (polluting both at the time of production and use and post-use by lack of biodegradability) usable in various fields, environmental protection and contribution to the achievement of the strategic objectives of sustainable development and to increase the competitiveness of the Romanian economy through RDI activities.



Conceptual design and experimental definition for innovative eco-biocomposite thermal insulation materials obtained by recycling and reuse of post-industrial textile waste concurrently with the use of natural plant fibers and sheep wool and their production technology

To demonstrate the functionality of the technological concept of the project is to obtain materials, thermal insulation, innovative and eco-biocomposites are obtained by the recycling and reuse of industrial textile waste, with the use of natural plant fibres and sheep wool, and the technology for producing them.

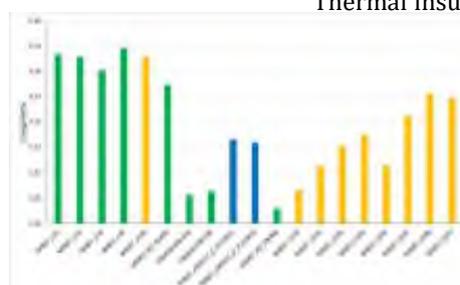
Laboratory validation of innovative eco-biocomposites, nonwoven, in the form of a mattress, obtained by recycling and reuse of post-industrial textile waste at the same time with the use of natural plant fibres and sheep wool.



Recycled textile fibres, recycled PET fibres and / or sheep wool non-woven type of thermo-insulating products.



Thermal insulation performance



Water vapour permeability

This work was supported by a grant of the Ministry of Research, Innovation and Digitization, CNCS/CCCDI – UEFISCDI, project number PN-III-P2-2.1-PED-2019-0463, within PNCDI III

INNOVATION BASED ON TRADITION -  
HEALTHY HUGS FROM NATURE



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***National Research-Development Institute for Textiles and Leather - INCDTP***

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# International Exhibition of Inventions

## INVENTICA 2021

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NATIONAL INSTITUTE OF  
INVENTICS, IASI, ROMANIA



**National Research and Development Institute for Textiles and Leather (INCDTP)**  
**Str. Lucretiu Patrascanu no. 16, 030508, Bucharest, Romania**

### **Textile composite functionalized by electroconductive polymeric deposits for flexible sensors**

**Patent application No. A/00875/9.12.2019**

**Inventors: AILENI Raluca Maria, CHIRIAC Laura**

#### **Description**

The invention refers to a hybrid composite material with electroconductive properties made of three layers, having the potential to be used for flexible sensors for monitoring systems and electromagnetic screens.

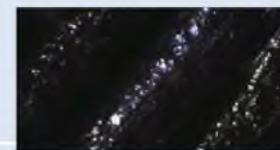
The invention is characterized by the fact that the manufacturing of the composite consists in the deposition on the 1<sup>st</sup> side of the fabric of a polymeric paste based on polyvinyl alcohol and nickel, by the process of screen printing/scraping followed by controlled crosslinking at 140... 160°C using a heating system based on electrical resistors, respectively by depositing of the polymeric film based on ESD filaments by 3D printing on the 2<sup>nd</sup> side of the fabric.



Textile surface functionalization using 3D printing with ESD filaments



1<sup>st</sup> side of the fabric - Composite functionalized by polymeric coating based Ni. Surface analysis by optical microscopy



2<sup>nd</sup> side of the fabric - Composite functionalized by 3D printing ESD filaments

#### **Advantages**

-By doping with nickel microparticles with dimensions  $<50 \mu\text{m}$ , the composite material can be used to make surface electrodes or screens for electromagnetic attenuation.

-Due to the Ni-based polymeric film B with the surface electrical resistance between  $1 \times 10^3 - 1.1 \times 10^3 \Omega$  deposited by scraping on 1<sup>st</sup> side of the fabric A and the polymeric film C deposited by 3D digital printing based on ESD filaments with the electrical resistance of surface between  $10^6 - 10^{10} \Omega$ , a 2-sided composite is obtained, the first face being conductive and the second face resistant to electrostatic discharge (ESD).

#### **Novelty**

The novelty consists in double functionalization of the fabric A by coating with polymeric film based Ni (B) on the 1<sup>st</sup> side of the fabric and by 3D printing of the ESD filaments (C) on the 2<sup>nd</sup> side of the fabric.

#### **Applications**

The composite material has applications in development of textile flexible sensors for monitoring systems and electromagnetic screens.

**Acknowledgment:** The Ministry of Education and Research has funded this research through the project 3D Electrotex, PN 19 17 01 01

**Contact person:** CS II Dr. Ing. Aileni Raluca Maria  
E-mail: [raluca.aileni@incdtp.ro](mailto:raluca.aileni@incdtp.ro), [www.incdtp.ro](http://www.incdtp.ro)

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***National Institute for Research and Development in Optoelectronics - INOE  
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The 25th International Exhibition of Inventions  
“INVENTICA 2021” Iasi, Romania

**METODĂ ȘTIINȚIFICĂ DE CURĂȚARE LASER CONTROLATĂ A SUPRAFEȚELOR POLICROME**

– A 00706/2020–

**M. Dinu , L. Ghervase, L.C. Ratoiu, R. Rădvan**

Invenția se referă la o metodă științifică de curățare laser controlată a suprafețelor policrome prin coroborarea unor tehnici optoelectronice de analiză și cartare pentru discriminarea diferitelor zone de culoare și selectarea regimului de curățare laser potrivit pentru fiecare zonă în parte.

Curățarea suprafețelor cu ajutorul unui fascicul laser este o tehnică dezvoltată complementar celorlalte tehnici utilizate tradițional de restauratori și este studiată de peste patruzeci de ani, de când sursele de radiație laser au devenit disponibile unui număr mai mare de cercetători. Această metodă aduce un grad ridicat de control, dat de versatilitatea radiației laser, caracterizată de:

- lungimea de undă: UV, VIS, IR
- Fluență: densitatea de energie /suprafață
- Frecvența: 1-20 Hz
- durata pulsului laser

Exista numeroase studii publicate care pot ajuta la selectarea regimului de lucru potrivit pentru a obține o curățare laser eficientă, dar – foarte important – în condiții de maximă siguranță, fără a afecta substratul original, în funcție de caracteristicile obiectului de patrimoniu (organic, anorganic, policrom, multistrat, compus etc.) și de tipul de depuneri aderente. Având în vedere cele expuse mai sus, este necesară o identificare și cartare a zonelor de culoare în vederea aplicării regimului potrivit de curățare laser.



Metoda propusă constă în:

1. Cartarea zonelor de culoare se va face aplicând tehnica de analiză hiperspectrală, iar clasificarea și discriminarea zonelor de culoare se va face în ENVI. În cazul obiectelor ce prezintă diferențe de planeitate, sau suprafețe 3D, se va scana cu un scanner laser 3D suprafața obiectului și apoi se va compune imagistic o hartă a clusterelor de culoare 3D.
2. Analiza chimică elementală este efectuată pentru a identifica compoziția chimică a straturilor picturale și tipurile de pigmenți folosiți. În cazul obiectelor multistrat se va utiliza punctual tehnica LIBS ce permite analiza stratigrafică, iar în cazul celor simple se va folosi doar XRF.
3. Având în vedere sintezele și studiile din domeniu, în funcție de compoziția elementală și tipurile de pigmenți identificați se stabilesc regimurile de curățare laser potrivite pentru fiecare cluster de culoare în parte. În cazul unei cauzistici deosebite, metoda va include în acest pas teste de curățare laser pe zonele de interes, iar în urma acestora se vor stabili regimurile de curățare pentru fiecare cluster de culoare în parte.
4. Pornind de la cartarea inițială [1], se aplica clusterelor de culoare și se generează harta 2D/3D a procesului de curățare.
5. Curățarea laser va fi aplicată în conformitate cu specificațiile cuprinse în harta generată [4].

Avantajele pe care le introduce aceasta metodă:

- identificarea și analiza complexă a compoziției chimice a obiectului, ce generează o hartă a zonelor discriminate
- digitalizarea procedurii de restaurare
- curățarea în siguranță, fără riscul de a afecta un artefact original

**Problema tehnică** pe care o rezolva invenția: Metoda ce face subiectul prezentei cereri de brevet, prin complexitatea tehnicilor asociate facilitează curățarea în siguranță a unor suprafețe complexe cum sunt cele de tip policrom (chiar și multistrat), generând un pachet de date ce are ca rezultat o hartă “fool-proof” ce discriminează zonele în funcție de tipul de pigment identificat și în funcție de regimul laser potrivit (lungime de undă, fluență, frecvență). Domeniul conservării și restaurării operelor de artă este unul foarte sensibil, iar pentru ca metodele inovative să fie transpuse în munca de zi cu zi a restauratorilor și conservatorilor, sunt necesare proceduri și metode ce pot aduce soluții clare la abordarea tehnică.

**Revendicări**

1. Metodă științifică de curățare laser controlată a suprafețelor policrome, **caracterizată prin faptul că** discriminează, analizează compoziția chimică, cartează 2D/3D clusterul de culori și aplică procedura de curățare laser potrivită pentru fiecare zonă în parte.

The 25th International Exhibition of Inventions  
“INVENTICA 2021” Iasi, Romania

PROCEDEU DE ANALIZA LIBS *in situ* A COMPOZITIEI CHIMICE A OBIECTELOR SUBMERSATE

– A 00353/2020–

M. Dinu , R. Rădvan

Pentru a obține informații spectrale cu tehnica LIBS pe obiecte submersate este necesară focalizarea a două pulsuri laser (de ordinul ns) cu o fluentă destul de mare pentru a triggera o ionizare în avalanșă, care va genera un mic nor de plasmă. Primul puls va avea ca efect încălzirea rapidă a lichidului, urmată de o expansiune explozivă și formarea unei bule de gaz, numită bulă de cavitație, iar cel de-al doilea puls laser (trimis cu un delay de ordinul ns) excită plasma în interiorul bulei, fiind observată o emisie spectrală relativ intensă și îngustă. Semnalul LIBS maxim este obținut dacă al doilea puls atinge suprafața când bula de gaz este la expansiune maximă.

Montajul optoelectronic pentru analiza LIBS a compozitiei chimice a obiectelor submersate este format din:

- Sistemul de iradiere: laser cu mediu activ solid, in regim Q-switched, cu lungimi de unda in domeniile spectrale VIS-NIR si sistem de focalizare cu distanta focala variabila,
- Sistemul de detectie si achizitie: colector optic subacvatic (fibra optica cu colector optic incorporat), spectrometru (*rezolutie spectrala*  $< 0.1$  nm), CCD sau ICCD (eficienta cantica  $> 30\%$ , trigerarea externa, rezolutia temporara a delay-ului si a gate-ului  $< 1$  ns), software pentru achizitie datelor.

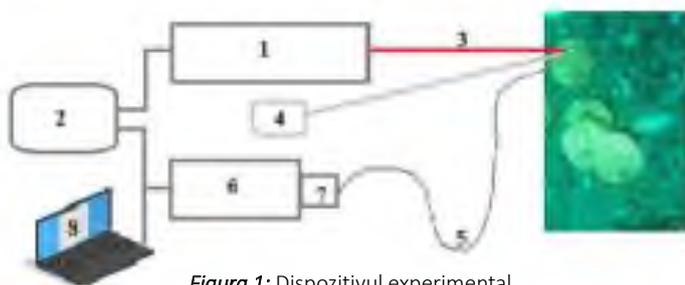


Figura 1: Dispozitivul experimental

- 1.Sursa de iradiere
- 2.Generator de pulsuri TTL
- 3.Sistem de focalizare
- 4.Sistem de iluminare si vizualizare de tip fibroscop
- 5.Colector optic subacvatic
- 6.Spectrometru
- 7.ICCD
- 8.Computer cu software dedicat.

Inventia prezinta urmatoarele avantaje:

- Permite ionizarea in avalansa a straturilor superficiale ale obiectelor aflate in mediu acvatic si colectarea emisiei acestora, in forma ionica sau atomica, in vederea determinarii compozitiei chimice si a stratigrafiei obiectului investigat.
- Permite detectia semnalului intr-un domeniu mai larg de lungimi de unda, intre 170 si 1100 nm, cu rezolutie de detctie mai mare, de 0.05 nm, deci identificarea a unei game mai mari de elemente chimice, printr-un LOD crescut.

**Problema tehnica** pe care o rezolva inventia consta in posibilitatea de a identifica in timp real, *in situ*, compozitia chimica a obiectelor submersate, fara a necesita prelevare de probe sau extragerea acestora din mediul de conservare. Acest procedeu se adreseaza cu precadere domeniului conservarii patrimoniului cultural – obiecte arheologice, oferind o solutie ideala de analiza a compozitiei elementale fara a induce stres sau modificarea conditiilor de conservare. Este bine cunoscut ca in cazul obiectelor arheologice ce au fost submersate o perioada mare de timp, in momentul in care acestea sunt extrase in mediul atmosferic, are loc o degradare accelerata datorata in mare parte proceselor oxidative si evaporarii apei.

Revendicari

1. Dispozitiv optoelectronic pentru analiza LIBS a compozitiei chimice a obiectelor submersate, **caracterizat prin faptul ca** este format din sursa de iradiere (laser YAG:Nd, in regim de puls, la lungimea de unda de 1064, 532 sau 355 nm), generator de pulsuri de tip TTL, sistem de focalizare, sistem de iluminare si vizualizare de tip fibroscop, sistem de colectare si transmitere a informatiei spectrale (fibra optica subacvatica) si spectrometru UV-NIR cu ICCD.
2. Procedeu de analiza a compozitie chimice a obiectelor submersate, **caracterizat prin** aplicarea unui tren de 2 pulsuri laser, emise de laser cu YAG:Nd, intr-un punct de interes de pe suprafata unui obiect ce se afla submersat intr-un lichid, la o fluenta suficient de mare astfel incat primul puls laser va crea o bula de aer pe suprafata investigata, iar cel de-al doilea puls va crea un mic nor de plasma ce contine elementele chimice componente, in forma atomica sau ionica.



# International Exhibition of Inventions INVENTICA 2021 23.06.2021 – 25.06.2021



## National Institute for Research and Development for Optoelectronics – INOE 2000



### Zinc and phosphor oxide films modified with reduced graphene oxide with controllable fluorescent properties and process to obtain them

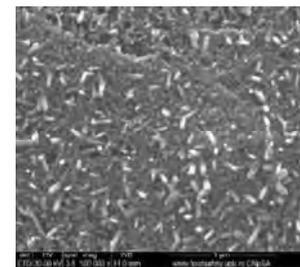
Patent application: [A00568/2020](#)

Inventors: National Institute for Research and Development for Optoelectronics –  
INOE 2000

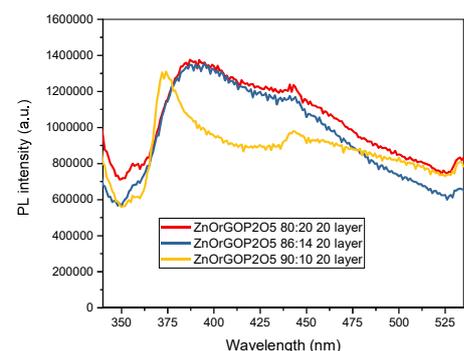
Authors: Ileana Cristina Vasiliu<sup>1</sup>, Ana Maria Iordache<sup>1</sup>, Mihail Elisa<sup>1</sup>, Irinela Chilibon<sup>1</sup>,  
Cristiana Eugenia Ana Grigorescu<sup>1</sup>, Iordache Stefan Marian<sup>1</sup>

<sup>1</sup> National Institute for Research and Development for Optoelectronics-INOE 2000, Romania

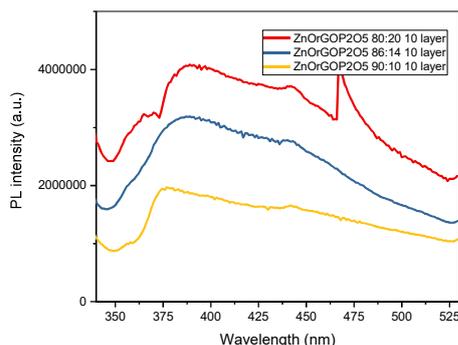
The invention refers to composite films based on oxides of zinc, phosphor and graphene with photoluminescence adjustable properties and their synthesis process by sol-gel method. Phosphor and graphene oxides modify the emission of zinc oxide from UV or visible by passivating or generation of defects at the interfaces of hybrid materials. The characteristic emission of these materials as red, blue, yellow and orange can be enhanced or turned off as a function of phosphor and graphene oxide concentration and the thickness of the film. The enhanced photoluminescent properties of ZnO-carbon hybrid structures have applications in detecting metal ions and biomolecules, biological fluorescence imaging, nonlinear multiphoton imaging, and fluorescence lifetime imaging. Also, shifting the optical response to the visible range by engineering O and Zn vacancies in ZnO-carbon hybrid structures the ZnO photocatalytic efficiencies will be enhanced.



SEM image for a film  
90ZnO10P<sub>2</sub>O<sub>5</sub>rGO 20 layers



Photoluminescence of 20 layers films at  $\lambda$  excitation=325 nm at different ZnO:P<sub>2</sub>O<sub>5</sub> ratios: 80:20; 86:14; 90:10 and 1%rGO



Photoluminescence of 10 layers films at  $\lambda$  excitation=325 nm at different ZnO:P<sub>2</sub>O<sub>5</sub> ratios: 80:20; 86:14; 90:10 and 1% rGO

**Acknowledgements:** This work was supported by a grant of the Romanian Ministry of Research and Innovation, CCCDI-UEFISCDI, project number PN-III-P1-1.2-PCCDI-2017-0619/2018; Contract nr. 42 PCCDI/2018



# International Exhibition of Inventions INVENTICA 2021

23.06.2021 – 25.06.2021



National Institute for Research and Development of  
Optoelectronics – INOE 2000  
National Institute of Lasers, Plasma and Radiation  
Physics  
National Institute of Research and Development for  
Materials Physics



## Phosphate-tellurite vitreous materials with magnetic and magneto-optical properties, for Faraday rotators and the process for obtaining them

**Patent proposal/** A/00752/19.11.2020

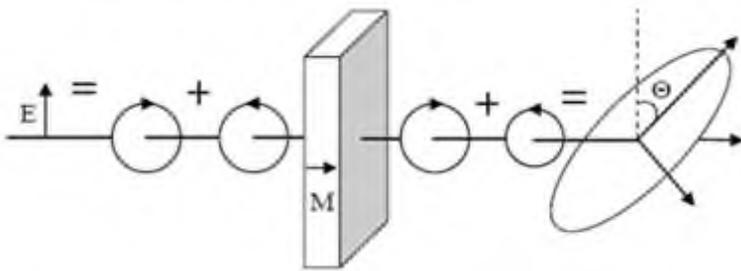
**Inventors/ authors):** Elisa Mihail, Iordache Stefan Marian, Sava Bogdan Alexandru, Boroica Lucica, Kuncser Victor, Galca Aurelian Catalin

The invention relates to phosphate-tellurite glasses containing lithium oxide and titanium dioxide and, respectively, zinc oxide and to the process for obtaining them. The preparation process of phosphate-tellurite glasses ensures a high chemical and optical homogeneity of the materials.

Te-1:  $35\text{ZnO}-10\text{Al}_2\text{O}_3-40\text{P}_2\text{O}_5-15\text{TeO}_2$   
Te-2:  $30\text{Li}_2\text{O}-10\text{Al}_2\text{O}_3-5\text{TiO}_2-45\text{P}_2\text{O}_5-10\text{TeO}_2$   
Te-3:  $25\text{Li}_2\text{O}-10\text{Al}_2\text{O}_3-5\text{TiO}_2-45\text{P}_2\text{O}_5-15\text{TeO}_2$

Unconventional wet method of reactant processing followed by melting (1100°C-1225°C, mechanical homogenization, refining (melt clarification), shaping by pouring the melt into pure spectral graphite mold, preheated, annealing (removal of residual stresses, 390°C-420°C) and optical processing.

The unconventional method ensures a high chemical and optical homogeneity of the phosphate-tellurite vitreous materials, lower melting and annealing temperatures compared to the conventional ones.



### Faraday magneto- optical effect

Property/Glass	Te-1	Te-2	Te-3
Low annealing temperature, $T_{IR}$	394	394	393
Glass transition temperature, $T_g$	429	427	426
High annealing temperature, $T_{SR}$	440	436	436
Softening temperature, $T_D$	453	446	450
Thermal expansion coefficient, $\alpha_{20}^{300} \times 10^{-6} (K^{-1})$	7.68	11.95	11.19

Glass/ Property	Diamagnetic susceptibility, $\chi (cm^3/g)$ , at 300 K	Faraday rotation angle, $\theta_F (^\circ)$ , at 633 nm	Verdet constant, $V$ (min/Oe/cm), at 633 nm
Te-1	$-64(2) \cdot 10^{-8}$	$0.134^\circ$	0.019
Te-2	$-180 \cdot 10^{-8}$	$0.098^\circ$	0.015
Te-3	$-370 \cdot 10^{-8}$	$0.127^\circ$	0.019

**Acknowledgements:** This work was supported by grants of the Romanian Ministry of Research and Innovation, CCCDI-UEFISCDI, project number PN-III-P1-1.2-PCCDI-2017-0619/2018, ctr. 42PCCDI and project number PN-III-P1-1.2-PCCDI-2017-0871, ctr. 47PCCDI.



# International Exhibition of Inventions

## INVENTICA 2021

23.06.2021 – 25.06.2021



NATIONAL INSTITUTE OF INVENTICS, IASI, ROMANIA



NATIONAL INSTITUTE OF RESEARCH AND DEVELOPMENT FOR OPTOELECTRONICS



## Smart optical device for temperature sensing, based on innovative luminescent IV-VI quantum dots-doped complex nanostructured thin films

ERANET-MANUNET-MNET20/NMCS3732-Contract 213/02.12.2020

**Authors: M. Elisa<sup>1</sup>, I. C. Vasiliu<sup>1</sup>, C. Elosua Aguado<sup>2,3</sup>, F. J. Arregui<sup>2</sup>, D. Lopez<sup>2</sup>, D. Ulieru<sup>4</sup>, X. Vila<sup>4</sup>, J. Caridad Hernández<sup>5</sup>, M. Á. Casanova González<sup>5</sup>, J. F. de Paz Santana<sup>6</sup>, M. Enculescu<sup>7</sup>**

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<sup>2</sup>Department of Electrical, Electronic and Communications Engineering, Public University of Navarra, E-31006 Pamplona, Spain

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<sup>4</sup>Research & Development Department, SITEX 45, 114 Bd. Ghica Tei, 022543, Bucharest, Romania

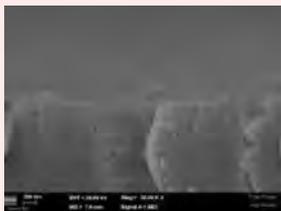
<sup>5</sup>Automation of The Internet of Things SL, AlfaIoT, 30 Campoamor Avenue, 37003, Salamanca, Spain

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<sup>7</sup>National Institute of Materials Physics, Multifunctional Materials and Structures Laboratory, 077125, Magurele, Ilfov, Romania

### Abstract

- ❖  $\text{SiO}_2\text{-P}_2\text{O}_5$  films ( $\text{I-H}_3\text{PO}_4$  precursor and  $\text{II-(C}_2\text{H}_5)_3\text{PO}_4$  precursor) were prepared by sol-gel method, spin coating technique.
- ❖ Different substrates were used for deposition, such as: glass, ITO (indium tin oxide layered on glass) and silicon.
- ❖ Composition, gelation time, substrate rotation rate, number of deposited layers and pH of the precursor solution were changed in order to regulate the hydrolysis and condensation mechanisms to accomplish uniform and homogeneous thin films.
- ❖ The influence of  $\text{P}_2\text{O}_5$  precursors on the gelation time and deposition parameters was explored.
- ❖ Nanostructured materials were obtained by drying and subsequent annealing of the deposited films.
- ❖ SEM (Scanning Electron Microscopy) analysis in cross section was used to investigate the morphology and the thickness of the films.



Film I deposited on glass



Film I deposited on ITO



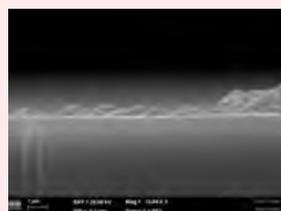
Film I deposited on silicon



Film II deposited on glass



Film II deposited on ITO



Film II deposited on silicon

### Acknowledgements

This work was supported by a grant of the Romanian National Authority for Scientific Research and Innovation, CCCDI-UEFISCDI, project ERANET-TEMSENTOPT, MNET20/NMCS3732, within PNCDI III, contract 213/02.12.2020.



# International Exhibition of Inventions

## INVENTICA 2021

23.06.2021 – 25.06.2021



NATIONAL INSTITUTE OF INVENTIVES, IASI, ROMANIA



National Institute for Research and Development in Optoelectronics INOE 2000

### Process for controllable silver-doping of thin hydroxyapatite layers obtained by magnetron sputtering method

Patent Application A / 00442 / 19.06.2018

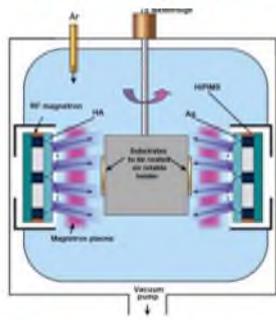
Inventors: Mariana BRAIC, Alina VLADESCU, Viorel BRAIC

Hydroxyapatite (HA) layers were deposited by magnetron sputtering method, with low and controllable concentrations of Ag, for coating metallic endoprostheses. The **process uses simultaneous RF sputtering of HA target, and Ag target by short-duration high power impulses with controllable duration (10...500µs) and frequency (1Hz...2kHz), within the range 0.5...3.0 kW/cm<sup>2</sup>/pulse (High Power Impulse Magnetron Sputtering-HiPIMS technique)**. The layers, are bio-conductive and osseo-conductive, present bactericide and antifungal effects, are resistant to corrosion in bio-environments, dense and highly adherent to metallic substrates, due to highly ionized plasma produced in HiPIMS discharge.

**Constant parameters:**  $P_{RF}(HA)=120\text{ W}$ ;  $T_{deposition}=450\text{ }^{\circ}\text{C}$ ;  
 $P_{deposition}=0.8\text{ Pa}$ ;  $t_{deposition}=120\text{ min}$ ;  $I_{pulse}(Ag)=14\text{ A}$ .

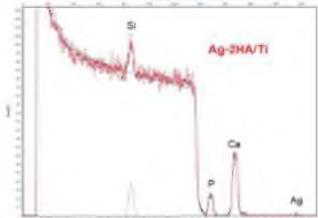
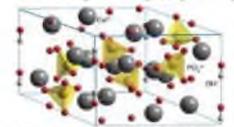
**Variable parameters:**  
 Pulse frequency – f; pulse duration t.

Elemental composition analysis



EDS

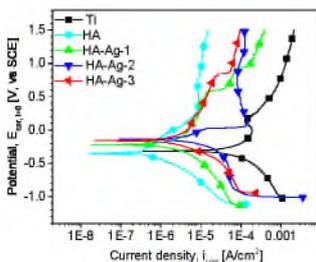
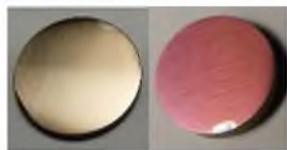
Absolute method:  
**Rutherford Back Scattering (RBS)** :  
 He ions,  $\alpha=60^{\circ}$ ;  
 $E_0(\text{He}^+)=2.629\text{ MeV}$



Sample	f [Hz]	t [µs]	Ca [% at.]	P [% at.]	O [% at.]	Ag [% at.]	Ca/P [% at.]	Thickness [nm]
HA/Ti	-	-	23.2	13.9	62.9	-	1.669	98.8±1.2
Ag1-HA/Ti	50	3	23.1	13.8	62.8	0.25	1.674	101.5±1.1
Ag2-HA/Ti	100	5	22.8	13.6	62.4	1.20	1.676	104.6±1.3
Ag3-HA/Ti	200	3	22.1	13.2	62.5	2.50	1.674	105.1±1.4

Ag addition:

- Color change
- Increased Hydrophilicity:  $39.7^{\circ}$  to  $28.5^{\circ}$
- Increased adhesion to the substrate: from 0.38 N to 0.45 N



Corrosion resistance in  $S_{imulate}B_{ody}F_{luid}$

Sample	$E_{CORR}$ [V]	$i_{CORR}$ [µA]	$R_p$ [kΩ]	Protection efficiency [%]
HA/Ti	-345	-	1.526	99.3
Ag1-HA/Ti	-157	3	3.619	98.3
Ag2-HA/Ti	-222	5	7.219	96.5
Ag3-HA/Ti	-140	3	20.712	90.0

In-vitro and in-vivo biocompatibility



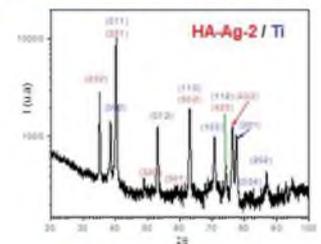
In-vitro tests: Cellular morphology of the cultured osteoblast cells after 72 h: Fluorescence microscopy (50 µm – up; 10 µm – down)

Radiography in dorsoventral position at 30 days after implant surgery indicated **positive biocompatibility, with no inflammation / infection.**

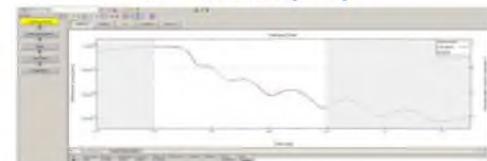
In-vivo tests: Ag2-HA coated implant in 4 months old Wistar rats (weight:250 g).

XRD analysis:

a - Crystalline structure (GIXRD)



b - Thickness (XRR)



Conclusions

- HiPIMS method allow the **fine control of Ag concentration, necessary to balance the biocid / anti-fungal and biocompatibility effects.**
- HiPIMS produced **Ag-doped coatings, with improved coatings adhesion to the substrate.**
- **Superior corrosion resistance was obtained for Ag-HA coatings with low Ag concentrations (≤ 1.2 at.%).**
- All coatings revealed **superior biocompatibility at in-vitro and in-vivo tests.**
- Ag2-HA coatings: **best bio and osseo-conductive and bactericide/ antifungal effects.**



# International Exhibition of Inventions INVENTICA 2021 23.06.2021 – 25.06.2021



National Institute of Research and Development for  
Optoelectronics INOE2000



## Innovative strategies for bioactive/antibacterial advanced prostheses

Research project: ERANET-M-ISIDE-1, no. 171/01.07.2020

Coordinator: dr.ing. Alina Vladescu

**ISIDE aims at reducing the implant failure risk due to bacterial infection and/or poor osteointegration and/or fit, while avoiding any second surgery. The new implants' generation will be highly customised and made of a resorbable metal: Magnesium. The implants will be produced using innovative processes, no more based on the subtractive approach: sheet metal forming processes like Superplastic Forming and Incremental Forming will be used. Mg custom implants will be improved by means of bioactive biofunctionalization aimed to (i)boost the bone formation; (ii)reduce the bacterial infections during healing; (iii) manage the corrosion/degradation time according to the region where the prosthesis is implanted.**

RF magnetron sputtering



cathodes: CaP & MgO  
Ar pressure: 0.67 Pa  
substrate bias: -60 V  
RF power fed on targets:  
HAP: 50 W  
MgO: **25 W & 50 W**  
deposition temperature: 700 °C  
deposition duration: 5 h

coating thickness ~ 400 nm

### CaP coatings + Mg

- Control the degradation rate
- Accelerate osseointegration
- Improve bone bonding ability
- Reduce local inflammation
- Guarantee the long-term the antibacterial abilities

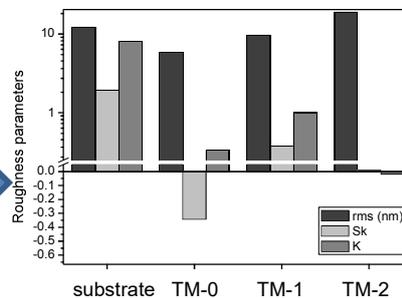
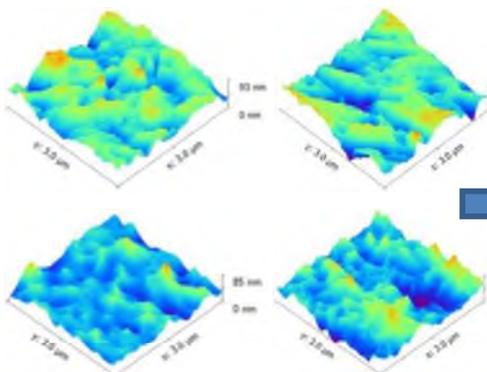
### EDS mapping of elemental compositions

Coatings	Ca	P	Mg	C	O	Ca/P
TM-0	5.9±0.2	3.6±0.2	8.9±0.3	-	81.6±2.8	1.64
TM-1	5.8±0.2	3.5±0.1	8.3±0.3	3.1±0.03	79.3±2.4	1.66
TM-2	6.2±0.2	3.7±0.1	8.1±0.2	9.2±0.1	72.8±2.1	1.68

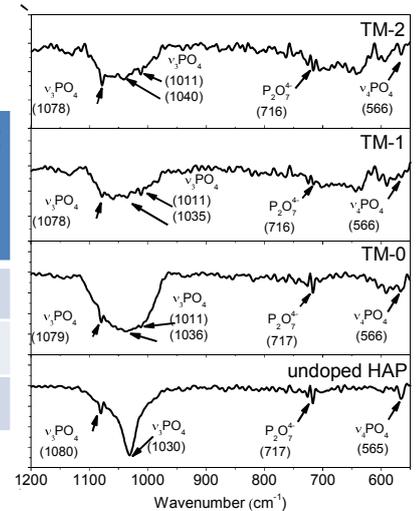
### E<sub>average</sub> and H<sub>average</sub> results of CaP coatings with and without Mg addition

Coating	Load (mN)	E <sub>av</sub> (GPa)	H <sub>av</sub> (GPa)	H/E	H <sup>2</sup> /E <sup>2</sup>	H <sup>3</sup> /E <sup>2</sup> (GPa)	H <sup>2</sup> /2E (GPa)
TM-0	1.0	87.156±1.83	8.809±0.23	0.1011	0.0102	0.0899	3382
TM-1		83.171±1.77	8.670±0.20	0.1042	0.0108	0.0942	3126
TM-2		52.993 ±1.46	5.764±0.18	0.1088	0.0118	0.0681	880

AFM results



### FTIR spectra



*elastic modulus of the coated samples decreases with Mg addition in the CaP structure, especially in the case of the coatings with high Mg concentration (53 GPa).*

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***National Research & Development Institute for Welding and Material  
Testing – ISIM Timisoara***



# International Exhibition of Inventions INVENTICA 2021 23.06.2021 – 25.06.2021



**NATIONAL RESEARCH & DEVELOPMENT INSTITUTE  
FOR WELDING AND MATERIAL TESTING - ISIM TIMISOARA, ROMANIA**

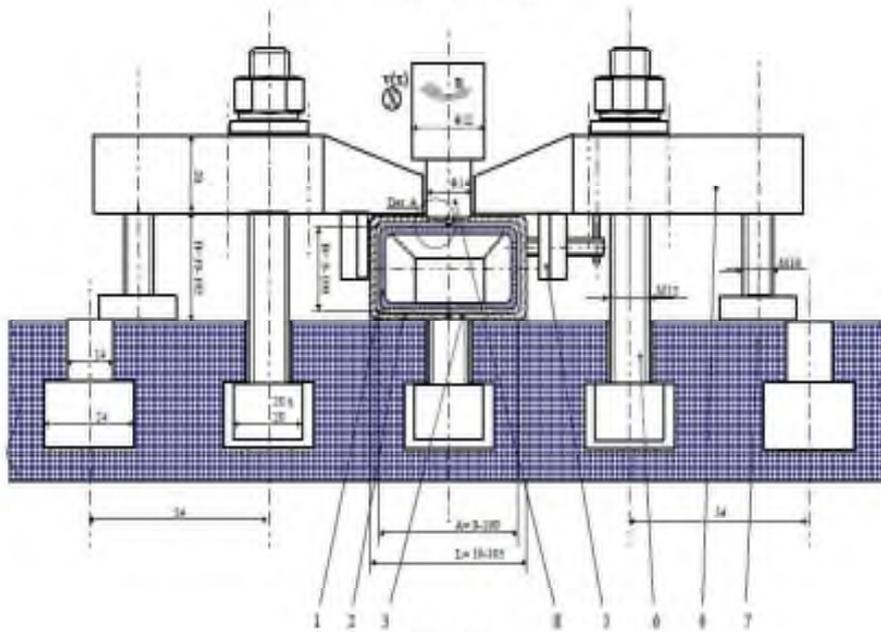
## **"Method of making rectangular and square tubes of aluminum alloys, by the process of friction stir welding (FSW)"**

**Patent application: Registration No. A 2020 00242 of 06th.05.2020**

**Inventors: VERBIȚCHI Victor; SÎRBU Nicușor-Alin and VLASCICI Miomir**

### **Object of the invention**

This method allows more efficient execution of rectangular or square tubes of aluminum alloys, with available machines of the mechanical shops, as an alternative to extrusion, rolling or other mechanical and welding technologies that are very expensive.



### **Method set-up**

1 – template (model); 2 – aluminum alloy sheet;  
3 – aluminum alloy sheet; 4 – clamps; 5 – vises;  
6 – screws; 7 – table of an FSW machine; 8 –  
FSW tool.

### **Parameters**

The depth of penetration  $h$ , the rotational speed  $n$  and the travel speed  $v(x)$  are the main parameters of an FSW joining process, followed by an optional friction stir processing (FSP), to improve the joint structure or to correct flaws.

The production of thermal energy by friction has a higher efficiency, because the support of the sheets that join is the wall of the template tube, having a reduced thickness of 1 - 3 mm, related to the 10 - 100 mm sides of the tubes (pipes) obtained by the proposed method.

Therefore, the wall of the template pipe accumulates a lower amount of heat until the plasticization of the base metal is reached.

**Figure 1.** Method device for the execution of rectangular and square tubes, by the FSW

### **Technical problem solved by the invention**

Tubes with the size range 10 - 100 mm of the cross section can be fabricated. The required tube length can be obtained by successive positioning of the components. The FSW joining and FSP processing device is simple, as it consists of the template that is needed to make the U-profile of the joining sheets and support it, to which some flanges, vises, screws, nuts and accessories are added, which are required in technology consideration, for the necessary accuracy range. This device has a low cost, as it consists only of a few materials, on which several machining operations are performed. The device does not require maintenance.

### **Description**

The method is characterized in that, it uses a model, two sheets that have been previously bent as U-shaped profiles on the model, which are placed on an FSW machine, so that an FSW tool rotates between the sheets and moves along their contact line, to weld the sheets and make a tube. Given the usual sizes of currently available semi-finished products (sheets, having a maximum length of 3 m, respectively rectangular and square profiles or pipes, having a maximum length of 6 m), the dimensions of the operational subassembly for mounting will be of this extent, in terms of length. Thus, 1 - 10 successive positions of the subassembly for mounting can be carried out on the FSW machine table. The overall width of the subassembly has a maximal extent in the range of 100 - 120 mm, respectively the height of the subassembly has the same range, given the dimensions mentioned at the beginning, for the application of the proposed method.

Several programs must be stored and available in the memory of the FSW machine controller, for the entire range of tubes or pipes running on the FSW machine or on the milling machine being used. Depending on the involved parameters, the steel tube template can be extracted from the executed aluminum alloy tube or can be kept inside, as a high-strength core, in certain applications.

### **Applicability**

- Construction, electro-technique, manufacturing, shipyard, rolling stock and automotive industries.
- Target products: various setups; light construction components; outdoor welded structures; ship, wagon and car body parts.

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# International Exhibition of Inventions INVENTICA 2021 23.06.2021 – 25.06.2021



**NATIONAL R & D INSTITUTE FOR  
WELDING AND MATERIAL TESTING  
I.S.I.M. TIMISOARA**

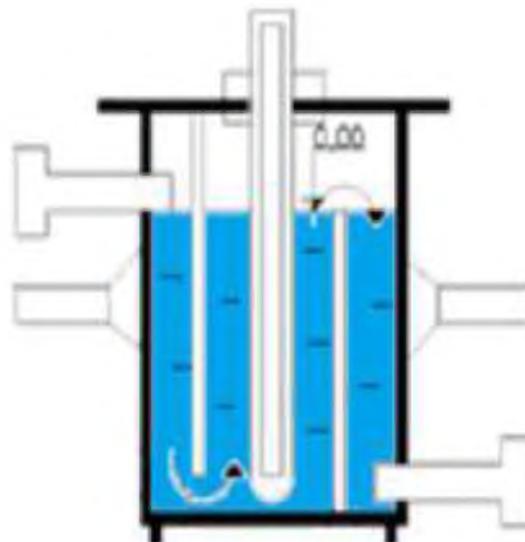
## INSTALLATION FOR WATER DISINFECTION

**Patent Application for Invention: A/00067/22.02.2021**

**Author: Ph.D student Eng. Emilia DOBRIN**

### Fields of use

- Medicine - Health Care - Cosmetics
- Industrial and laboratory equipment
- Environment – Pollution Control



### Technical data

- Ultrasonic (US) generator  
Power 500 W  
Frequency 20kHz
- Ultraviolet (UV) set  
Power 160 W/cm<sup>2</sup> (1m)  
Length 1554 mm  
Diameter 15 mm

### Advantage

- It covers a more efficient water disinfection process
- More optimal operation by remote monitoring of the installation
- It shows a better efficiency by registering, saving, archiving and real time data transmission in a local area network
- It has a more efficient control by remote control of the installation



# International Exhibition of Inventions INVENTICA 2021 23.06.2021 – 25.06.2021



**NATIONAL RESEARCH & DEVELOPMENT INSTITUTE  
FOR WELDING AND MATERIAL TESTING - ISIM TIMIȘOARA, ROMANIA**

## Method for monitoring of the friction stir welding process in inert shielding gas environment FSW-IG

**Patent application : Registration No. A/00746/18.11.2020**

**Inventors: Radu COJOCARU and Lia-Nicoleta BOȚILĂ**

Friction stir welding in inert shielding gas environment (FSW-IG) aims to improve the quality of welded joints, protect the welding tool and the welding materials against oxidation.

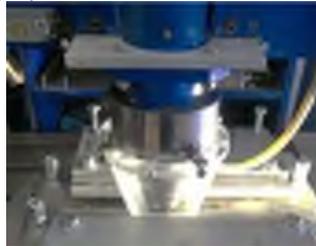
**Object of the invention:**

Development of a method for monitoring of the friction stir welding process in inert shielding gas environment FSW-IG, by identifying a technical solution that will allow to use the infrared thermography.

**Current technical solution:**

At the FSW-IG welding is currently used a small size inert gas enclosure which is mounted on the main shaft housing of the FSW welding machine. The monitoring of the process temperature cannot be performed, the walls of the enclosure being an obstacle on the focus direction of the thermographic camera.

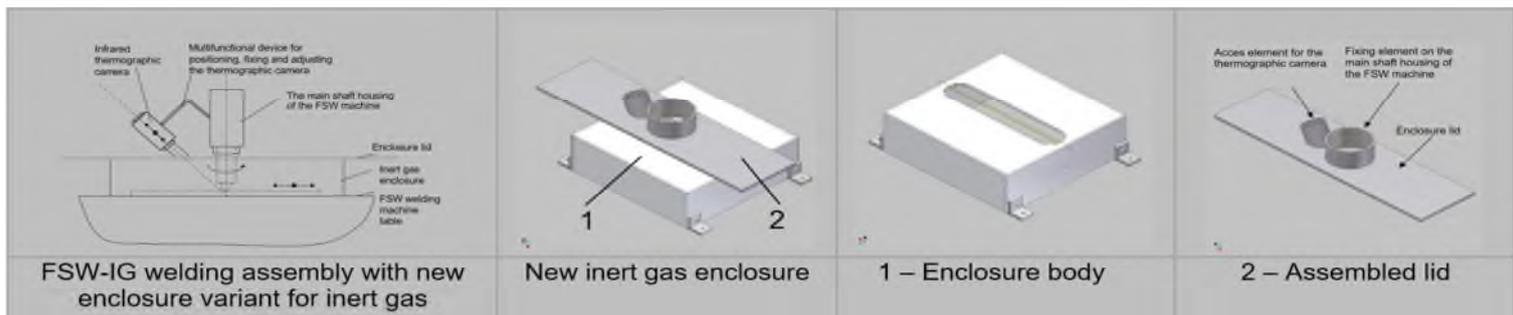
Enclosure version for inert gas application, mounted on the main shaft housing of the FSW machine



Friction stir welding machine (with inert shielding gas enclosure)

**Technical problem solved by invention:**

Possibility to monitor the process temperature at FSW-IG welding using an inert gas enclosure that will allow access of the infrared thermographic camera lens in the welding area to focus and measure the temperature on the joining line, at a short-distance behind the welding tool.



**Description:**

The method uses a shielding gas enclosure fixed to the table of the FSW welding machine, with the enclosure lid fixed on the main shaft housing of the FSW machine. The thermographic camera is properly positioned and fixed in the lid (and also fixed on the same main shaft housing). The enclosure moves during the welding process together with the machine table (with welding speed), slides in relation to the enclosure lid and the thermographic camera, allowing the thermographic camera to focus and measure the temperature on the joining line, at 1mm behind of the FSW tool shoulder, thus ensuring monitoring the welding process. The fixing on the machine and the adjustment of the thermographic camera lens is done through a multifunctional positioning, fixing and adjustment device in relation to the joining area.

**Benefits:**

- the possibility of the process temperature monitoring to the friction stir welding in inert gas environment FSW-IG, using infrared thermography;
- ensuring a large volume of inert gas in the working area, which should provide:
  - a uniform and wider protection of the area around the welding tool;
  - protection of welding materials and welding tool against oxidation.

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***National Institute for Laser, Plasma and Radiation Physics***

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# International Exhibition of Inventions INVENTICA 2021 23.06.2021 – 25.06.2021



NATIONAL INSTITUTE FOR LASER, PLASMA AND RADIATION PHYSICS

## LOVE WAVE SURFACE ACOUSTIC WAVE SENSOR BASED ON NANOPOROUS GOLD

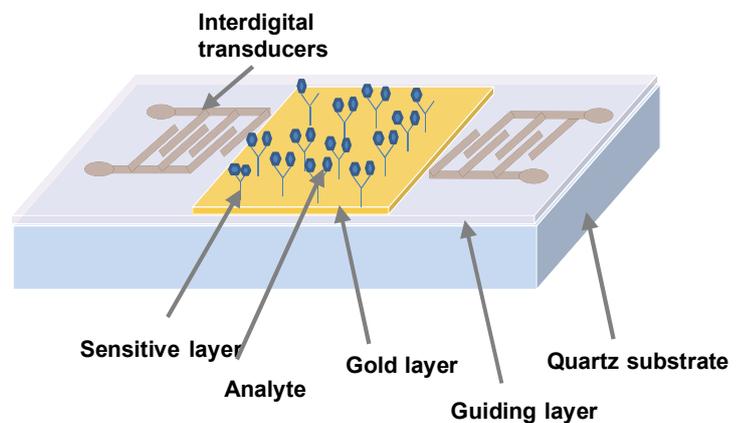
Patent application: A00305/02.06.2020

Authors: Dana Miu, Cristian Viespe, Izabela Constantinoiu

### ABSTRACT:

The invention refers to a Love-Wave Surface Acoustic Wave (LW-SAW) sensor having nanoporous (NP) gold as immobilization layer, which can be used as a biosensor for the detection of biological materials (proteins, nucleic acids, bacteria, viruses, etc). This is the first time that NP gold has been used in LW-SAW.

Love-Wave SAWs based on NP gold have improved sensitivity, selectivity, response and recovery time, compared to LW SAWs with a dense gold layer. The novel LW-SAW structure will have considerable impact by allowing sensitive, label-free early detection of various diseases.



Construction of Love-Wave Surface Acoustic Wave Sensor

The structure of LW-SAW consists in a piezoelectric substrate, a guiding layer and an immobilization layer. For the first time, this structure is modified in the invention by replacing the dense gold immobilization layer conventionally used with a nanoporous gold layer, which is placed on top of the guiding layer. The biological material is detected after immobilization by means of a sensitive material deposited over the nanoporous gold layer. The nanoporous gold layer has a much larger specific surface and a greater reactivity towards the analyte, leading to an increased sensor sensibility.

The morphological structure of the nanoporous gold includes open spaces which are accessible to the biological analyte and have dimensions of the same order of as those of the detected materials (enzymes, antigens, antibodies, etc). The open structures favor stable binding of the sensitive layer over large surfaces of the gold immobilization layer at high concentrations, and rapid reactions with the biological analytes. The surfaces of the structures also present greater reactivity than the surface of a dense gold layer.

SEM images of the nanoporous gold layer.  
left: surface; right: cross-section

ACKNOWLEDGMENTS: THIS WORK WAS SUPPORTED BY A GRANT OF THE ROMANIAN MINISTRY OF RESEARCH AND INNOVATION, CCCDI-UEFISCDI PROJECT NUCLEU PN16N/08.02.2019.  
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# International Exhibition of Inventions INVENTICA 2021 23.06.2021 – 25.06.2021



NATIONAL INSTITUTE FOR LASER, PLASMA AND RADIATION PHYSICS

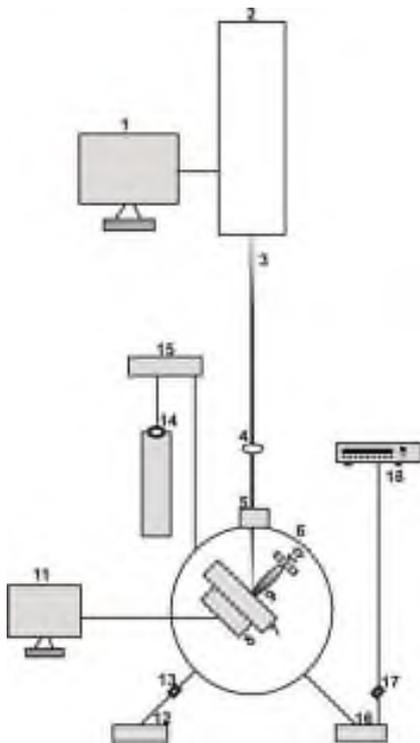
## Obtaining procedure of SnO<sub>2</sub> photoelectrodes using picosecond laser with dye sensitized solar cells applications

National PATENT APPLICATION A100226/06.05.2021

Inventors: Cornelia Enache, Cristian Viespe

**ABSTRACT:** The invention refers to one procedure of obtaining in situ of SnO<sub>2</sub> photoelectrodes (nanoporous films) using a picosecond laser by laser ablation method with DSSC (dye sensitized solar cells) applications. This type of photoelectrodes (SnO<sub>2</sub>) have the advantage of high electrons mobility, high absorption in red-IR domain, larger band gap. Nanoporous SnO<sub>2</sub> films obtained in situ meet the requirements of a photoelectrode from morphological point of view, in terms of adhesion and composition, for obtaining DSSC.

**CLAIMS:** Obtaining procedure of SnO<sub>2</sub> photoelectrodes by laser ablation using picosecond laser characterized by the fact that we obtained in situ nanoporous films that meet the requirements of a photoelectrode in terms of morphology, adhesion, composition for dye sensitized solar cells (DSSC) applications.



A laser beam (3) emitted by a ps laser (2) computer controlled (1) is focused on the focus lens (4) and then passes through the window (5) placed at the entrance of the deposition chamber (6) and focused onto the target (7) (tin metal). Following the interaction of the laser beam (3) – target (7) an ablation plume (9) is formed which is deposited onto FTO (fluorine doped tin oxide) substrate (10). During the deposition process, the target is moved by a motorized X-Y translation system (8) computer controlled (11). Before deposition, the deposition chamber (6) is evacuated by a high vacuum turbomolecular pump (12); during the deposition in the chamber is introduced gas from the gas cylinder (14) with a constant flow controlled by a system (15). The desired working pressure is maintained in the deposition chamber (6) by a valve (17) controlled by a controller (18) connected to a preliminary vacuum pump (16). After deposition, the films were treated in oxygen atmosphere in an oven connected to the gas cylinder.

ACKNOWLEDGMENTS: THIS WORK WAS SUPPORTED BY A GRANT OF THE ROMANIAN MINISTRY OF RESEARCH AND INNOVATION, CCCDI-UEFISCDI PROJECT NUCLEU PN16N/08.02.2019.

contact: NILPRP, Laser Department, Quantum Dots, Nanopowders and Thin Films Group, <http://qdntf.inflpr.ro/>  
Dr. C. Enache (cornelia.sima@inflpr.ro) , Dr. C. Viespe (cristian.viespe@inflpr.ro)

## RAPID HEATING/COOLING PROCESS APPLIED TO DOPED TRANSPARENT CONTACTS USED IN CHALCOGENIDE SOLAR CELLS

NATIONAL PATENT APPLICATION A/00235/ 11.04.2019

Inventors: **PETRONELA GAROI, CRISTIAN VIESPE, DOINA CRĂCIUN, FLORIN GAROI, VALENTIN CRĂCIUN**

The invention refers to a rapid heating/cooling procedure that takes place in oxygen flow and it is applied to doped transparent and conductive materials. These thin films have an increased crystallite size and improved electrical conductivity, making them, essentially, active elements for **chalcogenide solar cells**. In this procedure, the thin films are subjected to rapid heating in oxygen atmosphere, maintained on a temperature floor, followed by cooling/ heating and then the process continues with cooling at the end. Thin films as doped transparent contacts, resulting from rapid heating/ cooling, have improved structural and optoelectronic properties. The transparent conductive oxides (TCO), based on indium tin oxide (ITO) samples were prepared by rfMS method and next were rapid thermal annealed (RTA)

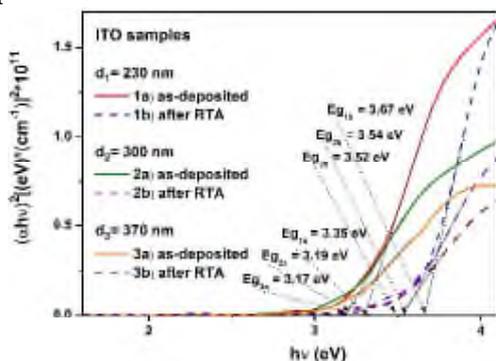
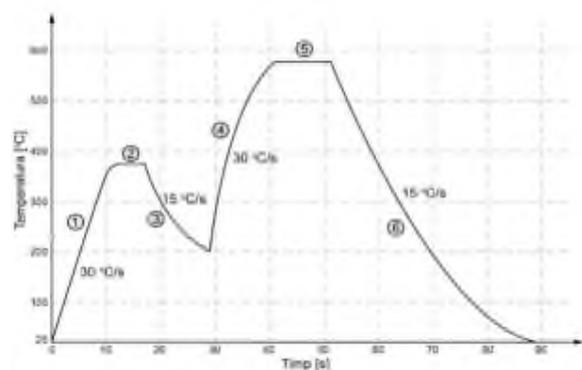


The two magnetrons of the sputtering equipment used to obtain TCO layers, which improve with RTA.

MILA-5000 Type (ULVAC Technologies Inc.)

+ for ITO thin films deposition

- mass flow controller: Ar flow rate of 30 sccm and O<sub>2</sub> flow rate of 1.5 sccm.
- pressure during deposition,  $p = 6.67 \times 10^{-1}$ ;
- intensity of the current: 0.1 A
- forward power/reflected power: 70W/0W;
- deposition rate: 9.6 nm×min<sup>-1</sup>.



+ for films annealed to 800 K,

- we used MILA-5000 Type (ULVAC Technologies Inc.) with a IR lamp;
- the heat treatment were annealed at 575 °C (heating rate 20 °C/s), maintained on a thermal plateau for 10 minutes, then cooled down to room temperature with a rate of 20 °C/s.

**CONTACT: DR. PETRONELA GAROI (petronela.garoi@inflpr.ro)**



# International Exhibition of Inventions INVENTICA 2021

23.06.2021 – 25.06.2021

NATIONAL INSTITUTE FOR LASER PLASMA AND RADIATION PHYSICS,  
ROMANIA



## A PROCESS FOR THE ANALYSIS OF ETHYLENE FROM GAS MIXTURES

Patent application: No. A/00068/2019

Inventors: **Cristina-Mihaela ACHIM (POPA)**, Ana-Maria BRATU, Mioara-Elena BERCU, Dan Constantin DUMITRAS, Doru Constantin Adrian DUTU  
contact person: [cristina.achim@inflpr.ro](mailto:cristina.achim@inflpr.ro)

The patent application no. A/00068/2019, refers to a *NOVEL* procedure for the analysis of ethylene from gas mixtures, with *USEFULNESS* in the human breath analysis, plants/fruits respiration analysis, assessment of pollution, and surgical smoke with great *MARKET OPPORTUNITIES* through the applications given by the quality evaluation of fruits, plants, and vegetables. The procedure consists of the ethylene gas detection unit, presented according to the process and includes, the acoustic unit along with a tunable laser in frequency and amplitude, the manipulation of the gas mixture and the electronics required to determine the ethylene concentration.

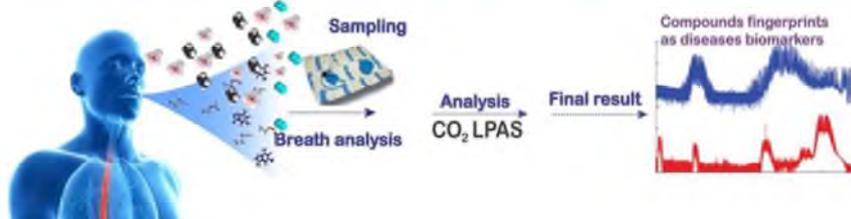
### Advantages & Applicability

- 1. Medicine - human health assessment:** The analysis of human breath for diagnosis of diseases has certainly one of the highest potential impacts on public health and quality of life. In clinical medicine, breath testing is the least invasive of all diagnostic tests, presenting minimal risk and negligible discomfort to patients. Trace ethylene analysis of the breath composition gives information about various processes occurring inside the human body. One such process is lipid peroxidation in which free radicals induce oxidative degradation of the polyunsaturated fatty acids, causing cell damage and cell death. In a normal situation, free radical formation and antioxidants are balanced. Under certain conditions (e.g. UV radiation, ionizing radiation (X-ray) trauma, pulmonary and skin diseases, heart failure, diabetes, mental disorders, cigarette smoke, etc.) this balance is disturbed.
- 2. Life sciences and Food quality evaluation - analysis of surgical smoke, pollution and evaluation of fruits, plants, and vegetables:** germination of seeds, ripening of climacteric fruits, plant resistance to stress factors and plant response to pathogen infection. Ethylene acts as a vegetal hormone produced by all plant tissues, is transported by diffusion through plant tissues, increases the plasmatic membrane permeability, has multiple effects on the cell metabolism, increases the oxidative processes, the transport inside the cells and the biodegradation of the organic acids and chlorophyll, plays a major role in many metabolic processes.

### Applications



#### GAS ANALYSIS WITH PHOTOACOUSTIC SPECTROSCOPY





## Process for obtaining superhydrophobic materials by laser ablation

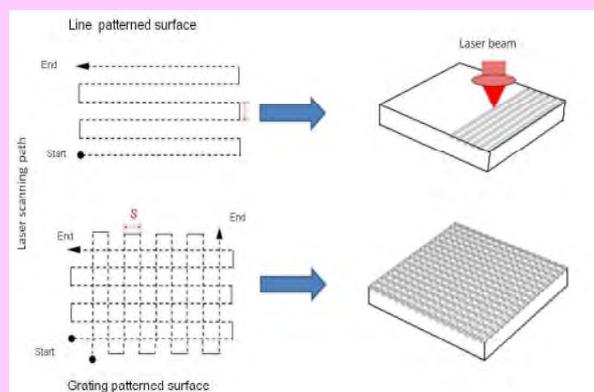
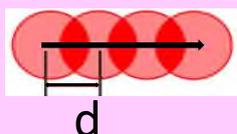
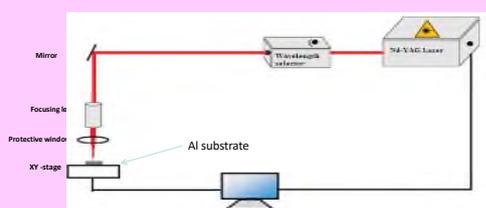


Urzica Iuliana, Simon Agota, Udrea Cristian, Logofatu Petre Catalin, Pascu Mihail Lucian  
**Patent number: A/00475/02.08.2019**

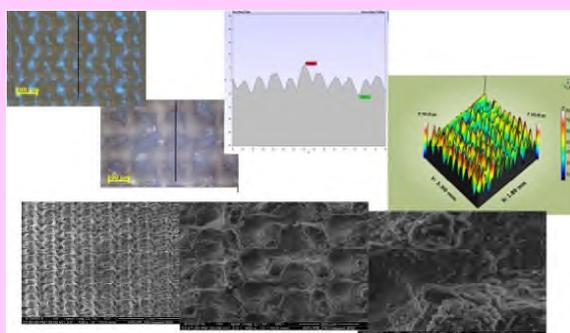
**Abstract:** The invention relates the design and implementation of a flexible, adaptive and low cost innovative system for the production by laser ablation in different environments of materials with "lotus" effect, superhydrophobic materials, using a laser in ultra-short pulses. The lotus leaf, the rice leaf, the butterfly wing and the water-strider spider legs have surfaces that possess several uniquely beneficial properties, such as extreme water repellency, self-healing, self-cleaning, anti-bacterial, anti-corrosion, enhanced heat transfer, drag reduction and improved corrosion resistance.

Recently, superhydrophobic surfaces, for which water contact angle is higher than  $150^\circ$  and sliding angle less than  $10^\circ$ , have received attention due to the many potential applications ranging from biological to industrial processes and usable/ applicable properties, not only scientific but even in daily life.

### ➤ Experimental set-up

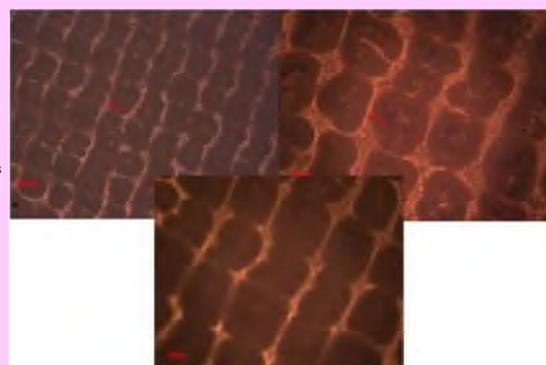


### ➤ Results



Al surface irradiated in the environment

Manufacture fingerprint systems of polymeric materials



The replica of the pattern on the PDMS

### Advanges

- (1) developing of pattern superhydrophobic metallic surfaces using an innovative, flexible and low costs by nanosecond laser ablation system;
- (2) nanosecond laser ablation takes place on the surface of a target with controlled composition whose stoichiometry is reproduced in the ablated material;
- (3) the ablation takes place in different environments, whose composition can be chosen so as to represent a chemically inert environment compared to the ablated elements or from a reactive environment;
- (4) both roughness and surface morphology can be controlled experimentally by surface variations and laser parameters;
- (5) the additional procedures performed on the surfaces after structuring are non-invasive techniques;
- (6) obtaining a fingerprint system can be applied universally to a wide class of polymeric materials;

### Applications

#### ➤ To create superhydrophobic food packaging!

We know that the COVID-19 is a highly infectious disease. Everyone is responsible for reducing the spread and must take simple precautions.

#### ➤ To create superhydrophobic surgical gloves!

#### ➤ To create superhydrophobic metallic surfaces for naval industry, food industry !



# International Exhibition of Inventions INVENTICA 2021 23.06.2021 – 25.06.2021



National Institute for Laser, Plasma, and Radiation Physics

## HPTLC densitometry method for the analysis of irradiated thioridazine solutions based on laser-induced fluorescence and fluorescence lifetime characterization

Patent application: no. A/00120 from 18.03.2021

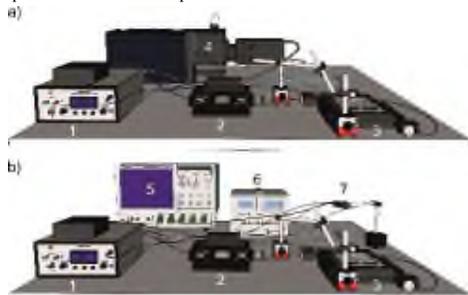
Inventors: Tozar Tatiana, Boni Mihai, Andrei Ionut Relu, Staicu Angela, Pascu Mihail-Lucian

### 1. Technical field

- The invention can be applied in the technical fields of chemical engineering and technology.
- The invention relates to an High Performance Thin Chromatography (HPTLC) densitometer able to generate the fluorescence chromatograms, the laser-induced fluorescence spectra and fluorescence lifetime of the constituents of the samples, obtaining qualitative and quantitative information.
- The invention was validated for thioridazine and was used to obtain the chromatograms, fluorescence spectra and fluorescence lifetime of the photoproducts of thioridazine prior exposed to laser radiation.

### 2. The invention

- The invention offers the vertical and horizontal chromatograms of compounds separated on HPTLC plates by recording laser-induced fluorescence spectra and the fluorescence lifetime.
- The excitation source is a laser diode emitting at 375 nm (pulse duration of 87.7 ps, pulse frequency 30 MHz, and an average power of 490  $\mu$ W). The radiation is perpendicular to the HPTLC plate.
- An automatic XY stage is used to move with 1 mm increment in the OX and OY directions the HPTLC plate.
- An optical fiber positioned at 45° from the incident beam, is used to collect the fluorescence signal emitted by the compounds separated on the plate. The fiber is alternately coupled to a spectrograph or photomultiplier, to record the fluorescence spectra or fluorescence signal resolved over time.
- The fluorescence signal is recorded in the OX direction (horizontal chromatogram - the evolution of the fluorescence of a certain compound) or OY direction (vertical chromatogram - the evolution of all compounds in a sample).
- The fluorescence spectra / fluorescence intensity and the fluorescence lifetime for the compounds separated on the HPTLC plate are obtained.



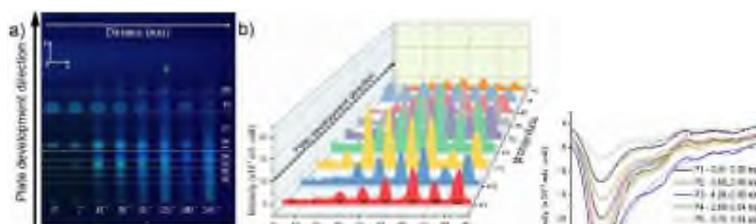
HPTLC densitometer setup used for recording the a) steady-state and b) time-resolved fluorescence; legend: 1 – laser control unit, 2 – laser head, 3 – translational stage with HPTLC plate on it, 4 – spectrograph, 5 – oscilloscope, 6 – control unit for photomultiplier, 7 – photomultiplier.

### 3. The technical problem that the invention solves

- The use of a laser diode for excitation instead of conventional lamps provides better reproducibility and selectivity of excitation radiation, providing fast and accurate measurements, especially in quantitative determinations.
- The excitation sources can provide manufacturers with miniaturization opportunities and lower cost solutions for the manufacture of new densitometers. The beam emitted by the laser diodes can be easily coupled to optical fibers.
- An advantage in using picosecond pulsed diodes is the possibility of determining the fluorescence lifetime of the compounds.
- The innovative method benefits from the superior characteristics of laser radiation compared to conventional light sources, namely coherence, directionality, monochromaticity.
- By using laser radiation, a good spatial resolution of the distribution of compounds on the HPTLC plate is obtained, allowing a better focus of the radiation on the plate and the investigation of an area determined by the beam size (in this case 1.6 x 1.8 mm).
- Determining the fluorescence lifetime can help to discriminate two molecules with overlapping fluorescence spectra but with different fluorescence lifetimes.

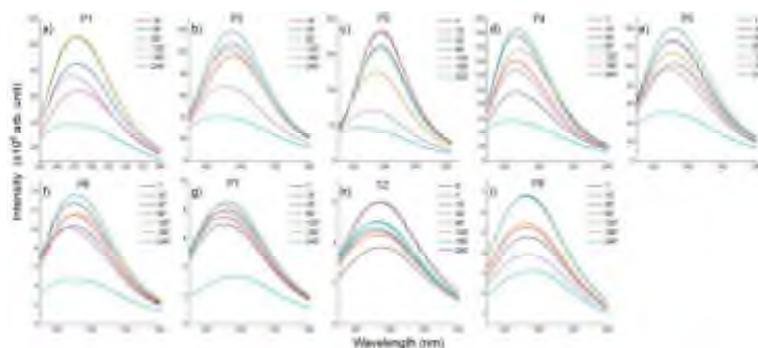
### 4. Invention results

- Thioridazine (TZ) dissolved in ultrapure water.
- TZ concentration = 2 mg/mL.
- TZ solutions were irradiated with laser beam at 266 nm, emitted by an Nd: YAG laser (6 ns FWHM, 10 Hz, 6.5 mJ).
- Exposure time = 1, 15, 30, 60, 120, 180 and 240 min.



a) HPTLC plate, developed in the mobile phase, visualized at 254 nm; b) 3D chromatograms of TZ and its photoproducts, resulting from laser-induced fluorescence scanning on OX direction.

Fluorescence signals resolved in time of TZ and the photoproducts and their fluorescence lifetime.



The evolution of the fluorescence spectra of TZ and its photoproducts.

### 5. Advantages and application

- The invention offers the laser-induced fluorescence chromatograms, the fluorescence spectra, and lifetime of the compounds separated on the HPTLC plate.
- To our knowledge, there is no reported up to now, a method to investigate the fluorescence lifetime of compounds from HPTLC plates.
- Comparing HPTLC densitometry with HPLC-FLD:
  - HPTLC densitometry is more advantageous due to its simplicity, flexibility, accessibility;
  - for HPLC-FLD the fluorescence spectra cannot be obtained for photoproducts that do not spend enough time in the FLD detector;
  - HPTLC densitometry provides a much faster discrimination than HPLC-FLD, where optimizing the method can take a long time.
- The translation to industrial applications requires the use of existing equipment (pulsed emission laser diode excitation source in the field of picoseconds, a spectrograph coupled with an ICCD, a photomultiplier coupled with an oscilloscope and an automatic translation stage).
- This invention can be applied industrially by a complete automatization of the data acquisition and processing for the developed equipment.

**ACKNOWLEDGMENT:** This research was funded by Ministry of Research, Innovation and Digitization, CNCS/CCCDI-UEFISCDI, project PN-III-P1-1.1-PD-2016-1072, NUCLEU Program 3N/2018, and NUCLEU Program 16N/08.02.2019.



**Universities from MOLDOVA**

*„Nicolae Testemițanu” State University of Medicine  
and Pharmacy of the Republic of Moldova*



International Exhibition of Inventions

INVENTICA 2021

23.06.2021 – 25.06.2021



NATIONAL INSTITUTE OF  
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NICOLAE TESTEMITANU STATE UNIVERSITY OF MEDICINE  
AND PHARMACY OF THE REPUBLIC OF MOLDOVA



## METHOD OF SURGICAL TREATMENT OF PAROTID GLAND TUMORS IN CHILDREN

**S 2021 0012 of 2021.02.25 (positive decision on granting the patent)**

**Inventatori:** Tsibirna Gheorghe, Railean Silvia, Tsibirna Andrei,  
Manascurta Ghenadie, Spinei Aurelia, Tarnarutscaia Rodica, Lisitsa Natalia,  
Golban Rodica, Porosencov Egor, Lupan Roman, Ciochina Mariana

The invention consists in developing a method of surgical treatment of tumors of the parotid gland in children, which would eliminate the disadvantages of known methods, with the possibility of performing surgeries with satisfactory access to the affected parotid gland as traumatic as possible in children, in order to avoid massive plastic surgeries and with the avoidance of recurrences.

Surgical treatment of benign and malignant tumors of the parotid gland (pleomorphic adenoma and mucoepidermoid tumor) in children should be performed based on certain principles. Rapid total discoloration of the tumor is not recommended due to the risk of resection of the branches of the facial nerve and the spread of tumor cells.

**Domains of application:** Surgery, oncology, pediatric

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# International Exhibition of Inventions INVENTICA 2021 23.06.2021 – 25.06.2021



NICOLAE TESTEMITANU STATE UNIVERSITY OF MEDICINE  
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## Anti-VEGF in the treatment of non-infectious intraocular inflammation

### Patent MD 1465

**Inventatori:** Cuşnir Valeriu, Dumbrăveanu Lilia, Groppa Liliana, Cuşnir Vitalie, Cuşnir Valeriu, Bobescu Nicolae

The invention relates to medicine, in particular to ophthalmology. It can be used for the medical treatment of non-infectious ocular inflammations.

The essence of the invention is that an antibiotic of the class fluoroquinolones, a non-steroidal anti-inflammatory drug and a corticosteroid, which is administered for 7 days, is administered concomitantly in the form of ophthalmic drops, a third-generation cephalosporin antibiotic is administered systemically, for 7 days, a corticosteroid preparation for 5 days and a triazole-derived antifungal on the first day of treatment and also on the first day of treatment is administered in the anterior chamber soil. Bevacizumab 1.25 mg / 0.05 ml after anesthesia with 0.5% tetracaine solution or lidocaine.

In 8 patients - 13 eyes was observed stabilization of IOP, improvement of inflammation and reduction of the complication rate. In 7 of them - 11 eyes, visual acuity varied within 1-2 rows, remission of the disease lasted 1-5 years. Macular edema persisted in one patient.



**Benefits:** Bevacizumab has stabilized remission in patients with refractory to treatment uveitis for 1-5 years and improved the inflammatory process and decreased the rate of uveitis-specific complications, such as macular edema and neovascular glaucoma.



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**NICOLAE TESTEMITANU STATE UNIVERSITY OF MEDICINE AND PHARMACY OF THE REPUBLIC OF MOLDOVA**  
**Research Laboratory of Gastroenterology**



### METHOD FOR DETERMINING LIVER FUNCTION IN CHRONIC VIRAL HEPATITIS B AND CHRONIC HBV ETIOLOGY INFECTION WITH MINIMAL ACTIVITY

Patent: MD 1474 (13) Y

**AUTHORS: Dr. hab.med.sc, LUPAȘCO Iulianna, Dr. hab. med.sc, DUMBRAVA Vlada-Tatiana, LUPASCO Daniela**

**Method consists in** fasting venous blood is sampled and the concentration of transaminases, namely alanine aminotransferase and aspartate aminotransferase, is determined, after which a load test is performed by oral administration of 50 g of glucose, dissolved in warm water and 0.5 g of euphylline (Fig 1,2), followed by dynamic blood sampling in 60 and 120 min (Fig 3), and the concentration of transaminases is re-determined, in the event if in the sample taken in 60 min from the load test, the concentration of alanine aminotransferase increases by 1.3...1.8 times, and the concentration of aspartate aminotransferase increases by 1.4...2.0 times, and in the sample taken in 120 min from the load test, the concentration of alanine aminotransferase decreases by 1.3...1.4 times, and the concentration of aspartate aminotransferase decreases by 1.4...1.6 times from the concentration level in samples taken in 60 min from the load test. liver dysfunction is determined.

In the double stress test with glucose and euphyllin, two mechanisms of double stimulation of intracellular messengers are influenced, which elucidate the hidden mechanisms of cellular metabolic abnormalities that allow their detection and correction until the onset of clinical and paraclinical manifestation. The use of the glucose and euphyllin exercise test allows early detection of liver disease in patients with chronic viral HBV hepatitis or chronic latent HBV infection, with minimal activity with hidden clinical and paraclinical symptoms.



Figure 1

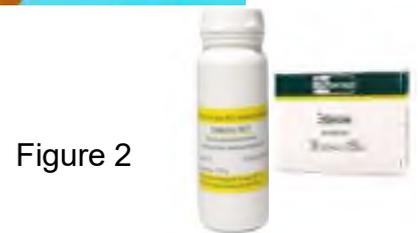


Figure 2

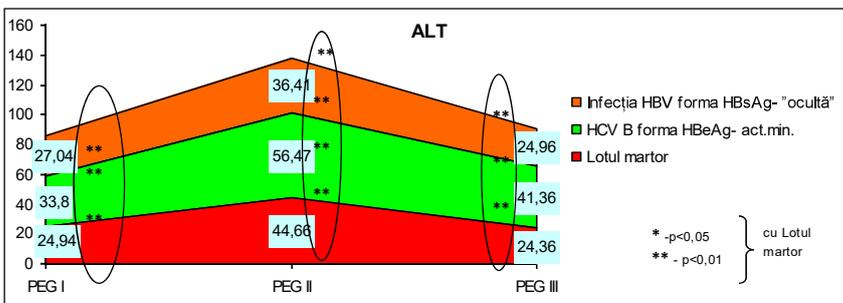


Figure 4. The cytolytic syndrome evaluation (ALT) with double effort test with glucose and ephyllin.



Figure 3

**Fields of application:** in medicine, especially in gastroenterology, hepatology and can be used for liver function evaluation in chronic viral hepatitis B and chronic viral HBV infection with minimal grade of activity (Fig 4).

**Advantages and the novelty of this method** is that it sets early, accurate determining liver function in chronic viral hepatitis B and chronic HBV infection with minimal activity, allowing the timely prescription of adequate treatment in asymptomatic patients.



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## Method for predicting the course of neuropsychomotor disorders in children with ischemic cerebral stroke

**Patent: MD 1487 (13) Y**

**AUTHORS:** Sprincean Mariana, Hadjiu Svetlana, Călcîi Cornelia, Lupuşor Nadejda, Bozadji Veaceslav, Revenco Ninel

The invention relates to medicine, in particular to pediatric neurology, neonatology, pediatrics, and can be used for predicting the course of neuropsychomotor disorders in children with ischemic cerebral stroke. Summary of the invention consists in that the patient of pediatric age undergoes the clinical and paraclinical examination, the clinical picture of brain structure affection is established, at the same time 2...3 ml of venous blood is sampled, centrifuged, the blood serum is separated and stored at a constant temperature of  $-20^{\circ}\text{C}$ , the serum concentration of vascular endothelial growth factor, S100B protein and endoglin is determined, if the serum concentration of vascular endothelial growth factor is  $1705.81...716.80\text{ pg/ml}$ , of S100B protein is  $1.024...0.720\text{ pg/ml}$  and of endoglin is  $1.90...2.11\text{ pg/ml}$ , a severe course of neuropsychomotor disorders is predicted; if the serum concentration of vascular endothelial growth factor is  $716.80...450.41\text{ pg/ml}$ , of S100B protein is  $0.720...0.399\text{ pg/ml}$  and of endoglin is  $2.11...2.24\text{ pg/ml}$ , a course of moderate severity of neuropsychomotor disorders is predicted; if the serum concentration of vascular endothelial growth factor is  $450.41...296.23\text{ pg/ml}$ , of S100B protein is  $0.399...0.272\text{ pg/ml}$  and of endoglin is  $2.24...2.29\text{ pg/ml}$ , a course of mild severity of neuropsychomotor disorders is predicted.

**Fields of application:** experimental medicine, neurology and pediatric neurology.

Medium values of markers in acute phase were as follows: (1) S100B –  $0.524 \pm 0.0850\text{ ng/ml}$  ( $F=9.330, p<0.01$ ); (2) VEGF –  $613.41 \pm 39.299\text{ pg/ml}$  ( $F=60.701, p<0.001$ ); (3) Endogline –  $2.06 \pm 0.012\text{ pg/ml}$  ( $F=84.812, p<0.001$ ), which were significantly different from the levels in control sample.

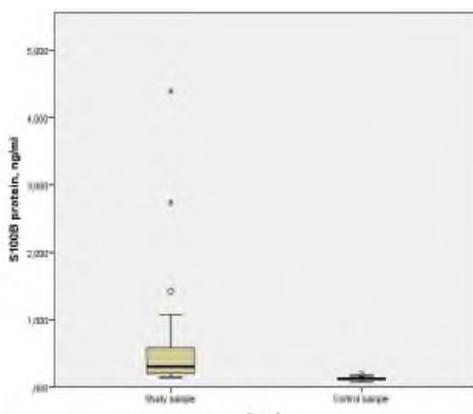


Figure 1. Serum levels of S100B proteins in children with IS compared to the sample of “practically healthy” children, ng/ml.

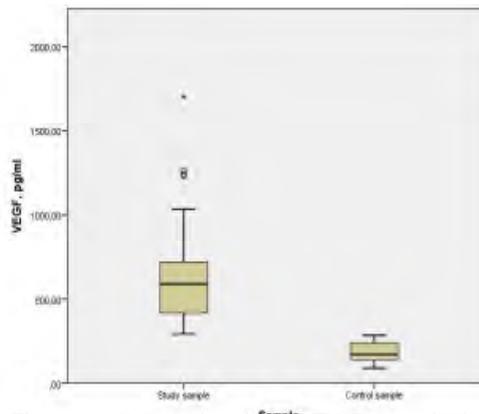


Figure 2. Serum levels of VEGF protein in children with IS compared to the sample of “practically healthy” children, pg/ml.

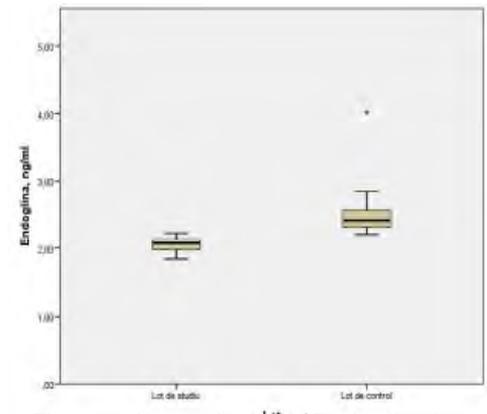


Figure 3. Serum levels of Endogline in children with IS compared to the sample of “practically healthy” children, pg/ml.

**Benefits:** The advantage of the invention consists in the early diagnosis of the degree and size of neuropsychomotor disorders to establish the prognosis of the severity of neuropsychomotor disorders in children with stroke for the administration of early treatment, assessment of the degree of child disability and remote prognosis.

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### Molecular genetic method for detecting Y chromosome microdeletions in male infertility

**Patent: MD 1489 (13) Y**

**AUTHORS: RACOVITĂ Stela, MOȘIN Veaceslav, CAPCELEA Svetlana, BOICIUC Chiril, SPRINCEAN Mariana**

The invention relates to medicine, in particular to molecular genetics and can be used for detecting Y chromosome microdeletions in male infertility. Summary of the invention consists in that the analysis of isolated genomic DNA is performed using the chain polymerization reaction (PCR), with the analysis of sY84 and sY86 (AZFa), sY127 and sY134 (AZFb), sY254 and sY255 (AZFc) and SRY and ZFX/ZFY, sDBY1 and sY620 (AZFa), sY153 and sY158 (AZFc), sY117 and sY143 (AZFb) sequences, amplification of DNA fragments is performed, after which the DNA is separated by electrophoretic method under the action of constant electric current in an 8% polyacrylamide gel in a continuous buffer system, then the gel is stained with a solution of ethidium bromide with a concentration of 0.5 µg/ml, for 5 min, washed for 1 min, and the resulting fragments are photodocumented.

**Fields of application:** medicine, molecular genetics and Assisted Human Reproduction.

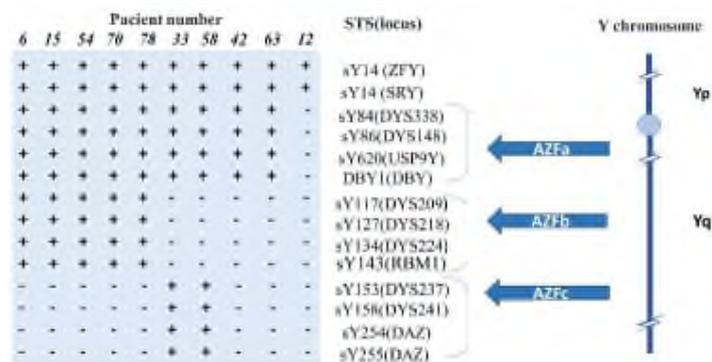


Figure 1. Schematic diagram illustrating different deletion patterns of the STS markers in the patients with deletions.

+:PCR product was present; -:PCR product was not detected

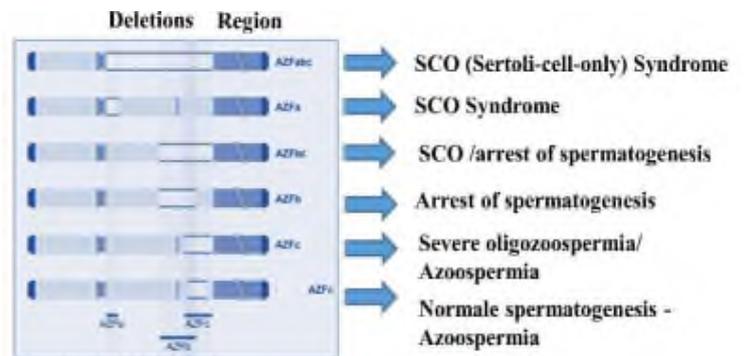


Figure 2. Phenotypic consequences of microdeletions in the AZF region on male fertility

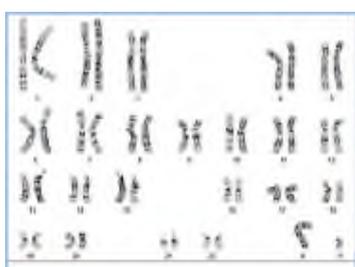


Figure 3. Patient with 46,XY karyotype, AZFc deletions

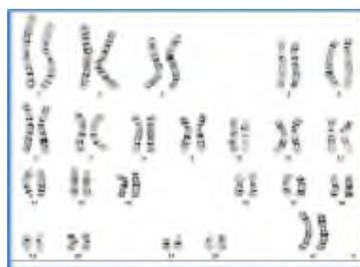


Figure 3. Patient with 46,XX karyotype in male, AZF a, b and c deletions

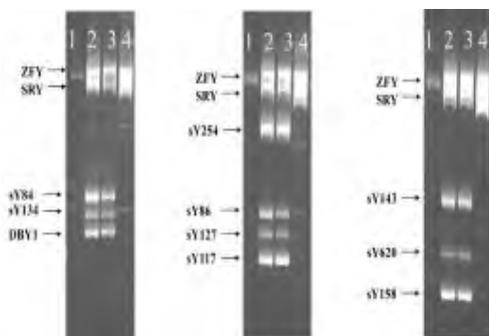


Figure 5: Results of electrophoresis for the detection of Y chromosome microdeletions: 1 – Female DNA; 2,3 – Normal male sample; 4 – patient with large deletion of Y chromosome (a, b, c) and presence of SRY and ZFY gene

**Benefits:** The advantage of the invention consists in development of an effective method for detecting Y chromosome microdeletions, which allows to increase the sensitivity of the multiplex PCR test and a more complex approach, much more accurate in the diagnosis and treatment of patients with male infertility.

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# International Exhibition of Inventions INVENTICA 2021

23.06.2021 – 25.06.2021

NICOLAE TESTEMITANU STATE UNIVERSITY OF MEDICINE  
AND PHARMACY OF THE REPUBLIC OF MOLDOVA



## METHOD OF DIAGNOSIS OF MORPHOLOGICALLY ALTERED GASTRIC PRECANCEROUS CONDITIONS

**Patent application: MD s 2020 0115**

**Inventors:** Botezatu Adriana; Istrate Viorel; Barba Doina; Turcanu Gheorghe;  
Luca Ecaterina; Ursu Catalina; Zlatovcena Alla; Antonova Natalia; Bodrug Nicolae

The invention relates to medicine, especially to gastroenterology and can be used for the diagnosis of morphologically altered gastric precancerous conditions.

**The essence** of the invention consists in determining in the patient's blood serum the quantitative values of pepsinogen I (PG-I), pepsinogen II (PG-II) and the ratio between the quantitative value of pepsinogen I and pepsinogen II, if the quantitative value of PG- I is 64.10 ..... 38.37  $\mu\text{g} / \text{L}$ , and the ratio of PG-I/PG-II is 4.59 ..... 2.55, the presence of a morphologically altered gastric precancerous condition is diagnosed.

**The technical result** of the invention consists in the elaboration of a non-invasive method, which all patients support, with the early diagnosis of this pathology and the indication of an effective treatment in order to prevent the appearance of gastric cancer.

**Tab 1. Mean values of serological markers correlated with the stages of the OLGA system**

**Tab 2. Mean values of serological markers correlated with the stages of the OLGIM system**

Parameter	The stages of the OLGA system				p
	I	II	III	IV	
PG-I ( $\mu\text{g/L}$ )	81,30 $\pm$ 3,9	67,56 $\pm$ 3,2	44,58 $\pm$ 2,2	46,36 $\pm$ 11,4	1-2** 1-3*** 1-4** 2-3*** 2-4**
PG-II ( $\mu\text{g/L}$ )	13,67 $\pm$ 0,9	14,99 $\pm$ 0,5	14,39 $\pm$ 0,6	17,29 $\pm$ 3,5	
PGR	6,48 $\pm$ 0,5	4,77 $\pm$ 0,3	3,41 $\pm$ 0,3	2,59 $\pm$ 0,3	1-2** 1-3*** 1-4*** 2-3*** 2-4***
NO in the blood serum ( $\mu\text{M/L}$ )	63,99 $\pm$ 1,7	65,28 $\pm$ 1,3	73,84 $\pm$ 1,7	80,66 $\pm$ 3,3	1-3** 1-4*** 2-3*** 2-4***
NO in gastric juice ( $\mu\text{M/g.prot}$ )	32,13 $\pm$ 1,4	34,50 $\pm$ 1,3	38,51 $\pm$ 1,2	43,38 $\pm$ 2,7	1-3** 1-4**

Parameter	The stages of the OLGIM system					p
	0	I	II	III	IV	
PG-I ( $\mu\text{g/L}$ )	72,54 $\pm$ 3,4	59,5 6 $\pm$ 3, 2	51,28 $\pm$ 7	32,80 $\pm$ 2,2	38,60 $\pm$ 3,4	0-1** 0-2*** 0-3*** 1-3*** 2-3**
PGR	5,74 $\pm$ 0,4	4,23 $\pm$ 0,3	3,47 $\pm$ 0,3	2,29 $\pm$ 0,1	2,73 $\pm$ 0,2	0-1** 0-2*** 0-3*** 0-4** 1-2** 1-3*** 2-3**
NO in the blood serum ( $\mu\text{M/L}$ )	59,53 $\pm$ 0,8	70,6 0 $\pm$ 1, 8	76,12 $\pm$ 5	85,55 $\pm$ 3,2	73,68 $\pm$ 6,8	0-1*** 0-2*** 0-3*** 1-3**
NO in gastric juice ( $\mu\text{M/g.prot}$ )	29,80 $\pm$ 1,1	38,0 7 $\pm$ 1, 5	40,39 $\pm$ 0	44,71 $\pm$ 1,7	38,65 $\pm$ 4,9	0-1*** 0-2*** 0-3***

Note: statistically significant differences: \* -  $p < 0.05$ , \*\* -  $p < 0.01$ , \*\*\* -  $p < 0.001$



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### PROCESS FOR RETICULATION OF DECELLULARIZED LIVER MATRIX

**Patent MD 1393**

**Inventatori:** Cobzac Vitalie, Nacu Viorel, Jian Mariana

Invenția se referă la medicina regenerativă și ingineria tisulară, și poate fi utilizată pentru reticularea matricei hepatice decelularizate pentru creșterea rezistenței transplantului la factorii agresivi interni ai organismului recipient.

Esența invenției constă în aceea că matricea hepatică decelularizată se spală de urmele de detergenți prin perfuzie cu apă distilată și/sau soluție tampon fosfat salin prin vena portă. Apoi, peste 1 oră se începe perfuzia continuă cu soluție apoasă sau alcoolică de riboflavină cu concentrația de 0,2...0,25 mM, în volum de 10 ml la 100 mg de matrice hepatică decelularizată, cu viteza de 1...5 ml/min, sub acțiunea razelor ultraviolete de tip A, cu lungimea de undă de 365 nm. Perfuzia și reperfuzia continuă până la decolorarea soluției de riboflavină, iar matricea hepatică decelularizată reticulată mai apoi se spală cu apă distilată și se păstrează la temperatura de 4°C.

**Domeniul aplicării:**

Medicină regenerativă, Inginerie tisulară și Transplantologie.

The invention relates to regenerative medicine and tissue engineering, and can be used for cross-linking of decellularized liver matrix to increase resistance of the transplant to the internal aggressive factors of the recipient.

The essence of the invention is that the decellularized liver matrix is washed by perfusion with distilled water and/or saline buffer phosphate solution through the portal vein, to remove remnants of detergents. Then, after 1 hour starts a continuous perfusion of the matrix with aqueous or alcoholic riboflavin solution with a concentration of 0.2 ... 0.25 mM, in a volume of 10 ml to 100 mg of decellularized liver matrix, at a speed of 1...5 ml/min, under the action of type A ultraviolet rays, with the wavelength of 365 nm, and the perfusion and reperfusion are prolonged until the discoloration of the riboflavin solution. Then, the cross-linked decellularized liver matrix is washed with distilled water and kept at 4°C.

**Domains of application:**

Regenerative Medicine, Tissue Engineering and Transplantology.

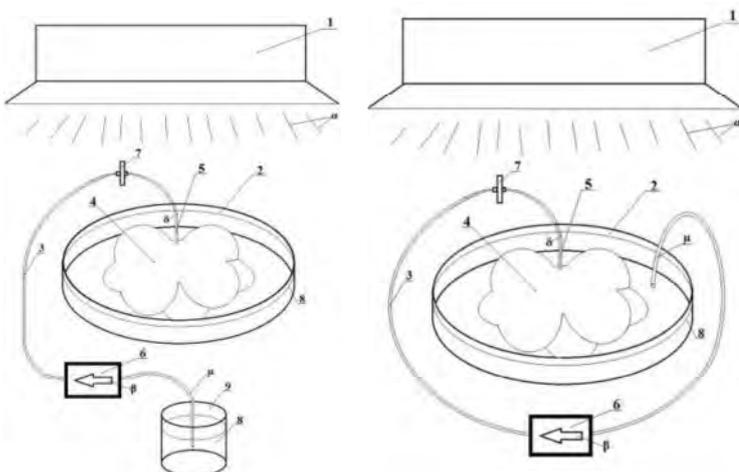


Figura 1. Perfuzia și reperfuzia matricei hepatice decelularizate cu riboflavină sub acțiunea razelor UV-A.

The process of cross-linking of the decellularized liver matrix (4) with riboflavin (8) and UV-A rays ( $\alpha$ ) consists of continuous perfusion of the decellularized matrix (4) with a riboflavin solution (8) through a tube (3) attached to a 0,22 $\mu$  filter (7) with a peristaltic pump (6). After depletion of the riboflavin solution from the vessel (9) The tube ent which is afferent to the peristaltic pump ( $\mu$ ) is inserted into the vessel with the decellularized matrix (2) for recycling of riboflavin solution (8), which lasts until the riboflavin solution is discolored.



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## NEW DEVICES FOR DISSECTION OF TISSUE GRAFTS

Patent no. 1501 (13) Y, 1502 (13) Y

**Inventatori:** MACAGONOVA Olga, NACU Viorel, COCIUG Adrian, IGNATOV Olga

### New devices for dissection of tissue grafts

### Noi dispozitive pentru disecția grefelor de țesut

invențiile brevetate în cadrul Proiectului din cadrul Programului de Stat: “Nanoarhitecturi în bază de GaN și matrici tridimensionale din materiale biologice pentru aplicații în microfluidică și inginerie tisulară”

Invențiile se referă la echipamente medicale, în special la dispozitive pentru disecția circulară și lamelară a grefelor de țesut și pot fi utilizate în medicina regenerativă. Prima invenție constă în aceea că dispozitivul cuprinde o suprafață de lucru, pe care este așezat un suport cilindric cu o gaură coaxială cu filet interior; două brațe, conectate pivotant la un capăt cu un șurub. Fiecare braț este format din două tije, de asemenea conectate pivotant cu un șurub. La capetele unite ale brațelor este fixat un mâner cilindric cu suprafața zimțată. Capătul opus al primului braț este prevăzut cu filet exterior pentru fixarea acestuia în orificiul suportului cilindric, iar la capătul opus al celui de-al doilea braț este pus pe un cilindru gol și este realizat o canelură, în care este plasat un dispozitiv detașabil lama ascuțită, cu posibilitatea fixării acesteia cu cilindrul gol la deplasarea sa în direcția distală. Toate elementele dispozitivului sunt fabricate din oțel inoxidabil. A doua invenție constă în aceea că dispozitivul cuprinde o placă de lucru pătrată, pe o margine a căreia este sudată o riglă cu diviziuni. Pe placa de lucru, cu posibilitatea de alunecare, este plasat un mecanism de disecție, care conține două plăci dreptunghiulare cu o secțiune în formă de U, în fiecare dintre care este realizată o canelură longitudinală, în care este plasată o lamă dreptunghiulară. La o distanță de 4 cm de fiecare față de capăt a plăcilor dreptunghiulare este realizată perpendicular o gaură de trecere, în care sunt introduse două tije cilindrice, cu posibilitatea de a aluneca pe acestea plăci dreptunghiulare. Perpendicular la fiecare orificiu de trecere este realizată o gaură cu filet interior, în care sunt așezate șuruburi pentru atașarea plăcilor dreptunghiulare la tije cilindrice, iar în mijlocul tijelor cilindrice este fixat un mâner, în același timp toate elementele dispozitivului sunt realizate din oțel inoxidabil.

**Domenii de aplicare::** medicina regenerativa, ingineria tesuturilor, oftalmologie, chirurgie

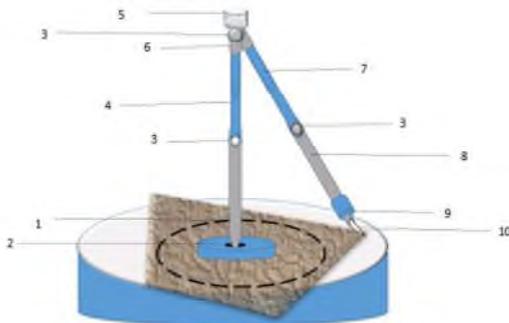


Figura 1.

patented inventions within the Project within the State Program: “GaN-based nano-architectures and three-dimensional matrices of biological materials for applications in microfluidics and tissue engineering

The inventions relates to medical equipment, in particular to devices for circular and lamellar dissection of tissue grafts, and can be used in regenerative medicine. The first invention consists in that the device comprises a working surface, on which is placed a cylindrical support with a coaxial hole with internal thread; two arms, pivotally connected at one end with a screw. Each arm consists of two rods, also pivotally connected with a screw. At the joined ends of the arms is fixed a cylindrical handle with serrated surface. The opposite end of the first arm is provided with external thread for its fixation in the hole of the cylindrical support, and on the opposite end of the second arm is put on a hollow cylinder and is made a groove, in which is placed a removable sharp blade, with the possibility of its fixation with the hollow cylinder upon its displacement in the distal direction. All elements of the device are made of stainless steel. The second invention consists in that the device comprises a square working plate, on one edge of which is welded a ruler with divisions. On the working plate, with the possibility of sliding, is placed a dissection mechanism, which contains two rectangular plates with a U-shaped section, in each of which is made a longitudinal groove, in which is placed a rectangular blade. At a distance of 4 cm from each end face of the rectangular plates is perpendicularly made a through hole, in which are inserted two cylindrical rods, with the possibility of sliding thereon of rectangular plates. Perpendicular to each through hole is made a hole with internal thread, in which are placed screws for attaching rectangular plates to cylindrical rods, and in the middle of the cylindrical rods is fixed a handle, at the same time all elements of the device are made of stainless steel.

### Applications:

regenerative medicine, tissue engineering, ophthalmology, surgery

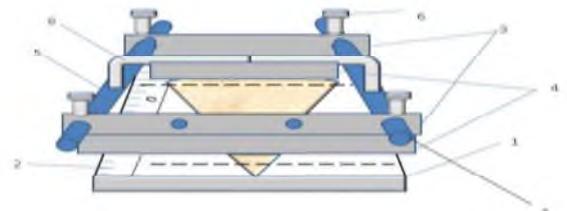


Figura 2.



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INSTITUTE OF EMERGENCY MEDICINE, Republic of Moldova

### DENTAL PERSONALIZED DEVICE CAD/CAM FOR DECOMPRESSION

**Patent MD -DMI -1915**

**Inventatori: STRÎȘCA S., SÎRBU D., CUCU G., TOPALO V.**

Personalized CAD/CAM decompression device in the treatment of giant maxillary cysts, located in the upper jaw in the lateral region, refers to medicine, in particular, medical devices and can be used in stomatology as a special medical device for decompression in treatment of giant maxillary cysts, located in the upper jaw in the lateral region (provided the relative preservation of its own shape).

The advantage of that technology consist in the possibility of individualizing the treatment and making the devices that adapt to the operating site with a high precision, the intervention acquiring a mini-invasive aspect.

DISPOZITIV CAD/CAM INDIVIDUAL DE DECOMPRESIE ALE CHISTURILOR GIGANTE LOCALIZATE LA NIVELUL MAXILARUL SUPERIOR ÎN REGIUNEA LATERALĂ

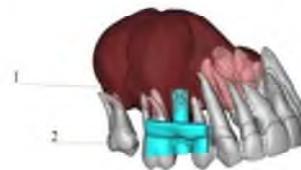


VEDEREA GENERALĂ A DISPOZITIVULUI

EXPLICATI ÎN DETALII

1. TUBUL DE DECOMPRESIE 2. CROȘETE DE ANCORARE A DISPOZITIVULUI

PLANIFICAREA CHIRURGICALĂ VIRTUALĂ



EXPLICATI ÎN DETALII

1. CHIST GIGANT  
2. DISPOZITIV DE DECOMPRESIE

ASPECTUL DISPOZITIVULUI ÎN CAVITATEA BUCALĂ





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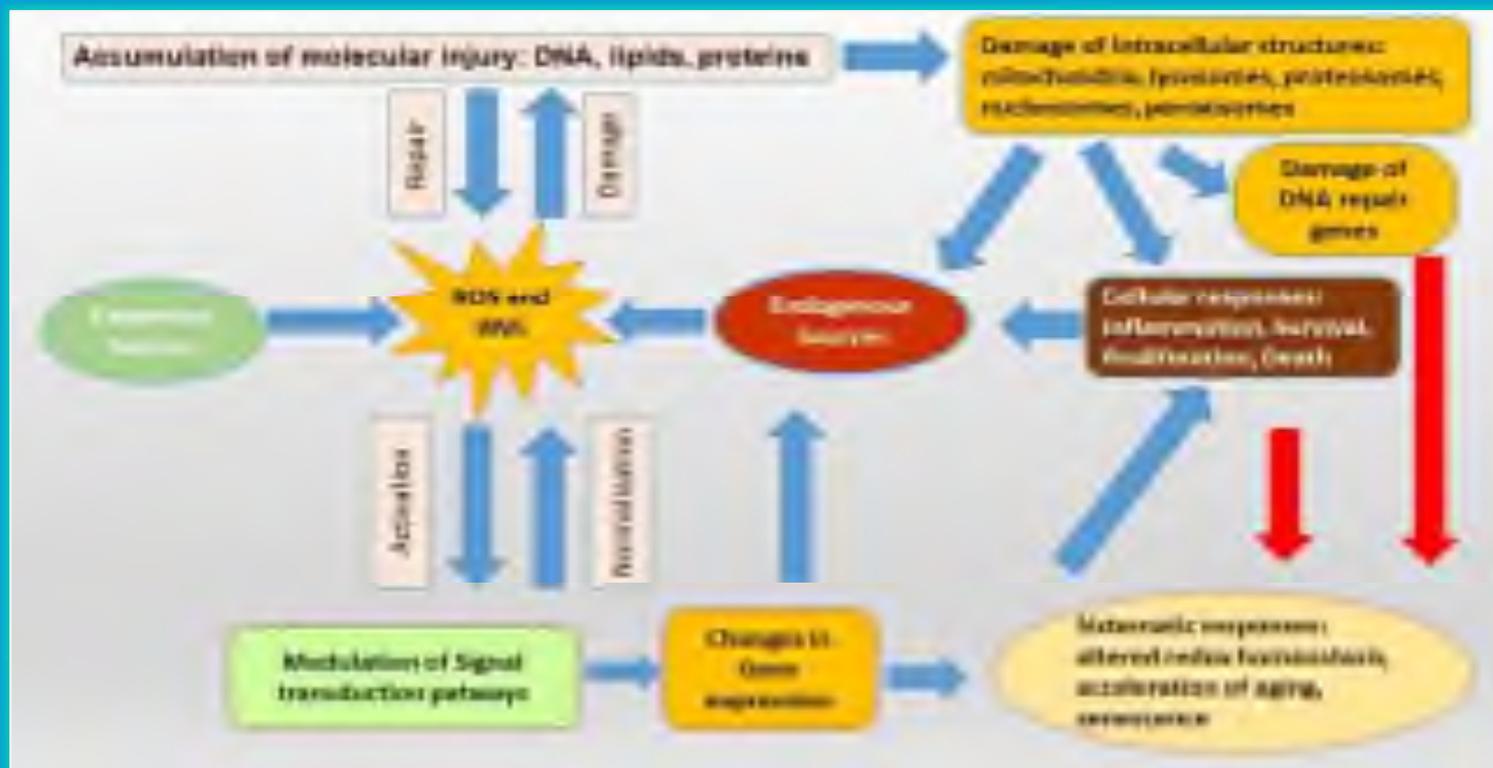
Use of bis( $\mu_2$ -acetato-O)-bis{[N-prop-2-en-1-yl-N'-(pyridin-2-ylmethylidene)carbamohydrazonothioato]copper} dihydrate as an inhibitor of superoxide radical

### Patent MD 4741

**Inventatori:** Gudumac Valentin, Gulea Aurelian, Țapcov Victor, Pantea Valeriana, Graur Vasilii, Andronache Lilia

The invention relates to medicine, namely to the use of a biologically active copper coordination compound from the class of transition metal thiosemicarbazidates. This compound can be used in medicine as a drug which, by inhibiting superoxide radicals in the body, prevents the development of cellular and tissue lesions, atherosclerosis and carcinogenesis.

The said compound expands the arsenal of synthetic inhibitors of superoxide radicals with high biological activity.



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***Moldova State University***

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**MOLDOVA STATE UNIVERSITY**

Research and Innovation Institute  
 Scientific Research Laboratory

**Advanced Materials in Biopharmaceutical and Technical**

Alexei Mateevici str., 60, Chisinau, MD-2009, Republic of Moldova  
 Tel.: +373 69434910; E-mail: roman.rusnac@usm.md



**NITRATE BIS{[(CYCLOHEXYLAMINE)PHENYL(PYRIDIN-2-YL)METILIDENHIDRAZONO]METANSULFINATO-N,N',S} IRON (III), WITH ANTIMICROBIAL ACTIVITY AGAINST *BACILLUS CEREUS***

**REQUEST FOR PATENT: MD a 2021 0015/2021.03.29**

**AUTHORS: Aurelian GULEA, Roman RUSNAC, Victor TSAPKOV, Greta BALAN**

**APPLICATION FIELDS: Medicine and Pharmaceutics.**

**AIM: The present invention consists in obtaining a novel coordination compound which possesses high bacteriostatic and bactericidal activity compared to *Bacillus cereus*.**

**SOLUTION: For the first time as an inhibitor of the growth and multiplication of bacteria of the species *Bacillus cereus*, a coordination compound of iron (III) is proposed with a new type of ligands of the hydrazonomethanesulfinate class, which contains a new combination of already known chemical bonds that manifest activity antimicrobial against *Bacillus cereus* bacteria, and which exceeds 156 times the analogous characteristics of furacillin.**

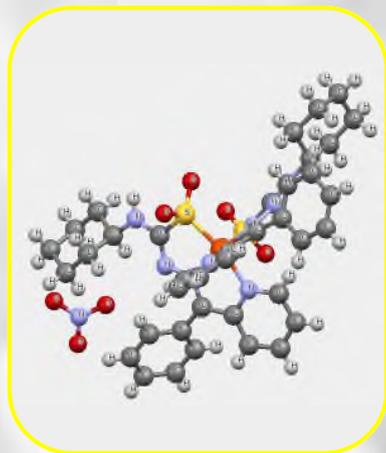


Figure. Crystalline structure of nitrate bis{[(cyclohexylamine)phenyl(pyridin-2-yl)metilidenhidrazono]metansulfinato-N,N',S}iron(III)

**Table**  
 The bacteriostatic and bactericidal activity  
 Minimum inhibition concentration (MIC) and minimum bactericidal concentration (CBM) of the declared compound against *Bacillus cereus* bacteria compared to the prototype, (µg/mL)

Compound	MIC	MBC
Initial compounds <sup>a)</sup>	> 10 000,0	> 10 000,0
Nitrofurazone	4,68	4,68
NITRATE BIS{[(CYCLOHEXYLAMINE)PHENYL(PYRIDIN-2-YL)METILIDENHIDRAZONO]METANSULFINATO-N,N',S} IRON (III)	0,03	0,03

\* Note: a) Initial compounds - Fe (NO<sub>3</sub>)<sub>3</sub>·6H<sub>2</sub>O and N-cyclohexyl-N'-[phenyl(pyridin-2-yl)methylidene]carbamohydrazon othioamide.

**ADVANTAGES: The compounds exhibit antimicrobial activity against *Bacillus cereus*, they can be used in medicine and veterinary medicine for the prevention and treatment of disease causing microbes.**

**IMPLEMENTATION STAGE: Prototype.**

**ACKNOWLEDGMENTS: This research was supported by the project # 20.80009.5007.10 of the Ministry of Education, Culture and Research of the Republic of Moldova.**

International Exhibition of Inventions INVENTICA 2021, 23.06.2021 – 25.06.2021

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Research and Innovation Institute  
Scientific Research Laboratory*Organic/Inorganic Materials for Optoelectronics*

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## PHOTOSENSITIVE MATERIAL MADE OF CARBAZOLE CONTAINING POLYMERS

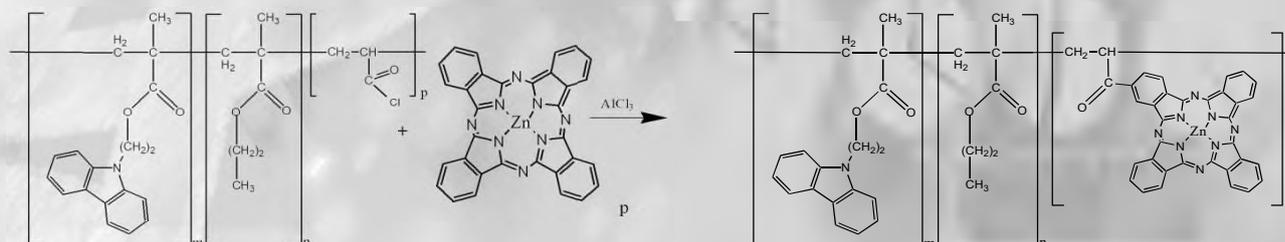
PATENT APPLICATION: MD a 2020 0084/2020.12.02

AUTHORS: Ion LUNGU , Pavel TIULEANU , Tamara POTLOG , Stefan ROBU

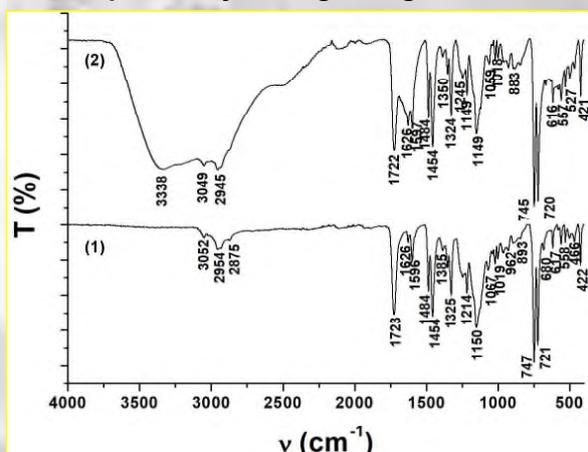
APPLICATION FIELD: Photosensitive materials – photovoltage.

**AIM:** The development of new photosensitive materials from carbazole-containing polymers and zinc phthalocyanines, which can be successfully used for the development of electrophotographic recording media, as well as for photovoltaics, due to their well known photosensitive properties.

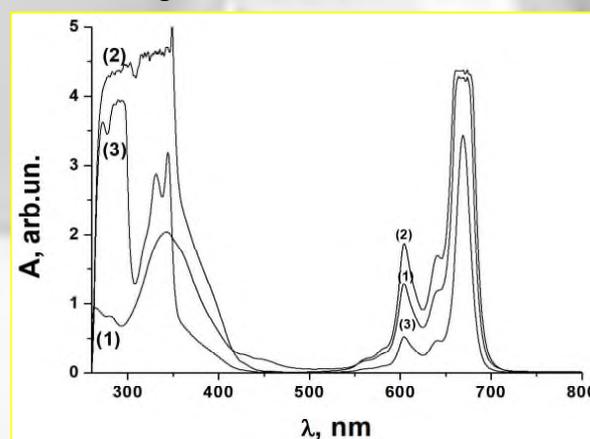
**SOLUTION:** Synthesis of zinc phthalocyanine copolymer consist of treatment of ZnPc with copolymer N-VC:OC-1:CI-AC at 0-5°C by using the Friedel-Kravts reaction, obtaining copolymers of zinc acryloyl phthalocyanine with octylmetacrilate and N-vinylcarbazole. Obtained solution is cleaned by precipitation, evaporated, then settles in methanol. The polymer-analog is dried in a vacuum desiccator, then used for further researches.



Zinc phthalocyanine grafting to N-VC : OC-1 : CI-AC according to Friedel-Crafts reaction.



IR spectra for N-VC copolymer: OC-1: CI-AC (1) and of this copolymer grafted with 10 mol% zinc phthalocyanine (2)



UV-Vis spectra for zinc phthalocyanine layers (1), 0.5% (2) and 0.02% (3) copolymer solution

**ADVANTAGES:** Ensure real photosensitivity in the visible range of the spectrum and near infrared, as well as a better solubility in organic solvents such as chloroform, chlorobenzene and tetrahydrofuran and the possibility to obtain thin layers with a thickness of 0.5 - 3 μm.

**IMPLEMENTATION STAGE:** Patent application.

International Exhibition of Inventions **INVENTICA 2021, 23.06.2021 – 25.06.2021**



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## PHOTOSENSITIZERS FOR PHOTODYNAMIC THERAPY AND PHOTOVOLTAICS

RESEARCH PROJECT: # 20.80009.5007.16

**AUTHORS:** Tamara POTLOG, Ștefan ROBU, Ion LUNGU, Pavel TIULEANU, Vadim FURTUNA, Ana POPUSOI, Galina DRAGALINA, Petru BULMAGA, Nelea POPA, Ion BULIMESTRU, Ion GUTU, Dumitru RUSNAC, Gleb COLIBABA

**APPLICATION FIELD:** Medicine – pharmacy – cosmetics; Energy and unconventional energy sources.

**AIM:** Photodynamic therapy (PDT) is a noninvasive treatment in medicine that utilizes photosensitizers (PSs) to produce highly cytotoxic reactive oxygen species (ROS) (e.g.,  $\cdot\text{O}_2$ ,  $\text{H}_2\text{O}_2$ ,  $\cdot\text{OH}$ ) to kill cancer cells. Dye photosensitizer is also key to photovoltaics. It requires not only a wide range of absorption of sunlight, combined with good absorption properties of materials, but also suitable oxidation–reduction potential, long lifetime of excited states, good photoluminescence, stability, ease of synthesis, and low cost. Tetrapyrrole structures such as porphyrins, chlorins, bacteriochlorin's and phthalocyanines with appropriate functionalization have proved its properties as PSs for PDT and transporting materials in solar cells. Therefore, the development of a new photosensitizers based on self-assembly of functionalized metallphthalocyanines (MePc) with amino acids or conjugation to antibodies, peptides, proteins and other ligands with specific cellular receptors highly soluble in non-toxic water/organic solvents, absorption in the (700-800) nm spectral region and long lifetime of excited states is the aim of this project.

### SOLUTION:

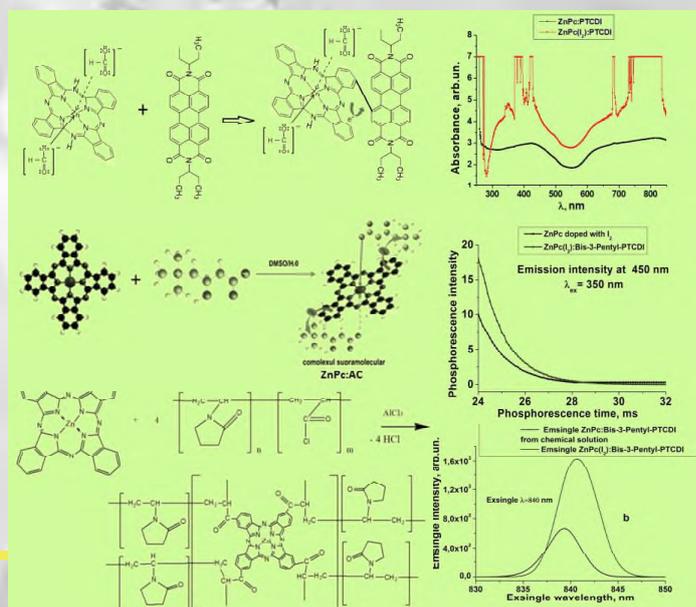
#### PHOTODYNAMIC THERAPY

PDT is a highly multidisciplinary field that involves chemists, physicists, biologists, engineers and physicians. Chemists, of course, are constantly seeking to design, synthesize, purify and characterize new compounds that can be used as PSs. Many significant advances have been made in PSs design during the last 20 years, and second-, third- and even fourth-generation PSs have been described. Main NOVELTY of the project is development of PSs based on self-assembled of Zinc Phthalocyanine (ZnPc) and Bis-3-Pentyl - PTCDI derivative, ZnPc formulation with (3R)-3-hydroxy-4-(trimethylamino) butanoic acid and grafted ZnPc to binary copolymers N-vinylpyrrolidone (N-VP) with acryloyl chloride (Cl-AC)

#### PHOTOVOLTAICS

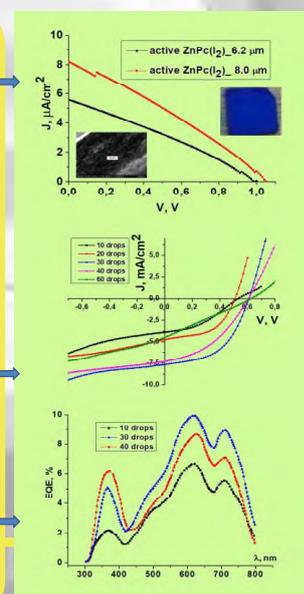
Recently, application of organic semiconductors in photovoltaic devices has acquired new impetus due to the growing interest in solar energy conversion. Organic semiconductors offer low material and fabrication costs with high power conversion efficiency that can possibly outcast existing inorganic solar-cell technologies. Metallphthalocyanines (MePcs) possess planarity, symmetry and electron delocalization that make them a perfect choice to be employed in solar cells. Another main NOVELTY of the project is the synthesis of ITO/PEDOT:PSS/ZnPc:12/Al Schottky diode devices with open circuit voltage 1.03 V and bulk ZnPc:Bis-3-Pentyl-PTCDI heterojunction solar cells with efficiency of about 2.4%.

### RESULTS OF KNOWLEDGE TRANSFER



#### ADVANTAGES:

- ❖ Absorbance band in the (700-800 nm).
- ❖ The higher values of the open circuit voltage (1.03 V) and the current density (8.2  $\mu\text{A}/\text{cm}^2$ ) than in the case of Schottky diode devices obtained by thermal vacuum evaporation were reached.
- ❖ The phosphorescence lifetime values of the ZnPc and ZnPc:Bis-3-Pentyl-PTCDI system were found to be 2.4 ms and 1.1 ms, respectively.
- ❖ The best bulk ZnPc: PCDDI photovoltaic device reached an efficiency of about 2.4%
- ❖ The singlet oxygen generation abilities of PSs at 840 nm.
- ❖ External quantum efficiency is situated between 300 nm and 800 nm wavelengths.



**IMPLEMENTATION STAGE:** Pilot production.

**ACKNOWLEDGMENTS:** This research was supported by the project # 20.80009.5007.16



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**MOLDOVA STATE UNIVERSITY**  
**Research and Innovation Institute**  
**Scientific Research Laboratory**



**Artificial Intelligence and Virtual & Augmented Reality**

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**TABLE OF DISTANCES BETWEEN DIAGNOSES  
 MENTAL AND BEHAVIORAL DISORDERS IN EPILEPSY**

**PATENT APPLICATION: Seria Operă Nr. 6807/01.02.2021**

**AUTHORS: Gheorghe CĂPĂȚĂNĂ, Alexandru POPOV, Mariana BUTNARU**

**APPLICATION FIELDS: Informatics and hardware.**

**AIM: Assessing the distances between mental and behavioral disorders in epilepsy (MBDE) using metric spaces developed for this purpose.**

**SOLUTION: Assessing the distances between mental and behavioral disorders in epilepsy (MBDE) using metric spaces developed for this purpose.**

	F05.12	F02.82x2	F07.82	F07.92	F7x1	F06.52	F05.92	F07.02	F06.42	F06.91	F06.81	F06.62	F05.02	F06.12	F06.31	F05.82	F06.92	F06.30	F06.99	F06.32	F06.22	F06.34	F06.82	F06.72	F06.33	F04.2	F06.02	G40
F05.12	0.0	18.8	35.7	40.6	40.2	40.1	36.2	39.5	38.6	35.9	33.4	44.5	40.3	37.3	41.8	41.1	48.8	40.3	53.7	57.6	46.9	63.5	65.2	63.7	66.9	73.4	71.1	100
F02.82x2	18.8	0.0	25.2	31.8	32.4	33.3	35.2	35.8	35.8	36.9	37.4	38.6	39.5	40.1	40.1	40.3	41.0	43.6	45.9	50.3	50.5	54.5	56.4	57.3	58.5	66.8	69.1	94.5
F07.82	35.7	25.2	0.0	9.6	14.6	18.6	24.8	18.2	22.7	25.0	28.9	18.0	31.7	40.4	27.8	32.0	18.6	38.3	25.8	29.9	40.1	34.5	35.1	35.5	37.3	48.7	49.8	77.1
F07.92	40.6	31.8	9.6	0.0	12.2	19.9	26.9	16.0	22.3	24.8	30.0	15.3	35.2	42.2	27.9	35.9	16.4	39.3	22.7	26.7	38.9	31.6	32.0	32.3	33.7	47.0	45.5	76.2
F7x1	40.2	32.4	14.6	12.2	0.0	19.7	28.3	18.6	21.4	25.2	27.9	17.2	36.5	40.1	26.5	36.8	19.7	36.2	22.3	26.3	36.8	29.1	33.7	31.0	33.8	50.1	45.7	75.8
F06.52	40.1	33.3	18.6	19.9	19.7	0.0	18.4	19.2	11.3	17.8	22.4	12.2	25.1	35.1	20.3	23.8	15.0	31.7	18.2	27.0	35.3	31.4	29.5	28.5	29.9	41.2	40.5	65.9
F05.92	36.2	35.2	24.8	26.9	28.3	18.4	0.0	20.9	19.2	13.3	16.6	21.4	15.3	34.9	24.4	14.6	22.6	32.6	29.5	38.6	33.0	44.6	39.7	36.4	41.2	42.1	42.9	67.9
F07.02	39.6	35.8	18.2	16.0	18.6	19.2	20.9	0.0	17.2	15.3	21.4	14.8	28.5	38.0	25.8	28.9	16.8	32.8	20.4	29.7	31.5	33.8	32.0	32.7	33.7	46.1	44.0	74.4
F06.42	38.6	35.8	22.7	22.3	21.4	11.3	19.2	17.2	0.0	12.2	17.0	14.3	26.5	32.6	16.4	25.2	19.2	27.4	20.1	27.0	29.6	33.1	30.7	29.0	31.3	43.7	38.7	67.1
F06.91	35.9	36.9	25.0	24.8	25.2	17.8	13.3	15.3	12.2	0.0	10.0	18.4	21.3	32.5	19.7	21.1	22.1	26.7	26.1	33.2	27.5	39.6	36.9	33.7	37.9	44.1	40.3	70.2
F06.81	33.4	37.4	28.9	30.0	27.9	22.4	16.6	21.4	17.0	10.0	0.0	23.2	24.4	31.1	21.8	23.0	28.3	25.1	31.7	36.5	24.8	43.4	42.6	37.8	43.3	51.0	42.1	73.0
F06.62	44.5	38.6	18.0	15.3	17.2	12.2	21.4	14.8	14.3	18.4	23.2	0.0	29.6	39.0	22.4	28.5	9.6	34.6	14.6	21.6	32.9	27.4	25.0	23.5	25.9	40.8	34.4	65.5
F05.02	40.4	39.5	31.7	35.2	36.5	25.1	15.3	28.5	26.5	21.3	24.4	29.6	0.0	38.8	32.7	8.0	29.0	38.8	35.3	46.5	41.6	50.9	44.7	40.3	46.6	39.5	50.3	67.8
F06.12	37.3	40.1	40.4	42.2	40.1	35.1	34.9	38.0	32.6	32.5	31.1	39.0	38.8	0.0	28.2	38.2	43.2	20.9	44.6	50.0	26.9	55.0	54.7	52.6	55.0	63.0	58.0	84.5
F06.31	41.8	40.1	27.8	27.9	26.5	20.3	24.4	25.8	16.4	19.7	21.8	22.4	32.7	28.2	0.0	31.3	26.3	19.9	28.0	28.3	24.1	36.0	35.6	31.8	35.7	46.7	39.1	67.0
F05.82	41.1	40.3	32.0	35.9	36.8	23.8	14.6	28.9	25.2	21.1	23.0	28.5	8.0	38.2	31.3	0.0	28.4	36.9	34.6	44.9	39.3	49.4	43.0	39.2	45.0	41.2	47.4	65.1
F06.92	48.8	41.0	18.6	16.4	19.7	15.0	22.6	16.8	19.2	22.1	28.3	9.6	29.0	43.2	26.3	28.4	0.0	39.3	12.2	22.4	37.8	25.9	20.8	21.1	22.6	34.7	35.9	61.8
F06.30	40.3	43.6	38.3	39.3	36.2	31.7	32.6	32.8	27.4	26.7	25.1	34.6	38.8	20.9	19.9	36.9	39.3	0.0	40.1	41.6	20.3	46.8	49.4	45.7	49.1	60.9	50.6	78.7
F06.99	53.7	45.9	25.8	22.7	22.3	18.2	29.5	20.4	20.1	26.1	31.7	14.6	35.3	44.6	28.0	34.6	12.2	40.1	0.0	19.9	38.6	19.9	15.5	20.6	15.3	37.2	36.6	61.0
F06.32	57.6	50.3	29.9	26.7	26.3	27.0	38.6	29.7	27.0	33.2	36.5	21.6	46.5	50.0	28.3	44.9	22.4	41.6	19.9	0.0	40.3	13.6	20.3	21.9	19.7	45.8	34.0	62.9
F06.22	46.9	50.5	40.1	38.9	36.8	35.3	33.0	31.5	29.6	27.5	24.8	32.9	41.6	26.9	24.1	39.3	37.8	20.3	38.6	40.3	0.0	47.1	46.5	43.1	46.5	60.1	43.4	76.6
F06.34	63.5	54.5	34.5	31.6	29.1	31.4	44.6	33.8	33.1	39.6	43.4	27.4	50.9	55.0	36.0	49.4	25.9	46.8	19.9	13.6	47.1	0.0	19.2	24.4	17.0	47.4	40.1	63.6
F06.82	65.2	56.4	35.1	32.0	33.7	29.5	39.7	32.0	30.7	36.9	42.6	25.0	44.7	54.7	35.6	43.0	20.8	49.4	15.5	20.3	46.5	19.2	0.0	20.3	7.0	35.2	34.4	53.9
F06.72	63.7	57.3	35.5	32.3	31.0	28.5	36.4	32.7	29.0	33.7	37.8	23.5	40.3	52.6	31.8	39.2	21.1	45.7	20.6	21.9	43.1	24.4	20.3	0.0	19.0	32.0	27.0	48.4
F06.33	66.9	58.5	37.3	33.7	33.8	29.9	41.2	33.7	31.3	37.9	43.3	25.9	46.6	55.0	35.7	45.0	22.6	49.1	15.3	19.7	46.5	17.0	7.0	19.0	0.0	36.1	33.0	53.2
F04.2	73.4	66.8	48.7	47.0	50.1	41.2	42.1	46.1	43.7	44.1	51.0	40.8	39.5	63.0	46.7	41.2	34.7	60.9	37.2	45.8	60.1	47.4	35.2	32.0	36.1	0.0	42.4	45.3
F06.02	71.1	69.1	49.8	45.5	45.7	40.5	42.9	44.0	38.7	40.3	42.1	34.4	50.3	58.0	39.1	47.4	35.9	50.6	36.6	34.0	43.4	40.1	34.4	27.0	33.0	42.4	0.0	48.8
G40	100	94.5	77.1	76.2	75.8	65.9	67.9	74.4	67.1	70.2	73.0	65.5	67.8	84.5	67.0	65.1	61.8	78.7	61.0	62.9	76.6	63.6	53.9	48.4	53.2	45.3	48.8	0.0

**ADVANTAGES: Propose metric spaces and evaluate the distances between MBDE (premiere).**

**IMPLEMENTATION STAGE: Used in: medical practice at the Medical Sanitary Institution, the Public Clinical Hospital of Psychiatry; medical practice at the Republican Clinical Center "Constructorul"; development of intelligent support systems for the TPCE; training of doctoral students.**

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## DEVICES WITH INDIUM PHOSPHIDE p-n JUNCTIONS

**PATENT:** MD 4686/2020.03.31, MD 4554 B1/2018.02.28, MD 4510/2017.08.31

**AUTHORS:** Vasile BOTNARIUC, Leonid GORCEAC, Boris CINIC, Sergiu VATAVU, Andrei COVAL, Simion RAEVSCHI, Petru Ion KETRUSH, Serghei MOLDOVANU

**APPLICATION FIELDS:** Energy and sustainable development.

**AIM:** Devices with Indium Phosphide (InP) junctions with an optimum antireflective layer.

**SOLUTION:** • Preparation of the junction of nCdS-pInP and n-pInP typ with a perfect intermediary layer and a SiO<sub>2</sub> antireflective layer by using HVPE (InP), quasi-closed volume in H<sub>2</sub> (CdS), thermal evaporation in vacuum (Ohmic contacts), electron beam evaporation, 300 K (SiO<sub>2</sub>);

- Assembling of photovoltaic module (PVM) by using a mixt commutation of elements;
- Junctions and PVM with SiO<sub>2</sub> testing for detection of the optical signals and as current sources.

### RESULTS:

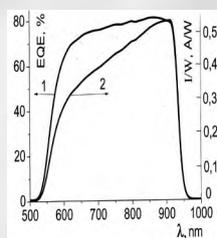


Fig.1. 1 – EQE=f(λ); 2 – I/W=f(λ)

#### 1. Photo-detector (PD, SiO<sub>2</sub>):

Maximum external quantum (EQE) of 80%, λ=650-900 nm (Fig.1, curve1);  
 Maximum absolute photosensitivity (I/W) of 0,51 A/W, λ=900 nm (Fig.1, curve 2).

#### 2. Photovoltaic cell (PVC):

Efficiency(η) – 12% (AM1),  
 S<sub>ef</sub>=3 cm<sup>2</sup> with SiO<sub>2</sub> (Fig.2, curve 1);  
 η=10,74% – without SiO<sub>2</sub> (Fig.2, curve2);  
 Short circuit current increase when an antireflective SiO<sub>2</sub> layer is used ΔI=15%.

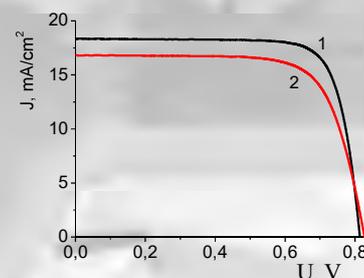


Fig.2. Load dependence :  
 1 – with SiO<sub>2</sub> antireflective layer;  
 2 – without SiO<sub>2</sub> antireflective layer



Fig.3. Photovoltaic module, SiO<sub>2</sub>

#### 3. Photovoltaic module, SiO<sub>2</sub>:

S<sub>ef</sub>=37 cm<sup>2</sup>, elements quantity – 25,  
 generated power 1,2 W; ΔI=30%.

4. Using of SiO<sub>2</sub> (80 nm) antireflective layer leads to EQE and of generated current (I) increase by an average of 15%.

**ADVANTAGES:** High resistance of PVC and PD to corpuscular radiation (electron, proton flow) influence and to the temperature; parameters degradation – about 5% in 10 years.

**IMPLEMENTATION STAGE:** Laboratory stage.

**ACKNOWLEDGMENTS:** This research was supported by the research projects: #20.80009.5007.12; #15.817.02.34A



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**Advanced Materials for Biopharmaceuticals and**  
**Technics**

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HR EXCELLENCE IN RESEARCH

## NEW SYNTHETIC INHIBITORS OF SUPEROXIDE ANION RADICALS

**PATENT:** MD 4749/2021.03.31; MD 4698/2020.05.31

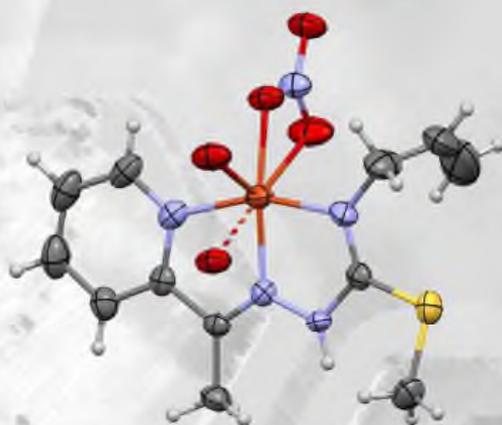
**AUTHORS:** Aurelian GULEA, Valentin GUDUMAC, Dorin ISTRATI, Irina USATAIA, Vasilii GRAUR, Victor ȚAPCOV, Inna ȘVEȚ, Valeriana PANTEA, Lilia ANDRONACHE

**APPLICATION FIELDS:** Medicine – Pharmacy – Cosmetics.

**AIM:** Chemical synthesis, characterization of new synthetic inhibitors of superoxide anion radicals that may find application in medicine.

**SOLUTION:** New copper coordination compounds with thiocarbamide ligands have been obtained using the directed synthesis method.

The IC<sub>50</sub> values towards  
superoxide anion radicals



Compound	IC <sub>50</sub> , μmol/L
Quercetin	61,86
Prototype	0,99
Patent #4698	0,54
Patent #4749	0,12-0,55

**ADVANTAGES:** The described compounds inhibit superoxide anion radicals. These agents exceed 515-112 times the analogous characteristics of quercetin that is used in medical practice, and 8-1.8 times analogous characteristics of prototype. The discovered properties of these substances are of interest for medical practice for enhancement of the arsenal of superoxide anion radical inhibitors.

**IMPLEMENTATION STAGE:** At the laboratory level.



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## INHIBITOR OF THE PROLIFERATION OF FUNGI OF THE SPECIES *Cryptococcus neoformans*

PATENT: MD 4675/2020.02.29

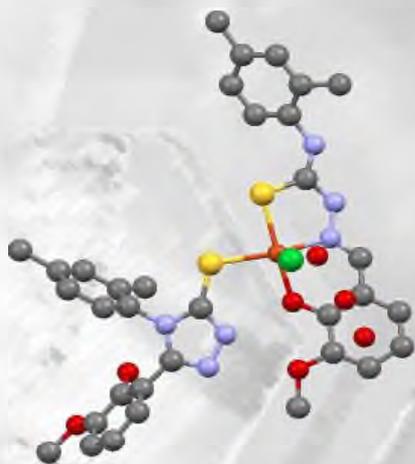
AUTHORS: Aurelian GULEA, Victor ȚAPCOV, Diana CEBOTARI,  
Greta BĂLAN, Olga BURDUNIUC, Valeriu RUDIC

APPLICATION FIELDS: Medicine - Health Care - Cosmetics.

AIM: Chemical synthesis, characterization of new synthetic antifungal agent that may find application in medicine.

SOLUTION: A new copper coordination compound has been obtained using the directed synthesis method.

Antifungal activity of the claimed compound compared to the prototype( $\mu\text{g/mL}$ )



Compound	<i>Cryptococcus neoformans</i> CECT 1043	
	MIC	MBC
2,5-bis(5-amidino-2-benzimidazolyl)furan	0.62	b
Claimed compound	0.48	1.95

\*MIC – minimum inhibitory concentration.  
\*\*MFC – minimum fungicidal concentration

ADVANTAGES: The claimed compound possesses fungistatic and fungicidal activity within the limits of concentrations 0.48...1.95  $\mu\text{g/mL}$  against fungi of the species *Cryptococcus neoformans*, which exceeds 1.3 times the activity of the prototype. The present invention expands the arsenal of fungal inhibitors of the *Cryptococcus neoformans* species with high antifungal activity.

IMPLEMENTATION STAGE: At the laboratory level.



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HR EXCELLENCE IN RESEARCH

## NEW NATIVE VARIETIES OF AROMATIC AND MEDICINAL PLANTS FOR THE REPUBLIC OF MOLDOVA

**PATENT APPLICATION:** Patent application for plant variety, no. 2021 0008/ 2021.02. 26, IMORTELA, AURIU 21

**AUTHORS:** Victor MELNIC, Elena PELEAH

**APPLICATION FIELDS:** Cosmetics, medicine, pharmaceuticals.

**PURPOSE:** This variety is proposed to producers of aromatic and medicinal plants as an alternative to traditional crops as a crop resistant to the challenges of increased drought and as a value-added crop per / ha. Drought-resistant variety, diseases and pests, with high yield of biomass and oil / ha, as a plant product and bioactive substances that can be used in the pharmaceutical, cosmetological, food industry and so on.

**SOLUTION:** The invention relates to the branch of agriculture in solving the local problem of the current drought, the introduction of new crops with high income in the value chain, raw material with high active principles for the pharmaceutical, cosmetological, curative industry of the food industry.

### Auriu 21



**ADVANTAGES:** Variety with resistance to drought, diseases and pests, accumulates high biomass at 1 ha, high content of essential oil - up to 0.8-1.1%. Multiannual culture. Rich quality in active principles Long-term storage of conditioned plant product. Valuable in the cosmetology, food, spice, pharmaceutical industry as an antimicrobial, antiviral, cardiotoxic.

**IMPLEMENTATION STAGE:** In private businesses.



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## EFFICIENT METHOD OF ORGANIC SEWAGE SLUDGE DEODORIZATION

**PATENT APPLICATION:** MD a 2020 0014/2020.02.18; Patent granted by decision 9705/2021.01.22

**AUTHORS:** Victor COVALIOV, Veaceslav SACHEVICH, Olga COVALIOVA, Arcadie RUSNAC, Gheorghii POLESCHUK

**APPLICATION FIELDS:** Environment - Pollution Control.

**AIM:** To ensure cheaper and simple deodorization process of the sewage organic sludge formed at the municipal wastewater treatment plants (WWTP), and enhance their operation efficiency.

**SOLUTION:** Novel composition of deodorization agent and its application method was proposed, which allows to efficiently remove/suppress the strong stinking unpleasant smells of organic sewage sludge resulted from the municipal wastewater treatment processes.

**ADVANTAGES:** A cost-efficient, simple to use deodorization agent was elaborated, containing several components. Deodorization efficiency is provided due to: 1) high oxidation capacity of the proposed agent, destroying the fetid-smelling thiotic compounds molecules due to the generated free active radicals; 2) inhibition of sludge biomass fermentation through application of natural vegetable compounds capable to suppress the vital activity of bacteria; 3) environmentally-friendly properties of the proposed agent, assuring the disinfection of organic wastes, destroying the helminths and pathogen microflora; 4) in addition, essential oils as perfumery production wastes can be sprayed locally over the mass of treated sludge.

Deodorizing agent proposed represents a water solution containing fermentation inhibitor, catalyst of oxidation process, oxidizing agent and other components.

The treatment method involves primary moistening of treated sludge up to 35% humidity, mixing with deodorization agent, exposure for up to 5 hours, and, finally, dehydration of mixture obtained up to 15-20% humidity.

Treatment of fermenting sludge biomass with strong unpleasant odour is performed under pH=2.7-3.5; dose of deodorization agent is 0.07-0.15% with regard to the mass of fermented sludge.

As a result, efficient or complete removal of stinking unpleasant smells of fermented sludge, containing broad spectrum of organic wastes, is reached.



**IMPLEMENTATION STAGE:** Pilot tests.

**ACKNOWLEDGMENTS:** This work was performed under the National Research Project #20.80009.5007.27



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HR EXCELLENCE IN RESEARCH

## SEWAGE SLUDGE DEWORMING METHOD

**PATENT APPLICATION: MD a 2020 0077/2020.10.23**

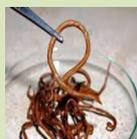
**AUTHORS: Victor COVALIOV, Olga COVALIOVA, Dumitru UNGUREANU, Natalia CIOBANU, Gheorghe DUCA**

**APPLICATION FIELD: Environment – Pollution Control.**

**AIM: Reducing the costs and improving the efficiency and fiability of wastewater sewage sludge deworming, in order to protect the environment and use the sludge as organo-mineral fertilizer for technical crops.**

**SOLUTION: A new environmentally-friendly sewage sludge deworming agent was proposed, containing the solution of ovicidal substances of natural origin with strong antibacterial and antiseptic properties with pesticide action against worms and numerous microorganisms.**

**ADVANTAGES: The deworming agent proposed is cheap, being based on the easily available local vegetable source. Its application does not need any costly technical devices, it is easy-to-use and can be used at wastewater treatment plants of any capacity. High rate and efficiency of deworming helps to resolve the problem of further using of treated sludge, which may be used as a fertilizer for technical crops, flower beds, forest trees nurseries, decorative trees and bushes, etc.**



Application of the sludge deworming agent involves its mixing with treated sludge in doses of 0.1-0.5 g/dm<sup>3</sup> sludge.

The exposure of helminths eggs for 6-8 hours, under the anaerobic stabilization conditions, has demonstrated the high sludge disinfection efficiency, reaching 97-100% of helminths eggs destroyed.

The deworming agent proposed can be applied at wastewater treatment plants, in the fields of communal services and agriculture, especially for the disinfection of sewerage sludge containing the helminths eggs.

**ACKNOWLEDGMENTS: This work was performed under the National research project #20.80009.5007.27**



**International Exhibition of Inventions INVENTICA 2021, 23.06.2021 – 25.06.2021**



**MOLDOVA STATE UNIVERSITY**  
 Research and Innovation Institute  
 Scientific Research Laboratory  
*Environmental Physics & Modeling Complex Systems*

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HR EXCELLENCE IN RESEARCH

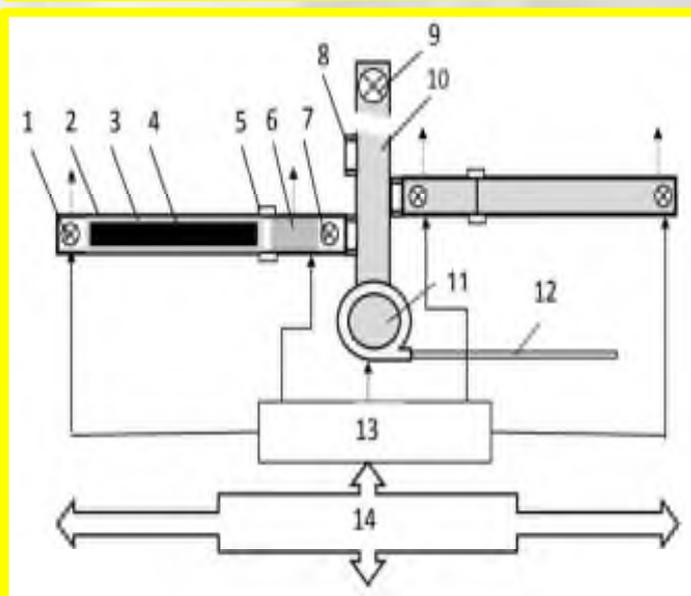
**METHOD AND EQUIPMENT FOR TAKING AIR SAMPLES IN THE ATMOSPHERE**

**AUTHORS:** Petru LOZOVANU, Florentin PALADI, Tatiana BULIMAGA  
**PATENT APPLICATION no. a 2020 0085 / 2020.12.07**

**APPLICATION FIELDS:** Environmental monitoring, Carbon nanoclusters.

**AIM of invention** is monitoring of harmful impurities in the form of gases and aerosols, including those in low concentrations; determining 3D distribution dynamics of air pollutants in hard-to-reach areas adjacent to the stationary and mobile sources.

**SOLUTION:** *Method for collection of atmospheric air samples* consists in the forced filtration of air through a fibrous filter installed in a container, whereas the additional filtration is done by using a second filter made of carbon nanoclusters  $C_n$ , both components (including the container) having been subjected beforehand to heat treatment in vacuum. Inside part of the container is maintained in vacuum until the collection of air samples. Afterwards, the impurities retained are extracted separately from the two filters, a fibrous filter with solvents and a nanocarbon cluster filter, via thermal desorption.



Device transfer to the site of sample collection, recording coordinates and controlling sample collection process are done by drone. The method is implemented with the help of *air samples collection device in the atmosphere*, which includes an air distribution appliance 10, equipped with a ventilation valve 9, coupled to an adjustable air pump 11, an air duct 12, a mechanism 1 and 7 for coupling the container 2, a programmed control unit 13, and one or more containers with two valves, inside of which a fibrous filter 3 is placed for additional filtration. The filter 3 is made in the shape of a cylindric casing out of a composite porous material and an absorbent substance composed of nanocarbon clusters.

**ADVANTAGE of the invention** consists in an increased efficiency and reduction of costs in the process of taking air samples in the atmosphere, especially in hard-to-reach areas adjacent to both stationary and mobile sources.

**IMPLEMENTATION STAGE:** Laboratory stage.

**ACKNOWLEDGMENTS:** This research was supported by the *NARD&MSU research project #20.80009.7007.05.*

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***Technical University of Moldova***

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# International Exhibition of Inventions

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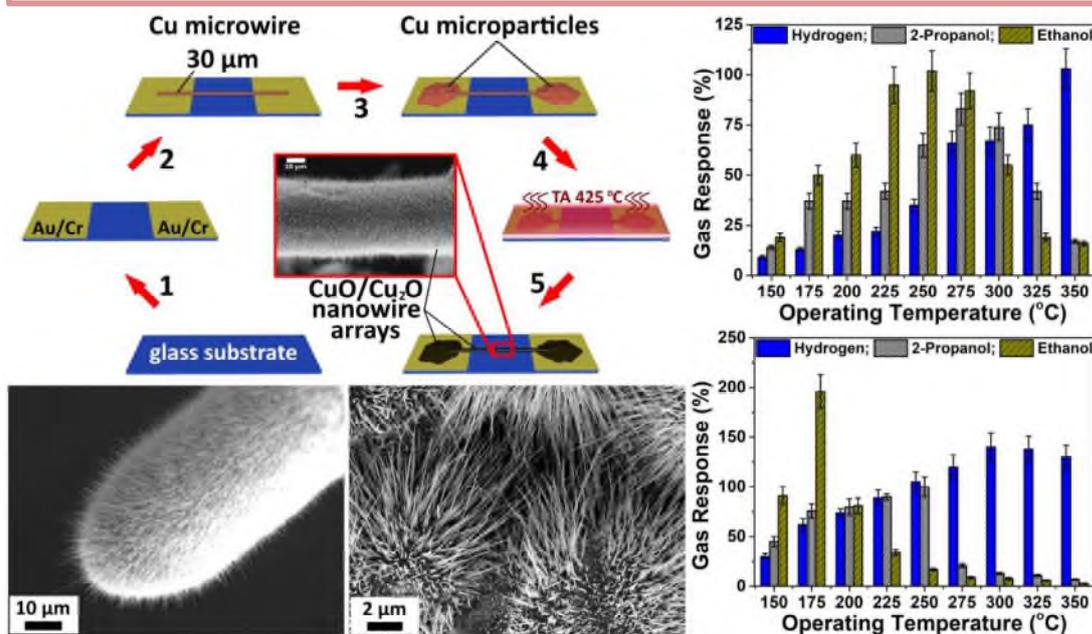
NANO RESEARCH CENTER

TECHNICAL UNIVERSITY OF MOLDOVA,  
Center for Nanotechnology and Nanosensors,  
Department of Microelectronics and Biomedical Engineering

### A single CuO/Cu<sub>2</sub>O/Cu micro-wire covered by a nano-wire network as gas sensor for the detection of battery hazards

Project: [NATO Science for Peace and Security Programme \(SPS\) under grant G5634 „Advanced Electro-Optical Chemical Sensors” AMOXES](#)

Authors: LUPAN Oleg, *dr.hab., prof.univ.*; ABABII Nicolai, *drd.*



**Keywords:** copper oxide, heterostructures, p-type, ethanol sensor, DFT, three-in-one sensor.

**Abstract:** In this work, a strategy to prepare CuO/Cu<sub>2</sub>O/Cu microwires which is fully covered by a nanowire network using a simple thermal oxidation process is developed. These sensors show different dominating gas responses with operating temperatures, to ethanol at 175 °C, to 2-propanol at room

temperature and 225 °C, and to hydrogen gas at ~300 °C, respectively. This research shows the importance of the non-planar CuO/Cu<sub>2</sub>O layered hetero-structure as a bright nanomaterial for the detection of various gases, controlled by the working temperature, and the insight presented here will be of significant value in the fabrication of new sensing devices through simple nanotechnology.

**Highlights:** • 2-Propanol sensor operating at room temperature based on a single CuO/Cu<sub>2</sub>O microwire was developed in premiere.

- Obtained CuO/Cu<sub>2</sub>O/Cu microwire-nanowire sensor through a simple thermal oxidation process.
- Control the gas selectivity by changing the operating temperature.
- Possibility to fabricate a 3-in-1 sensor from an individual Cu-microwire.
- 3-in-1 CuO/Cu<sub>2</sub>O/Cu microwire-nanowire-based gas sensor for early hazard detection in batteries.
- Density functional theory based calculations reveal that 2-propanol molecule binds with the most stable CuO (111) surface with significant charge transfer and band gap change.

**Application:** Gas sensors based on a single CuO/Cu<sub>2</sub>O/Cu micro-wire covered by a nano-wire network, can have a variety of applications such as: early hazard detection in portable batteries, in different industrial areas, namely the laboratories, pharmaceutical, chemical, agro-food and alcohol-based fuel industries or prevent the serious chemical accidents in chemical storage and process industry and transport applications.

Ref: <https://doi.org/10.1021/acsami.0c09879>



# International Exhibition of Inventions

## INVENTICA 2021

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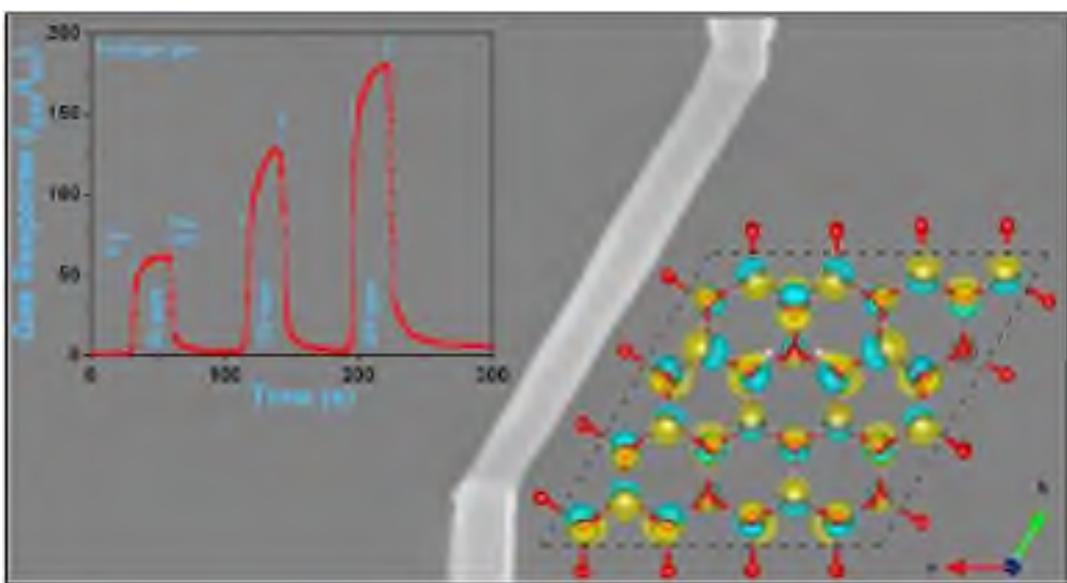
NANO

TECHNICAL UNIVERSITY OF MOLDOVA,  
Center for Nanotechnology and Nanosensors,  
Department of Microelectronics and Biomedical Engineering

## Comparison of Thermal Annealing vs Hydrothermal Treatment Effects on the Detection Performances of ZnO Nanowires

This paper was partially supported by the Technical University of Moldova and the ANCD-NARD Grant No. 20.80009.5007.09 at TUM.

Authors: LUPAN Oleg, *dr.hab., prof.univ.*; Magariu Nicolae, *drd.*



**Keywords:** ZnO, nanowires, electrodeposition, hydrothermal photoluminescence, nanosensors.

**Abstract:** A comparative investigation of the post-electroplating treatment influence on the gas detecting performances of single ZnO nanorod/nanowire, as grown by electrochemical deposition and integrated into nanosensor devices, is presented. In this work hydrothermal annealing

in a furnace at 150 °C in air were used as post-growth treatments to improve the material properties. Herein, the morphological, optical, chemical, structural, vibrational, and gas sensing properties of the as-electrodeposited and treated samples are investigated and presented in detail. By varying the growth temperature and type of post-growth treatment, the morphology is maintained, whereas the optical and structural properties show increased sample crystallization. It is shown that hydrothermal treatment in H<sub>2</sub>O vapors affects the optical and vibrational properties of the material. After investigation of nanodevices based on single ZnO nanorod/nanowire, it was observed that higher temperature during synthesis process results in a higher gas response to H<sub>2</sub> gas within the investigated operating temperature range from 25 °C to 150 °C.

- Highlights:**
- Fabrication of high performance gas nanosensors based on individual ZnO nanowires with different types of post-growth annealing.
  - Possibility to control the gas response by conventional thermal annealing in air and by hydrothermal treatment in H<sub>2</sub>O vapors.
  - The treatment in H<sub>2</sub>O vapors showed the possibility for a further increase in gas response of the elaborated nanosensors by a factor of ~8.
  - DFT calculations indicate that ZnO (0001) planes are very reactive towards gas sensing.

**Application:** The individual ZnO NRs/NWs were integrated into micro- and nanodevices by the FIB/SEM technique for detailed detection tests and developed nanodevices could be key element for flexible nanoelectronics and wearable electronics.

Ref: <https://doi.org/10.1021/acsami.0c19170>



# International Exhibition of Inventions INVENTICA 2021 23.06.2021 – 25.06.2021



**TECHNICAL UNIVERSITY OF MOLDOVA**

## AGROBOT – ROBOTIC SYSTEM FOR CROP MAINTENANCE

**Research project: 2SOFT/1.1/64: Cross border cooperation in mechatronics engineering education CBCinMEE**

**Authors: AXENTE Ion, CAZAC Florin, SUDACEVSCHI Viorica, ABABII Victor**

**The goal:** *Development of an AgroBot system for the maintenance of agricultural crops in an intelligent Agriculture.*

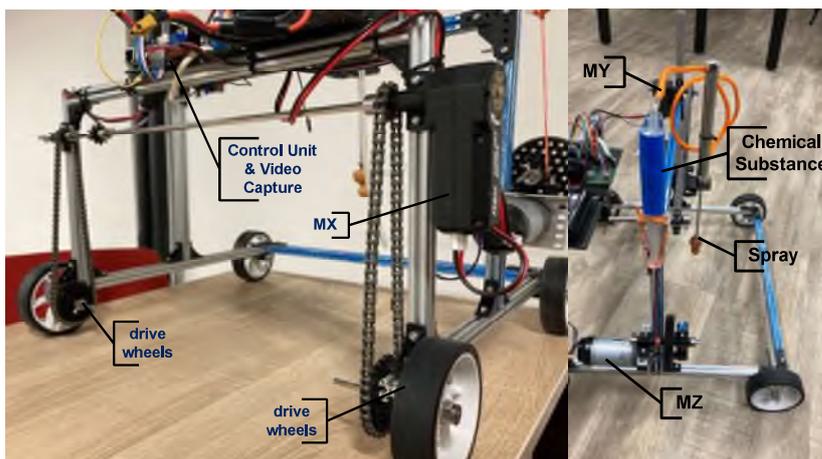
**Solution:** *Integration of video information processing methods in order to identify plants affected by diseases or pests and the selective application of chemical compounds on these plants.*

**Benefits:** • *Efficient use of chemical compounds in the maintenance process of agricultural crops;* • *Increasing the quality of agricultural products by reducing the amount of chemical compounds applied directly to plants;* • *The possibility of storing video information and processing it in order to analyze the process of plant growth and spread of diseases and pests;* • *Functional extension of the system by assigning additional functions for extracting harmful plants and thinning crop plants;* • *Use of the system for automatic plant planting operations by observing special geometric conditions.*

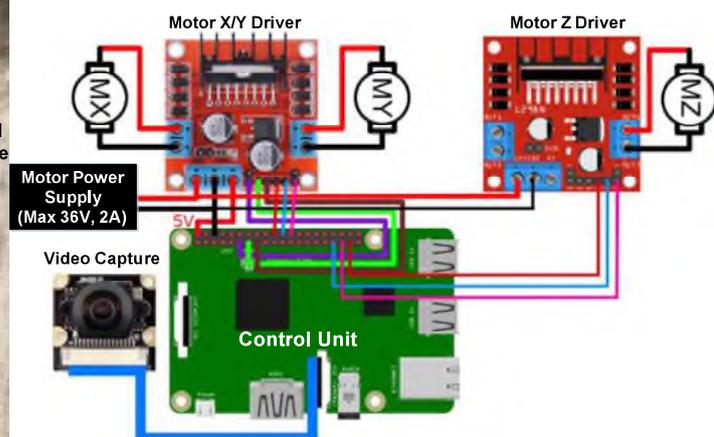
### Project description:

This elaboration is part of the field of Intelligent Agriculture, especially for the development of autonomous plant protection systems. The system is developed based on a SBC Raspberry Pi 3 Model B +, which realizes an algorithm for capturing and processing video images in real time, as a result of which the plants affected by pests are identified. For the processing of images are used models of neural networks that provide a learning ability in the process of operation. Plants identified as being affected by pests are processed individually by spraying protective chemicals.

The AgroBot system (Figures 1 and 2) shows a four-wheeled mobile platform that is driven by the MX engine moving on the maintenance ground. The movement of the spray system is ensured by two MY and MZ motors which, by translational movement, are positioned exactly above the plant to be sprayed with chemicals. The application of the AgroBot system in the maintenance process of agricultural crops will reduce costs through the efficient use of chemicals and their negative influence on the quality of agricultural products. Including, it will change the vision of modern agriculture to an ecological vision without pollution and maximum efficiency.



**Figure 1.** Views of the AgroBot system.



**Figure 2.** AgroBot control system diagram.



# International Exhibition of Inventions INVENTICA 2021 23.06.2021 – 25.06.2021



## TECHNICAL UNIVERSITY OF MOLDOVA

### SMART GARDEN – Monitoring and Control System

**Research project: 2SOFT/1.1/64: Cross border cooperation in mechatronics engineering education CBCinMEE**

**Authors: ABABII Victor, SUDACEVSCHI Viorica, MUNTEANU Silvia, LEASCENCO Valeria, GUSTIUC Victor**

**The goal:** *The purpose of the project is to develop an autonomous control system to ensure the maintenance and growth of plants in special climatic conditions.*

**Solution:** *Design of a closed system to ensure the maintenance and automatic control of climatic parameters and the generation of special conditions by injecting harmful gases, solutions and radiation.*

**Benefits:** • *Continuous monitoring and real-time control of climatic parameters: soil and air temperature, humidity, CO, CO2 concentration;* • *Creating the special conditions for plant growth by injecting harmful gases, solutions and radiation based on timed mathematical models;* • *Video surveillance and identification of critical situations for plant growth;* • *Remote access to hardware and software resources for management and administration operations, video observation of the plant maintenance and growth.*

**Project description:** The project concerns the field of ecology and plant protection, namely methods and techniques for the analysis of the plants growth in special environments. The analysis and study of plant resistance is important for agricultural crops growth in geographical regions not specific to them. At the same time, the system can be used to study the ability of plants to adapt to special growing conditions. The authors developed an experimental system, which creates an isolated environment with autonomous control on climatic parameters (Figure 1): air and soil temperature, air and soil humidity, gas concentration (CO, CO2, and other), brightness and IR radiation. The plant growth is also monitored using a video camera.

The climate control system is designed based on the Raspberry Pi 3B device (Figure 2) which provides data acquisition from the set of sensors, operations on the air, CO and CO2 pumps, heating and light source, exhaust fan, water evaporation system and irrigation pump to create extreme climatic conditions. The system is connected to the global Internet network which allows remote process monitoring.

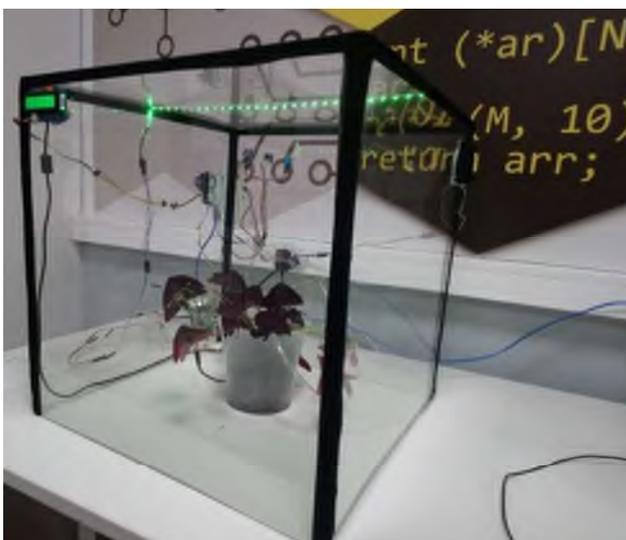


Figure 1. Experimental Solution Development.

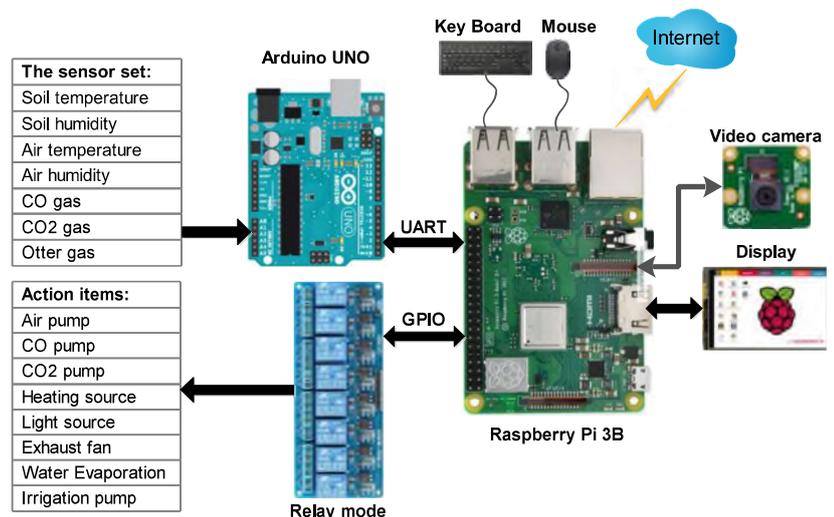


Figure 2. Climate Control System Diagram.



23.06.21 – 25.06.21, Iași - România

THE 25<sup>th</sup> INTERNATIONAL EXHIBITION OF INVENTICS

“INVENTICA 2021”



Technical University of Moldova



NATIONAL INSTITUTE OF INVENTICS, IASI, ROMANIA



# Increasing the competitiveness of precessional transmissions by developing and capitalizing on the gear with "conforming" contact of the teeth

Ion Bostan, *academician al AȘM, dr. hab., prof. univ.*; Maxim Vaculenco, *dr., conf. univ.*; Viorel Bostan, *dr. hab., prof. univ.*; Țopa Mihai, *dr. conf. univ.*; Valeriu Dulgheru, *dr. hab., prof. univ.*; Radu Ciobanu, *dr., conf. univ.*; Oleg Ciobanu, *dr., conf. univ.*; Ion Bodnariuc, *dr., conf. univ.*; Nicolae Trifan, *dr., conf. univ.*; Dumitru Vengher, *drd.*; Serghei Scaticailov, *drd.*

## Project description:

Mechanical transmission consumers impose more and more demands on increasing the energy efficiency and their load bearing capacity. If about 80% of the global energy is transmitted to the drive mechanisms of the machines through mechanical transmissions, then the increase of their mechanical efficiency by only 1% leads to the saving of 0.8% of the energy produced on a global scale.

The development of the robotics and mechanical systems with compactness restrictions impose to the gear ever more stringent requirements regarding the mass and gauges, the quality of the gear material, the technological efficiency measured during the manufacturing operations, the cost of production, etc.

These requirements taken as a whole lead to the need to diversify and modernize the toothed gears  $A$  in the form of the tooth contact of the gear geometry and toothed wheels manufacturing technology.

These requirements can largely be met by precessional transmissions with a new toothed gear concept with „congruent” concave-concave contact.

Ensuring the competitiveness of PT with specific constructive-kinematic features of the toothed gears with gear with “congruent” concave-concave contact needs research in the following directions:

- Development of a new toothed gear concept with “congruent” concave-concave contact with small difference of the curvatures of the flanks
- Elaboration of the generation processes by spatial tumbling-rolling of the convex / concave profiles and in a circle arc on numerically controlled machines and of the additive technologies with prototyping in 3D printers.
- Creation of the CAD/CAM/CAE platform for designing, manufacturing and researching the congruent contact and the precessional gear as a whole with major functional characteristics.

The foreseen researches have a complex multidisciplinary character with a pronounced opening to the patenting of inventions, including all the aspects necessary for the manufacture of industrial products for the purpose of their commercialization.

The expected results of the researches will be expressed in the elaboration of new  $A$  toothed gears with straight  $A_{cv-cv}^D$  and inclined  $A_{cv-cv}^{Dil}$  toothed gears with “congruent” concave-concave contact of the teeth, of new generation technologies by spatial tumbling-rolling of the convex/concave profiles and in a circle arc and expanding the field of applications.

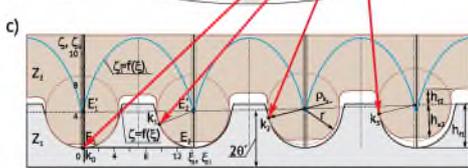
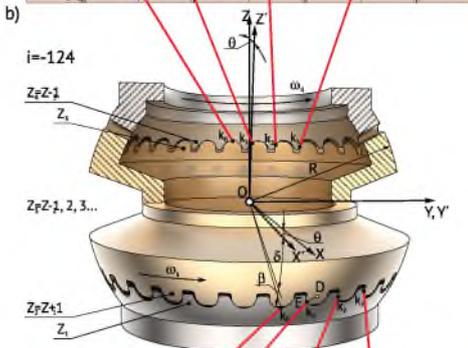
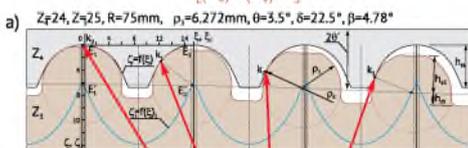
## The mathematical model and the synthesis of the precessional gearing

The executory coordinates of the tooth profile are:

$$X_{E_0} = k_1 z_0, Z_{E_0} = d_2 z_0$$

$$Y_{E_0} = k_1 z_0, Z_{E_0} = d_1 z_0$$

$$Z_{E_0} = \frac{\left[ (k_1 z_0 - d_1 z_0 - k_2 z_0) - \left[ (k_1 z_0 - d_1 z_0 - k_2 z_0)^2 + (k_1 z_0)^2 + 1 \right] \left[ R^2 - (d_1 z_0)^2 - (d_2 z_0)^2 \right] \right]^{1/2}}{\left[ (k_1 z_0)^2 + (k_2 z_0)^2 + 1 \right]}$$

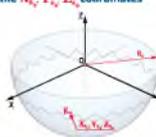


Precessional gear 2K-H with reduced relative slip in the teeth conform contact: a, c - teeth gearing ( $Z_1-Z_4$ ) and ( $Z_1-Z_2$ ) with conform contact; b - gearing with sphero-spatial movement.

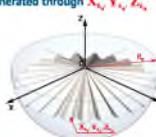
The profile of the teeth in the precessional gear, unlike the classic ones, is variable depending on the parametric configuration  $[Z_1, Z_2, Z_3, Z_4, \dots]$  which ensures high bearing capacity and mechanical efficiency.

## CAD | CAM modeling and manufacturing phases

The  $E_0$  point trajectory in the  $X_0, Y_0, Z_0$  coordinates



The surface of the profile flank generated through  $X_0, Y_0, Z_0$



The billet 3D model overlapped with flank profile surface



Flank profile of the gearwheel crown



1. Positioning of the billet



2. Roughing of the toothed crown



3. Preventive generation of the flank surface



4. Intermediate generation of the flank surface



5. Final generation of the flank surface



6. The actual gear wheel



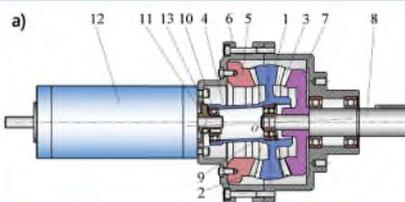
CNC Center



CMM for Gear Inspection



Coordinate measurement



A precession motor gearbox with an  $A^D$  gearing with a gear ratio  $i = -68.8$ : (a) assembly drawing; (b), general view.



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NATIONAL INSTITUTE OF INVENTICS, IASI, ROMANIA



# Digital gear manufacturing technologies with non-standardized profiles from precessional planetary transmissions

Viorel Bostan, *dr. hab., prof. univ.*; Ion Bostan, *academician al AȘM, dr. hab., prof. univ.*; Valeriu Dulgheru, *dr. hab., prof. univ.*;  
Maxim Vaculenco, *dr., conf. univ.*; Sergiu Mazuru, *dr. hab., conf. univ.*; Ion Bodnariuc, *dr., conf. univ.*;

Radu Ciobanu, *dr., conf. univ.*; Oleg Ciobanu, *dr., conf. univ.*; Nicolae Trifan, *dr., conf. univ.*; Iulian Malcoci, *dr., conf. univ.*; Ion Dicusară, *dr., conf. univ.*;  
Dumitru Vengher, *drd.*; Alexandru Buga, *dr., conf. univ.*; Serghei Scaticailov, *drd.*; Vitalie Gladîș, *drd.*; Alina Bregnova, *drd.*

## Project description:

The success of the competition in which the producers of new industrial products are engaged is based on the time consumed in the activities of designing, making prototypes, testing and putting them into manufacturing. The main performance factors in the development of a new product are the reduction of the time and the costs of carrying out all the steps prior to its launch on the market.

The research field refers to the technological development of precessional transmissions.

The time and costs of achieving the precessional transmissions mostly refer to the manufacture of central wheels with non-standard convex-concave profiles and to the satellites with circular arch profiles of the teeth.

These objectives were achieved by developing non-conventional technologies based on digital manufacturing.

I. In case of precessional kinematic transmissions for the manufacture of wheels and satellite of the precessional gear with non-standard profiles of the teeth, three non-conventional technologies have been used:

1. Plastic injection molding of the wheels of the precessional gear with small diameters up to 42mm and averages up to 105mm (figs. 1, 2). The innovative elements consist in the construction of wheels with metallic

reinforcements which substantially reduce the inevitable deformations characteristic of the process. The inserts of the molds with negative profiles to the real ones are produced by digital manufacturing on numerically controlled machine tools based on the CAD / CAM system;

2. Pressing technology from metal powders (fig. 3). The innovative elements consist in the construction of pressing forms (double pressing) that provide airship porosity and lubrication regime with dry lubrication for operation in vacant spaces. The insertions of the pressing forms also have negative profiles to the real ones and are produced by CNC digital fabrication;

3. Direct digital manufacturing technology - 3D printing. Direct digital manufacturing is a process of obtaining the physical parts directly from a 3D CAD file. The main advantages of the process are: low energy consumption, small losses of material, high manufacturing speed, parts with complex geometries can be realized, reducing the time required to execute the industrial product.

II. For precessional power transmissions with bolt gear, the technology of digital manufacture of central wheels with variable convex-concave profile on CNC machine tools based on CAD / CAM system with straight and inclined teeth has been developed (fig. 4).

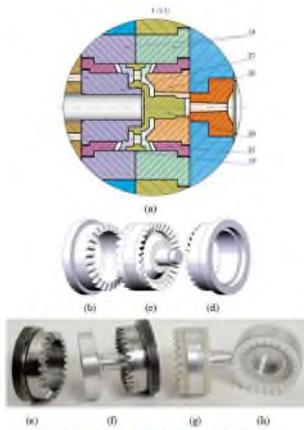


Fig. 1. Pressure injection molding form: (a) - the local section of the wheel-satellite forming node of the 2K-H precessional gear; (b), (c), (d), respectively, 3D views of the molds with tooth profiles of the teeth and the wheel-satellite; (e), (g), (f), (h) - respectively, manufactured samples of dies, crank shaft and satellite wheels.

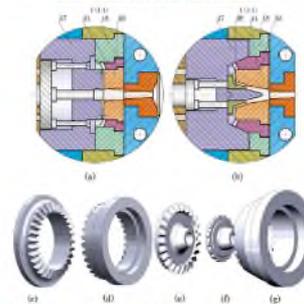


Fig. 2. Local sections of the mold forming knot: (a), (b) - for the manufacture of fixed and movable central wheels of the 2K-H precessional gear respectively; (c), (d) - 3D views of fixed center wheel and mirror profile die; (e), (f), (g) - respectively the views of the central movable wheel, the reinforcement and the mold with mirror profile.



Fig. 3. The technological equipment for individual pressing: the central wheels with convex / concave profile of the teeth (a); of the two-wheeled satellite-wheels in a circle arc (b); cogwheels and cogwheels with a diameter of 24, 38, 46, 62mm (c).



Fig. 4. Phases of manufacture on a machine tool with numerical control of the central cogwheel with straight teeth.

# Precessional gear transmission

**Viorel Bostan, dr. hab., prof. univ.;** **Ion Bostan, academician al AȘM, dr. hab., prof. univ.**  
**Maxim Vaculenco, dr., conf. univ.;** **Radu Ciobanu, dr., conf. univ.;** **Oleg Ciobanu, dr., conf. univ.**

### Goal:

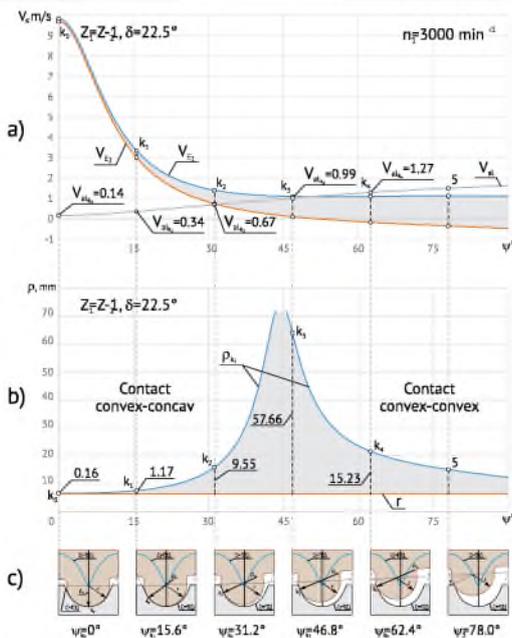
Increasing the convex-concave contact load bearing capacity by identifying the conjugated profiles with the small difference in the curvature radius.

### Solution:

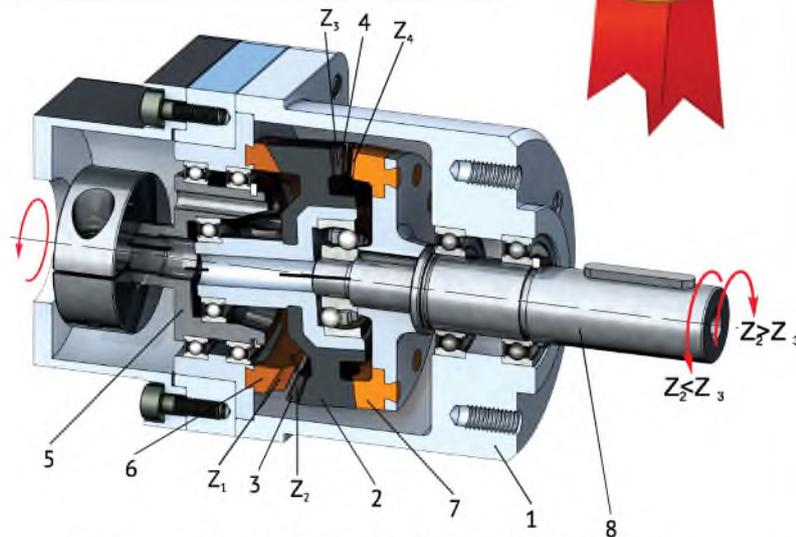
The teeth gearing is performed in contacts with convex-concave geometry, wherein the central bevel wheels are made with curvilinear flank profiles with variable curvature with one tooth less than the satellite wheel gear rings made with circular arc flank profiles, the teeth flanks mate with frontal overlap  $\varepsilon_f$  within the limits  $1.5 \leq \varepsilon_f \leq 4.0$  simultaneously engaged pairs of teeth, at the same time the gearwheels are made with the conical axoid angle within the limits  $0^\circ \leq \delta \leq 30^\circ$  with the angle between the axes of the crank

and the central bevel wheels within the limits  $1.5^\circ \leq \theta \leq 7^\circ$ , and the circular arc radius of the flank profile of the Z-toothed satellite wheel gear rings is within the limits  $(1.0-1.57) D/Z$  [mm], which generally provides a reduction of the difference in the curvatures of the flank profiles in the section with diameter D of up to  $(0.02-1.5) D/Z$  [mm] and a decrease in the pressure angle  $\alpha$  between the flanks of up to  $15^\circ$ , as well as a decrease in the relative sliding velocity between the mating flanks.

**Invention  
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2019.12.31



Linear velocities at the contact point  $V_{e1}, V_{s1}, V_{d1}$  (a) the difference in curvature radii ( $\rho_1, \rho_2$ ) (b) of the conjugated profiles in the contact  $k_1(c)$  depending on  $\psi$  for  $Z_F Z_1 - 1$  and  $\delta = 22.5^\circ$  ( $Z_F Z_1 = 24, Z_2 = 25, \theta = 3.5^\circ, \delta = 22.5^\circ, r = 6.27 \text{ mm}, R = 75 \text{ mm}$ )



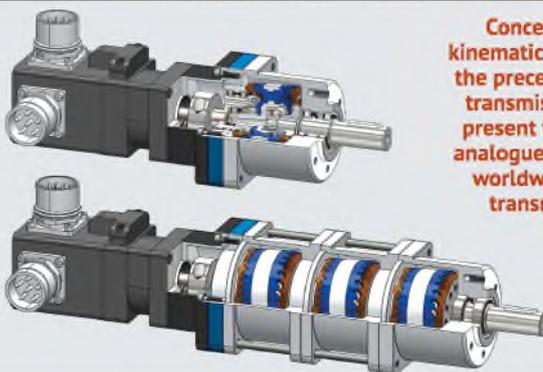
Precessional toothed gear transmission comprises a body (1), a satellite wheel (2) with two bevel gear rings (3) and (4) driven by a crankshaft (5) in sphero-spatial motion around a fixed point, two central bevel wheels (6) and (7), one immobile (6) fixed in the body (1) and the other mobile (7) mounted on a driven shaft (8).

### Advantages:

- ✓ Increasing the load-bearing capacity of the transmission by engaging the teeth in contacts with the convex-concave geometry and the minimum difference in the curvatures of the mating flanks;
- ✓ Increasing the mechanical efficiency by changing the tooth shape, reducing the pressure angle between the flanks and at the expense of increasing the rolling share of the engaging teeth by decreasing the relative frictional sliding between the flanks with a reduction in the frontal overlap degree and a compensatory increase in the longitudinal overlap degree with pure rolling of teeth in the sphero-spatial interaction of the mating wheels with the nutation angle $\theta$ ;
- ✓ Extending the kinematic and technological possibilities.

### Stage:

Technical project, industrial prototype.



Concerning the kinematic possibilities, the precessional gear transmission at the present time has no analogues among the worldwide known transmissions.



# International Exhibition of Inventions

## INVENTICA 2021

23.06.2021 – 25.06.2021



NATIONAL INSTITUTE OF INVENTICS, IASI, ROMANIA



### Technical University of Moldova



Alexandra SAVCENCO, Alexei BAERLE, Pavel TATAROV, Raisa IVANOVA

## *PROCESS FOR OBTAINING RED DYE*

## *CARTHAMIN IN POWDER FORM*

Patent Application MD. National Patent Authority (AGEPI) decision nr. 0159 from 24.12.2020

### *Aim:*

To replace synthetic red dyes in foods with harmless natural dyes

### *Solution:*

Extraction of red dye Carthamin from Safflower petals using aqueous solution, ensuring control of pH and other conditions, only by use of permitted food additives; obtaining of solid red dye in powder form

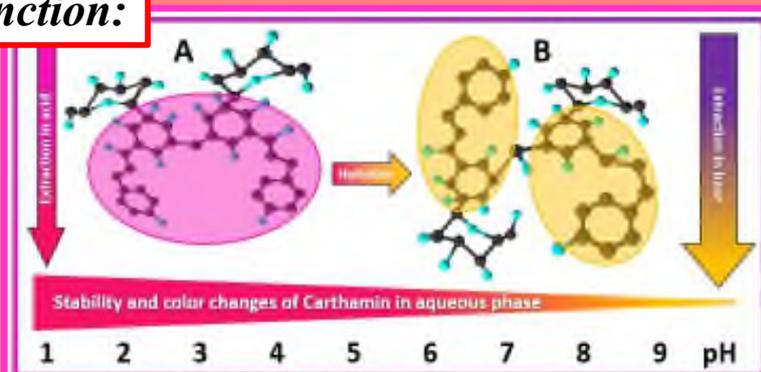
### *Advantages:*

Auxiliary materials used are food additives, allowed in EU, encoded by “E”;  
The invention contributes to the implementation of the European Commission Decision about exclusive use of natural dyes in the food industry;  
Due to the harmless of natural chalconic dyes, they can be added in foods *quantum satis* (“so much as it is necessary”), that is conformable by Codex Alimentarius

### *Description:*

The essence of the invention consists in obtaining a red dye Carthamin in the powder form by extraction of Safflower petals, filtration, neutralization of the filtrate at pH 3.5 ... 6.0 in the suspension of polysaccharides with high molecular weight, and drying the product using IR.

### *Distinction:*



*Instability of Carthamin obtained by the prototype*



*Stable powdered Carthamin*



# International Exhibition of Inventions INVENTICA 2021 23.06.2021 – 25.06.2021



TECHNICAL UNIVERSITY OF MOLDOVA

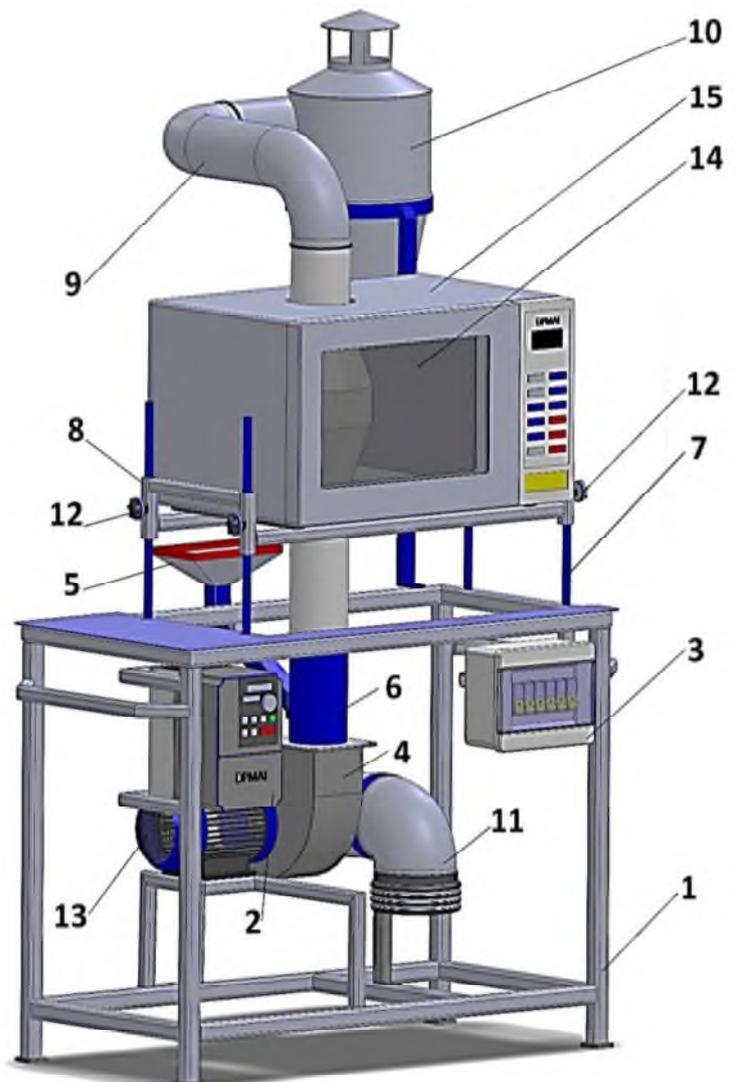
## DRYING INSTALLATION FOR GRANULAR PRODUCTS IN THE SUSPENSION LAYER

### Brevet MD 1481

**Autors:** Bernic Mircea, Țislinscaia Natalia, Balan Mihail,  
Vișanu Vitali, Melenciuc Mihail

### Description of the invention

The installation for drying granular products in a suspended layer, allows to obtain a product with increased quality indices, due to the removal from the microwave area of influence of each particle when it has dried to the final moisture. At the same time, the drying quality of the finished product is positively influenced due to the possibility of adjusting the drying area, by moving the drying chamber vertically in relation to the middle area of the tube. The suspended layer drying product consists of a housing and a tube, which is composed of the upper zone A, the middle zone B and the lower zone C; the tube is mounted on the fan, to which the product supply bunker is connected; the tube also intersects the microwave generator vertically; the product drain pipe is mounted on top of the tube.



Patent application: Food Industry

Fig.1. Installation for drying granular products in a suspended layer



# International Exhibition of Inventions INVENTICA 2021 23.06.2021 – 25.06.2021



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## PROCESS FOR DRYING PEARLS BY CONVECTION IN A CO<sub>2</sub> MODIFIED ENVIRONMENT

**Patent MD 2186**

**Autors:**

**Bernic Mircea, Ţislinscaia Natalia, Balan Mihail, Vişanu Vitali, Melenciuc Mihail**

### **Description of the invention**

The invention relates to a process for drying pears by convection, in a modified CO<sub>2</sub> environment, and can be applied to enterprises in the food industry, in research laboratories and research centers related to the drying process. The process of drying the pears consists of: subjecting wet pears, sliced with a thickness of 3-5 mm, in a CO<sub>2</sub> stream with a speed of 1.5 m / s, heated to a temperature of 70 ° C. When the pears reach a humidity of 18-22%, the drying process is completed. The use of CO<sub>2</sub> instead of air, allows to obtain a high quality product, keeping the qualitative properties at a high level and stopping the oxidation process of the pears by limiting their contact with oxygen.

**Patent application: Food Industry**

### **Advantages:**

- Simple construction;
- Reduction of aerobe microorganisms development;
- Reduction of oxidative processes, such as browning;
- Increase the quality of the final product;
- Creating new jobs;
- Increasing the export of autochthonous production.





# International Exhibition of Inventions INVENTICA 2021 23.06.2021 – 25.06.2021



NATIONAL INSTITUTE OF  
INVENTICS, IASI, ROMANIA



Technical University of Moldova

## PROCESS FOR MAKING ACHLORIDE BREAD STICKS

Patent application

nr. 2197 from 23.04.21

Inventors/ authors: SUHODOL Natalia, COVALIOV Eugenia, Deseatnicova Olga,  
CAPCANARI Tatiana, CHIRSANOVA Aurica, RESITCA Vladislav.

### Raw materials used to impart taste



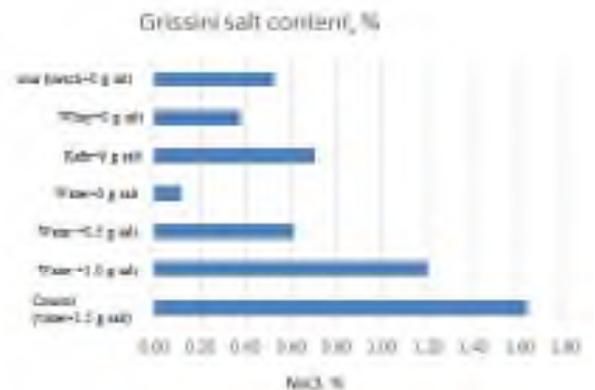
sour borsch



kefir



whey



Water+0 g salt



Kefir+0 g salt



Whey+0 g salt



Sour borsch+0 g salt





# International Exhibition of Inventions INVENTICA 2021 23.06.2021 – 25.06.2021



**TECHNICAL UNIVERSITY OF MOLDOVA**

## PROCESS FOR OBTAINING FUNCTIONAL BREAD WITH THE ADDITION OF FLAXSEED FLOUR

**Patent application:** Nr. 0095 of 2020.08.11  
**Inventors:** Eugenia COVALIOV, Violina POPOVICI, Tatiana CAPCANARI,  
Rodica SIMINIUC, Carolina GROSU

### *Aim*

Obtaining a novel product of bread with improved nutritional and functional properties intended for both consumption mass, as well as dietary, functional, therapeutic and prophylactic nutrition for adults and children.

### *Solution*

The process for obtaining functional bread with increased nutritional value is obtained by having the following ratio of components: wheat flour 73.5...87%, defatted flaxseed flour with a fat content of max. 5% 5.8...19.3, sugar 5.0, salt 1.3 and yeast 0.9. The bread dough is prepared by the direct dough method which involves activating the yeast in a mixture containing 20% of the amount of wheat flour, sugar and water for 20...30 minutes, and subsequent mixing with the rest of the ingredients. The formed dough is left to rise for 60 minutes, cut into 300 g pieces, leave to rise for a second time at a temperature of 37... 40 ° C and a relative humidity of 70... 85% for 30 min and bake at a temperature of 180...190 ° C for 30...40 minutes.

### *Advantages*

1. Increasing the sensory characteristics, the nutritional and biological values of bread
2. Reducing the glycemic index of bread
3. Diversification of the assortment range of bread





# International Exhibition of Inventions INVENTICA 2021 23.06.2021 – 25.06.2021



NATIONAL INSTITUTE OF  
INVENTICS, IASI, ROMANIA



TECHNICAL UNIVERSITY OF MOLDOVA

## PROCESS FOR OBTAINING YOGURT WITH JERUSALEM ARTICHOKE POWDER (HELIANTHUS TUBEROSUS)

Patent application:

Nr. 2269 of 2021.02.19

Inventors:

Ecaterina Gîncu, Aurica Chirsanova, Eugenia Covaliov, Vladislav Reșitca, Tatiana Capcanari, Alina Boiștean



Yoghurt nutritional and biological value enhancing by replacement of synthetic sweeteners with Jerusalem artichoke powder



Obtaining yoghurt with nutritional properties that show improved sensory characteristics and rheological properties, without the addition of stabilizers, indicated for people with diabetes.



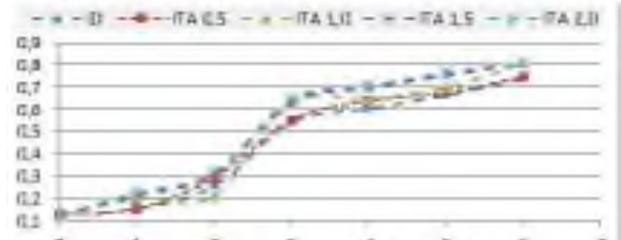
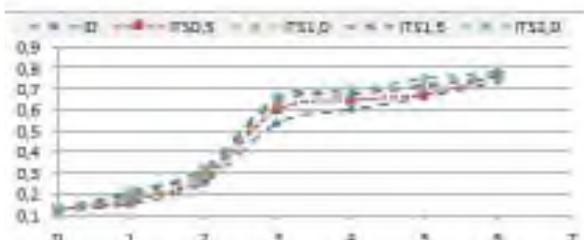
Jerusalem artichoke tuber contains high amount of dietary fiber namely inulin and fructo-oligosaccharides, a very low fat content and low caloric value;  
The addition of probiotic bacteria to yoghurt progresses its functionality and health effects; the product obtained will contribute to the diversification of the assortment of dairy products intended for people with diabetes.

### Results



### Sensory and physico-chemical characteristics of Jerusalem artichoke powder yogurt (Helianthus tuberosus)

Quality indicator	Example 1	Example 2	Example 3
Appearance and consistency	The curd of firm consistency, without gas bubbles and removal of whey, with the appearance of porcelain.		
Color	White, uniform	Yellowish, the color intensity increases with increasing amount of Jerusalem artichoke powder added.	
taste and smell	Pleasant, sour, specific to yogurt, with characteristics specific to lactic fermentation and slightly more pronounced than Jerusalem artichoke.		
Dry matter content, %	12,43±0,42	12,85±0,42	13,28±0,43
Protein content, %	4,46±0,02	4,48±0,02	4,5±0,02
Fat content, %	0,01±0,01	0,02±0,01	0,04±0,02
Titrateable acidity, °T	85±2	87±2	90±3
Total microorganisms number, cfu/cm <sup>3</sup>	10 <sup>7</sup>	10 <sup>7</sup>	10 <sup>7</sup>



Evolution of titrateable acidity expressed in% lactic acid in yoghurt samples with artichoke flour:  
a) AMIC I type, b) SOLAR type, during fermentation



# International Exhibition of Inventions INVENTICA 2021 23.06.2021 – 25.06.2021



TECHNICAL UNIVERSITY OF MOLDOVA

## PROCESS FOR OBTAINING FUNCTIONAL BARS FROM PUMPKIN (*Curcubita maxima*)

**Patent application:** Nr. 9736 of 2021.03.03  
**Inventors:** Eugenia COVALIOV, Tatiana CAPCANARI, Natalia SUHODOL, Olga DESEATNICOVA, Rodica STURZA

### The goal

The invention relates to the food industry, in particular to the manufacture of functional confectionery products. The process of obtaining the bars includes the use of pulp flour and pumpkin seeds (*Cucurbita maxima*). The elaborated confectionery product with improved biological and nutritional value and functional properties is intended for consumption mass, as well as dietary, functional, therapeutic and prophylactic nutrition for adults and children in a quality of healthy snack.

### Solution

The mixture of pumpkin pulp flour and pumpkin seed flour in the composition of the finished product is obtained by thoroughly homogenizing them and keeping at lower temperatures  $t=2\div 4^{\circ}\text{C}$ . The process allows to obtain functional bars with increased nutritional value having the following ratio of components: pulp flour (15.5...22.5%), pumpkin seeds flour (9.0...15.5%), pumpkin (8.0...10.0%), tahini (46.0...48.0%), cocoa (0.1...1.0%), pumpkin oil (6.0...9.0%), honey (6.0%). The sticks are prepared by homogenizing the components well, so the product is given the shape of bars.

### Results

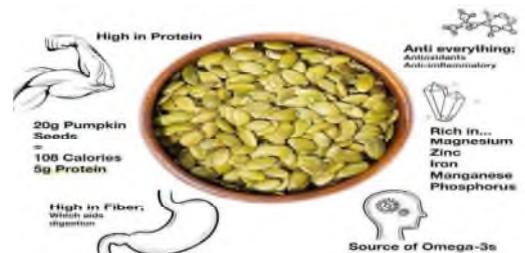
1. New confectionary product with NO added sugar
2. Low glycemic index and caloric content
3. Increasing the sensory characteristics
4. Increasing the nutritional and biological value
5. Important source of principal vitamins and minerals
6. Healthy snack



Experimental samples of functional confectionary bars



### Pumpkin seeds functional properties



The main raw material

#### Proportion 50%/50%

- ✓ 50g - pumpkin seeds flour
- ✓ 50g - pumpkin pulp flour



✓ 25g - Pumpkin seeds

#### Proportion 70%/30%

- ✓ 70g - pumpkin seeds flour
- ✓ 30g - pumpkin pulp flour



✓ 25g - Pumpkin seeds

# PRECESSIONAL PLANETARY TRANSMISSION

Dr. Sc., prof. Ion BOSTAN; Dr. Sc., prof. Valeriu DULGHERU; PhD., assoc. prof. Maxim VACULENCO;  
PhD., assoc. prof. Iulian MALCOCI; PhD., assoc. prof. Radu CIOBANU; PhD., assoc. prof. Oleg CIOBANU;  
master st-t. Stanislav SLOBODEANIUC; st-t. Victor GUȘTIUC.

## Goal:

The problem solved by the invention is the simplification of the construction and the increase of the reliability of the precessional planetary transmission by reducing the dynamic loads.

Patent  
application  
nr. s 2020 0020,  
of 06.03.2020

## Solution:

The proposed technical solution allows to increase the reliability of the gearbox by reducing the dynamic load, in particular, on the bearings and gear elements.

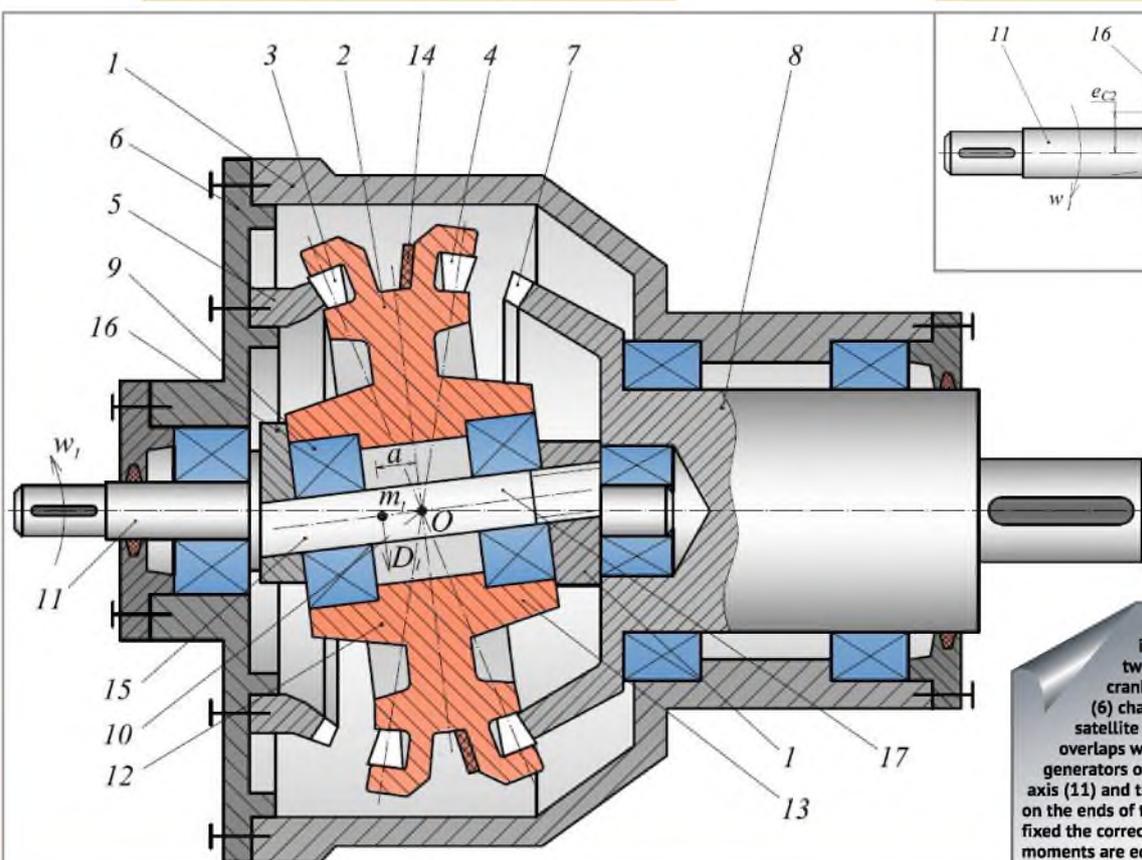
## Advantages:

- ✓ Simplicity of construction;
- ✓ High reliability;
- ✓ Reduction of dynamic loads.

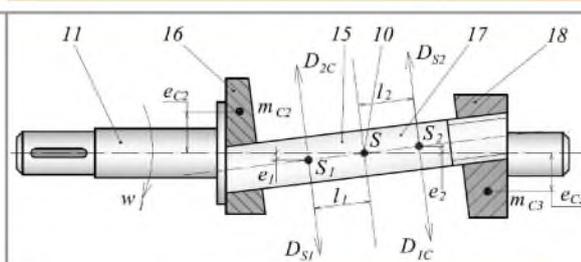
## Stage:

Computerized model.

Overview of precessional planetary transmission



Shaft-crank subassembly with balancing elements



### Component parts:

- 1-housing, 2- satellite block, 3, 4 - tapered rollers, 5 - fixed central gear, 6 - gearbox cover, 7 - movable central gear, 8 - driven shaft, 9 - bearings, 10 - precession center O, 11 - crankshaft, 12 - inclined sector, 13 - outer part of the lighter half of the satellite block, 14 - additional table, 15 - segment, 16 - eccentric bushing, 17 - segment with threaded end, 18 - eccentric nut.

Precessional planetary transmission, which includes a housing (1), the satellite block (2) with two crowns with tapered rollers (3) and (4), the crankshaft (10), the fixed (5) and movable central gears (6) characterized in that the center of mass of the satellite block (2) with two conical roller crowns (3) and (4) overlaps with the point of intersection of the axes and generators of the conical rollers (3) and (4), of the crankshaft axis (11) and the axis of the inclined sector (10), at the same time on the ends of the inclined sector (10) of the crankshaft (11) are fixed the correction masses (16) and (18), whose dynamic moments are equal in size and opposite in direction to the dynamic moments of imbalance of segments (15) and (17).



# METHOD AND INSTALLATION FOR RECORDING AND RECOGNIZING THE IMAGE RENDERED BY OSCILLATIONS IN FREQUENCY OR DURATION TUNING FORK

PhD., *assoc. prof.* Zaharia DONȚU; PhD., *assoc. prof.* Radu CIOBANU; PhD., *assoc. prof.* Oleg CIOBANU; PhD., *assoc. prof.* Nicolae TRIFAN; PhD., *assoc. prof.* Maxim VACULENCO; PhD., *assoc. prof.* Iulian MALCOCI; PhD., *assoc. prof.* Ion DICUSARĂ; PhD., *assoc. prof.* Ion BODNARIUC; PhD., *st-t.* Dumitru VENGER.

### Goal:

- ✓ To expand the control and coordination capacity of the dynamic characteristics generated by the external element with those of the impulse generator, - the teacher and obtaining coherence in the teacher-student tandem;
- ✓ To have at its disposal the method of storing large volumes of information in confined spaces with the possibility of recognizing and extracting information about each object and process mechanical, biological or otherwise falling under the incidence of interrupted and broken nonlinear oscillations.

Patent application, OSIM nr. A/00998, of 16.12.2013

### Solution:

The proposed invention uses systems with adjustable dynamic parameters, and this makes them distinguished by the numerical value of its own frequency imposed by the force of self-maintaining oscillation provided by the individual friction force to each system which requires the condition that this force be primary, while the force is at the base of the mechanical pulsation to be secondary.

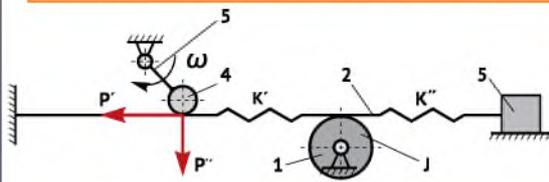
### Advantages:

- ✓ Expanding the control and coordination capacity of the dynamic characteristics generated by the external element with those of the impulse generator, the teacher and obtaining coherence in the teacher-student tandem.
- ✓ The installation is equipped with a controlled stretching element of the modeling element and the connection with the external object is ensured.
- ✓ The existence of the process of storing large volumes of information in confined spaces with the possibility of recognizing and extracting information about each object and mechanical, biological or other process that falls under the incidence of interrupted and broken nonlinear oscillations.

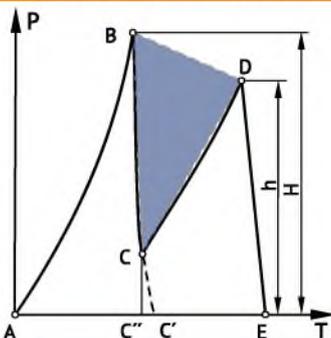
### Stage:

Computerized model.

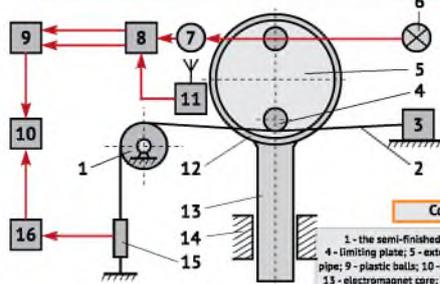
The dynamic model of the student-teacher tandem



The impulse reproduces the learning process in school (high school)



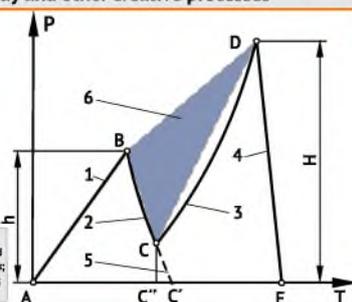
Installation for carrying out the process



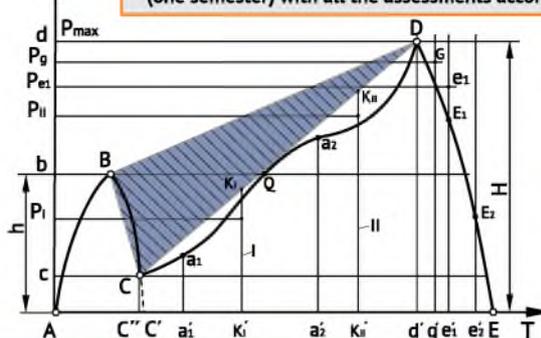
Component parts:

- 1 - the semi-finished product; 2 - technological tool;
- 4 - limiting plane; 5 - extension card; 6 - arc; 7 - disc; 8 - rigid pipe;
- 9 - plastic balls; 10 - pipe; 11 - pusher; 12 - guide rollers;
- 13 - electromagnet core; 14 - springs; 15 - coil; 16 - housing;
- 17 - electrical outlet; 18 - guides; 19 - table.

Overview of an impulse, which corresponds to the learning process in school (high school), university study and other creative processes



The impulse shows the study process in the university with reference to the object and the concrete student for a concrete duration (one semester) with all the assessments according to the curriculum



The proposed procedure solves the problem due to the construction and examination of an impulse belonging to the interrupted and broken nonlinear oscillations. The impulses that form the broken oscillations are caused by two forces - dominant impulses (other impulse forces can appear in the process but their contribution is to the formation of nonlinearity, - they do not have enough power) which always have one of the tandem forces: time-time, time-thought or thought-thought.

## SCRAPER WITH VIBROMECHANICAL DRIVE

PhD., assoc. prof. Radu CIOBANU; PhD., assoc. prof. Oleg CIOBANU; PhD., assoc. prof. Alexei BOTEZ;  
PhD., assoc. prof. Nicolae TRIFAN; PhD., assoc. prof. Ion BODNARIUC; PhD., assoc. prof. Iulian MALCOCI.

### Goal:

Simplification of scraper construction, advancement of processing productivity, quality and improvement of working conditions, reduction of energy consumption.

Patent  
nr. 1422 Y MD,  
of 29.02.2020

### Solution:

- ✓ The operator holds the technological tool of the rigid pipe 8 by hand, maneuvering with it according to the processing needs of the semi-finished product 1.
- ✓ High-precision flat surfaces are manually machined by scraping by highly qualified locksmiths. For example, the machine guides - turning tools are processed by scraping by the most qualified locksmiths for 30 - 40 hours.

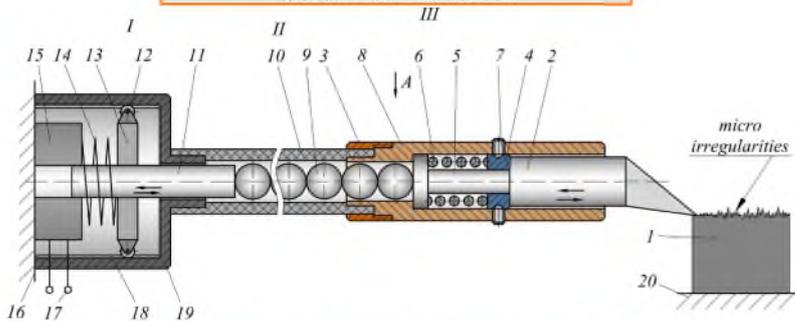
### Advantages:

- ✓ Simplicity of construction;
- ✓ Advanced productivity;
- ✓ Low energy consumption;
- ✓ The possibility of handling the scraper according to the processing needs;
- ✓ Superior quality of the processed surface.

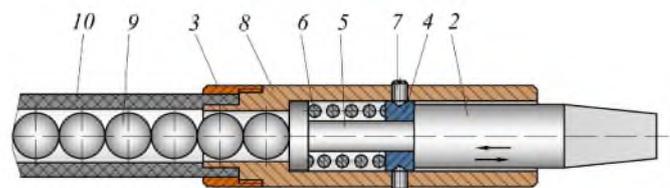
### Stage:

Computerized model.

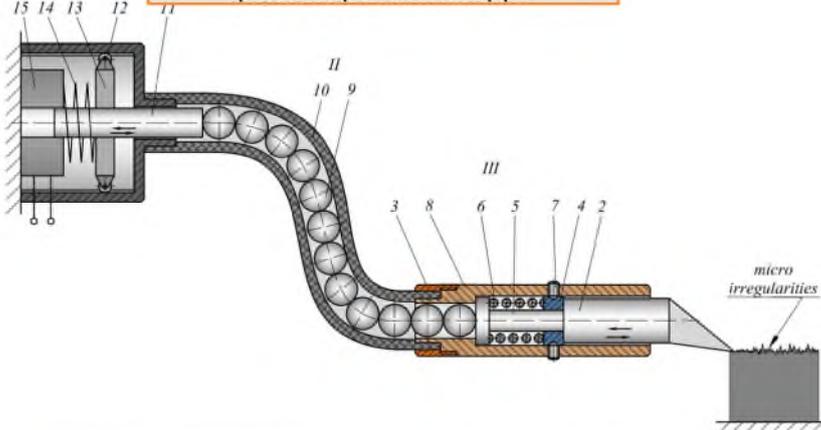
Constructive scheme of the scraper  
with vibromechanical drive.



View A



Construction diagram of the vibromechanically  
operated scraper with flexible pipe.



Component parts:

- 1 - the semi-finished product;
- 2 - technological tool; 4 - limiting plate;
- 5 - extension cord; 6 - arc; 7 - disc; 8 - rigid pipe; 9 - plastic balls; 10 - pipe; 11 - pusher;
- 12 - guide rollers; 13 - electromagnet core;
- 14 - springs; 15 - coil; 16 - housing;
- 17 - electrical outlet; 18 - guides; 19 - table.

High-precision flat surfaces are manually machined by scraping by highly qualified locksmiths. For example, the machine guides - turning tools are processed by scraping by the most qualified locksmiths for 30... 40 hours. Using the proposed scraper can reduce the processing time by 6... 10 times. The worker holds the scraper with his hand on the rigid pipe 8 and presses it on the surface of the semi-finished product.



## ROTOR BLADE FOR VERTICAL AXIS WIND TURBINE

PhD., assoc. prof. Rodion CIUPERCĂ; PhD., st-t. Ivan RABEL; PhD., assoc. prof. Marin GUȚU;  
PhD., assoc. prof. Oleg CIOBANU; PhD., assoc. prof. Radu CIOBANU.

### Goal:

Increasing the conversion efficiency of the wind turbines intended for areas with low wind speeds, increasing the rotor's reliability by reducing the parts number and lowering the noise and vibration levels.

Positive decision  
to grant the patent  
nr. 9782 MD,  
of 29.04.2021.

### Solution:

- ✓ The blades are developed from blade segments and the airfoil on which they are based has an opening at the trailing edge, located either on the either or on the outer side of the blade;
- ✓ The vertical axis wind turbine allows the transformation of wind energy into electricity with an increased conversion factor.

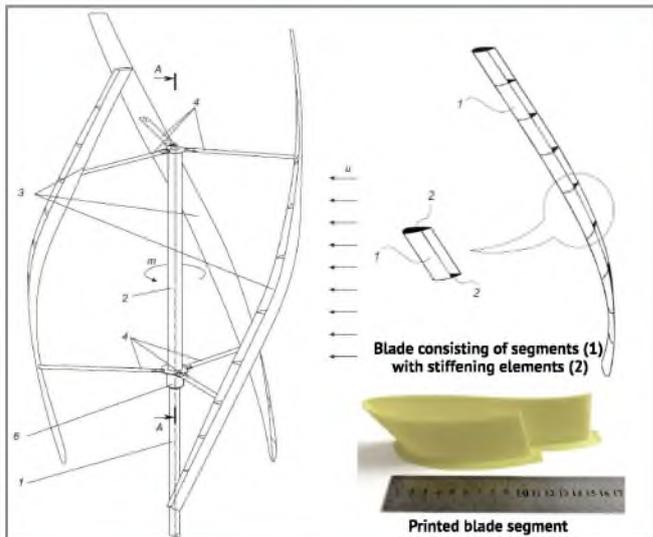
### Advantages:

- ✓ Decreased number of constructive parts;
- ✓ Decreasing the complexity of the manufacturing system by employing the blade segments;
- ✓ Increased wind energy conversion efficiency;
- ✓ Decreased noise level and vibration;
- ✓ The possibility of using recycled plastics for blade manufacturing
- ✓ Increased self starting abilities.

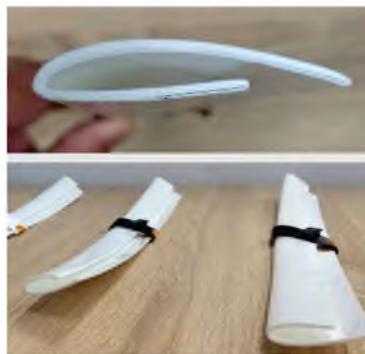
### Stage:

3D CAD model, CFD simulation. Prototype for laboratory research.

### Computerized model of vertical axis wind turbine.



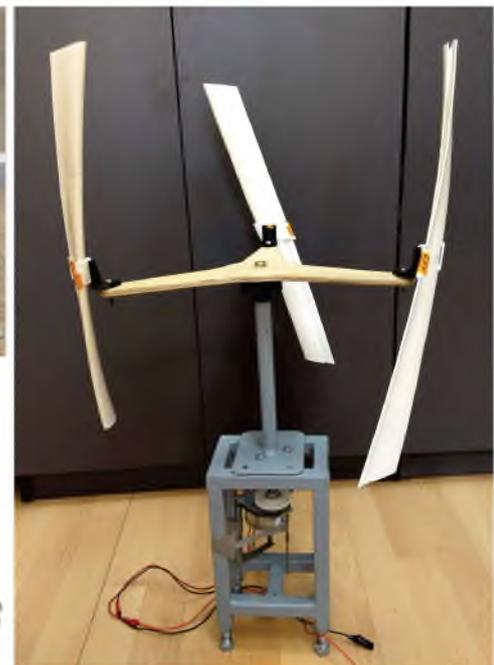
### Prototype for laboratory research



Helical blades with open asymmetrical profile at the flight edge



The core of the mold made of laser cut elements from plywood



The assembly of the wind rotor blade from the blade sectors contributes to the simplification of the manufacturing technology, the assembly process, the possibility of generating different blade sizes, facilitates the transport and service of the wind rotor.

The blade sectors can be obtained by various technological processes such as plastic extrusion, generation by additive methods using 3D printers, by sheet metal bending processes, etc.

The opening made in the aerodynamic profile of the blade on the extrados or on the soffit of the blade, ensures the development of an additional torque necessary to start the wind turbine rotor in the limit of low wind speeds.

## MINI-HYDROELECTRIC POWER PLANT

*Dr. Sc., prof. Ion BOSTAN; Dr. Sc., prof. Viorel BOSTAN; Dr. Sc., prof. Valeriu DULGHERU; PhD., engineer (RO) Cătălin DUMITRESCU; PhD., st-t. engineer (RO) Liliana DUMITRESCU; PhD., assoc. prof. Oleg CIOBANU; PhD., assoc. prof. Radu CIOBANU.*

### Goal:

The mini-hydroelectric power plant is intended for the production of electricity from renewable sources, namely for the transformation of water flow energy into electricity.

### Solution:

- ✓ - Increasing the conversion efficiency by optimally orienting the blades against water currents and reducing power losses when changing the position of the blade from the relatively passive position to the optimal working position at different phases of rotor rotation;
- ✓ - Simplification of the construction of the micro-flow power plant by using a relatively simple mechanical system for orienting the blades.

Patent application, OSIM nr. A/00549, of 22.06.2020.

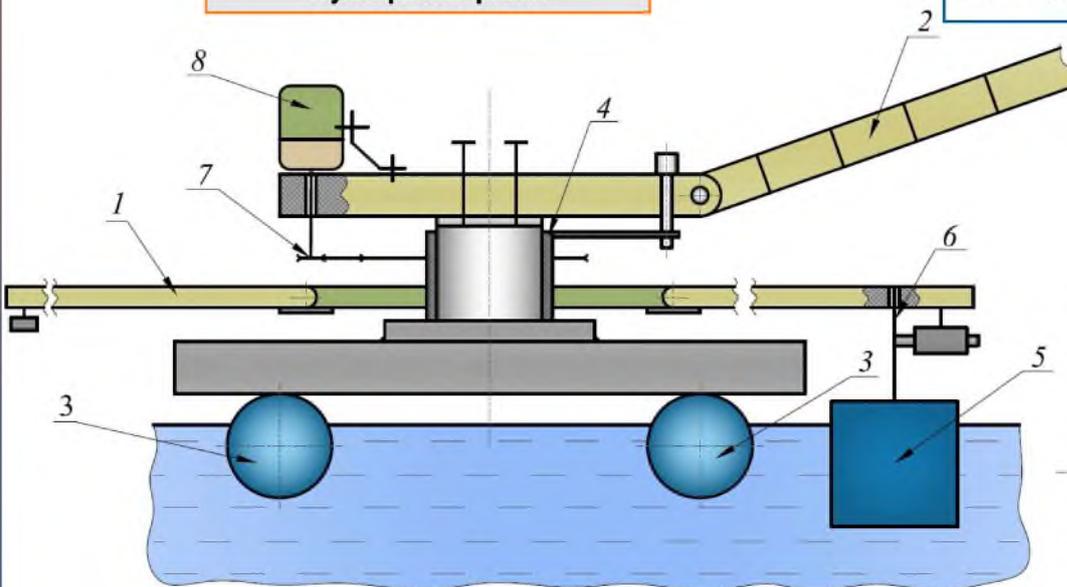
### Advantages:

- ✓ Simplification of construction;
- ✓ Increasing the efficiency of converting the kinetic energy of water into mechanical energy.

### Stage:

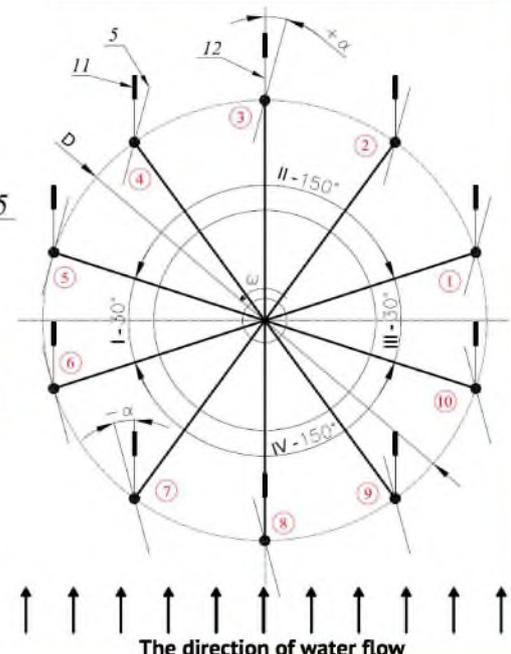
Experimental prototype.

### Overview of the mini-hydropower plant



The power generated by the proposed mini-hydropower plant is higher than that produced by the existing mini-hydropower plants at the same geometric (blade size) and kinematic parameters of the water.

### The positions of the blades in the rotor in working process



The proposed mini-hydropower plant allows the transformation of the kinetic energy of water currents into mechanical or electrical energy with an increased efficiency of conversion of the kinetic energy of water.

## UNCONVENTIONAL TECHNOLOGIES FOR MANUFACTURING GEARS WITH NON-STANDARD TOOTH SIDE PROFILES

Dr. Sc., prof. Valeriu DULGHERU; Dr. Sc., prof. Ion BOSTAN ;  
PhD., assoc. prof. Radu CIOBANU; PhD., assoc. prof. Oleg CIOBANU;  
master st-t. Stanislav SLOBODEANIUC; st-t. Victor GUȘTIUC.



### Goal:

The invention relates to the construction of machines, in particular to additive technologies for the manufacture of gears from precessional planetary transmissions.

### Solution:

- The manufacture of teeth with the help of several heads with additive nozzles by the immediate deposition of the next layer ensures a better adhesion between layers and to the increase of the mechanical resistance of the teeth;
- ✓ The manufacture of gears from one-component metal powders with fine density of the tooth core and coarse density of the tooth surface layer with the addition of solid lubricant (graphite or MoS<sub>2</sub>) ensures increased mechanical resistance of the teeth and reduction of sliding friction power losses in the system precessional gearing;

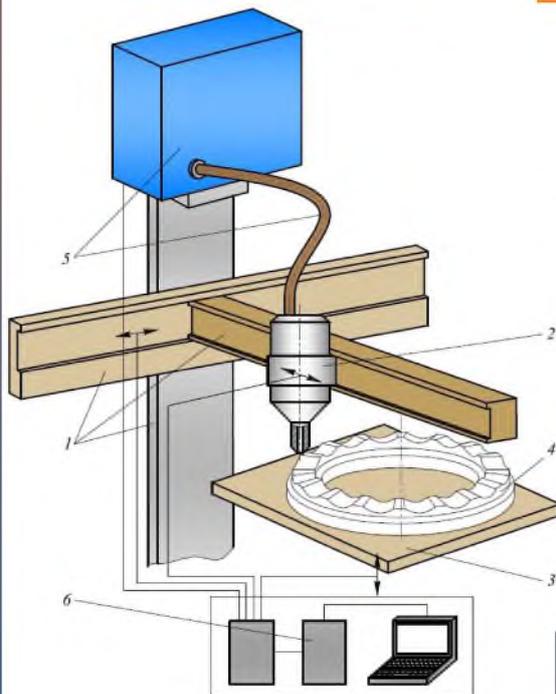
### Advantages:

- ✓ Reduction of slip friction power losses in the precessional gear system;
- ✓ Increasing the mechanical and antifriction characteristics of the tooth surface material;
- ✓ Relative technological simplicity.

### Stage:

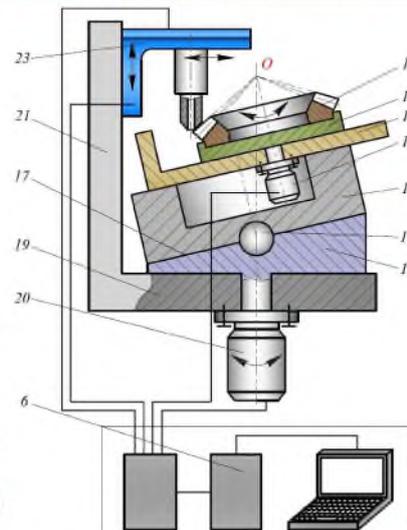
Computerized model.

3D printer overview



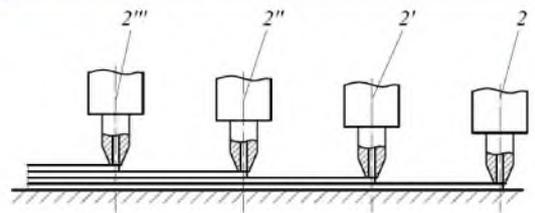
Deposition of the surface layer of teeth with non-standard convex-concave profile already formed ensures technological simplicity and improved mechanical characteristics of the surface layer of teeth;

Overview of the 3D printing device (second variant) with precessional additive head

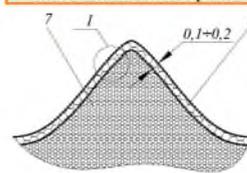


- The manufacture of teeth from fine-powder metal powders of dendrous cell units, on which a polymeric layer of diamond-type cell units with elastic structure is deposited ensures the reduction of power losses in the gear while respecting the mechanical strength of the teeth;  
- Filling the pores of the surface layer of teeth from metal powders with liquid lubricant ensures the reduction of power losses at slip friction in the gear.

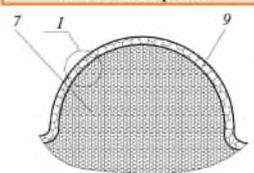
Additive deposition scheme with several additive heads



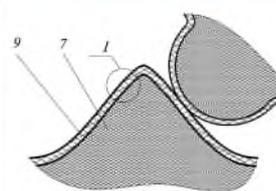
The image of the tooth with a convex-concave profile



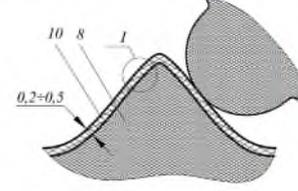
The image of the tooth with a circular profile



Tooth gear system (convex-concave profile) - circular tooth made of metal powders, both teeth with elastic surface layer



Tooth gearing system (convex-concave profile) - circular tooth made of metal powders, with elastic surface layer only on one tooth





## HORIZONTAL AXIS WIND TURBINE WITH AUTOMATIC POWER CONTROL

*Dr. Sc., prof. Viorel BOSTAN; Dr. Sc., prof. Ion BOSTAN; Dr. Sc., prof. Valeriu DULGHERU;  
PhD., assoc. prof. Radu CIOBANU; PhD., assoc. prof. Oleg CIOBANU; PhD., st-t. Alexandru TOACĂ.*

### Goal:

The invention relates to energy, namely, vertical axis wind turbines, and can be used for the transformation of wind energy into electricity, with power control.

Positive decision  
to grant the patent  
nr. 9783 MD,  
of 05.05.2021.

### Solution:

- ✓ Replacing the actuator mechanism of the peripheral damper, consisting of electric motor, drive shaft along the entire length of the blade and its rigid or flexible connecting elements with the peripheral damper, with simple inertial mechanisms leads to simplification of construction;
- ✓ The inertial mechanisms activate themselves when the wind speed and the rotor speed, respectively, exceed a limit value, which ensures a better reliability of the blades by avoiding their overload at high wind speeds.

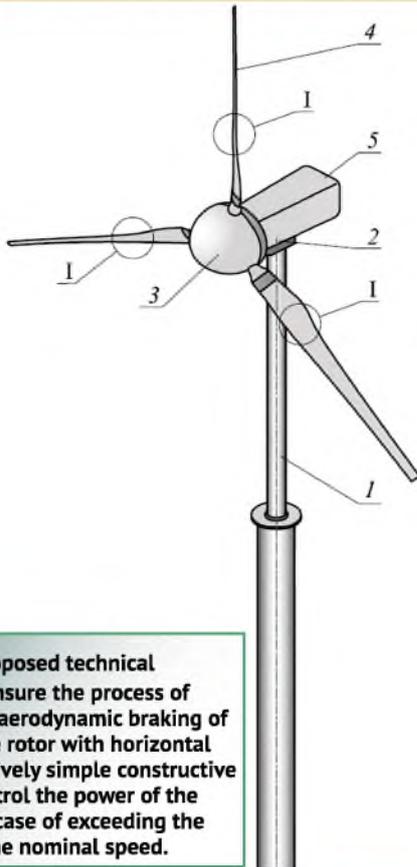
### Advantages:

- ✓ Simplicity of construction;
- ✓ Increasing the reliability of the wind rotor.

### Stage:

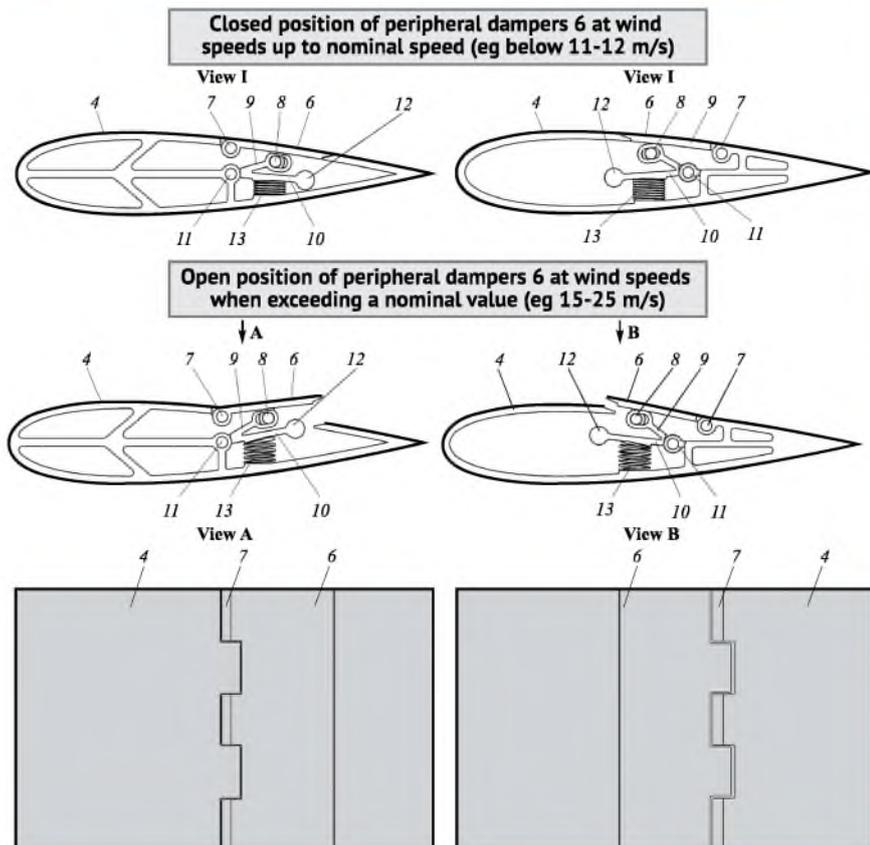
Computerized model.

### Overview of the horizontal axis wind turbine



The proposed technical solutions ensure the process of mechanical and aerodynamic braking of the wind turbine rotor with horizontal axis, being relatively simple constructive solutions to control the power of the wind turbine in case of exceeding the wind speed of the nominal speed.

### Shaft-crank subassembly with balancing elements





## WIND TURBINE WITH HORIZONTAL AXIS WITH POWER CONTROL

*Dr. Sc., prof. Viorel BOSTAN; Dr. Sc., prof. Ion BOSTAN; Dr. Sc., prof. Valeriu DULGHERU;  
PhD., assoc. prof. Radu CIOBANU; PhD., assoc. prof. Oleg CIOBANU; PhD., st-t. Alexandru TOACĂ.*

### Goal:

The invention relates to energy, namely, vertical axis wind turbines, and can be used for the transformation of wind energy into electricity, with power control.

Patent  
application  
nr. s 2020 0067,  
of 22.06.2020

### Solution:

- ✓ Replacing the actuator mechanism of the peripheral damper, consisting of electric motor, drive shaft along the entire length of the blade and its rigid or flexible connecting elements with the peripheral damper, with simple inertial mechanisms leads to simplification of construction;
- ✓ The inertial mechanisms activate themselves when the wind speed and the rotor speed, respectively, exceed a limit value, which ensures a better reliability of the blades by avoiding their overload at high wind speeds.

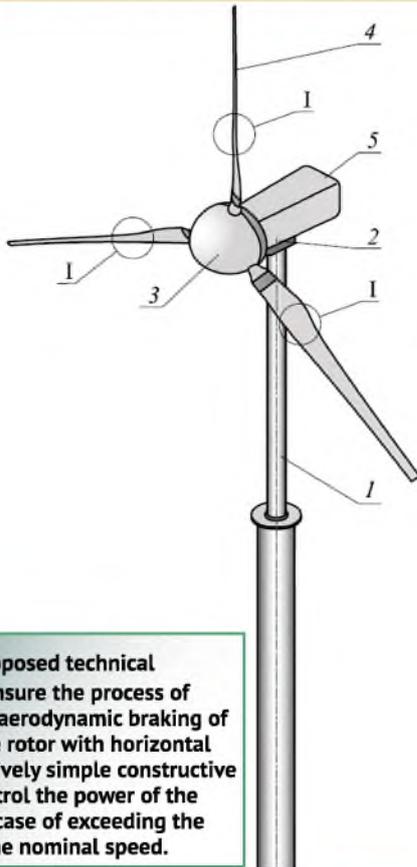
### Advantages:

- ✓ Simplicity of construction;
- ✓ Increasing the reliability of the wind rotor.

### Stage:

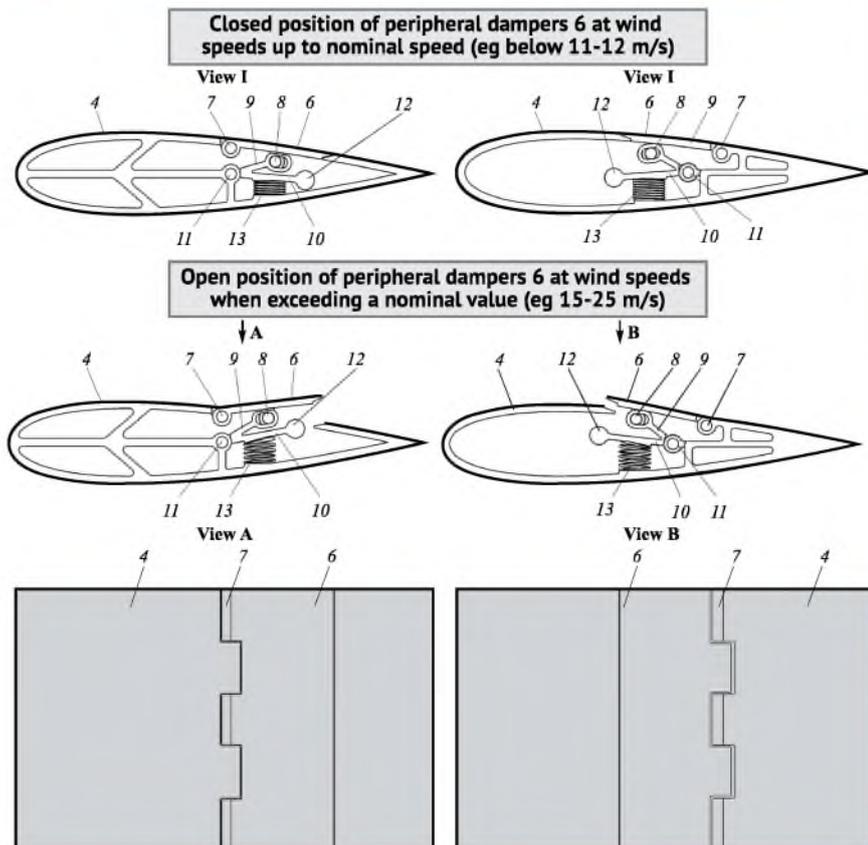
Computerized model.

### Overview of the horizontal axis wind turbine



The proposed technical solutions ensure the process of mechanical and aerodynamic braking of the wind turbine rotor with horizontal axis, being relatively simple constructive solutions to control the power of the wind turbine in case of exceeding the wind speed of the nominal speed.

### Shaft-crank subassembly with balancing elements





THE 25<sup>th</sup> INTERNATIONAL EXHIBITION  
OF INVENTICS

# "INVENTICA 2021"



NATIONAL INSTITUTE OF  
INVENTICS, IASI, ROMANIA

23.06.21 - 25.06.21, Iasi - Romania

Technical University of Moldova



## HYBRID WIND TURBINE WITH VERTICAL AXIS

Dr. Sc., prof. Viorel BOSTAN; Dr. Sc., prof. Ion BOSTAN; Dr. Sc., prof. Valeriu DULGHERU; PhD., engineer (RO) Cătălin DUMITRESCU; PhD., assoc. prof. Oleg CIOBANU; PhD., assoc. prof. Radu CIOBANU; PhD., st-t. Ivan RABEL; PhD., assoc. prof. Marin GUȚU; Dr. Sc., prof. (RO) Adrian CIOCĂNEA; Dr. Sc., prof. (RO) Edmond MAICAN; PhD., engineer (RO) Radu RĂDOI; engineer (RO) Ștefan ȘEFU.

### Goal:

The turbine can provide greater autonomy to individual and dispersed users (private residential homes, small businesses, street lighting systems, anti-hail systems, etc.).

### Solution:

- ✓ At wind speeds of 3.0-3.5 m/s the Savonius rotor supplements the torque already generated by the Darreus rotor, ensuring the production of electricity;
- ✓ The shafts of each turbine are kinematically connected to each other with the possibility of rotating in opposite directions.

Patents:  
nr. 1261 Y MD,  
of 30.06.2018;  
nr. 934 Y MD,  
of 31.07.2015.

### Advantages:

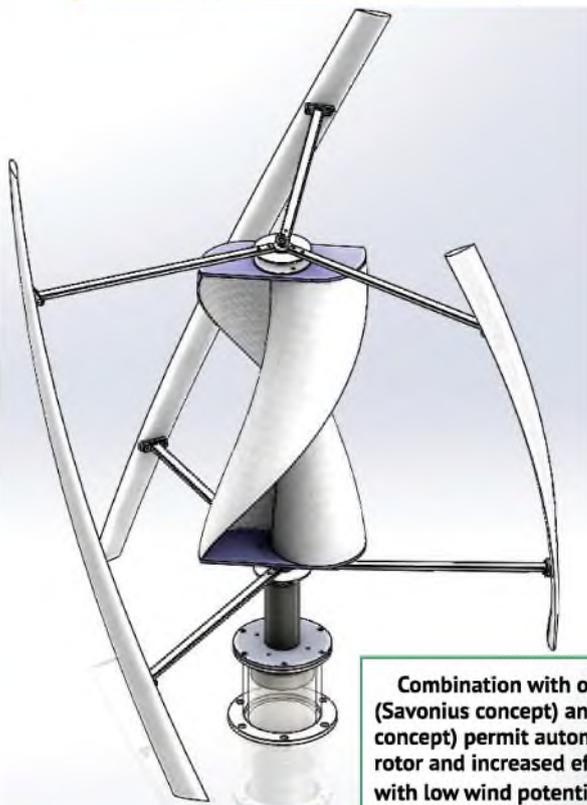
- ✓ Simplification of construction;
- ✓ Increase the turbine reliability;
- ✓ Enhance wind power conversion efficiency;
- ✓ Increasing the amount of produced electricity.

### Stage:

Experimental prototype.

Experimental prototype of vertical axis wind turbine designed, manufactured and researched experimentally at UP Bucharest.

Computerized model of vertical axis wind turbine.



Combination with one rotor the high solidity (Savonius concept) and high tip speed ratio (Darreus concept) permit automatic starting-up the external rotor and increased efficiency in region with low wind potential.

Aerodynamic profile blades, located on helical lines and opposite rotation of Savonius and Darreus rotors permit the increases of the turbine efficiency.

## WIND TURBINE WITH VERTICAL AXIS

*Dr. Sc., prof. Viorel BOSTAN; Dr. Sc., prof. Ion BOSTAN; Dr. Sc., prof. Valeriu DULGHERU; PhD., st-t. Ivan RABEL; PhD., assoc. prof. Marin GUȚU; PhD., assoc. prof. Radu CIOBANU; PhD., assoc. prof. Oleg CIOBANU.*

### Goal:

The invention relates to energy, namely to vertical axis wind turbines, and can be used to transform wind energy into electricity. The problem solved by the invention is to increase the reliability of the wind rotor and to simplify the construction.

Positive decision  
to grant the patent  
nr. 9715 MD,  
of 11.02.2021.

### Solution:

- ✓ The process of mechanical and aerodynamic braking;
- ✓ relatively simple constructive solutions;
- ✓ Securing the tower from overloads generated by high wind speeds.

### Advantages:

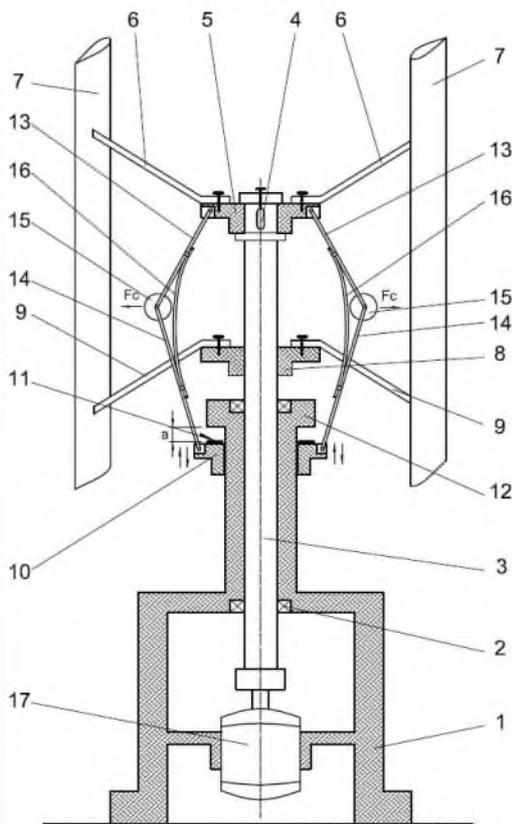
- ✓ High reliability;
- ✓ Simple construction of the vertical axis wind turbine;
- ✓ Increased wind energy conversion efficiency
- ✓ Securing the tower from overloads generated by high wind speeds.

### Stage:

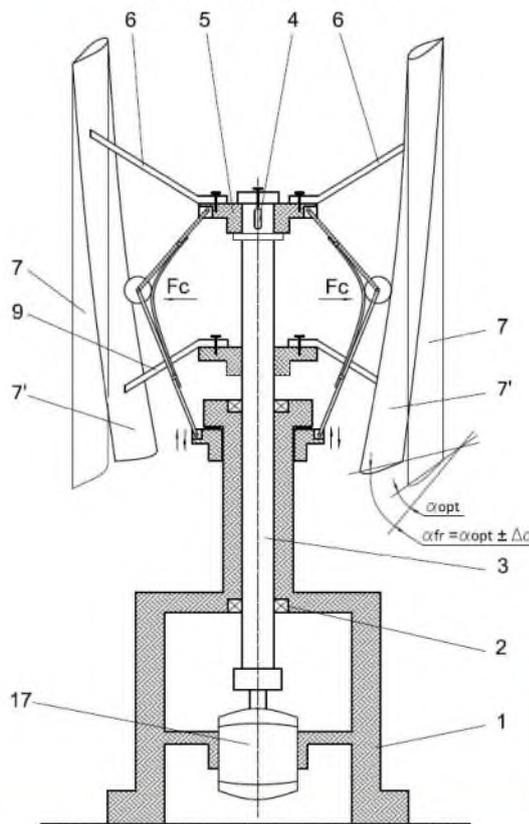
3D CAD model, CFD simulation.

### Computerized model of vertical axis wind turbine

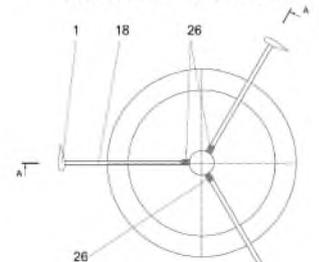
Overview of the vertical axis wind turbine



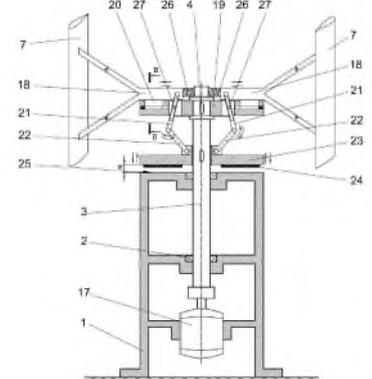
View of the turbine with the modified angle of attack



Top view of the vertical axis wind turbine in variant II



View A-A



The proposed technical solutions ensure the process of mechanical and aerodynamic braking through relatively simple construction solutions and the securing of the overload tower generated by high wind speeds.



**International Exhibition of Inventions  
INVENTICA 2021  
23.06.2021 – 25.06.2021**



**Technical University of Moldova**

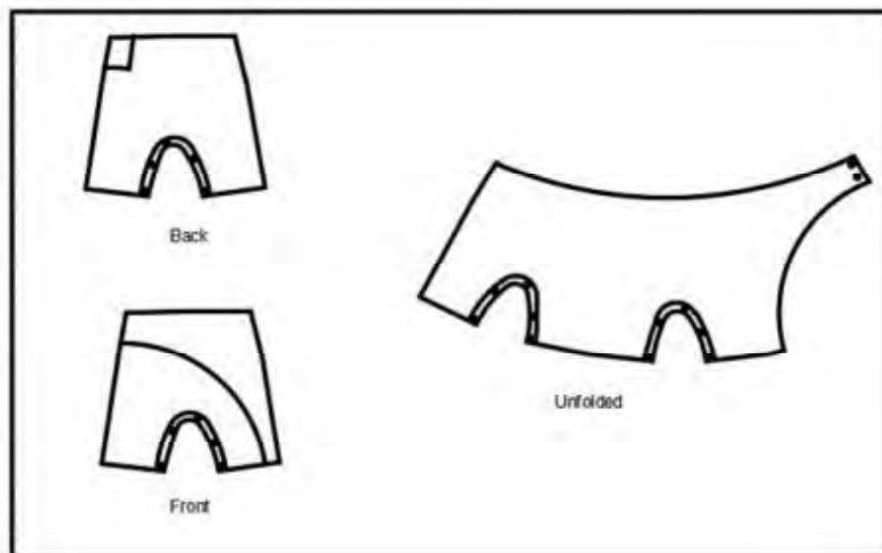
**ADAPTABLE CLOTHING FOR CHILDREN WITH SPECIAL  
NEEDS**

**Brevet/ Cerere brevet / Proiect (Patent/Patent application/ Research project): NR.  
DM/203338**

**Inventatori (Inventors/ authors): Victoria Danila, Antonela Curteza, Stela Balan**

**Products for children with special needs. The defining characteristics are:**

- ✓ Comfort (ergonomic and anthropomorphological parameters);
- ✓ Easy-to-fit closing system (tailored stitches);
- ✓ Adjustable size;
- ✓ Gender neutral styles;
- ✓ Health (soft materials with high hygienic properties, provides thermal insulation, easy to sterilize and disinfect, 100%cotton);
- ✓ Easy access for equipment medical;
- ✓ Secure (Ensure and maintain body heat, improving the child's condition from the therapy).



**Figure 1. Pants for children**



# PROCESS FOR ADJUSTING THE AXIAL CLEARANCE IN THE CONICAL GEAR

Ion BOSTAN, acad., dr.hab., prof.univ.; Sergiu MAZURU, dr.hab., conf.univ.; Andrei PLATON, drd.; Alexei TOCA dr. conf.univ.

### Goal:

Increased accuracy of the axial clearance in the conical gear and reduce assembly costs of the front surfaces of machine nodes with conical gears.

MD 1217 Z  
2018.07.31

### Solution:

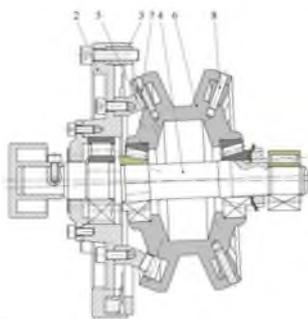
The process comprises calculating the error compensation value and determining the number of steps of a compensator, consisting of an auxiliary ring (3) with at least three protrusions and a main ring (4), on the end face of which are formed at least three mounting areas with steps. In the main ring (4) are made axial ducts, in which are installed attaching bolts, and in the auxiliary ring (3) are made axial holes for their passage. From the compensator dimension chain, by the method of complete interchangeability, is determined the upper and lower deviation value of the running clearance ( $J_f$ ) and the clearance between the cover (2) and the body (1) of the conical gear. One ring rotates relative to the other until the width of the compensator coincides with the value of compensated clearance ( $A_{comp}$ ), after which the compensator is fixed in the desired position.

### Advantages:

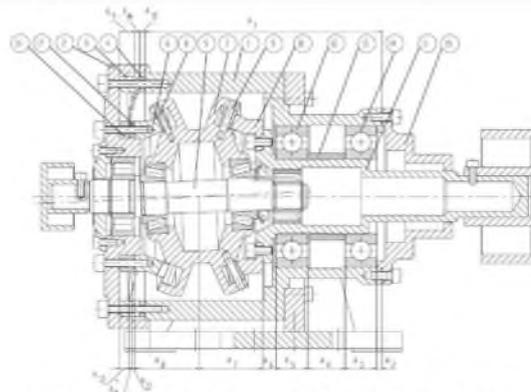
- increased accuracy of the axial clearance;
- reducing assembly labor;
- reduce assembly costs of the machine nodes with conical gear.

### Stage:

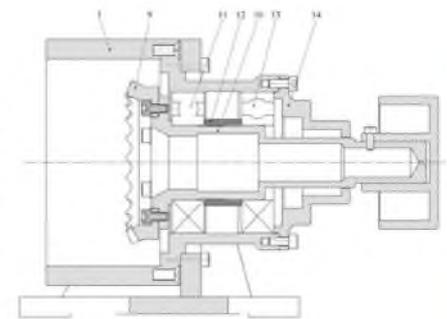
Computerized model.



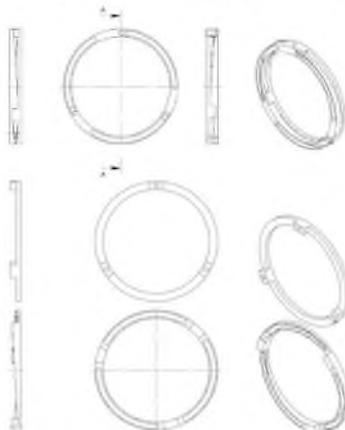
Left subassembly of reducer.



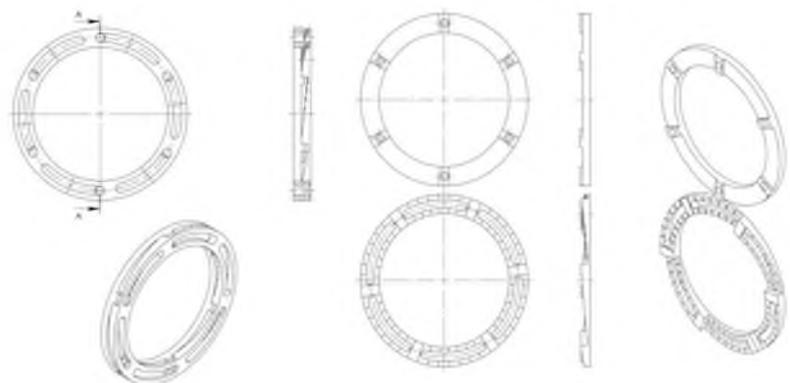
Axial section of reducer with two compensators.



Right subassembly of reducer.



Model of the compensator.



Model of the additional compensator.



# PROCESS FOR MACHINE PROCESSING OF PRECESSION GEAR TEETH

Ion BOSTAN, acad., dr. hab., prof. univ.; Sergiu MAZURU, dr. hab., conf. univ.; Andrei PLATON, drd.;  
Serghei SCATICAILOV, lect.univ.

## Goal:

Reduction of waste after processing and increasing the precision of the precessional gear processing.

MD 4700 C1  
2021.02.28

## Solution:

The process for machine processing of precession gear teeth consists in that the tool is communicated a motion that simulates the real operating conditions by coordinated motions relative to the moving coordinate system  $X_1, Y_1, Z_1$  and the fixed one  $X, Y, Z$ , the origin of which coincides with the center of precession motion, and the tool, made in the form of a disk, profiled at the end, with a radius  $R$ , is communicated an oscillatory motion relative to the  $X_1$  and  $Y_1$  coordinate axes and an additional linear motion along the tooth at an angle  $\delta \geq 0$  with the plane formed by the  $X_1$  and  $Y_1$  axes, at the same time the tool is also communicated an alternating motion on the tooth profile by means of a pair of gear-wheels with variable radius with the transmission ratio  $i = 1$ , installed between the crankshaft and the main axle of the machine tool.

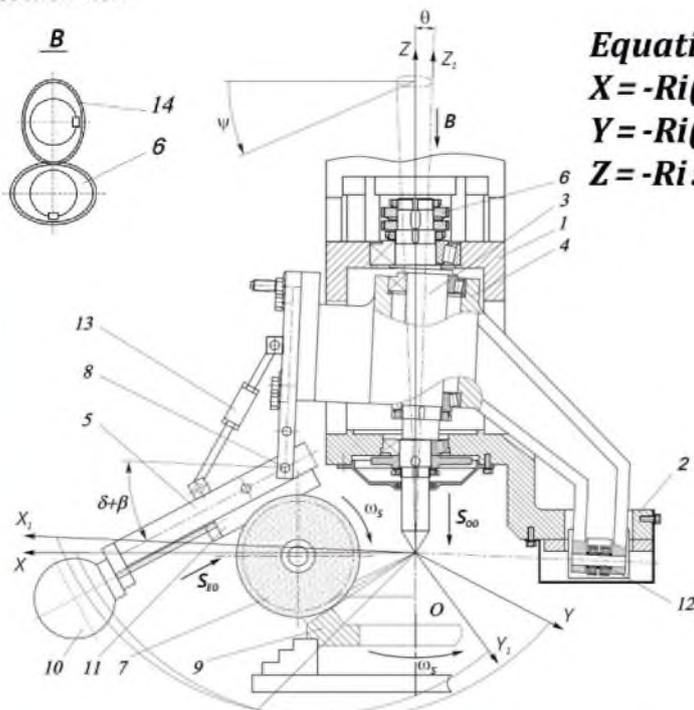
## Advantages:

- reduction of vibrations in the process of processing gear teeth;
- increasing the precision of the precessional gear processing;
- reduction of waste after processing;
- more economical use of the tool material and increasing the cutting capacity of the tool;
- the roughness of the processed surface is better
- higher precision for pitch, profile, frontal beats of the tooth etc.

## Stage:

Computerized model.

### Section view

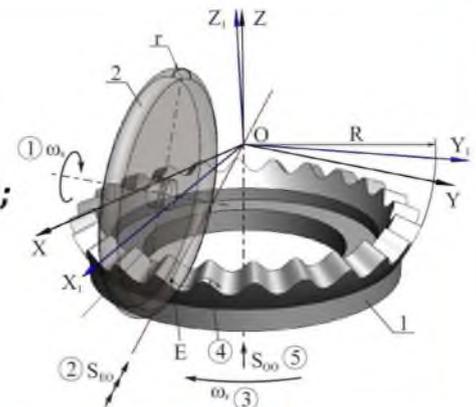


### Equations of motion:

$$X = -Ri(1 - \cos\theta)\cos\psi\sin\psi;$$

$$Y = -Ri(\sin^2\psi + \cos\theta\cos^2\psi);$$

$$Z = -Ri\sin\theta\cos\psi.$$



The scheme of the process for machine processing of precession gear teeth.



# International Exhibition of Inventions INVENTICA 2021 23.06.2021 – 25.06.2021



**TECHNICAL UNIVERSITY OF MOLDOVA**

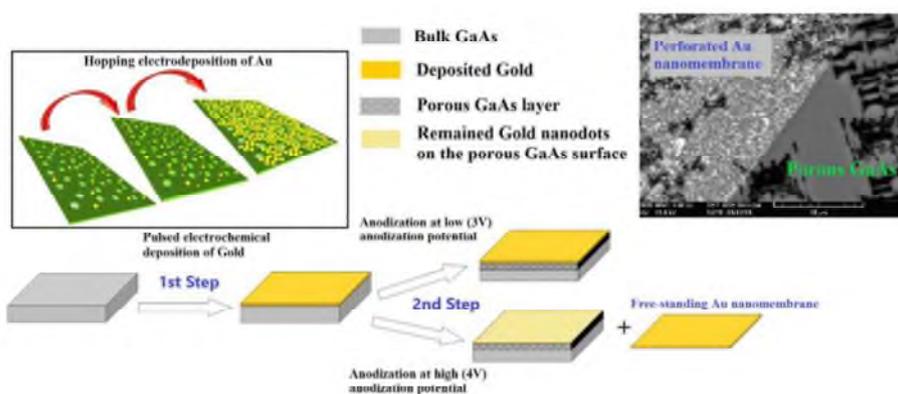
## NOVEL ELECTROCHEMICAL APPROACH FOR THE FABRICATION OF FREE-STANDING PERFORATED Au NANOMEMBRANES.

**Patent application: a 2020 0052 deposition date 09.06.2020**

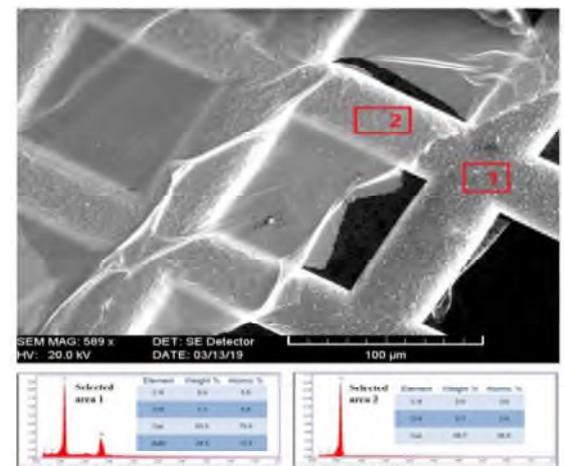
**Inventors/ authors: Eduard MONAICO, Elena MONAICO, Veaceslav URSAKI, Ion TIGINYANU**

Herein, we propose a room-temperature two-step cost-effective electrochemical technology for the preparation of free-standing Au nanomembranes. A thin Au film with thickness less than 100 nm was deposited by pulsed electroplating on a GaAs substrate in the first step, followed by anodization in the second technological step to introduce porosity into the GaAs substrate underneath the Au film. At optimized parameters of anodization, detachment of the film from the substrate occurs. The gold film consist of a monolayer of Au nanoparticles 20-30 nm and proved to be flexible and stretchable, with possibilities to transfer the prepared nanomembranes to various substrates.

- **Simple technological setup;**
- **The prepared nanomembranes exhibit good flexible properties;**
- **Possibilities for transfer of the gold nanomembranes to various substrates;**
- **Different geometrical designs of Au nanomembranes can be obtained via photolithography.**



Schematic representation of the technological route for the fabrication of Au nanomembrane on a porous semiconductor substrate with possibilities to be transferred to another substrate. Inset is the illustration of the mechanism of hopping electrodeposition of a monolayer of Au nanodots and SEM image of an Au nanomembrane prepared by electroplating with pulse duration of 300 us.



EDX analysis of an Au nanomembrane transferred to a TEM grid.

**Acknowledgements:** The authors acknowledge the support from the Ministry of Education, Culture and Research of the Republic of Moldova under the Grant #20.80009.50007.20 and to the European Union's Horizon 2020 research and innovation programme under grant #810652 (NanoMedTwin project).



# International Exhibition of Inventions INVENTICA 2021 23.06.2021 – 25.06.2021



**TECHNICAL UNIVERSITY OF MOLDOVA**

## **PROCESS FOR PRODUCING YOGHURT WITH HIGH BIOLOGICAL VALUE**

**MD 1497 (13) Y from 28.02.2021**

**INVENTORS: POPESCU Liliana, MD; GHENDOV-MOȘANU Aliona, MD; STURZA Rodica, MD; PATRAȘ Antoanela, RO; LUNG Ildiko, RO; OPRIȘ Ocsana-Ileana, RO; SORAN Maria-Loredana, RO.**

**PATENT DESCRIPTION: The invention relates to the dairy industry, in particular to a process for producing yoghurt with high biological value. The process, according to the invention, comprises milk normalization, pasteurization, cooling, leavening with starter cultures for yoghurt, fermentation, introduction of a water-alcohol extract of berries, mixing, packaging, cooling and maturation of yoghurt. At the same time, a hydroalcoholic extract of berries is introduced, obtained by mixing berry powder with water-alcohol solution and microwave extraction followed by filtration and concentration, and as berries are used aronia or sea-buckthorn or rosehip, or hawthorn fruits.**

### **YOGHURT WITH HYDROALCOHOLIC EXTRACT OF ARONIA FRUIT**



### **YOGHURT WITH HYDROALCOHOLIC EXTRACT OF ROSEHIP FRUIT**





# International Exhibition of Inventions INVENTICA 2021 23.06.2021 - 25.06.2021



**Technical University of Moldova**

## Center for communication and monitoring of educational satellites

**Project:** Nr. 20.80009.5007.09 “Development and launch of the series of nanosatellites with research missions on the International Space Station, monitoring, postoperating and promoting space technologies.

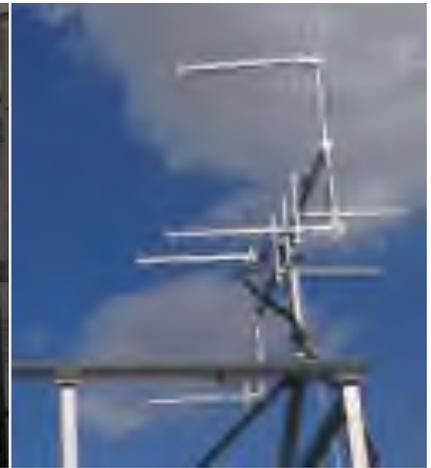
**Authors:** Vladimir VĂRZARU, Valentin ILCO, Alexei MARTINIUC, Vladimir MELNIC, Ion Bostan, Viorel BOSTAN, Nicolae SECRIERU



Ground station located in Chisinau

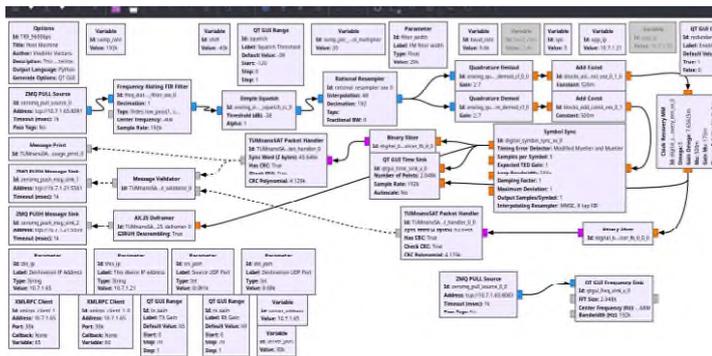


Command and control center

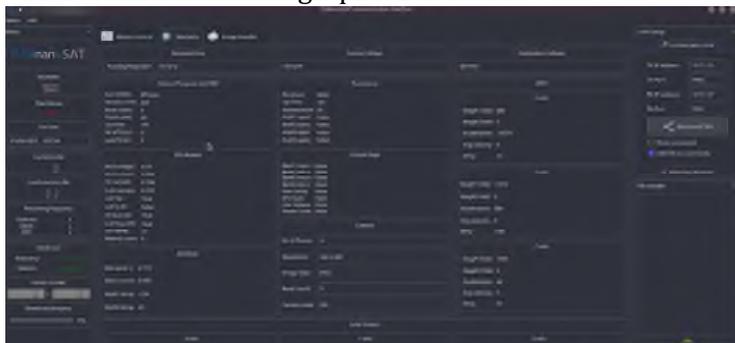


Ground station locate in Cahul

The communication and monitoring center of the UTM Space Technology Center has 2 ground stations, being at a distance of 200 km. Both stations have a set of antennas for communication on VHF and UHF frequencies.



GNU Radio flowgraph for TUMnanoSAT TRX



TRX Software developed at STC of TUM

Both stations are based on SDR (Software Defined Radio) technology, in our case the basic equipment being Ettus USRP E310 and B200. This makes the station versatile and easily reconfigurable for different communication parameters with educational satellites that communicate on VHF and UHF frequencies.

Within the project, digital processing blocks were created in the GNU Radio environment for communication with the TUMnanoSAT educational satellite. Such processing blocks can be created for each individual satellite.

At the same time, the software platform developed at STC allows the transmission of remote controls and the visualization of all useful data from the TUMnanoSAT educational satellite.



# International Exhibition of Inventions

## INVENTICA 2021

23.06.2021 - 25.06.2021



NATIONAL INSTITUTE OF  
INVENTICS, IASI, ROMANIA



MD 2270 (13) Y 2021.02.19



## The manufacture of bakery products from triticale flour

**TURCULEȚ Nadejda; GHENDOV-MOȘANU Aliona; STURZA Rodica; VEVERIȚĂ Efimia ;  
BUIUCLI Petr; LUPAȘCU Galina; ROTARI Silvia; GORE Andrei; LEATAMBORG Svetlana**

*Technical University of Moldova, 168 Stefan cel Mare Boulevard, MD 2004, Chisinau, Republic of Moldova  
Institute of Genetics, Physiology and Plant Protection, 20 Padurii Street, MD 2002, Chisinau, Republic of Moldova*

### AIM OF WORK

Manufacture of triticale flour bread with increased biological and nutritional value without synthetic food additives and containing fat-soluble extract from berries (sea buckthorn or rosehip or mountain ash).



Mountain ash

Rosehip

Sea buckthorn

### THE SOLUTION

The process includes the preparation of dough from triticale flour, compressed yeast, salt, sugar, whey, fat-soluble extract of sea buckthorn (*Hippophae rhamnoides* L.) or rosehip (*Rosa canina* L.) or mountain ash (*Sorbus aucuparia*) fruits and water, kneading, fermentation at a temperature of 25 ... 27 ° C for 90 ... 180 min, division, shaping, fermentation for 40 ... 60 min, at a temperature of 38 ... 40 ° C, baking, whey and fat-soluble extract are taken in quantities of 5 ... 30% and 0.5 ... 2.5% by weight of the flour, the fat-soluble extract being obtained by mixing the respective powder with a granularity of 10 ... 70 μm, with sunflower oil, in the respective ratio 1: (12-20), ultrasonic extraction at the frequency 35 kHz, temperature 20 ... 45 ° C, for 0.5 ... 1.5 hours and vacuum filtration.

### Triticale flour



Samples of with sea buckthorn fat-soluble extract and whey

### ADVANTAGES

Increasing the nutritional value and increasing the shelf life of bread by adding whey and fat-soluble extracts, while maintaining the antimicrobial action of the extracts and diversifying the range of bread.





INVENTICA 2019

**Institutes from MOLDOVA**

*National Agency of Public Health*



## NATIONAL AGENCY FOR PUBLIC HEALTH



Republic of Moldova



MD-2028, Chisinau, Gh.Asachi 67A St., ph. (+373 22) 574574, Fax. (+373 22) 729725  
E-mail: constantin.spinu@ansp.gov.md

### Identification method of anti-COVID-19 marker in humans blood serum

Patent pending  
Nr. S2020 0101

#### Authors:

Spînu Constantin, MD, DHM, Cebotari Svetlana, MD, Isac Maria, MD, PhD,  
Sajin Octavian, MD, PhD, Spînu Igor, MD, PhD, Ceban Alexei, MD, Donos Ala, MD, DHM,  
Suveică Luminița, MD, Ion Dopira, MD

#### Objectives:

Development of an original technology for the detection of Sars-Cov-2,  
anti-IgM and anti-IgG virus markers in human blood serum.

#### Solution:

It proposes a new technology that allows to exclude equivocal results  
following the investigation of patient serum markers of COVID-19  
infection.

#### Advantages:

The proposed method significantly modifies the effectiveness of the  
test by increasing the specificity and sensitivity, excluding the  
appearance of equivocal results.

#### Application domain (significance):

Human medicine. Laboratory diagnosis (paraclinical) in the regional  
laboratories including those of reference. If necessary, it can be applied  
in other laboratories, indifferent of the level of healthcare.

#### Implementation:

Applicable to all levels of healthcare, especially in the departments,  
clinics and hospitals of infectious diseases. It is of professional  
interest for the SUMPh "N. Testemițanu" chairs, students, residents,  
virologists, infection disease specialists, epidemiologists.

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***Institute of Applied Physics***

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Research project "Biomedical application of polarized digital holographic microscopy", ANCD 20.70086.16/COV

Achimova E., Abaskin V., Prisar A., Meşalchin A., Cazac V., Loşmanschii C., Slepnev I.

### Goals of Project

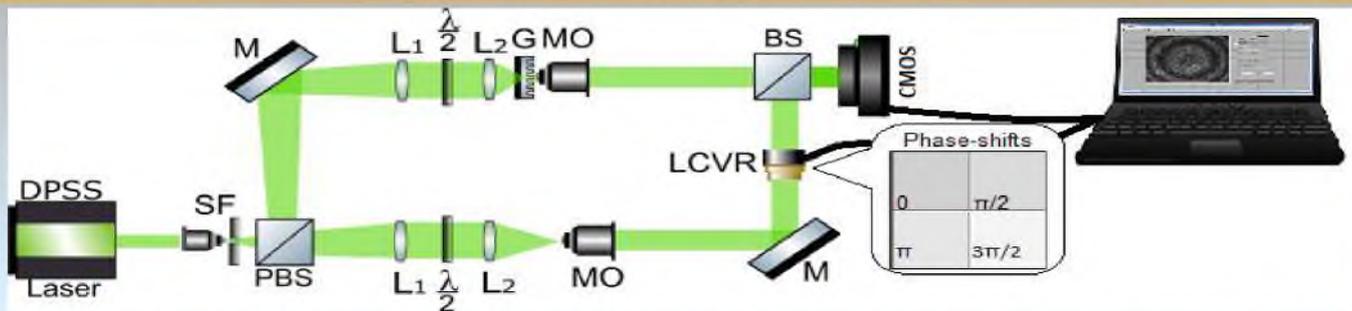
1. Engineering of polarized-sensitive digital holographic microscope (DHM)
2. Application of the developed DHM in biomedicine to study the structure and polarization properties of phase biomedical samples.

### Advantages of the laser based polarized-sensitive DHM

**Hardware:** Integrated input/output measurement hardware (Liquid Crystal Retarder- optical phase shifting and Videocamera-image acquiring) based on LabVIEW home-made code.

**Software:** 3D reconstruction of polarization images of transparent biomedical specimens, which allows retrieve information without staining living samples on MATLAB code.

### Polarized phase-shifting DHM set-up



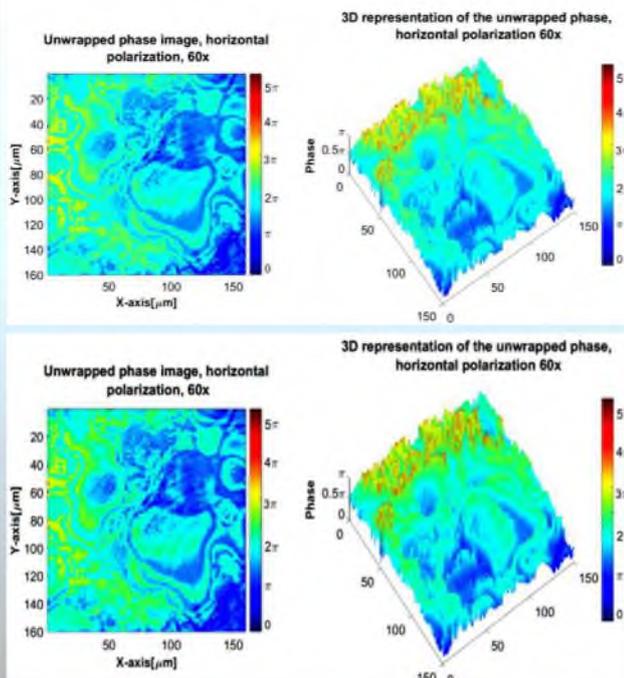
DHM set-up: G-sample,  $\lambda/2$  wave plates, M-mirror, SF-spatial filter, MO-microscope objective, LCVR-liquid crystal variable in 4 steps phase retarder, BS/PBS-non/polarized beam-splitter,  $L_1, L_2$ -lenses, CMOS videcamera

### Set-up components and they functions:

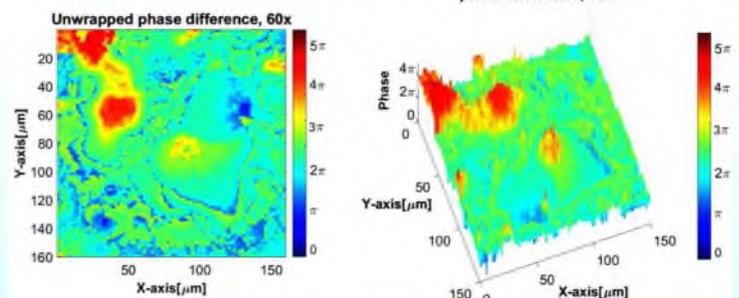
- Polarization states control by  $\lambda/2$  waveplates orientations
- Phase-shifting of the reference wave is produced by LCVR
- Computer-controlled digital hologram recording and phase-shifting via LCVR based LabVIEW graphical platform

### Polarization-sensitive DHM images of the leucoblastoma cells

#### Phase images in vertical / horizontal polarization



#### Optical phase difference



### Project Results

- The polarized-sensitive DHM was designed and implemented for quantitative measurement of polarizations, optical phases and amplitude distributions into transparent bio samples;
- The DHL provides information on the optical anisotropy of the bio samples;
- Low in contrast samples no needed to be staining in order to produce a details;
- The digital acquisition and processing of images was modified for quantitative measurements of the structural characteristics of cancer cells based on MATLAB and LabVIEW softs.



NATIONAL INSTITUTE OF INVENTIONS, IASI, ROMANIA



**International Exhibition of Inventions  
INVENTICA 2021  
23.06.2021 - 25.06.2021**



**Institute of Applied Physics**

***Inhibitor of steel corrosion in water***

**Patent MD № 1329**

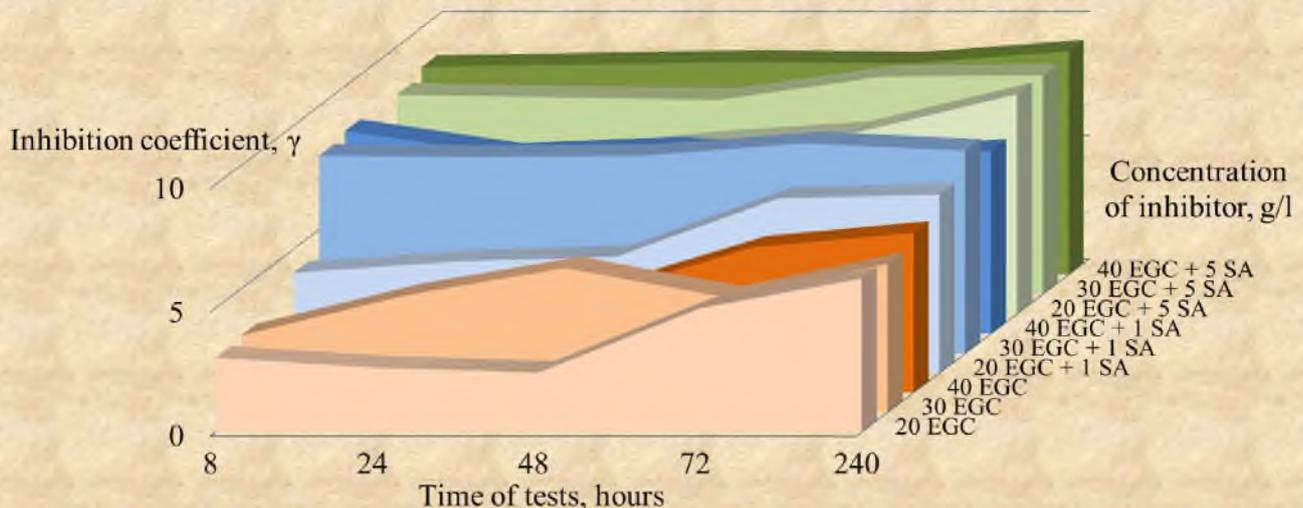
**Parshutin VI., Cernysheva N., Covali A., Agafii V.**

The invention relates to inhibitors of steel corrosion in water, and can be used to inhibit corrosion in closed steel pipe systems. The inhibitor, according to the invention, comprises an aqueous extract of dry leaves and stems of greater celandine *Chelidonium majus* and concentrated sulphuric acid, in the following content of components, ml/L: water extract of greater celandine – 20...40 (EGC), sulphuric acid – 0.5...2 (SA), at the same time, the aqueous extract of greater celandine is obtained by extracting the raw material in water at a temperature of 80...90 °C for 1...3 hours, taken in a mass ratio of 1:(10...30).

**Advantages:**

Utilization of this inhibitor has the following advantages:

- reduction of corrosion losses up to 9,02 times, what allows to prolong considerably terms of systems of steel pipelines maintenance in which carrier is water.
- ecologically safe, inexpensive,
- allows to refuse burning of foliage which does harm to the nature.



**Influence of concentration of inhibitor on corrosion suppression process.**

**Contact data:** str. Academiei 5, MD-2028, Kishinev, Republic of Moldova  
Tel: (373 22) 72-58-90; E-mail: [vlad.parshutin40@mail.ru](mailto:vlad.parshutin40@mail.ru), web-site: [www.phys.asm.md](http://www.phys.asm.md)



## International Exhibition of Inventions

INVENTICA 2021

23.06.2021 - 25.06.2021

Institute of Applied Physics



# Process for corrosion protection of steel in water

Patent MD № 1507

Parshutin Vi., Covali A.

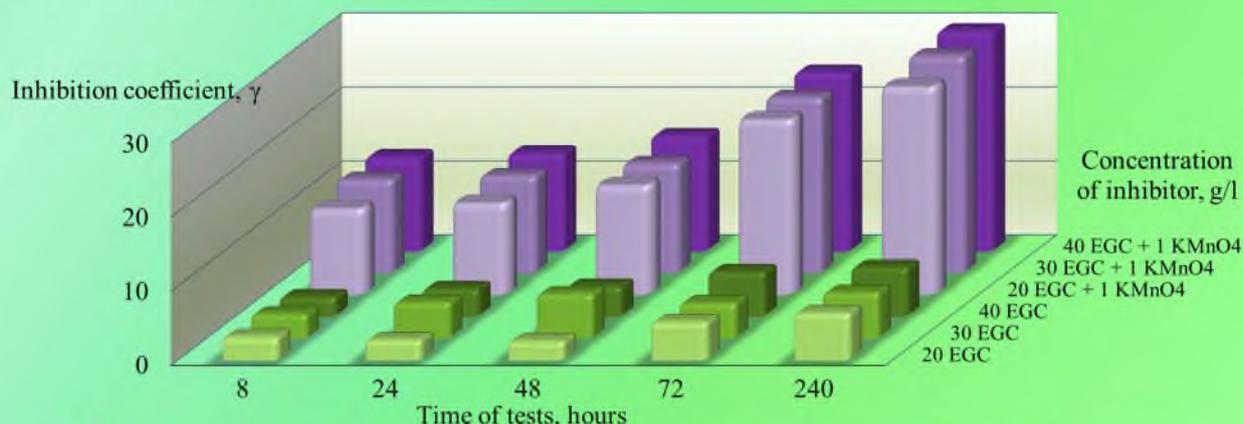
The invention relates to the field of metal protection from corrosion in water and can be used to inhibit corrosion in closed steel pipeline systems. The process for corrosion protection of steel in water comprises the introduction into the corrosive medium of 0.5-1.5 g/L of potassium permanganate  $KMnO_4$  and 10-40 ml/L of aqueous extract of greater celandine *Chelidonium majus*, obtained by water extraction of dry leaves and stems in a mass ratio of 1:(20-30) at a temperature of 75-90 °C for 2-3 hours, with subsequent filtration. The technical result of the invention consists in using an environmentally friendly, effective and inexpensive inhibitor, which provides an increase in corrosion resistance of up to 29.6.



### Advantages:

Utilization of this inhibitor has the following advantages:

- reduction of corrosion losses up to 29,6 times, what allows to prolong considerably terms of systems of steel pipelines maintenance in which carrier is water.
- ecologically safe, inexpensive,
- allows to refuse burning of foliage which does harm to the nature.



**Influence of concentration of inhibitor on corrosion suppression process.**

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Tel: (373 22) 72-58-90; E-mail: [vlad.parshutin40@mail.ru](mailto:vlad.parshutin40@mail.ru), web-site: [www.phys.asm.md](http://www.phys.asm.md)

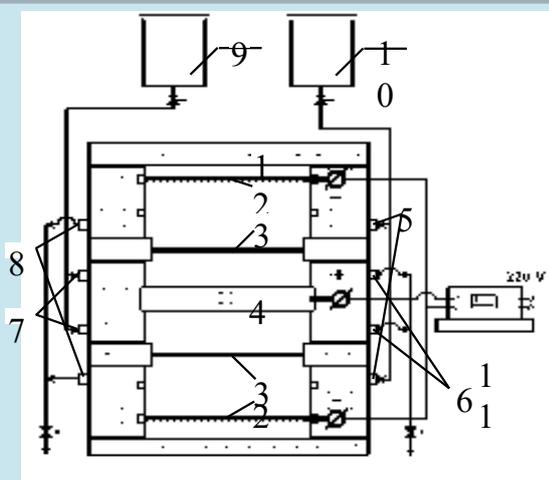


**Method of obtaining acetic acid from fermented whey by electrochemical oxidation method in an electrolyzer.**



Patent application number : Nr. s 2020 0145 din 2020.11.18  
Authors : *BOLOGA Mircea, VUTCARIOVA Irina*

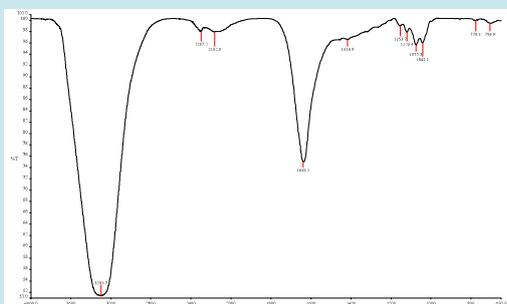
**Abstract :** The invention relates to the dairy industry, namely, to a method for producing of acid acetic from fermented whey. The method includes electrolytic treatment in the cathode chamber of an electrolyzer with a steel cathode and an ion-selective membrane, fermented whey with a pH of 3.8...4.7 and an acetic acid content of at least 5% by mass, with a 0.1% solution of sodium bicarbonate fed to the anode chamber, with a graphite anode. The electrolysis process is carried out at a pH of 3.8...11.0 and a certain density of the anode current for 30...60 min, with the release of acetic acid from the solution.



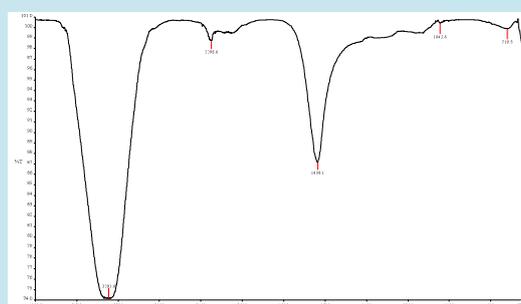
**Fig. 1** schematically shows the installation that works according to the proposed procedure. It contains the dielectric body 1; mesh steel cathode 2, non-selective membrane 3, graphite anode 4, fermented whey inlet nozzle 5, acetic acid solution evacuation nozzle 6, electrolyte inlet nozzles 7 (0.1% NaHCO<sub>3</sub> solution), nozzles 8 for elimination of processed whey.

**Fig. 1**  
Scheme of the electrolysis installation.

**Advantages :** The technical result is to obtain acetic acid in its pure state at optimal regimes from fermented whey by a simple and environmentally friendly method.



**Fig. 2**  
The result of spectroscopy of fermented whey.



**Fig. 3**  
The result of the spectroscopy of the sample in the anodic chamber.

**Contacts**

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## International Exhibition of Inventions INVENTICA 2021 23.06.2021 – 25.06.2021

**INSTITUTE OF APPLIED PHYSICS**

**BREVET DE INVENTIE Nr. MD 4720 C1 2021.05.31.**

Gologan, V.; Sidelnicova, S.; Ivașcu, S.

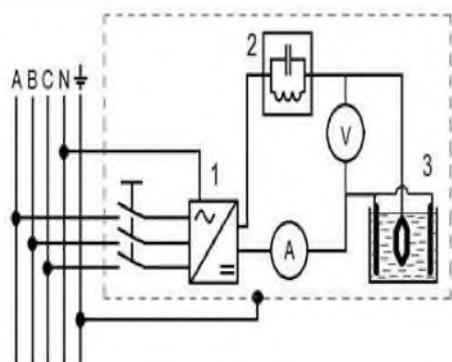


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INVENTICS, IAȘI, ROMANIA



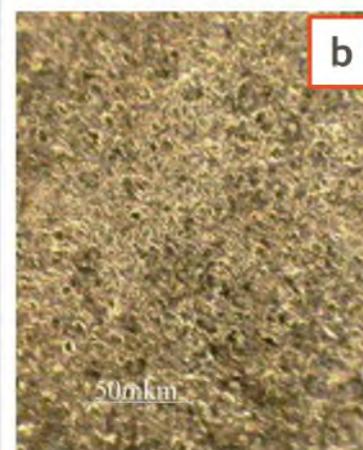
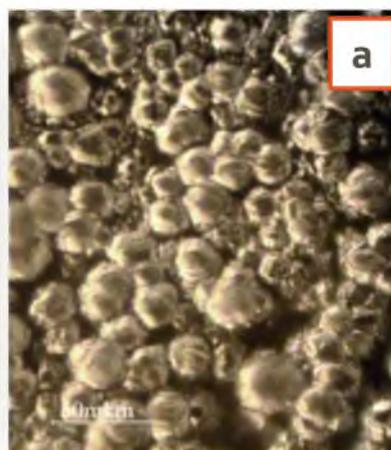
### Procedeu de depunere a acoperirilor din electrolit pe bază de crom trivalent

Invenția se referă la galvanotehnică, în special la depunerea electrolică a cromului din soluțiile compușilor săi trivalenți și poate fi utilizată în industriile constructoare de mașini și echipamente tehnice, în diverse aplicații industriale, precum și în industria de semiconductori



Schema instalației experimentale pentru depunerea acoperirilor de crom:

- 1 – redresor trifazat;
- 2 – dispozitiv inductiv-capacitiv;
- 3 – baie galvanică



Morfologia depunerilor de crom obtinute din electrolit oxalat-sulfat pe bază de crom trivalent ( $i_k = 4,0 \text{ kA/m}^2$ ,  $t = 40^\circ\text{C}$ ,  $\text{pH} = 0,95$ , durata 3 ore):  
a – electrolit initial (conventional);  
b – electrolit modificat, cu utilizarea DIC

Invenția constă în posibilitatea obținerii unor parametri avansați ai procesului de cromare, cât și ai depunerilor obținute, fără a recurge la metodologia convențională (inclusiv în electrolit a diferitor lianți, acizi organici, "catalizatori" etc.), doar cu conectarea dispozitivului inductiv-capacitiv (DIC), reglat la parametri determinați.

Avantajele procedeu propus de cromare cu utilizarea DIC din electrolit pe bază de crom trivalent are următoarele avantaje:

- ✓ Creșterea productivității de câteva ori,
- ✓ Mărirea vitezei de depunere ( $\leq 1 \mu\text{m}/\text{min}$ ),
- ✓ Nu conține crom hexavalent care este foarte toxic
- ✓ Creșterea microdunității până la 13-15 GPa,
- ✓ Lipsa agenților toxici, corozivi,
- ✓ Economii de până la 30% față de procedeele clasice
- ✓ Toxicitatea mai scăzută implică cheltuieli reduse la ventilare și la neutralizarea deșeurilor





International Exhibition of Inventions INVENTICA 2021  
 23.06.2021 – 25.06.2021



NATIONAL INSTITUTE OF  
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Institutul de Fizică Aplicată

PROIECT INTERNAȚIONAL DE CERCETĂRI ȘTIINȚIFICE  
 cu cifrul 19.80013.58.07.06A/BL

V. Mihailov, N. Kazak, S. Ivascu, A. Ianachevici, S. Iatco, V. Crupnic



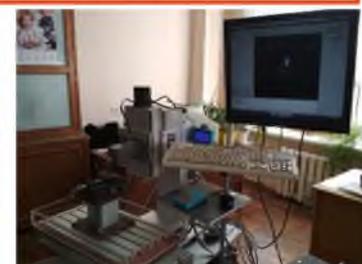
**Tehnologie de sintetizare a carburilor și a nanostructurilor la alierea prin scânteii electrice cu electrozi din grafit, Ti, W și studierea influenței lor asupra proprietăților suprafețelor metalice**

Prezentul proiect este consacrat elaborării utilajului și tehnologiei de aliere succesivă prin (ASE) a suprafețelor de lucru a organelor de mașini și a sculelor, utilizând electrozi din grafit (~ 98% carbon), titan și wolfram în locul electrozilor standardizați scumpi și deficitari care practic au dispărut de pe piață.

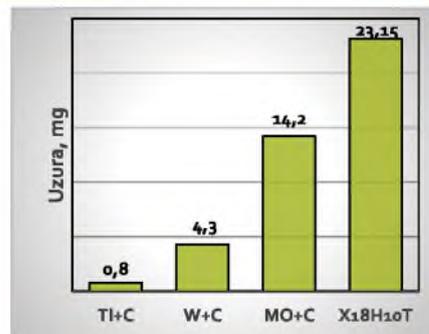
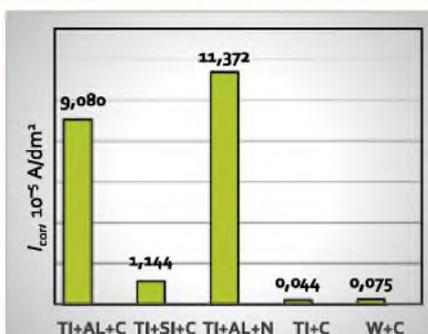
### Rezultatele științifice ale cercetărilor efectuate în cadrul proiectului

În rezultatul investigațiilor științifice s-au stabilit legăturile de bază ale procesului ASE:

- influența parametrilor energetici și tehnologici asupra formării stratului superficial durificat;
- stabilirea valorilor optime ale energiei descărcării în impuls și frecvenței trecerii acestora, precum și a parametrilor tehnologici, la care s-au obținut straturi durificate de înaltă calitate cu conținut de carburi metalice și faze nanostructurate



### Rezistența la coroziune și uzură



Au fost elaborate instalații experimentale cu generatoare de impulsuri (concepție nouă) cu un grad înalt de stabilizare a parametrilor energetici (energia descărcării în impuls și frecvenței acestora) ce au permis intensificarea formării straturilor superficiale durificate.

În premieră la alierea succesivă prin scânteii electrice cu electrozi din grafit, titan și wolfram în straturile superficiale ale metalelor a fost sintetizate carburi metalice, faze nanostructurate și amorfe ceea ce a permis creșterea considerabilă a caracteristicilor fizico-mecanice și de exploatare: rezistența la uzură și coroziune.

### Avantaje:

- aderență înaltă cu suportul acoperirilor formate;
- utilaje simple de realizare a tehnologiei, care nu necesită personal calificat;
- localizare strictă a zonei de prelucrare fără demontarea mașinilor, agregatelor etc.;
- mic consumator de materiale și energie.

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***Institute of Genetics, Physiology and Plant Protection***

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### “AMETIST”

rhizogenic interspecific genotype *V. vinifera* (2n=38) x *M. rotundifolia* (2n=40)

ALEXANDROV Eugeniu, BOTNARI Vasile, GAINA Boris

Certificate No. 782/2021 (1694514/2018)



The early-ripening interspecific genotypes *V. vinifera* x *M. rotundifolia* can be propagated by cuttings, without grafting, thus obtaining rhizogenic planting material, which will help reducing the costs of setting up and maintaining vineyards.

The technique of training a grape bush determines its habit, in this case, forming a horizontal, single or double cordon, with one or two trunks, 70-80 cm in height, training the shoots in a vertical position. Planting scheme: between rows – 3.0 m, and in a row, between plants – 1.5 m. The recommended type of support is a vertical trellis with upright (vertical) shoot management, the height of the stake - 2.0 m with three levels (first level - one wire, the second and third levels – by two parallel wires, at a distance corresponding to the thickness of the stake).

The creation of plantations of the above-mentioned interspecific genotypes will allow expanding the area of growing rhizogenic grapevine to the north.



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**Institute of Genetics, Physiology and Plant Protection**

**EARLY CLARY SAGE (*Salvia sclarea* L.) VARIETY AMBRIELA**

**GONCEARIUC Maria, BALMUS Zinaida, COTELEA Ludmila,  
BUTNARAS Violeta, BOTNARENCO Pantelimon**

**Patent application V 2020 0019**

**AMBRIELA variety are distinctive by:**

***Physiological properties:***

**Variety of 2-3 years, very good resistance to wintering; high resistance to drought; resistant to foliar diseases and root system diseases.**

***Quality properties:***

**Essential oil content: first year of vegetation: 0.353% (standard humidity, 70%); 1.175% (dry substance); second year of vegetation: 0.335% standard humidity; 1.185% dry substance. Major components in essential oil: linalyl acetate 61.06%, linalool, 8.59%, sclareol, 5.25%.**



***Production capacity:***

**Variety of 2-3 years of vegetation; flowering capacity in the first year of vegetation.**

**Average harvest of raw material in 2 years of plantation operation—16.1t /ha, average production of essential oil - 55.6 kg/ha.**

**Yield – 3.1 kg essential oil/ton of inflorescences.**

**APPLICATION: - Agriculture, perfumery, cosmetics, medicine**



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**Institute of Genetics, Physiology and Plant Protection**

### **Stefanel cultivar soybean (*Glycine max* (L.) Merrill)**

**BUDAC Alexandru, CELAC Valentin, CORETCHI Liuba, HARCUC Oleg**

Patent No. 20200025/2020.09.14

The Stefanel variety was created by individual selection of the Irina x Hodgson hybrid. Plant average height is 70-90 cm with erect growth, compact bush, brown pubescence. Height insertion of pods basal – in average 15-16 cm. Inflorescence: brush, purple flowers. Leaves: yellowish color, Sharp-oval sheets. Grain yellow color, hilum – dark-brown, mass of 1000 seeds – 113-153 g. Production potential: 3.6 t/ha. Seeds quality: protein: 39%, fat: 20%. Good resistance to fall, common rust (*Uromyces appendiculatus*), bacteriosis. Good resistance to drought, septoria (*Septoria glycines* Hemmi), fusariosis of the cotyledons (*Fusarium* sp.), fomopsis (*Phomopsis sojiae*). It is recommended for the northern zone of the Republic of Moldova.



**Application. Used in agriculture, food industry**

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**Web: www.igfpp.md**



INVENTICA-2021



Institute of Genetics, Physiology and Plant Protection

**METHOD FOR DETERMINING THE TEMPERATURE OF INHIBITION OF THE ROOT SYSTEM IN CUCUMBER *Cucumis sativus* L.**

CAUS Maria, CALUGARU-SPATARU Tatiana, DASCALIUC Alexandru

Patent no MD 1134 Z 2017.11.30



Fig. 1. Germinated seeds of *Cucumis sativus* L., cv Concurrent, subjected to heat shock in the temperature range of 42°C - 54°C for 10 minutes.

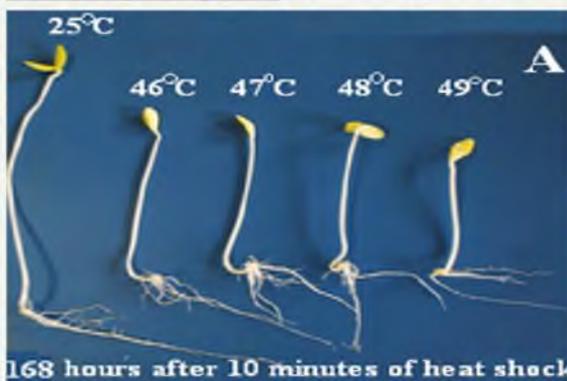


Fig. 2. Influence of 10 minutes heat shock of different intensity, applied to germinated seeds, on subsequent growth of **main roots** of cucumber plants. t = 25°C – control; t = 42°C, 43°C, 44 ° C, 45°C – heat shock.

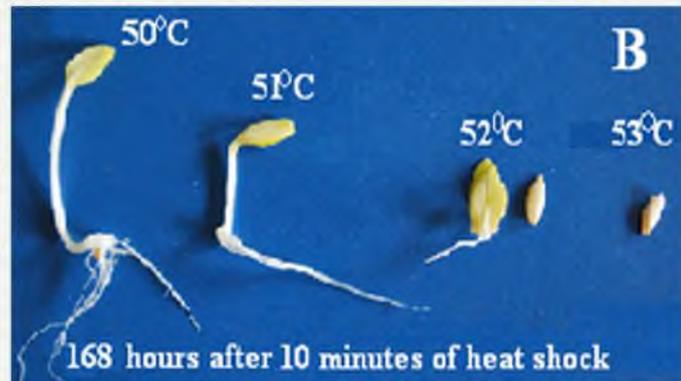


Fig.3. Influence of 10 minutes heat shock of different intensity, applied to germinated seeds, on subsequent growth of **secondary roots** of cucumber plants. t = 25°C – control; A – heat shock temperature of 46°C - 49°C; B - heat shock temperature of 51°C - 53°C.

The essence of the invention consists in the simplicity of determining the effect of heat shock on cucumber germs, with obtaining reliable results on high limiting values of positive temperatures that affect the growth and development of cucumber seedlings, by damaging the cells of the apical root meristem and the secondary meristem of the intermediate zone between the root and the stem, causing irreversible damage leading to occlusion of growth of the **primary roots** and, respectively, **secondary roots**.

So, it has been established that at the same duration of action - 10 minutes, the initials of the lateral roots, due to the apical dominance, resist the heat shock temperature by 7°C higher than that characteristic for the primary root meristem.

**Application.** The invention relates to agriculture, especially to plants growing, and can be used to determine the high positive inhibitory temperature of the root system in the incipient stages of ontogenesis.

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Institute of Genetics, Physiology and Plant Protection

## New garlic varieties Berechet

Authors

BOTNARI Vasile, CHILINCIUC Alexei

Patent no Nr.300 from 2019.12.31

The Berechet garlic variety is of late maturity. The vegetation period is 119-134 days. The plants have a vigorous growth, form floral stems and 9-11 dark green leaves. The bulb is characterized by pronounced density and long shelf life, flat-round shape weighing 35-60 g, consists of 5-7 puppies and covered with 4-5 dry white leaves with slightly pronounced purple stripes. The inflorescence forms 32-38 aerial bulbs. The color of the aerial bulbs is gray-purple, weight -3.0-7.0g. The harvest of the bulbs for food consumption is 11.2-13.3t/ha., And of the aerial bulbs 1.5 - 1,8 t/ha. The variety is resistant to extreme temperatures in winter and summer, tolerant to the most common diseases. It is intended for fresh consumption and preservation.



**Application.** Agriculture and Food Industry.

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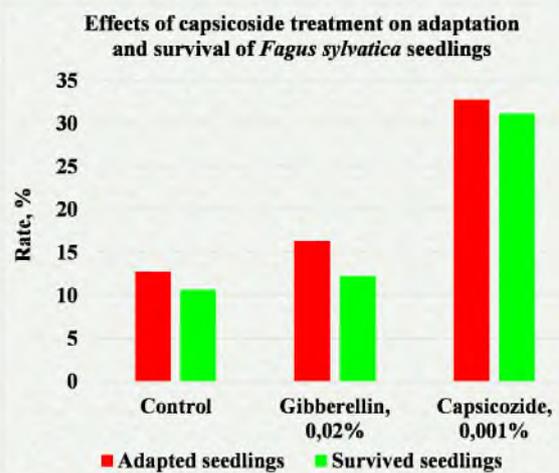
## METHOD FOR INCREASING SEED GERMINATION AND RESISTANCE OF BEECH (*Fagus sylvatica*) PLANTS

ELISOVETCAIA Dina, IVANOVA Raisa, MASCENCO Natalia, BOROVSKAIA Alla

Patent application s2020 0103,  
 application date 19.08.2020, MD

**PURPOSE.** Reducing seed germination time and increasing the resistance of beech seedlings.

**SOLUTION.** The method consists in treating beech seeds with a solution of 0.001% capsicoside for 22-24 hours and then stratifying the seeds at 30% humidity and a temperature of +4-+6°C until germination.



**ADVANTAGES.** The method of seed treatment with capsicoside leads to:

- stimulation of daily seed germination up by 18.5%;
- significant reduction in the period of total seed germination by 20-22 days, which allows for an earlier sowing of germinated beech seeds;
- better adaptation of germinated seeds transferred to the soil, the rate of seedling appearance and their survival in the variant with capsicoside treatment was higher by 2.7-3.0 times.



**APPLICATION:** forestry, agriculture

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## Institute of Genetics, Physiology and Plant Protection

### A new variety of winter triticale (*Triticosecale* Witt.) - Costel

VEVERITSA Efimia, LYATAMBORG Svetlana, LUPASCU Galina, GORE Andrei,  
ROTARY Silvia

Registered No. 490. 2018.09.21

The Costel variety was obtained by hybridizing (Coerulescens 635 x Ciulpan) x Lasco (durum wheat, rye and hexaploid triticale) with individual selection from the F<sub>3</sub> generation. The variety is part of the *Eritrospermum* variety. Spike yellow, cylindrical, without pubescence, length (10.0-12.0 cm) with 28-30 spicules per spike. Long yellow kernels, the 1000 grains are 42-44 g, contains 23-25% gluten and 12.0-14.0% protein. The number of kernels in the spike varies from 42 to 75. The vegetation period is 275-280 days. The plants have a height of 100-120 cm, the number of stems per plant is 2.8-3.0. It is resistant to drought, wintering, fall and disease (brown rust, septoriosi, fusariose). It records a harvest of 5.5-7.5 t/ha, 2.0-2.5 t more than control cultivar Ingen 93. It is recommended sowing at the beginning of October with a seeding rate of 4.5-5.0 million grains per hectare. The cultivation technology is similar to that of common winter wheat. The variety is being tested for the third year in the State Commission for Testing Plant Varieties



**Application.** Used in agriculture, bakery industry

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INVENTICA-2021



**Institute of Genetics, Physiology and Plant Protection**

**NEW TOMATO CULTIVAR - *MATRIONA***

**MAKOVEI Milania, BOTNARI Vasile, GANEA Anatolie**

**Patent no MD 309 2019.08.31**

***Matriona*** cultivar of determinant type of growth (*sp*). Early-ripening variety with a short vegetation period (100 to 107 days). The leaves are large, thick and intense green. The flowers are yellow. The first inflorescence appears after the 6<sup>th</sup> to 7<sup>th</sup> node, the next after 1-2. It has large fruits of the red-intense colour, with high palatability qualities. Fruit weight is 140 to 200 g. It is characterized by the long-lasting retention of fruits on the plant at the biological maturity stage (10 to 15 days), highly transportable. Total yielding capacity is 58.7...64.4 t/ha with while the standard fruit yield 91...96%.



***Recommendation.***

The cultivar ***Matriona*** are recommended for fresh use, producing juice and other tomato products. It is recommended to be grown in the conditions of open field and in greenhouses

**Homologate in Republic  
of Moldova - 2019**

**APPLICATION DOMAIN:** - ***Agriculture*** (cultivation in private associations farmers and households in individual) ***and Food Industry*** (for processing and preparation of tomato products-tomato paste, juice, whole-fruit canning and pickling)



INVENTICA-2021



**Institute of Genetics, Physiology and Plant Protection**

## **NEW TOMATO CULTIVAR - DESTEPTAREA**

**Mihnea Nadejda, Grati Maria, Lupascu Galina,  
Botnari Vasile, Grigorcea Sofia**

**MD 279 2018.07.31**

The fruits of the variety *Desteptarea* are of large size weighing 110-130 g. The fruits contain 5.9-6.2% of dry matter, 5.3...5.9% of sugars, 22.0...26.0 mg/% of vitamin C, 0.45...0.55% of acidity. The variety is medium ripening vegetation period is 114 days. In the transplant culture, the variety ensures a yield of 56.0...62.0 t/ha, while the standard fruit yield is high (93.0%).



### **Advantages**

The variety *Desteptarea* harmoniously combines high productivity, good tasting qualities with the resistance to heat and *Alternaria alternata*. The productivity is high at cultivation through both seeds and seedling transplants.

**Homologate in Republic  
of Moldova - 2018**

**APPLICATION DOMAIN: - Agriculture and Food Industry**

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Web: www.igfpp.md



INVENTICA-2021



## Institute of Genetics, Physiology and Plant Protection

### Sofidurum a new variety of winter durum wheat (*Triticum durum* Desf.)

ROTARY Silvia, VEVERITSA Efimia, LUPASCU Galina, GORE Andrei,  
LYATAMBORG Svetlana, COINAC Irina

Registered No 489. 2018.09.21

The Sofidurum variety was created by the repeated individual selection of the elite plant from the hybrid population [Hordeiforme 333 x 1610-4 / 01-1162 / Parus / 1296 / 7-11]. The variety is part of the *Hordeiforme* variety. Spike and awns red, white-yellow grain. The spike has a length of 7.0 - 7.6 cm, cylindrical with 22-25 spicules per spike. The oval kernels, the 1000 grains are 45-46 g, contains 26-30% gluten and 13.5-14.2% protein. The number of kernels in the spike varies between 45-50. The vegetation period is 262 - 266 days. It is a semi-early variety, with high resistance to fall. The height of the plant is 80-82 cm, with 2.8-3.2 stems per plant. Manifest high resistance to drought, wintering and disease (brown and yellow rust, root rot). It is productive with a production capacity of 5.5-7.0 t/ha. The Sofidurum variety proved to have very good quality indices for the production of pasta. It is recommended to be sown in optimal terms with the seeding norm of 5 million grains per 1 ha.



**Application.** Used in agriculture, pasta production.

IGPPP, Padurii Str. 20, MD 2002, Chisinau, Republic of Moldova  
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INVENTICA-2021



Institute of Genetics, Physiology and Plant Protection

NEW TOMATO VARIETIES *Solanum lycopersicum* L. FLACARA

**Authors**

SIROMEATNICOV Iulia, BOTNARI Vasile, COTENCO Eugenia,  
CHIRILOV Eleonora

**Patent no Nr.306 from 2019.08.31**

The vegetation period is 81-108 days; it is the medium early variety. The fruit is orange color, round-slightly elongated with weigh 48.0-65.0 g, 2-3 seminal lodges. Fruits with high taste qualities, the dry substance content of the fruits is 5.6-6.5%, sugars 5.3-7.6%, ascorbic acid 31.5-41.3 mg/%, titratable acidity 0.34-0.39 mg/%. The total harvest of tomato fruit consists 49.9-52.4 t/ha and standard fruit yield 44.3-49.9 t/ha.



*The variety is productive, resistant to drought. It is recommended for fresh consumption and processing.*

**Application.** Agriculture and Food Industry.

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***Institute of Microbiology and Biotechnology***

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Institute of Microbiology and Biotechnology

## PROCESS FOR EXTRACTING MANNOPROTEINS FROM BREWER'S YEAST SEDIMENTS

Authors: BEȘLIU Alina, CHISELIȚA Natalia, CHISELIȚA Oleg,  
EFREMOVA Nadejda, TOFAN Elena, LOZAN Ana

Patent application No. a20210004 from 2021.01.29

**Aim:** The invention relates to microbial biotechnologies, in particular to the process of extracting mannoproteins from yeast sediments from waste from the beer industry.



**Essence:** The process according to the invention includes the use of brewer's yeast biomass (30 g) which is mixed with 30 ml of sodium phosphate buffer (1:1 ratio) then subjected to autolysis at +37°C or +45° C for hours, with periodic stirring, then centrifugea and the process of remaining the sediments with 1N NaOH solution (1: 5 ratio) at +80±5° C for 2 hours, centrifugation at 3500 rpm. For 15 minutes, the alkaline supernatants obtained were sedimented with 96% ethyl alcohol in a volume of 1: 2.



**Advantage:** Elaboration of a process for extraction of mannoproteins from yeast sediments from beer production, which allows obtaining 7-16% more mannoproteins than the nearest solution, use of waste that pollutes the environment, reduction of autolysis time, temperature and amount of ethyl alcohol used.

**Field of application:** Environment-Pollution Control, Agriculture, Zootechnics, Medicine - Health Care-Cosmetics, Food and Pharmaceutical Industry

The research was carried out within the project 20.80009.5107.16 "New biologically active microbial preparations for increasing the reproductive and productive potential of animals of zootechnical interest", funded by National Agency for Research and Development (NARD), Republic of Moldova.

MINISTRY OF EDUCATION CULTURE AND RESEARCH  
OF THE REPUBLIC OF MOLDOVA  
INSTITUTE OF MICROBIOLOGY AND BIOTECHNOLOGY

## **Biologically active preparation based on yeast biomass from the waste beer industry**

**Authors:** CHISELIȚA N., CHISELIȚA O., BEȘLIU A., EFREMOVA N., TOFAN E., LOZAN A., DANILIȘ M.

**Patent application** No. a 2021 0016, 2021.03.30.

**THE PURPOSE:** The elaboration of new biologically active preparation based on yeast biomass from the waste beer industry



**THE ESSENCE:** The invention relates to the field of ecology and microbial biotechnology, in particular to the production of a biologically active natural preparation from yeast biomass from wastes from the beer industry which can be used in various fields, including the livestock sector and the food industry.

**THE ADVANTAGE:** The preparation, obtained by freezing and thawing of the yeast biomass, autolysis of biomass in sodium phosphate buffer (1:1 ratio) at +45°C, for 8 hours, containing: proteins - 64,6±2,6%, carbohydrates - 11,7±2,2%, lipids - 0,13±0,02%, ash 13,5±1,4% and is characterized by a high summary contain of essential aminoacids of 55,7 g /100 g of protein. The implementation of the invention will contribute to the diversification of natural biologically active preparations and the efficiency of the processing and recovery of waste from the beer industry, which will significantly reduce their negative impact on the environment.

**FIELD OF APPLICATION:** Agriculture and Food Industry, Medicine , Health Care, Cosmetics, Environment , Pollution Control

The invention was created based on scientific results obtained within the project 20.80009.5107.16 "New biologically active microbial preparations for increasing the reproductive and productive potential of animals of zootechnical interest", funded by National Agency for Research and Development (NARD), Republic of Moldova.

**Nitrate of 2,6-diacetylpyridine-bis(picolinoylhydrazone)-bis(aqua)iron(III)-hydrate(1/2,5) with stimulating properties on exocellular lipase synthesis for the *Rhizopus arrhizus* CNMN FD 03 fungal strain and nutrient medium for cultivation**

*Danilescu Olga<sup>1</sup>, Bulhac Ion<sup>1</sup>, Cocu Maria<sup>1</sup>, Bourosh Pavlina<sup>2</sup>, Ciloci Alexandra<sup>3</sup>, Clapco Steliana<sup>3</sup>, Labliuc Svetlana<sup>3</sup>, Matroi Alexandra<sup>3</sup>*

<sup>1</sup>Institute of Chemistry, <sup>2</sup>Institute of Applied Physics, <sup>3</sup>Institute of Microbiology and Biotechnology, Chisinau, Republic of Moldova

E-mail: [olgadanilescu@mail.ru](mailto:olgadanilescu@mail.ru); [alexandra.ciloci@gmail.com](mailto:alexandra.ciloci@gmail.com)



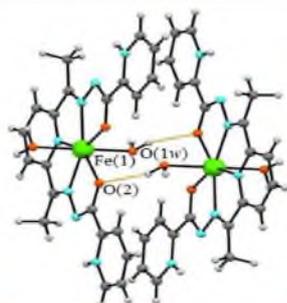
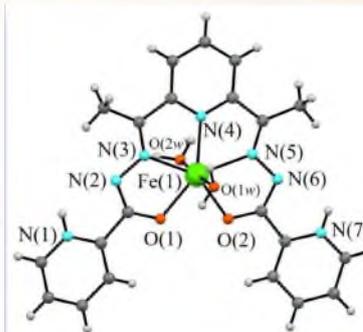
IMB

**Patent application no. 6804/2021**

Coordination compounds derived from 2,6-diacetylpyridine hydrazones and transition metal ions have yielded a surprisingly rich chemistry. The *dap* ligands, due to their multicoordination sites, are capable of efficiently stabilizing the metal center by forming unique geometries. As a result of interaction  $\text{Fe}(\text{NO}_3)_3 \cdot 9\text{H}_2\text{O}$  with 2,6-diacetylpyridine bis(picolinoylhydrazone) ( $\text{H}_2\text{L}$ ) (molar ratio of 1:1) in methanol under refluxing (80°C, 4 h), mononuclear coordination compound  $[\text{Fe}(\text{H}_2\text{L})(\text{H}_2\text{O})_2](\text{NO}_3)_3 \cdot 2,5\text{H}_2\text{O}$  was synthesized.

The coordination polyhedron of the metal cation represents pentagonal bipyramid formed by  $\text{N}_3\text{O}_4$  set of donor atoms going from the pentadentate Schiff base ligand and two oxygen atoms of the coordinated  $\text{H}_2\text{O}$  molecules.

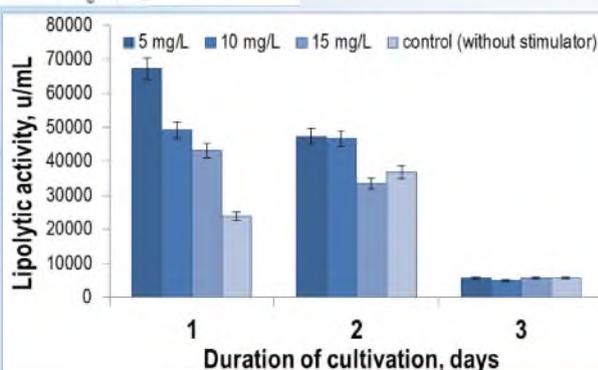
$\text{FeN}_3\text{O}_4$   
 $\text{Fe}(1)-\text{N}(3) = 2,186(2) \text{ \AA}$ ;  $\text{Fe}(1)-\text{O}(1) = 2,0717(19) \text{ \AA}$ ;  
 $\text{Fe}(1)-\text{N}(4) = 2,196(2) \text{ \AA}$ ;  $\text{Fe}(1)-\text{O}(2) = 2,0842(19) \text{ \AA}$ ;  
 $\text{Fe}(1)-\text{N}(5) = 2,185(2) \text{ \AA}$ ;  $\text{Fe}(1)-\text{O}(1w) = 1,9979(19) \text{ \AA}$ ;  
 $\text{Fe}(1)-\text{O}(2w) = 2,0393(19) \text{ \AA}$ .



The compound  $[\text{Fe}(\text{H}_2\text{L})(\text{H}_2\text{O})_2](\text{NO}_3)_3 \cdot 2,5\text{H}_2\text{O}$  was investigated by X-ray diffraction. It was established, that crystals consists from complex mononuclear cations  $[\text{Fe}(\text{H}_2\text{L})(\text{H}_2\text{O})_2]^{3+}$ ,  $\text{NO}_3^-$  anions and solvated water molecules.

**The complex is highly soluble in water, which ensures a practical use as a component of nutrient mediums.**

*Rhizopus arrhizus* CNMN FD 03



**ADVANTAGE**

The addition of coordination compound  $[\text{Fe}(\text{H}_2\text{L})(\text{H}_2\text{O})_2](\text{NO}_3)_3 \cdot 2,5\text{H}_2\text{O}$  to the nutrient medium of *Rhizopus arrhizus* CNMN FD 03 fungal strain, in concentration of **5,0...15,0 mg/L** increases biosynthesis of lipases with **17,4 – 82,7%**, depending on the concentration and reduces the producer's cycle of cultivation by 24 h. Thus, the highest values of lipase activity were found at the first day of growth, while in the control (without stimulator) the maxim of activity was revealed on the second day. The most effective concentration for enzyme production was **5,0 mg/L**.

**APPLICATION**

Industrial microbiology

**Acknowledgment:** The authors are grateful to projects of the Institute of Chemistry, inclusive joint project with Institute of Microbiology and Biotechnology – 20.80009.5007.28 and 20.80009.7007.21, and of the Institute of Applied Physics – 20.80009.5007.15 financed by ANCD.

Institute of Microbiology and Biotechnology, Chisinau, Republic of Moldova  
 Joint Institute of Nuclear Research, Dubna, Russia  
 Horia Hulubei National Institute for Physics and Nuclear Engineering (IFIN-HH),  
 Bucharest - Magurele, Romania

## PROCEEDING FOR OBTAINING SPIRULINA BIOMASS - RAW MATERIAL FOR NEW IMMUNOMODULATORY, ANTIVIRAL, ANTIMICROBIAL AND ANTICANCER REMEDIES

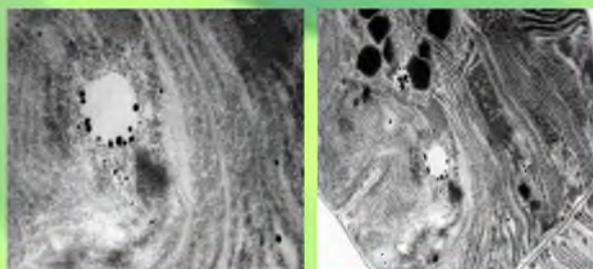
RUDI Liudmila, CHIRIAC Tatiana, CEPOI Liliana,  
 RUDIC Valeriu, DJUR Svetlana, ROTARI Ion, MISCU Vera,  
 VALUȚA Ana, IATCO Iulia, CODREANU Liviu, ZINICOVSCAIA Inga

**Patent application: 4714 MD, 2020.09.30**

It is proposed a proceeding of cyanobacterium *Spirulina platensis* cultivation in order to obtain raw material for the development and manufacture of preparations based on **biofunctionalized nanoparticles** suitable for use in medicine, pharmaceuticals and cosmetology.

The proceeding involves growing spirulina culture on a mineral medium with the addition of 5 nm water-soluble copper nanoparticles in concentration of 3.15-3.18 µg/L to obtain biomass and, in particular, to stimulate lipid and other biologically active compounds biosynthesis.

At the same time, spirulina produces **biofunctionalized copper nanoparticles** that can be used as **immunomodulatory, antiviral, antimicrobial, and anticancer agents**.

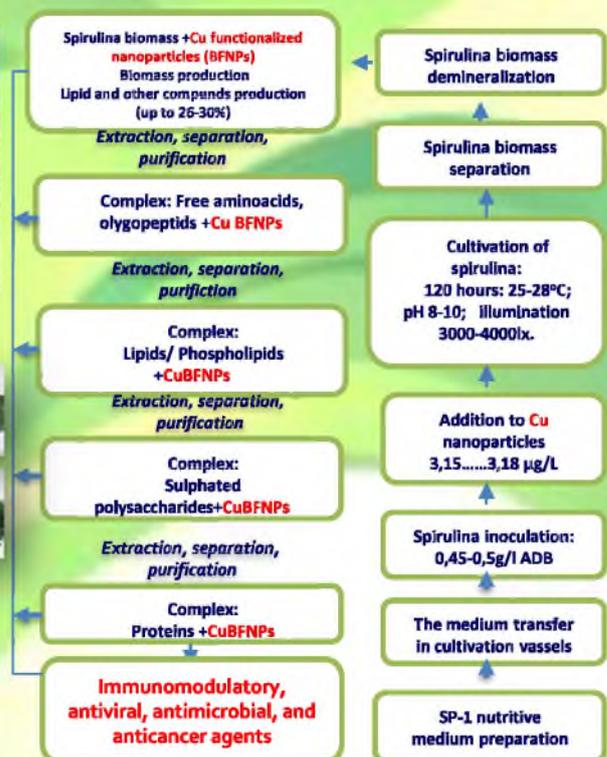


Spirulina biomass + Cu nanoparticles



### Application:

Biotechnology, Bionanotechnology,  
 Pharmaceutical and biotech producing companies;  
 Human health, Food production and security;  
 Medicine; Pharmaceuticals.



The invention was created based on scientific results obtained within the project **20.80009.5007.05 "Biofunctionalized metal nanoparticles - obtaining using cyanobacteria and microalgae"**, funded by National Agency for Research and Development (NARD), Republic of Moldova.

**Institute of Microbiology and Biotechnology**  
**National Collection of Nonpathogenic Microorganisms**

**Medium for lyophilization of fungal strains of the genus *Trichoderma***

**Authors:**

SÎRBU Tamara, TIMUȘ Ion, GORINCIOI Viorina, MOLDOVAN Cristina, ȚURCAN Olga, BIRSA Maxim

**Patent number:**

1475 (13) Y

**Purpose:**

Elaboration of lyoprotective medium for efficient conservation of fungal strains of the genus *Trichoderma*.

**Solution:**

The invention relates to biotechnology, namely to a medium for lyophilization of fungal strains of the genus *Trichoderma* and can be used for conservation and long-term storage of fungal strains. The medium, according to the invention, comprises, %: glucose - 7, Fe<sub>2</sub>ZnO<sub>4</sub> nanoparticles - 0.0005 and skim milk - the rest. The result of the invention consists in increasing the viability of fungal strains after lyophilization and after storage in lyophilized state.



*Trichoderma viride*



*Trichoderma harzianum*

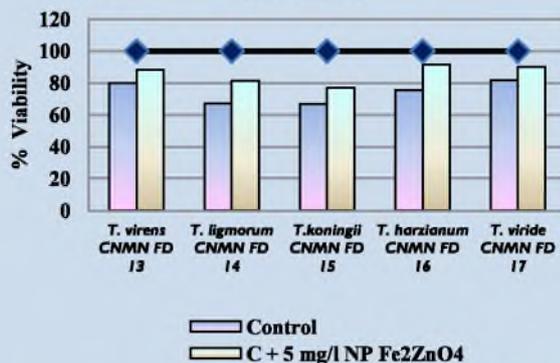


Fig. 1 Viability of the *Trichoderma* strains after lyophilization

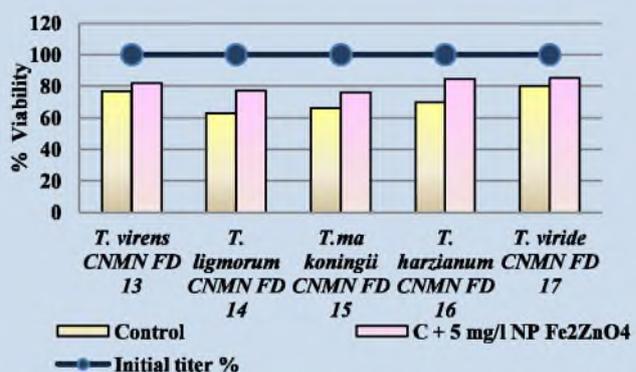


Fig. 2 Viability of *Trichoderma* strains after 1 year of preservation in lyophilized state

**Advantages:**

The proposed protection medium (skimmed milk + 7% glucose + 5 mg / l nanoparticles Fe<sub>2</sub>ZnO<sub>4</sub>) for lyophilization of fungi of the genus *Trichoderma* contributes to the stimulation of their viability after lyophilization and keeping in lyophilized state by 5-14,7% compared to the control variant.



Lyophilized strains of the genus *Trichoderma*

The invention was created based on scientific results obtained within the project 20.80009.7007.09 „Conservation and exploitation of microbial biodiversity as a support for the development of sustainable technologies and agriculture, integration of science and education”, funded by National Agency for Research and Development (NARD), Republic of Moldova.

**Application :**

Microbiology, Biotechnology

Țurcan Olga, Adres: 1, Academy str., MD 2028, Chisinau, R. Moldova, tel. +(373) 22 73 96 09, E-mail: turcanolga2019@mail.ru



# International Exhibition of Inventions INVENTICA 2021

23.06.2021 – 25.06.2021



NATIONAL INSTITUTE OF  
INVENTICS, IASI, ROMANIA



INSTITUTE OF MICROBIOLOGY AND BIOTECHNOLOGY



## THE BIODEGRADATION OF PLASTICS IN PLASTICS IN THE PRESENCE OF PHYTOREMEDIATING MICROBIOL DEGRADANTS

COȘCODAN MIHAIL

Project research 20.80009.7007.03

**Aim:** The project relates to the biodegradation of plastics in plastics in the presence of phyto-remediating microbial degradants.

One of the main current problems of the research manner is to study in laboratory conditions the phyto-stimulating microorganisms that can use polyethylene as a source of carbon and/or energy. In turn, these microorganisms can be isolated, studied and used as biodegradation agents for non-recyclable plastic waste. Among the potential microbial agents used for biodegradation, belonging to the following species: *Pseudomonas*, *Bacillus*, *Streptomyces*, *Arthrobacter*, *Rhizobium*, and *Ferrobacterium*.



Nodules *Rhizobium  
leguminosarum*

The novelty consists in the elaboration of a biotechnological process for reducing the risk of environmental pollution with plastic, based on the use of phyto-remediating microorganisms for the biodegradation of non-recyclable plastic.



*Rhizobium* microorganisms have been applied to *P. sativum* and their contribution to the biodegradation of plastic has been studied.

**Field of application:** Environment-ecology,  
Biology.

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# International Exhibition of Inventions

## INVENTICA 2021

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INSTITUTE OF MICROBIOLOGY AND BIOTECHNOLOGY



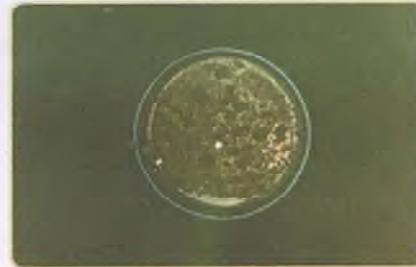
**CONTRIBUTION OF RHIZOSFERE MICROORGANISMS DIVERSITY FOR  
AGRICULTURAL DEVELOPMENT AND ENVIRONMENT PROTECTION**

**COȘCODAN MIHAIL**

**Project research 11.817.04.11 A**



Area of solubilization



Area of colonization



Rooting in cuttings of beans



Plant productivity

**PURPOSE:** Development new methods for the study of new microbial bio- and high-potential actions that promote growth and development cycle of the plants.

**SOLUTION:** 1) solubilization of mineral phosphorus in the soil  
2) colonization of soil microorganisms  
3) rootedness in agricultural plants  
4) increasing plant productivity

Application prospect microorganisms as microbial bio-agriculture.  
area of solubilization. Area of colonization.

**ADVANTAGES:** Appreciation a bio-product of the first party nased on the rhizosphere microorganisms solubilizing properties of organic substances and inorganic phosphorus in the soil, which depends on their effecteveness is increased compared with the control grup.

**Domains of application:** Biology-agronomy, Environmetal protection

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Moldova National Agency of Public Health***

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MINISTRY OF EDUCATION, CULTURE AND RESEARCH OF THE  
 REPUBLIC OF MOLDOVA

Ghitu Institute of Electronic Engineering and Nanotechnologies

## Deformation vacuum gauge



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Deformation vacuum gauges are direct pressure measuring instruments. The principle of operation of deformation vacuum gauges is based on the deformation of flexible structural elements of the transducer owing to pressure difference. The main advantage of deformation instruments is that the pressure readings are independent of the gas type. This feature is particularly important in view of the increasing number of applications of ion-plasma technological processes that occur at pressures of a few Torr.

Tensoresistive deformation vacuum gauges use a change in the resistance of tensoresistors upon a deformation of the silicon membrane and operate in a range of 1–1000 Torr.

Significant disadvantages of the existing tensoresistive vacuum gauges are the strong dependence of the pressure measurement error on the ambient temperature and low sensitivity, which limits their use in processes that occur at pressures below 1 Torr.

### Method to increase the pressure measurement accuracy

To improve the accuracy of low pressure measurements, a VD-10 tensoresistive vacuum gauge sample has been developed and constructed; the gauge includes a measuring unit and a transducer, the sensitive element of which is a silicon crystal in the middle part of which a thin membrane with tensoresistors placed on the outer surface is formed.

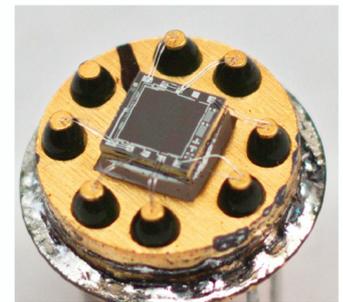
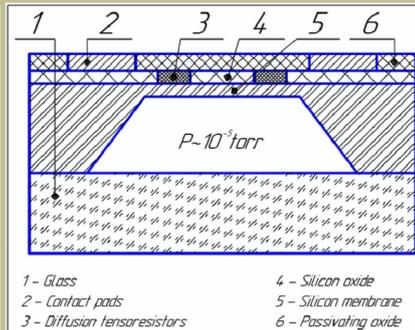
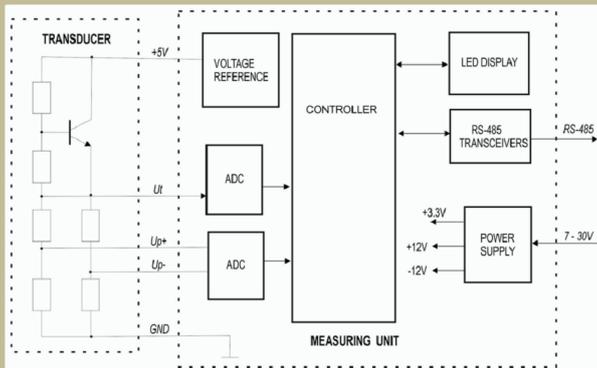
To decrease the dependence on the ambient temperature, a circuit consisting of a transistor and resistors is formed on the crystal; the circuit provides power to the bridge circuit with a temperature-dependent voltage to compensate for the drift. In addition, temperature fluctuations are recorded by the measuring unit for additional software correction.

### Advantages of the proposed deformation vacuum gauge

A decrease in the membrane thickness has made it possible to increase the sensitivity of the transducer and, accordingly, expand the range of measured pressures to  $5 \times 10^{-2}$  Torr.

Compensation for the effect of change in the ambient temperature reduces the pressure measurement error from 0.3% to 0.1% Full Scale.

The use of modern analog-to-digital electronics, along with a high-performance microcontroller, in the electronic unit has made it possible to provide the stability of maintaining the electrical modes of the transducer and a high accuracy of measurements of the output parameters of the transducer.



Sensitive element of the transducer

### TECHNICAL DATA

- Measurement range  $5 \times 10^{-2} - 1000$  Torr
- Accuracy  $\pm 0.1\%$  full scale
- Power consumption 1 W
- Interface RS-485
- Resolution 0.01 Torr
- Dimension 60x35x135 mm

### ADVANTAGES

- Wide range of measured pressures
- High accuracy and reproducibility of measurement
- Small size and low power consumption
- Any position of the gauge
- Transducer temperature compensation
- Wide range of supply voltages (7 – 30V)

### References

DECISION on registration of industrial designs «Vacuumetru» Nr. f 2019 0041 2019.05.23 Date of publication: 2019.09.30





Ministerul Educației, Culturii și Cercetării al Republicii Moldova

Institutul de Inginerie Electronică și Nanotehnologii „D.GHIȚU”

## Fotoreceptor de radiație UV

Autorii: V. MORARI, V. URSACHI, E. RUSU, I. TIGHINEANU

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The 25<sup>th</sup> International Exhibition of Inventions

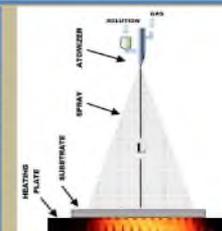
“INVENTICA 2021” Iași, România, 21-23 June

### Introducere

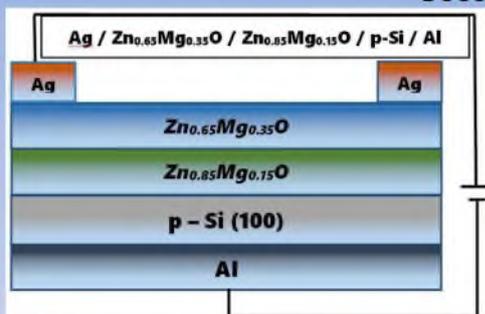
Domeniul UV al spectrului optic este caracterizat prin subdomeniul UV-A 400-320 nm, UV-B 320-280 nm, UV-C 280-200 nm, care corespund domeniilor bactericide, fapt ce are o importanță majoră în detectarea și dozimetria radiației optice la tratamentul antibacterian. Este cunoscut fotoreceptorul de radiație (UV) în baza structurii cu p-n-joncțiune  $Al_xGa_{1-x}N/GaN$  [1,2]. Compusul  $Al_xGa_{1-x}N$  este un material semiconductor cu bandă interzisă largă de 3,4 eV – 6,2 eV și tranziții directe ce corespunde absorbției radiației UV în domeniul 365 nm – 200 nm. Curentul de întunecare al fotodiodei constituie mărimea de  $\approx 10^{-8}$  A la tensiunea inversă de 60 V. Sensibilitatea spectrală maximă a fotodiodei constituie  $10^{-1}$  A/W în domeniul spectral 308-380 nm. Neajunsul acestui tip de fotoreceptor constă în tehnologia costisitoare de obținere a structurii de bază  $GaN/Al_xGa_{1-x}N$  prin metoda depunerii la 1050°C din componente metalorganice. Noutatea invenției noastre constă în depunerea din soluții chimice sol-gel prin pulverizare din aerosoli sau prin spin coating pe suporturi de Si a unui film de absorbție cu compoziția  $Zn_{1-x}Mg_xO$  [3] cu valoarea lui x din diapazonul 0÷0.8, totodată, deasupra filmului de absorbție este depus un film transparent de  $Zn_{1-x}Mg_xO$  cu valoarea x, care asigură o bandă energetică mai mare cu cel puțin 0.1 eV față de cea a filmului de absorbție.

### Procedul de obținere

Tehnologia de depunere din aerosoli și spin coating sunt unele dintre cele mai ieftine și simple metode pentru depunerea filmelor oxidice (Fig.1). Temperatura soluției precursorare în timpul procesului de depunere este de 25 °C, în timp ce temperatura substratului este menținută la 500 °C. Viteza de depunere a soluției precursorare este de 0.33 ml/min, iar timpul de depunere 15 minute. Pentru a obține filmele subțiri  $Zn_{1-x}Mg_xO/p-Si$  cu diferite concentrații de Mg, soluția chimică care conține zinc și magneziu, s-a obținut prin dizolvarea în etanol a acetatului de zinc dehidrat și a acetatului de magneziu tetrahidrat (0.35M).

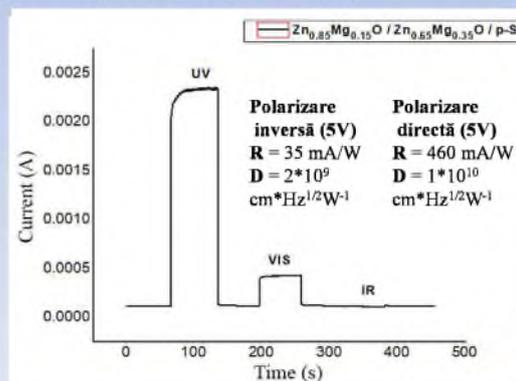


### Procedul Experimental



Structura fotoreceptorului ce conține suportul de Si cu conductibilitate de tipul p, filme oxidice de  $Zn_{0.85}Mg_{0.15}O$  și  $Zn_{0.65}Mg_{0.35}O$ , ce formează un gradient al benzii interzise, bariera Schottky Ag- $Zn_{0.65}Mg_{0.35}O$  și contactul ohmic Al-p-Si este reprezentată în (Fig. 2). Utilizarea stratului  $Zn_{0.65}Mg_{0.35}O$  cu banda energetică mai mare față de stratul de absorbție, joacă rolul de fereastră optică. Stratul de absorbție a radiației este protejat de stratul fereastră ce duce la diminuarea stărilor de suprafață a stratului absorbant, micșorând astfel pierderile în urma recombinării purtătorilor de sarcină și respectiv la majorarea fotocurentului.

Fotorăspunsul detectorului confecționat în baza structurii cu stratul  $Zn_{0.85}Mg_{0.15}O / Zn_{0.65}Mg_{0.35}O/p-Si$ , supus polarizării inverse și directe de 5V, excitare cu puterea de 63 mW este prezentat în (Fig. 3). Fotorăspunsul în domeniul IR al spectrului optic lipsește, iar în domeniul vizibil al spectrului este neesențial. Fotorăspunsul maxim este situat în domeniul UV al spectrului. Performanța fotodetectorului este caracterizată prin determinarea valorilor fotorăspunsului (R) și a detectivității ( $D^*$ ).



**Mulțumiri.** Această lucrare a fost susținută financiar de Agenția Națională pentru Cercetare și Dezvoltare, Republica Moldova, prin proiectul cu cifrul Nr. 20.80009.5007.02.

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MINISTERUL EDUCAȚIEI, CULTURII ȘI CERCETĂRII AL REPUBLICII MOLDOVA  
 Institutul de Inginerie Electronică și Nanotehnologii „D. GHÎȚU”

## Metoda de reglare a necoliniarității structurilor magnetice remanente (Method for tuning the non-collinearity of remanent magnetic structures)



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"INVENTICA 2021" Iași, România

### Abstract

Invention relates to microelectronics, more concrete: design of switching elements of spintronics – spin valve. It is possible to use invention for design of devices for communication, memory elements for supercomputer, operating of two orders more rapid than semiconducting devices.

Superconducting spin-valve consists of substrate, operating 2 ferromagnetic layers, superconducting film and antiferromagnetic layer [1].

### Esența invenției

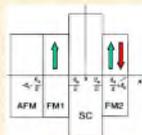
Metoda de reglare a dispozitivului spintronic bazat pe o stivă de straturi, cuprinzând un substrat, un strat feromagnetic cu o anizotropie magnetică uniaxială care include o axă ușoară, un strat nemagnetic dispus pe primul strat feromagnetic, un al doilea strat feromagnetic dispus pe stratul nemagnetic, cuprinzând o anizotropie unidirecțională și un strat antiferromagnetic dispus pe al doilea strat feromagnetic. Reglarea necoliniarității structurii magnetice remanente se poate obține prin încălzirea stivei de straturi deasupra temperaturii Néel  $T_N$ , a stratului antiferromagnetic și aplicarea unui câmp magnetic  $H_{ext}$  stivei de straturi sau prin răcirea stivei de straturi sub temperatura Néel  $T_N$  a stratului antiferromagnetic cu câmpul magnetic  $H_{ext}$  aplicat [1].

### Introduction

In superconducting spin valve with the layer sequence F1/S/F2 the superconducting transition temperature  $T_c$  of the system can be controlled by mutual alignment of magnetizations  $M_1$ , 2 of the two ferromagnetic layers F1 and F2. Therefore, at a temperature  $T$  fixed inside the range of  $T_c$  variation, there is an opportunity for switching the superconductivity on and off by reversing the magnetization direction of the F1 or F2 layer. The main goal of the present invention was development of reliable method for tuning of the non-collinearity in magnetization of the two ferromagnetic layers in the spin-valve nanostructures. For implementation of the proposed method, it was fabricated F/S/F nanostructures and provided control of the magnetic alignment of the layers using polarized neutron spectrometry. For this purpose it would be necessary to develop a special technology for preparation of a very smooth (the roughness less than 1 nm) superconducting layers with constant thickness within a large area for preparation of a whole set of samples in a single deposition run, which allows the fabrication of the spin-valve FSF-core structures.

The potential advantages of the spintronic device spin-valve are:

- nonvolatility,
  - increased data processing speed,
  - decreased electric power consumption,
  - increased integration densities,
- compared with conventional semiconductor devices.

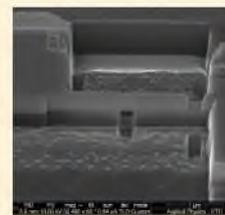
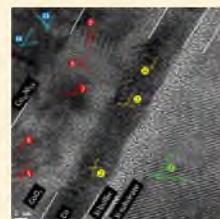
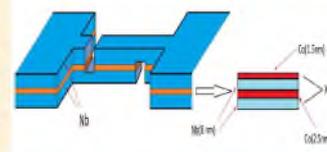


### Spin-valve core multilayer structure

Spin-valve in the measuring platform

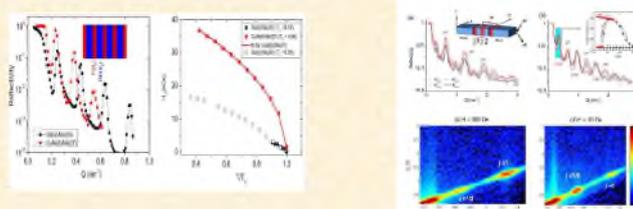


Sketch of the core-structure of the spin-valve, based on multilayered nanostructure



Cross sectional SEM image of the multilayered nanostructure (right panel) and HRTEM image of the layered nanostructure (sketch is shown above - core-structure)

### Polarized neutron spectrometry – determination of the magnetic state of the layers



Neutron reflectivities taken at room temperature on the  $[CuNi(6)/Nb(27)]_{20}$  sample and  $[Gd(5)/Nb(25)]_{12}$  for comparison. Inset shows a sketch of the structure where blue and red colors indicate Nb and CuNi (or Gd) layers. One can also notice a smeared total reflection plateau and suppressed intensity of the Bragg peaks for Gd/Nb SL comparing to CuNi/Nb system. These features are explained by a high neutron absorption of  $^{157}Gd$  and  $^{155}Gd$  isotopes present in Gd layers

### SF-Nanostructures preparation – Advanced Technology

Sidorenko A.S., Zdravkov V.I., Morari R.A. "Dispozitiv de obținere a peliculelor supraconductoare", Patent of RM №175 from 31.03.2010.

- DC, RF- magnetron sputtering with high rate (2- 4 nm/s)
- Deposition in one run of the structure with constant «S» and wedge-like «F» layers
- Deposition of long (80 nm) Nb films with constant thickness in the range of the thickness 5 – 50 nm.
- Protection of the sample by covering Si-layer.

Magnetron sputtering on (111) silicon substrates at 300K  $8 \times 10^{-3}$  mbar of 99,999% pure Argon as sputter gas. The targets: Nb (99,99%),  $Cu_{1-x}Ni_x$  ( $x=59$ , proofed by RBS), Si (99,999%). For homogeneity and proper thickness of Nb layer – controlled movement of the target-holder during the sputtering. For the variation of the F-layer thickness – wedge-like deposition.



### Conclusion

The proposed method of control of the remanent magnetic configuration of the functional multilayered nanostructures make it possible to construct novel base elements for non-von Neumann computers, based on artificial neural network.

The utilization of the competition ferromagnetic (F) and antiferromagnetic (AF) correlations in construction of spin valves serving as artificial neurons, layered nanostructures of ferromagnetic/antiferromagnetic layers serving as artificial synapses, provide a possibility for design of superconducting non-von Neumann computers, such as computers with neuromorphic architecture [3].

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- [2] Sidorenko A., Zdravcov V., Morari R. Dispozitiv de obținere a peliculelor supraconductoare. (Device for preparation of superconducting films, Patent RM Nr. 175 from 32.03.2010
- [3] Controlling the proximity effect in a Co/Nb multilayer: the properties of electronic transport. Sergey Bakurskiy, Mikhail Kupriyanov, Nikolay V. Klenov, Igor Soloviev, Andrey Schegolev, Roman Morari, Yury Khaydukov and Anatoli S. Sidorenko. *Beilstein J. Nanotechnol.* 2020, 11, 1336–1345. <https://doi.org/10.7705/bjnano.1111>

The work was supported by the European Union H2020-WIDESPREAD-05-2017-Twinning project "SPINTECH" under agreement Nr.810144, and by the project PS Nr. 65/22.10.19 A "Nanostructuri și nanomateriale funcționale pentru industrie și agricultură".



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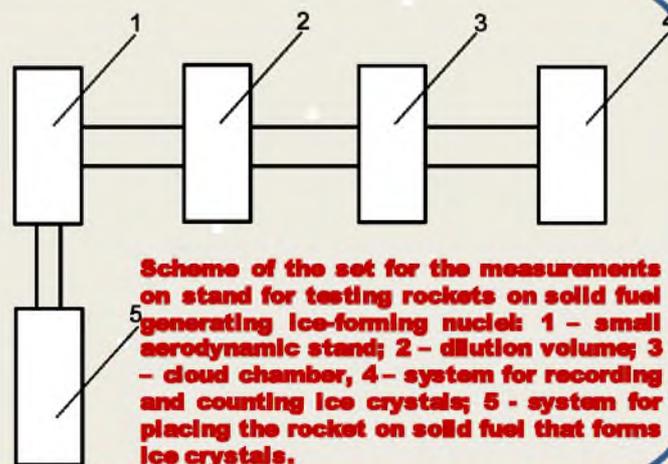
**STAND PENTRU TESTAREA RACHETELOR PE COMBUSTIBIL SOLID CARE  
FORMEAZĂ GHEAȚĂ**

**(STAND FOR TESTING ROCKETS ON SOLID FUEL GENERATING ICE-FORMING NUCLEI)**

**E. A. Zasavitsky, D. I. Karagenov and A. S. Sidorenko**

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“INVENTICA2021” Iași, Romania

**The technology is based on the use of a small aerodynamic stand, which makes it possible to test the yield of various rockets for active impacts on clouds, in particular, rockets with a propulsion engine that operates throughout the entire flight path and uses a new type of solid propellant. These rockets can significantly increase the yield of active crystallization centers per unit length of the seeding path.**



**An experimental verification of the yield of active crystallization centers per gram of the composition of rockets on solid fuel generating ice-forming nuclei has been conducted at Ghitu IEN on an upgraded stand, which makes it possible to test the rockets under conditions that closely simulate the flight conditions. The verification has confirmed the advantages of the rockets and shown that the yield of active ice-forming nuclei during the combustion of full-sized mid-flight rocket engines is  $\sim 10^{14} \text{ g}^{-1}$  at a supercooled model fog temperature of  $-10^{\circ}\text{C}$ .**

**The tests conducted on a stand for testing rockets on solid fuel generating ice-forming nuclei have shown that, compared with a conventional anti-hail rocket, the tested rockets can significantly increase the yield of active crystallization centers. It has been shown that use of rockets on solid fuel generating ice-forming nuclei provides the high-efficiency seeding of hail-hazardous clouds with artificial nuclei and, as a consequence, the suppression of hail-formation processes in potentially hazardous clouds. It is significant that the aerosol is characterized not only by a high particle yield, but also an extremely high temperature threshold for crystallization (about  $-4^{\circ}\text{C}$ ). This fact suggests that a fairly high yield of active crystals in the above temperature region will make it possible to implement active impacts to artificially increase precipitation and dissipate clouds.**

The work was supported by the project PS Nr. 65/22.10.19 A “Nanostructuri și nanomateriale funcționale pentru industrie și agricultură”.

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***The Institute of Physiology and Sanocreatology of Moldova***

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**Republic of Moldova**  
**Institute of Physiology and Sanocreatology**

**Biologically active food additive with  
antioxidant activity**

**Mereuta Ion, Caraus Vladimir,  
Strutinschii Tudor, Dubcenco Valeriu**

**Patent 1478 MD**

**Solution:** The invention relates to the food industry and sanocreatology, namely to a biologically active food additive with antioxidant activity. The food additive, according to the invention, comprises, in wt.%: dry extract of amaranth seeds 30, dry extract of wormwood leaves 40, dry extract of dihydroquercetin 15 and activated carbon 15.

**Advantages:** Biologically active food supplement can be used for prophylactic purposes or included in the composition of predestined functional foods to increase the body's adaptive and antioxidant potential.

**Domains of application:** Food industry, Sanocreatology and Medicine

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**Republic of Moldova**

**Institute of Physiology and Sanocreatology**

**Biologically active food additive with  
antioxidant activity**

**Mereuta Ion, Caraus Vladimir,  
Strutinschii Tudor, Dubcenco Valeriu**

**Patent 1479 MD**

**Solution:** The invention relates to the food industry and sanocreatology, namely to a biologically active food additive with antioxidant activity. The food additive, according to the invention, comprises, in wt.%: dry extract of amaranth seeds 25, dry extract of wormwood leaves 40, dry extract of dihydroquercetin 12, dry extract of walnut shell 8, activated carbon 15.

**Advantages:** Biologically active food supplement can be used for prophylactic purposes or included in the composition of predestined functional foods to increase the body's adaptive and antioxidant potential.

**Domains of application:** Food industry,  
Sanocreatology and Medicine

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Republic of Moldova

Institute of Physiology and Sanocreatology

**Biologically active food additive with  
antioxidant activity**

Mereuta Ion, Caraus Vladimir,  
Strutinschii Tudor, Dubcenco Valeriu

Patent 1480  
MD

**Solution:** The invention relates to the food industry and sanocreatology, namely to a biologically active food additive with antioxidant activity. The food additive, according to the invention, comprises, in wt. %: dry extract of amaranth seeds 25, dry extract of wormwood leaves 35, dry extract of dihydroquercetin 10, dry extract of walnut shell 10, dry extract of dandelion roots 10 and activated carbon 10.

**Advantages:** Biologically active food supplement can be used for prophylactic purposes or included in the composition of predestined functional foods to increase the body's adaptive and antioxidant potential.

**Domains of application:** Food industry,  
Sanocreatology and Medicine

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## Republic of Moldova

Institute of Physiology and  
Sanocreatology

### Phytotherapeutic composition for producing an aqueous infusion with body weight reducing effect

MEREUȚĂ Ion, FEDAȘ Vasile,  
CARAUȘ Vladimir, BACIU Anatol

Patent MD 1498

**Purpose:** The invention relates to preventive medicine, namely to a phytotherapeutic composition for producing an aqueous infusion with body weight reducing effect.

**Solution:** The composition, according to the invention, comprises chicory root, burdock root, celery root, aloe leaves, aboveground part of lady's-mantle, aboveground part of common agrimony, aboveground part of sweet flag calamus, milfoil flowers, wormwood leaves, black cumin seeds, dry extract of astaxanthin and guava fruits.

**Domains of application:** Sanocreatology and Physiology, Food industry, Medicine, Pharmacology.

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## Republic of Moldova



### Institute of Physiology and Sanocreatology

## Phytotherapeutic composition for producing an aqueous infusion with low density lipoprotein reducing effect

CARAUȘ Vladimir, FEDAȘ Vasile,  
MEREUȚĂ Ion, BACIU Anatol

Patent MD 1499

**Purpose:** The invention relates to preventive medicine, namely to a phytotherapeutic composition for producing an aqueous infusion with low density lipoprotein (LDL) reducing effect.

**Solution:** The composition, according to the invention, comprises dry laminaria extract, juniper fruits, dandelion root, restharrow root, buckthorn bark, linden flowers, dry cannabidiol extract, wormwood leaves and tansy flowers.

**Domains of application:** Sanocreatology and Physiology, Food industry, Medicine, Pharmacology.

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## Republic of Moldova



Institute of Physiology and  
Sanocreatology

### Phytotherapeutic composition for producing an aqueous infusion antihypertensive effect

FEDAȘ Vasile, MEREUȚĂ Ion  
CARAUȘ Vladimir, BACIU  
Anatol

Patent MD 1500

**Purpose:** The invention relates to preventive medicine, namely to a phytotherapeutic composition for producing an aqueous infusion with antihypertensive effect.

**Solution:** The composition, according to the invention, comprises chicory root, aboveground part of winter cress, birch buds, black currant leaves, garden orach leaves, stinging nettle leaves, dandelion leaves, burdock root, hawthorn fruits, common horsetail leaves, dry cannabidiol extract, elder flowers and corn silk.

**Domains of application:** Sanocreatology and Physiology, Food industry, Medicine, Pharmacology.

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Republic of Moldova

Institute of Physiology and Sanocreatology

## Method of treatment of the average form of SARS-CoV-2 viral infection

Mereuta Ion, Caraus Vladimir,  
Bodrug Nicolae, Strutinschi  
Tudor, Chiciuc Andrei

Patent application MD no. deposit:  
s20200140, date of deposit: 2020.10.27  
Decision nr.9777/2021.04.22 for the  
grant of patent

**Solution:** The invention relates to medicine, in particular to infectious diseases, and can be used for the treatment of SARS-CoV-2 viral infection.

The method of treatment of the medium severity form of SARS-CoV-2 viral infection is as follows: paracetamol 500 mg x 4 times/day, umifenovir 100 mg 4 times/day, and the composition containing dry extracts of wormwood, cornet, maral root, walnut peel, horseradish, larch, taxifolin, astaxanthin and ginseng in a certain ratio of components, based on ethyl alcohol of 96.4%, 15-20 minutes before meals, three times a day, 50 ml each.

**Advantages:** It decreases the term of treatment 4 times; the duration of treatment will not exceed 5 days; it saves treatment costs.

**Domains of application:** the Ministry of Health, COVID-19 Centers.

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***"Alexandru Ciubotaru" National Botanical Garden (Institute) of Republic of  
Moldova***



# International Exhibition of Inventions

## INVENTICA 2021

23.06.2021 - 25.06.2021



NATIONAL INSTITUTE OF INVENTIONS, IASI, ROMANIA

“Alexandru Ciubotaru” National Botanical Garden  
(Institute) Chisinau, Republic of Moldova



### THE NEW CULTIVAR ‘MELIFERA’ OF PHACELIA *Phacelia tanacetifolia*

Patent no. MD 208 2016.05.31

Author Victor ȚÎȚEI

The cultivar ‘*Melifera*’ has been created by mobilization activities, individual selection and breeding of introduced plant taxa of phacelia, *Phacelia tanacetifolia* Benth., family Hydrophylaceae (Boraginaceae) native to the Americas.

The cultivar ‘*Melifera*’ registered in the Catalogue of Plant Varieties (no.0713129) of the Republic of Moldova, as annual multi-purpose herbaceous crop: melliferous, fodder, ornamental, green manure, bioenergy production.



This cultivar is a source of pollen and nectar for bees, available for 40-50 days, and makes it possible to obtain 400-780 kg/ha honey.



fresh mass fodder

The green mass productivity varied from 31 t/ha (early May) to 51.4 t/ha (in late June), for feeding animals as fresh mass, hay or haylage, with a nutrient concentration of 12-21% CP, 1.6-2.7% EE, 30-40% ADF, 45- 60% NDF, 3-6% ADL, 27-34% Cel, 15-20% HC, 10-17% ash, nutritional value 57.7-65.4% DDM, 0.9% P, 3.6-3.8% Ca, RFV = 110- 130.



hay



green manure

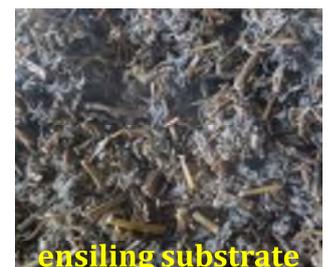
The incorporation of phacelia ‘*Melifera*’ as green manure contributed to the increase of the content of organic matter in soil with 3.1 - 8.1 t/ha, concentration of nitrogen 126-182 kg/ha, phosphorous 34-37 kg/ha, magnesium 11.8-27.4 kg/ha, potassium 140.6- 353.0 kg/ha, calcium 144.4-419.0 kg/ha, sodium 0.36-0.75 kg/ha, copper 0.03-0.05 kg/ha, zinc 0.10-0.18 kg/ha, manganese 0.29-0.33 kg/ha, iron 1.36-2.32 kg/ha.



The crop residues (stalks) had moderate gross calorific value of 18.4 MJ/kg, the briquettes have specific density 916 kg/m<sup>3</sup>, were very solid and were not cracking.



green mass substrate



ensiling substrate

The cv. ‘*Melifera*’ substrates for anaerobic digestion have optimal C/N ratio, hemicelluloses and lignin content, the biomethane potential was 220-300 l/kg organic matter.

Financially supported NARD project cod no. 20.80009.5107.02.

“Mobilization of plant genetic resources, plant breeding and use as forage, melliferous and energy crops in bioeconomy”  
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# International Exhibition of Inventions

## INVENTICA 2021

23.06.2021 – 25.06.2021



NATIONAL INSTITUTE OF  
INVENTIONS, IASI, ROMANIA



### “Alexandru Ciubotaru” National Botanical Garden (Institute) Chisinau, Republic of Moldova

## THE INNOVATIVE TECHNOLOGY FOR FOUNDING PLANTATIONS AND VALORIFICATION OF SOME NON-TRADITIONAL CROPS

Patents no. MD 204 2016.05.31, MD 205 2016.05.31, MD 207 2016.05.31, MD 209 2016.05.

Author Victor ȚÎTEI

The new cultivars of non-traditional crops created in National Botanical Garden (Institute), Chisinau, registered in the Catalogue of Plant Varieties and patented by the State Agency on Intellectual Property (AGEPI) of the Republic of Moldova: ‘Vital’ (MD 204), ‘Gigant’ (MD 205), ‘Energio’ (MD 207), ‘Solar’ (MD 209) are used to found industrial perennial plantations with multi-purpose valorification. The phytomass can be valorification as fodder for livestock (green mass and silage) and as substrates for biomethane production.



cv. ‘Vital’ *Silphium perfoliatum*

For the foundation of plantations with cv. ‘Vital’ of cup plant, *Silphium perfoliatum* L. are necessary 5-10 kg/ha seeds or 28-40 thousand seedlings/ha; the plant spacing should be 70 cm x 50 cm or 70 cm x 35 cm, 45 cm x 45 cm. The green mass productivity (1-2 cuts) is 124- 148 t/ha with potential fodder production 15-18 t/ha nutritive units and 1700-1800 kg/ha digestible protein. Silage quality: pH 4.00-4.30, 77-80 % lactic acid, 19-22% % acetic acid, 0-1.1 % butyric acid, 9.9-13.5 % CP, 3.26-4.08 % EE, 8.9-12.7 % ash, 56.5.7-59.5 % NDF, 41.0-43.3 % ADF, 4.0-4.8 % ADL, 3.7-5.5 g/kg Ca and 1.8-2.7 g/kg P, 11.93-13.00 MJ/kg DE, 9.79-10.67 MJ/kg ME and 6.0-7.2 MJ/kg NEL. The biomethane potential 4500-5800 m<sup>3</sup>/ha/year.



cv. ‘Gigant’ *Polygonum sachalinense*

For the foundation of plantations with cv. ‘Gigant’ of Giant knotweed *Polygonum sachalinense* F. Schmidt ex Maxim are necessary 20-28 thousand plants/ha; the distance between plants should be 70 cm x 70 cm or 70 cm x 50 cm. The green mass yield after cutting the plants 2-3 times is 124-148 t/ha, the potential fodder production – 14-18 t/ ha nutritive units and 1800-2000 kg/ha digestible protein. Silage quality: pH 3.80-4.10, 80-85 % lactic acid, butyric acid not identified, 13.5-18.0 % CP, 2.3-2.6 % EE, 8.9-14 % ash, 54-8 % NDF, 34-45 ADF, 5.0-7.8 % ADL, 4.7-5.5 g/kg Ca and 2.3-2.5 g/kg P.

Biomethane potential 4050-4300 m<sup>3</sup>/ha/year.



cv. ‘Energio’ *Sida hermaphrodita*

For the foundation of plantations with cv. ‘Energio’ of Virginia mallow *Sida hermaphrodita* Rusby. are necessary 3-5 kg/ha seeds or 28-40 thousand seedlings /ha; the plant spacing should be 70 cm x 50 cm or 70 cm x 35 cm. The fresh mass yield obtained after cutting the plants twice: 104-112 t/ha; the potential fodder production is 15-18 t/ha nutritive units and 1750-2000 kg/ha digestible protein. Silage quality: pH 3.96-4.65, 75-80 % lactic acid, butyric acid not identified, 13.5-18.2 % CP, 2.20-3.00 % EE, 7.80-11.0 % ash, 53.6-73.4 % NDF, 35.0-51.5 % ADF, 5.7-6.3 % ADL, 3.2-5.7 g/kg Ca, 2.8.8-3.1 g/kg P, 11.33 MJ/kg DE, 8.91-9.30 MJ/kg ME and 5.06-5.32 MJ/kg NEL. From the fresh and silage substrates, about 4350- 5300 m<sup>3</sup>/ha/year biomethane can be obtained.



cv. ‘Solar’ *Helianthus tuberosus*

For the foundation of plantations with cv. ‘Solar’ of topinambur *Helianthus tuberosus* L. are necessary 40-50 thousand tubers /ha; the plant spacing should be 70 cm x 25 cm. The fresh mass yield after cutting the plants 1-2 times is 74-118 t/ha, and tubers – 34-43 t/ha, potential fodder production – 16-20 t/ha nutritive units and 1600-1750 kg/ha digestible protein. Silage quality: pH 3.90-4.30, 77-80 % lactic acid, 0-1.1 % butyric acid, 9.7-13.5 % CP, 1.90- 3.07 % EE, 8.90-12.96 % ash, 55.9-62.3 % NDF, 31.0-45.8 % ADF, 4.8-6.3 % ADL, 4.7-6.5 g/kg Ca and 2.8-3.1 g/kg P, 11.25-12.43 MJ/kg DE, 9.23-10.21 MJ/kg ME and 5.96-7.02 MJ/kg NEL. Biomethane potential – 4000-6000 m<sup>3</sup>/ ha/ year.

Financially supported NARD project cod no. 20.80009.5107.02.

“Mobilization of plant genetic resources, plant breeding and use as forage, melliferous and energy crops in bioeconomy”



**POLAND**

*Represented by*

***CZESTOCHOWA UNIVERSITY OF TECHNOLOGY, POLAND***



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# CZESTOCHOWA UNIVERSITY OF TECHNOLOGY

M. Nabiałek, K. Błoch, B. Jeż

## Bulk nanocrystalline iron alloy

### SCIENCE IMPROVES THE QUALITY OF LIFE

The subject of the invention is a massive nanocrystalline iron alloy classified as magnetically soft, which can be used in electronics, electrical engineering and energy and in particular as: high power transformers for switched mode power supply systems, high accuracy current transformers for energy meters or impulse transformers for communication.

The massive fast-cooled nanocrystalline alloy according to the invention, the main component of which is iron, is characterized in that Si (Si: 0.25 or 0.5 or 0.75 or 1%) was introduced as a structure stabilizer. Increasing the Si content blocks the growth of Fe phase and borides by limiting the diffusion of atoms over further distances.

The massive nanocrystalline alloy was produced in one production step, which means that it was not subjected to additional processing enabling its nanocrystallization. In the casting process it was cooled at a speed of about 102 K/s, which at this speed causes a significant relaxation of structure and gives the alloy the expected properties. The Fe<sub>65</sub>Co<sub>11-x</sub>B<sub>20</sub>Si<sub>x</sub>Zr<sub>2</sub>Hf<sub>2</sub> alloy material according to the invention contains (atomically) respectively: Fe - 65%; B - 20%; Zr - 2%; Si - from 0.25% to 1%; Co - from 10% to 10.75%, Hf - 2% when meeting the Co<sub>11-x</sub>Si<sub>x</sub> relationship (where x = 0.25 or 0.5 or 0.75 or 1) with permissible contamination not more than 0.09%.

The advantage of the proposed alloy according to the invention is also that in relation to the produced amorphous materials of thin alloy strips they can be made in one production stage with a thickness of 0.5 mm while maintaining a low coercive field value, high saturation induction and good temperature stability.

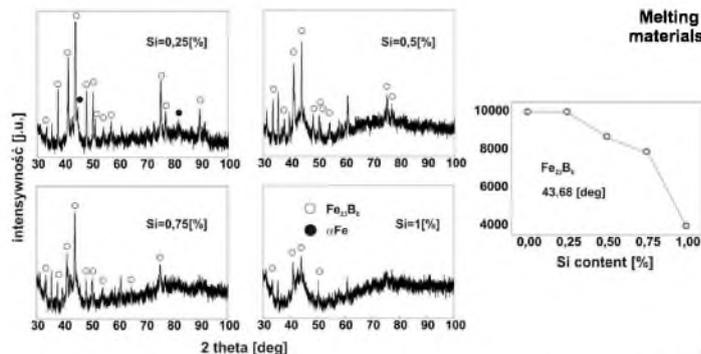
MODERN ALLOYS FOR SPECIAL APPLICATIONS. THE SOLUTION HAS VERY GOOD OPINIONS ABOUT INNOVATION

### Patent application No. P.432728

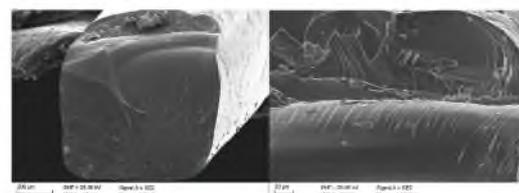
	Alloy	H <sub>C</sub> [A/m]	M <sub>s</sub> [T]	D <sub>sp</sub> [meV/nm <sup>2</sup> ]	T <sub>c</sub> [K]
Pattern	Fe <sub>65</sub> Co <sub>11</sub> B <sub>20</sub> Zr <sub>2</sub> Hf <sub>2</sub>	310	1.43	46	690
Sample I	Fe <sub>65</sub> Co <sub>10.75</sub> B <sub>20</sub> Si <sub>0.25</sub> Zr <sub>2</sub> Hf <sub>2</sub>	143	1.40	45	672
Sample II	Fe <sub>65</sub> Co <sub>10.5</sub> B <sub>20</sub> Si <sub>0.5</sub> Zr <sub>2</sub> Hf <sub>2</sub>	56	1.40	43	668
Sample d III	Fe <sub>65</sub> Co <sub>10.25</sub> B <sub>20</sub> Si <sub>0.75</sub> Zr <sub>2</sub> Hf <sub>2</sub>	62	1.38	43	663
Sample IV	Fe <sub>65</sub> Co <sub>10</sub> B <sub>20</sub> Si <sub>1</sub> Zr <sub>2</sub> Hf <sub>2</sub>	61	1.37	43	655



Melting device for quickly cooled materials with the applied solutions



A nanocrystalline massive iron alloy characterized in that it has the atomic composition of Fe<sub>65</sub>Co<sub>11-x</sub>B<sub>20</sub>Si<sub>x</sub>Zr<sub>2</sub>Hf<sub>2</sub>, where the value of x is 0.25 or 0.5 or 0.75 or 1, and the permissible amount of impurities does not exceed 0.09%.



### Patent application No. P.432728



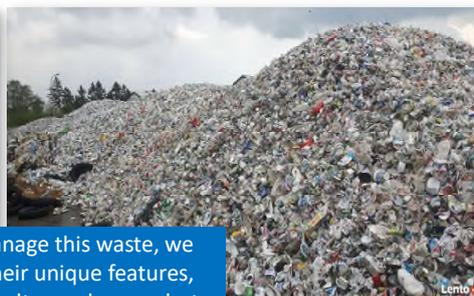
www.pcz.pl

# CZESTOCHOWA UNIVERSITY OF TECHNOLOGY

## Innovative composite aggregate made from recycling of ash and plastic waste

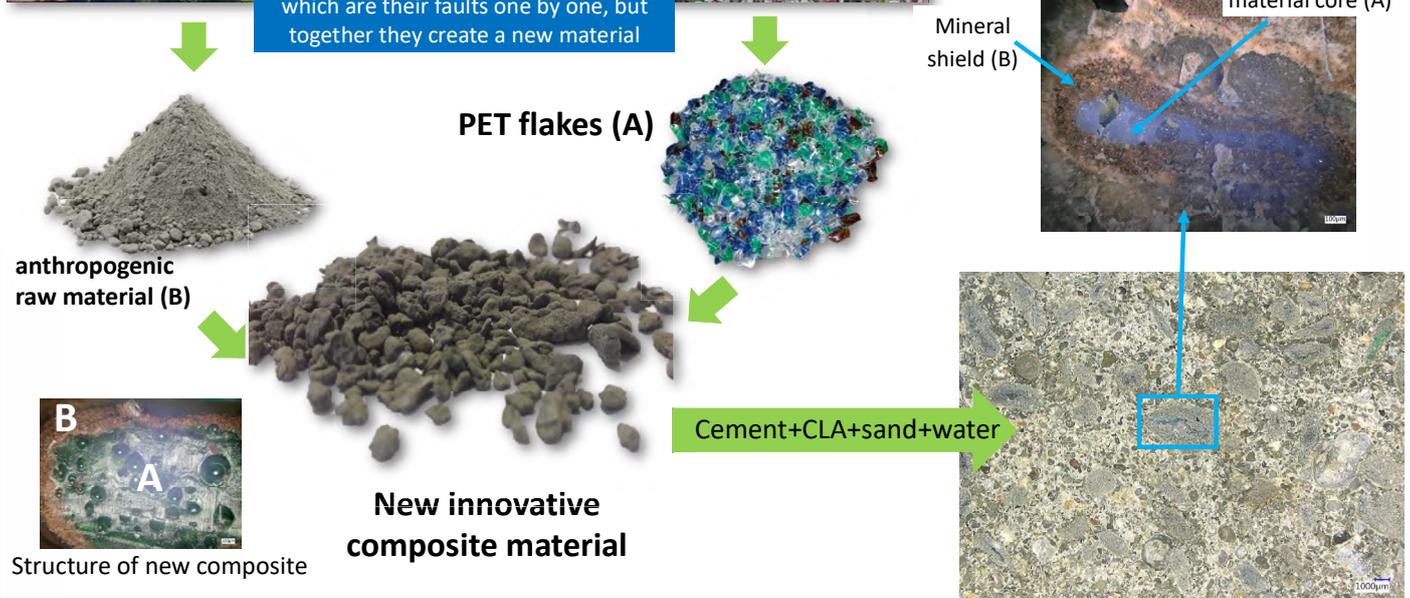
Authors: Piotr GÓRAK, Przemysław POSTAWA, Jarosław KRET  
 CZESTOCHOWA UNIVERSITY of TECHNOLOGY

Faculty of Mechanical Engineering & Computer Science, Department of Technology and Automation



If we want to manage this waste, we must combine their unique features, which are their faults one by one, but together they create a new material

**Sustainability** now is the philosophy of life of modern civilization, the direction of new scientific development that is being carried out, it is the necessity to use the potential of interdisciplinary teams, it is the duty of our generation in the aspect of the future of our planet.



### Indication of technical field (the invention relates to):

The subject of the invention is a lightweight composite aggregate. The product of such a reaction, while maintaining the specific conditions of the process, may be a composite aggregate lightweight (CLA). As a matrix in the created composite the flakes from recycling of a post-consumer thermoplastic polymer PET (polyethylene terephthalate) were used (any thermoplastic polymer can be used in that technology). The filler's role was fulfilled by fine-grained anthropogenic raw materials.

### What problem the invention solves:

- waste management of PET, PE, PP plastic,
- management of waste of combustion processes (fly ashes)
- the possibility of using waste heat from other processes for their production, reduction of energy compared to current methods of producing lightweight aggregate by 60-70%

### Defined problems:

- Defined problems:
- millions of tons of mineral and plastic waste, and no idea what to do with them
  - no possibility of multiple recycling of plastic waste (max 5 times)
  - problems with mineral waste management

### Purpose and application areas:

- Purpose and application areas:
- architecture (concrete, light mortars, insulation)
  - road engineering,
  - chemical industry (fillers mortars and resins,
  - gardening (filtration layers)

Contact person: Przemysław POSTAWA  
 Email: [postawa@ipp.pcz.pl](mailto:postawa@ipp.pcz.pl)

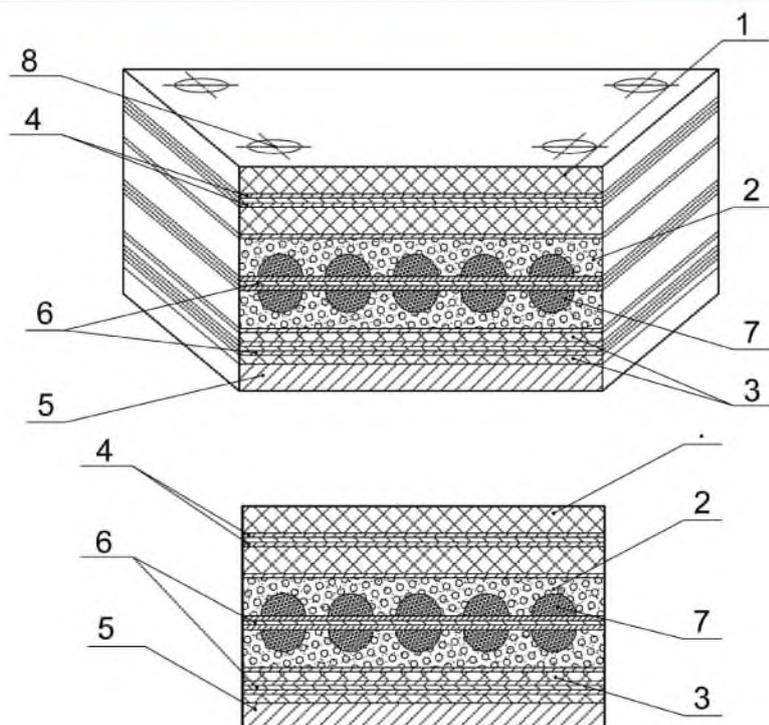


# Politechnika Częstochowska

## Elastomer shock absorber

The subject of the invention is an elastomer shock absorber which is used in engineering steel structures and industrial machine structures where high dynamic loads occur.

The aim of the invention is to develop an elastomer shock absorber with increased vibration damping capacity and resistance to dynamic interactions acting on the shock-absorbed structure and harmful external factors during the shock absorber's operation. The analyzed elastomer shock absorber consists of two homogeneous rubber layers (1, 3) with a hardness of 80 to 900 Sh A divided by a porous rubber layer (2) with a hardness of 30 to 400 Sh A and containing uniformly distributed rubber, spherical elements in the middle part (7). Each rubber layer (1, 2, 3) in the central portion having a carbon fiber cloth layer (6), stabilized with an epoxy adhesive layer (4). The bottom rubber layer (3) is connected to a steel stabilizing plate (5).



- 1,3 - homogeneous rubber layers
- 2 - porous rubber layer
- 4 - epoxy adhesive layer
- 5 - steel stabilizing plate
- 6 - carbon fiber cloth layer
- 7 - uniformly distributed rubber, spherical elements

With the new solution was increased durability elastomer shock absorber and reduced have harmful the dynamic interactions acting on structures in which the shock is applied. The developed structure of the shock absorber thanks to a porous rubber damping layer with spherical microporous rubber elements is characterized by high internal damping and the ability to absorb sound, which improves the comfort of work of people staying nearby.

**Name of the Inventors:**  
 Major Maciej  
 Major Izabela  
 Niemiro-Mażniak Judyta

**CROATIA**

*Represented by*

***CROATIAN INVENTORS NETWORK***



# CROATIA



## NiKEL OLIVE line

NiKEL OLIVE line with virgin olive oil extracted from cold-pressed Mediterranean olives and 100% natural active ingredients for fresh and beautiful skin.

Author:  
 Mag. Pharm. **MIRJANA BRLEČIĆ**

Company:  
**PRIRODA LIJEČI d.o.o.**  
 HR-10000 Zagreb, Vlaška 40  
 tel: +385 1 4814 152  
 fax: +385 1 4814 033  
 e-mail: info@nikel.com.hr  
 www.nikel.com.hr



OLIVE, a mythical tree revered since the ancient times. Olive oil, also called "liquid gold", has been used to preserve beauty since the ancient times. Olive oil in combination with vitamin E has a protective effect on the body's cells. Cold pressing green Mediterranean olives preserves all of their beneficial properties. It replenishes skin and protects it from moisture loss. It acts as a natural protection factor, reflecting around 25% of sunrays.

*Hydrating Cream, Nourishing Cream, Oil-Serum,  
 Gentle Cleansing Foam, Gentle Exfoliant, Sun Oil SPF6*

*NiKEL is a registered trademark*  
 WIPO: IR1083058, IR1083061, IR1124243, IR1235283  
 OHIM: 001622580-0001, 001622580-0002, 001622580-0003, 001622580-0004, 001622580-0005  
 DZIV: Z20050257, Z20060688, Z20060689, Z20101735, Z20111709A, Z20111226, Z20111227, Z20081154, Z20081151, Z20121262A

***MACAU***

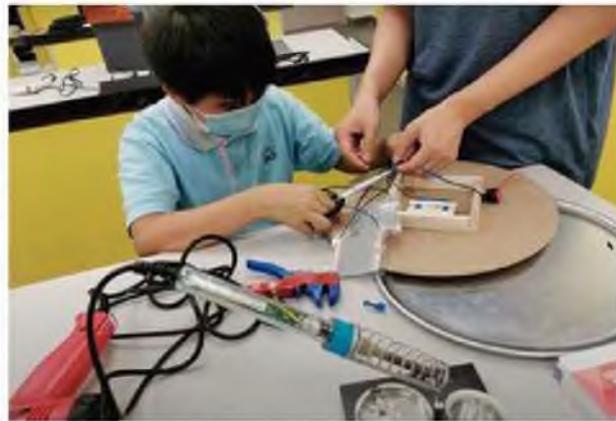
***Represented by***

***Hou Kong Middle School***



## Pizza Heat Preservation Device

*Premier School Affiliated to Hou Kong Middle School*



Because I remember that when I went to dinner with my mom, we ordered a lot of food. Because I like to eat pizza the most, I left the pizza at the end. But the pizza became very unpalatable when they got cold. I thought it was a waste.

So I decided to design a device that can keep the pizza warm so that pizza lovers can enjoy delicious pizza throughout the meal. This device provides power to the heating module through a lithium battery, and transfers heat to the entire invention through a thermally conductive pizza pan. The invention outside the device heats up to keep the inside and outside of the pizza at a proper temperature, so that the pizza can be maintained at the best status of use.

At the same time, the 3 wooden chassis structure provides a heat-proof effect, and the heat is used to maintain the temperature of the pizza, so that the pizza can be kept in the best eating state on the table.

**CANADA**

*Represented by*

*Toronto International Society of Innovation & Advanced Skills (TISIAS)*



**SYNERGISTIC TRAFFIC INTERSECTION  
 具有协同作用的交通交叉路口**

Contact: Inv Valiant Yuk Yuen Leung 梁育元  
 3110284705@qq.com



Patented  
 EP17798405  
 SG11201810147T  
 RU2018144861

Patent-Pending  
 AU2016901871  
 AU2017266443  
 CN20178035540  
 IN201817045733  
 VN1-2018-05624  
 ID P00 2018 10707  
 US16/304654  
 JP2019516891  
 HK19128471.0

**SYNERGISTIC TRAFFIC INTERSECTION**  
 was invented on 19/5/2016 and targets  
 the worldwide urban traffic congestions.

Flyovers, subways, and tunnels are not  
 necessary. What we need to do are just  
 rearrange the layout pattern of the  
 functions, install extra traffic lights, and  
 readjust the traffic light timing and  
 phases per cycle.

Existed road spaces are wisely  
 rearranged to lower the red and green  
 phase ratio from 3:1 to 1:1. Two red-light  
 phases of the waiting time will be saved.  
 By reducing the time-costly red  
 traffic-light phase without losing any  
 function, the congested volume will then  
 be reduced to 1/3 as existed.



**8 Golds  
 1 Silver  
 1 Special**

**Awards:**

- 2019 IIF India Gold
- 2018 IEI China Gold
- 2017 IIDC Hong Kong Gold
- 2017 WIIF China Gold
- 2017 CIIE Hong Kong Gold
- 2017 CSITF Shanghai Gold
- 2017 Geneva Silver
- 2016 IEI China Gold
- 2016 ICAN Canada Gold
- 2016 ICAN Morocco  
 Special Award

Combinations of continuous green-wave  
 flows are grouped comparatively easier  
 and further. As a result, a constant  
 high-speed smooth circulation will clean up  
 all hotbeds of traffic congestion.

Unlike CONTINUOUS FLOW INTERSECTION  
 (CFI) and DISPLACED LEFT/RIGHT TURN  
 (DLT/DRT), SYNERGISTIC TRAFFIC  
 INTERSECTION (STI), can also be applied to  
 most of the narrow 3 or 4 lanes two ways  
 urban slow traffic. It displaces the existed  
 inefficient traffic within the original  
 pavement. No extra land will be required.

Since the construction period is short and  
 simple with a higher cost performance, this  
 should become the priority choice for the  
 world, no matter developed or developing  
 countries.



**SYNERGISTIC TRAFFIC CONSULTANCY  
 PTY. LTD. (Australia)**  
**SYNERGISTIC TRAFFIC LTD. (Hong Kong)**  
[www.synergistictraffic.com](http://www.synergistictraffic.com)



***MALAYSIA***

*Represented by*

***Universiti Malaysia Perlis***



# UNIVERSITI MALAYSIA PERLIS

knowledge . sincerity . excellent [www.unimap.edu.my](http://www.unimap.edu.my)



UNIVERSITI  
MALAYSIA  
PERLIS



**Inventors**  
Assoc. Prof. Ir. Dr. Mohd Fathullah bin Ghazali, Prof. Ts Dr Mohd Mustafa Al Bakri Abdullah, Ir Shazwan bin Shahril, Assoc. Prof. Ir. Dr. Shayfull Zamree bin Abd Rahim, Dr Nonnah Afri bin Shuib, Ir Mohd Nazeem bin Mat Sood, Muhamad Fairuan bin Rosli, Ir. Amrul bin Talib, Ir. Mohd Khalid Fadly Abu Bakar, Ir. Dr Man bin Abd Rahim

**Contact Details**  
Centre of Excellence Geopolymer & Green Technology (CEGeoTech)  
Faculty of Mechanical Engineering Technology,  
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Email: fathullah@unimap.edu.my



## A New Innovation of Fire-Retardant Fly Ash Geopolymer

**INTRODUCTION**

GFRE composite is used in aeroplanes, land and water vehicles, defence, medical uses, biomechanics, robots, civil works and machineries.

**MAIN PROBLEM**

GFRE susceptible to fire hazard, making its use limited in application where fire rules are strict and the existing fire retardant materials are not green.

### WHAT WE FOUND IN EXTENSIVE LITERATURE REVIEW ABOUT GEOPOLYMER? [1]

Geopolymer has the growth of SELF-INSULATING properties; as temperature increases it protects the constituent materials

OUR PAPER:

[1] Shahari, S., Fathullah, M., Abdullah, M. M. A. B., Shayfull, Z., Mia, M., & Darmawan, V. E. B. (2021). Recent developments in fire retardant glass fibre reinforced epoxy composite and geopolymer as a potential fire-retardant material: A review. *Construction and Building Materials*, 277, 122246. Q1, Impact Factor: 4.419

### INTRODUCING FLY ASH GEOPOLYMER-GLASS FIBER REINFORCED EPOXY (GFRE) COMPOSITE



INTELLECTUAL PROPERTY  
COPYRIGHT MYIPO:  
APPLICATION NO. **LY2021E00678**

### GEOPOLYMER FIBER REINFORCED COMPOSITE

- FIRST IN THE WORLD**
  - Increase fire retardancy
  - Safer to use
- NOVEL**
  - COPYRIGHT
  - Already Published in IJ Journal
- INDUSTRIAL RECOGNITION**
  - Furtek Technology Sdn Bhd commercializes this innovation
- GREEN MATERIALS**
  - Geopolymer is made from waste / by product



**BETTER FIRE RETARDANCE**



**COLLABORATION**



***TAIWAN***

*Represented by*

***Kuai Ji Junior High School***



## 360° roof air intake ventilation

*Kuai Ji Junior High School / Dong Xing Junior High School /  
Sin shih Elementary School*



Different from the existing exhaust function of the existing roof ventilation. The ventilator rotates 360° can Turns the vent to the windward side, and bring fresh cool air into the room to regulate the function of reducing indoor temperature. This device can prevent rain or insects from entering the room.

**INDIVIDUALS**

*Terraflux Control Ltd. Iasi*



# International Exhibition of Inventions INVENTICA 2021 23.06.2021 - 25.06.2021

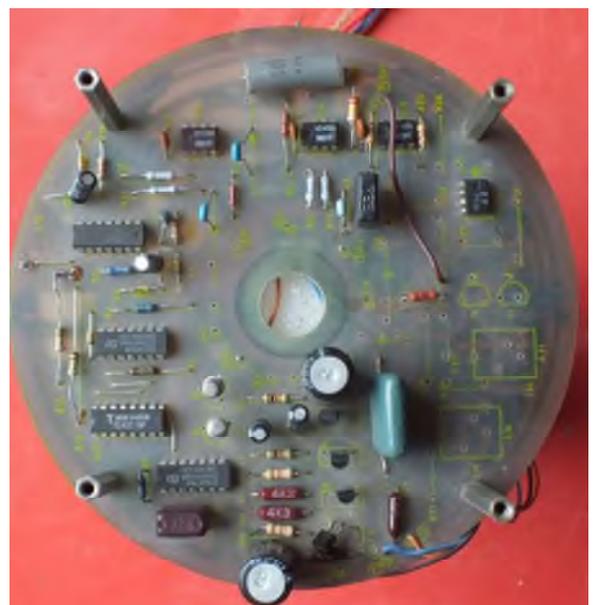
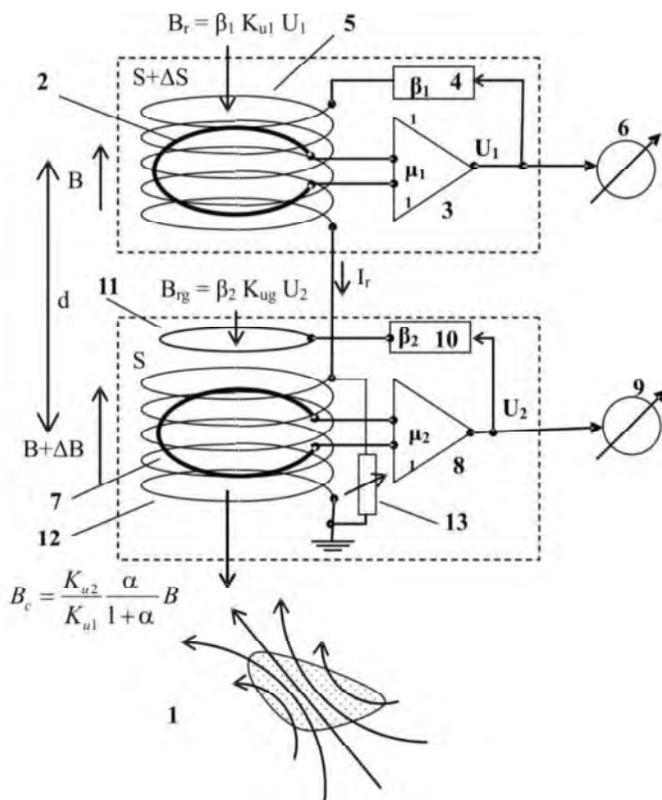


**TERRAFLUXCONTROL LTD.**

## MAGNETOMETRU DE GRADIENT

**Cerere brevet: A 00161 / 2021 Inventator: Octavian Baltag**

A gradient magnetometer intended for measuring the first-order gradient of the magnetic field, is composed of two magnetometric channels I and II, having field transducers arranged coaxially at a distance  $d$  called the gradient measurement base, the channel I being placed at a greater distance, and channel II at a distance less than a magnetic field source 1.



**Applications domain: Biomagnetism, magnetic detection, geophysical exploration**

***DINU MONICA GABRIELA***



# International Exhibition of Inventions INVENTICA 2021 23.06.2021 – 25.06.2021



## PRIVAT INVENTOR

### SPIRULINFOOD- COMPOSITION AND METHOD FOR HEALTHY FOOD

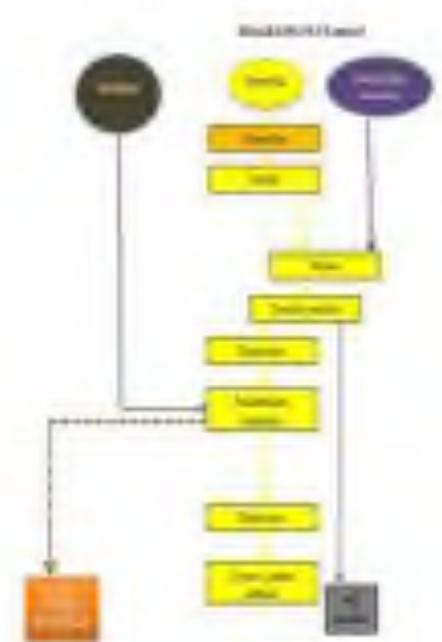
**Cerere brevet: A 2019 00918**

**Inventatori (Inventors): DINU MONICA GABRIELA**

THE COMPOSITION AND THE PROCESS According to the invention consist in establishing the destination of the SPIRULINFOOD powder mixture for the manufacture of ice cream both in domestic and industrial fields, but also for sherbets, wafers, bakery products - pastry, confectionery, etc., based on rice flour. The goal is to determine the proportion of spirulina: another ingredient: thickener. Then correct the rice flour with guar gum until the rheological parameters are obtained or you want according to the destination of the flours (wafers, cakes, etc.).

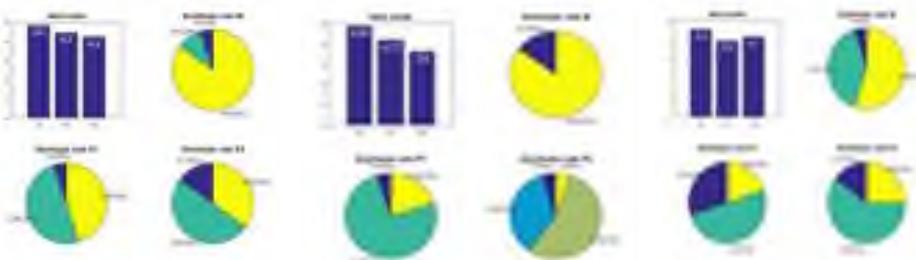
The invention relates to a mixture composition based on spirulina, to a process for the preparation and to an ice cream food product based on it. The composition according to the invention is in the form of doses packed in 20 g paper sachets, consisting (in mass percent) of 30% spirulina, 50% sea buckthorn and 20% guar gum. The process according to the invention consists in homogenizing the spirulina with a stabilizer, then adding aloe vera or honey in two stages, with homogenization, followed by decontamination, mixing dosing and packaging in doses of 20 g.

#### RESULTS FOR ICE CREAM APPLICATION. M-CONTROL, P1 – WITH ADDED HONEY & SPIRULIN, P2- WITH SPIRULIN



#### ORGANOLEPTIC RESULTS FOR ICE CREAM APPLICATION M-CONTROL, P1 – WITH ADDED HONEY & SPIRULIN, P2- WITH SPIRULIN.

##### 1- COLOR, 2 – STABILITY SYSTEM, 3- TEST



1

2

3

Flow diagram

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***OncoGen Research Centre***

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# International Exhibition of Inventions INVENTICA 2021 23.06.2021 – 25.06.2021



“Pius Brînzeu” Clinical County Emergency Hospital Timișoara



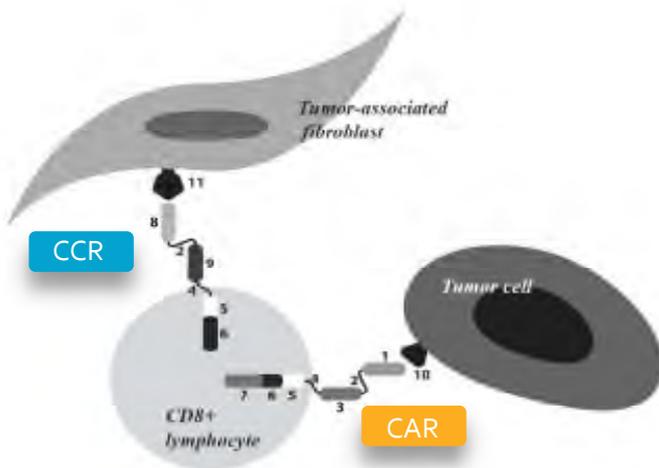
**OncoGen** Research Centre

## Bispecific CAR-T Cells for the Treatment of Solid Tumors and Method of Obtaining Thereof

Patent application  
a 2020 00705

**Inventors:** Bojin Florina, Gavriluc Oana, Tănăsie Gabriela, Tatu Călin, Panaitescu Carmen, Păunescu Virgil, Nedeu Eduard

**Contact:** Assoc.Prof. Florina Bojin, florinabojin@umft.ro



The present invention is referring to a method of obtaining selective bispecific CAR-T cells (SMaRT CAR-T lymphocytes) for the treatment of solid tumors, which would simultaneously target a tumor-associated antigen (TAA=Her2) and an antigen found on peritumoral cells (TmAA=FAP). The method consists of the following steps: selection of a tumor-associated antigen and a peritumoral antigen, design of chimeric antigen receptors, generation of lentiviral vectors carrying the CAR transgenes, transduction of T lymphocytes using the lentiviral vector, assay of SMaRT CAR expression on T cells and functional *in vitro* and *in vivo* validation of the selective bispecific CAR-T cells.

### Activation of selective bispecific SMaRT CAR T cells

Engagement of both chimeric antigen receptors (CAR and CCR) is required for optimal activation. Signal transduction and cytotoxic effector function is supported by the anti-Her2 CAR, which includes a CD3z fragment. **Legend:** 1. scFv Trastuzumab VL; 2. G4S linker; 3. scFv Trastuzumab VH; 4. CD8a hinge; 5. CD28; 6. 4-1 BB; 7. CD3 zeta; 8. scFv Sibrotuzumab VH; 9. scFv Sibrotuzumab VL; 10. protein Her2; 11. protein FAP

For the generation of bispecific SMaRT CAR-T cells, we have designed a 3rd generation complete chimeric antigen receptor (CAR) targeting a tumor-associated antigen (TAA), HER2, and another incomplete chimeric antigen co-receptor (CCR), that recognized a antigen found on peritumoral cells (FAP). The CCR does not include a CD3z fragment, therefore dissociating T cell activation signal from the tumor microenvironment from activation due to the recognition of tumor cells. For each receptor construct, we generated lentivirus and transduced CD8+ T lymphocytes. Transduced cells were sorted based on the expression of both receptors and expanded further.

### Advantages

of using bispecific SMaRT CAR-T cells for the treatment of solid tumors

01

CAR and CCR targets, as well as binding domains are chosen based on a high degree of specificity and selectivity.

02

Ensures appropriate recognition of tumor and tumor-associated cells, respectively, by T lymphocytes.

03

Bispecific selective SMaRT CAR-T lymphocytes are optimally activated only when both receptors are engaged, thus limiting their cytotoxic effect to the tumor microenvironment.

04

This system can also be applied for the treatment of other solid tumors, if combinations of TAA and TmAA are identified.



# International Exhibition of Inventions INVENTICA 2021 23.06.2021 – 25.06.2021



“Pius Brînzeu” Clinical County Emergency Hospital Timișoara



OncoGen Research Centre

## DECODE

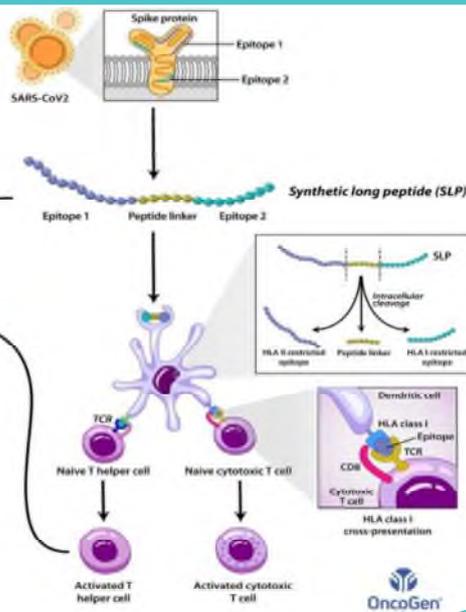
Development of new technologies, drugs and vaccines for prevention of SARS-CoV-2

Research project 11Sol/2020  
PN-III-P2-2.1-SOL-2020-0073

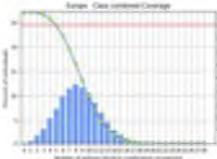
Authors: Bojin Florina, Gavriliuc Oana, Păunescu Virgil  
Contact: Assoc.prof. Florina Bojin, florinabojin@umft.ro  
<https://oncogen.ro/ro/decode-project/>

We designed 28-30 aa synthetic long peptides (SLPs) using a cathepsin-sensitive linker (LLSVGG) for linking MHC class I-restricted epitopes to MHC class II-restricted epitopes, with the MHC class II epitope located always at the N-terminal end, to stimulate both CTLs and Th lymphocytes.

Model of immune activation by SLPs.



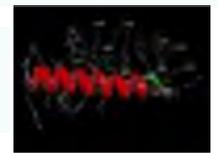
*In silico* validation of SLP vaccine



Coverage analysis for combined MHC class I and II for European population.

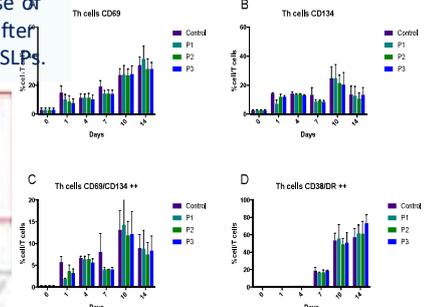
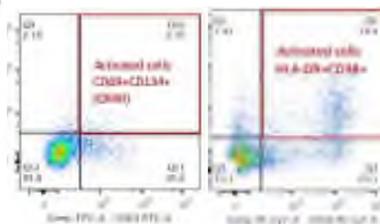


SLP recognition by immune cells. Docking between SLP and TLR3.



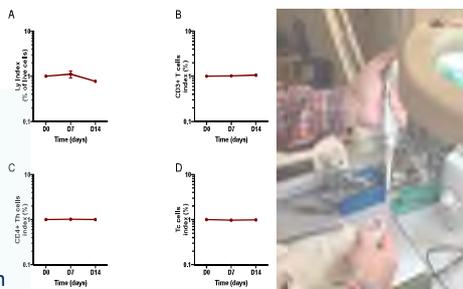
*In vivo* studies

Specific immune response of Tc and Th lymphocytes after *in vitro* stimulation with SLPs.



*In vivo* studies

Analysis of immune status in rat model at day 7, 14 after intranasal administration



1. *In silico* validation of 11 SLPs for activation of T and B lymphocytes against SARS-CoV-2
2. Synthesis and purification of 11 SLPs as vaccinal peptides
3. Protocols for isolation, storage and analysis of peripheral blood mononuclear cells (PBMCs)
4. Qualitative and quantitative reports on flow cytometric activation markers for T cells
5. Evaluation of biological parameters in animal model – toxicity studies
6. Elaboration of documentation for phase I clinical trial

Publications:

Paunescu V. Novel vaccination platform for COVID-19. The XIII<sup>th</sup> National Congress of the Romanian Physiology Society, 22-24 October 2020, [www.fiziologie2020.ro](http://www.fiziologie2020.ro)  
 Bojin F, Tîrziu A, Gavriliuc O, Păunescu V. Paradigm shift in vaccine strategy – synthetic long peptides (SLPs). The 4<sup>th</sup> Conference of Romanian Association of Immuno-Dermatology; The 49<sup>th</sup> Conference of Romanian Immunology Society, 30.09-03.10.2020  
 Bojin F, Gavriliuc O, Margineanu M, Paunescu V. Design of an Epitope-Based Synthetic Long Peptide Vaccine to Counteract the Novel China Coronavirus (2019 nCoV). *Preprints* 2020, 2020020102  
 Ordodi LV, Dumitrel GA, Pană AM, Todea A, Mățiu-Iovan L, Ionel RC, Săndesc D, Bedreag OH, Păpurică M, Rogobete AF, Simion I, Motica A, Groapă DS, Păunescu V, Bojin MF, Gavriliuc OI. Device for reduction of microbiological load in exhaled air from mechanically ventilated patients. *A/00280/2020*, 22/05/2020, OSIM.

