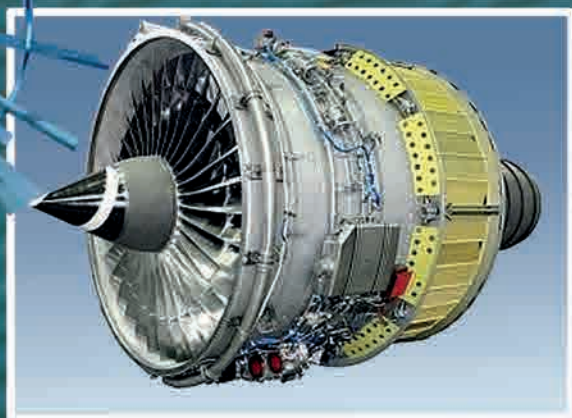


ADVANCED R&D AND TECHNOLOGIES

**THE NAS
OF UKRAINE**

2022



**THE NAS
OF UKRAINE**

**ADVANCED
R&D
AND TECHNOLOGIES
2022**

**INFORMATION TECHNOLOGY
INFORMATION SENSORY
SYSTEMS AND DEVICES**

**MECHANICAL ENGINEERING
AND INSTRUMENT-MAKING**

**CONSTRUCTION AND FUNCTIONAL
MATERIALS TECHNOLOGY**

**POWER ENGINEERING
AND ENERGY EFFICIENCY**

**FUEL AND LUBRICANT
MATERIALS AND TECHNOLOGIES**

**TECHNOLOGIES AND EQUIPMENT
FOR EXPLORING, ESTIMATING,
AND EXTRACTING MINERALS**

**ECOLOGY AND ENVIRONMENT
PROTECTION**

**PHARMACEUTICALS
AND MEDICAL DEVICES**

**AGRO-INDUSTRIAL COMPLEX
AND ORNAMENTAL HORTICULTURE**

FOOD INDUSTRY

Kyiv
Akademperiodyka
2022

Editor-in-Chief

A.G. ZAGORODNY, Full Member of the NAS of Ukraine

Compiled by:

I.A. Malchevsky and S.A. Bespalov

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of the Presidium of the NAS of Ukraine
No. 232 dated 21.04.2021*

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Two hundred and five R&D innovations made by institutions of the National Academy of Sciences of Ukraine, which are ready for the introduction have been presented. They are grouped into eleven subject areas. The publication is structured as follows: for each R&D, there is a separate page with information on the areas of application, specification, advantages over existing analogs, readiness level in terms of international classifiers IRL and TRL, protection of intellectual property rights, and contact persons.

UDC 001.894.2:061.12"2022"(477)

PREFACE BY THE PRESIDENT OF THE NAS OF UKRAINE Anatoly ZAGORODNY

Popularizing science and R&D achievements of Ukrainian researchers both in Ukraine and abroad is one of the major tasks of the National Academy of Sciences of Ukraine.

While aiming at raising the prestige of R&D, forming a scientific worldview, developing the intellectual capacity of society and international prestige of Ukraine, starting with 2017, the National Academy of Sciences every two years publishes *Advanced R&D Projects of the NAS of Ukraine* advertising catalog. The publication is available in Ukrainian and English for eleven thematic areas, in electronic and printed versions, is widely distributed among ministries, departments, embassies, corporations, foreign delegations, and guests of the Academy. The electronic versions of all issues are available at the academic portal in *The Academy Offers* section at <https://www.nas.gov.ua/rdoutput/UA/book2017/Pages/Default.aspx>.

This third edition of *Advanced R&D and Technologies of the NAS of Ukraine* presents the latest research results, including two hundred and five R&D innovations offered by the institutions of the National Academy of Sciences of Ukraine, which have been ready for commercialization.

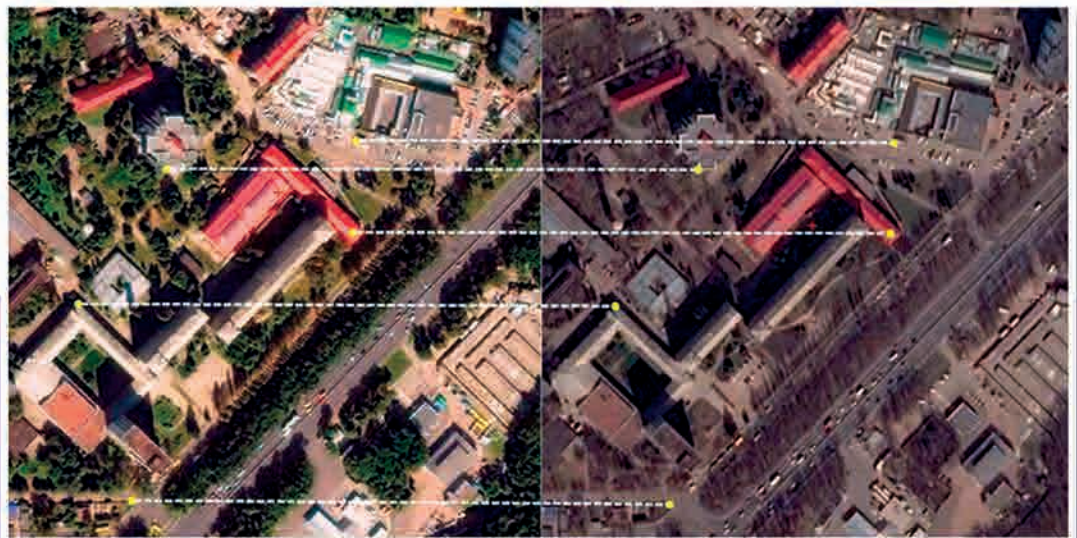
I am sure that the publication is useful for all those who are interested in implementing high-tech innovations and for the public at large.

The President
of the NAS of Ukraine



Anatoly ZAGORODNY

- INTEGRAL ADAPTIVE AUTOPILOT FOR SPATIAL MANEUVERING OF AN UNMANNED AERIAL VEHICLE
- INFORMATION TECHNOLOGY FOR LICENSE PLATE RECOGNITION
- POLYHEDRON COGNITIVE IT-PLATFORM
- PACKAGE OF MATHEMATICAL MODELS FOR BLAST MELTING AUTOMATIC CONTROL SYSTEMS
- EDITOR OF KNOWLEDGE BASE ONTOLOGICAL SCENARIOS WEB-SOFTWARE COMPLEX COMPUTER PROGRAM
- SOFTWARE FOR SOLVING THE INVERSE PROBLEM OF IK-2020 MULTIPROBE INDUCTION SURVEY AND BKZ-2019 CONVENTIONAL ELECTRICAL SURVEY
- AUTONOMOUS UNMANNED AERIAL VEHICLE NAVIGATION SYSTEM BASED ON TOPOGRAPHIC CLUSTERING OF VISUAL IMAGES
- METHOD FOR OPTICAL-ACOUSTIC DIRECTION MEASUREMENT AND GROUP COUNTERACTION TO UNMANNED AERIAL VEHICLES
- TEXTURE SEGMENTATION OF VISUAL IMAGES
- TECHNOLOGY FOR IDENTIFYING AND STRATEGIZING THE LEVEL OF SUSTAINABLE DEVELOPMENT
- TRANSDISCIPLINARY NETWORK-CENTRIC INFORMATION AND ANALYTICAL SYSTEM FOR THE ASSESSMENT OF STUDENT ACHIEVEMENTS
- PURPOSEFUL SELECTION OF APPROPRIATE ACTIONS BY AN AUTONOMOUS MOBILE ROBOT IN A DYNAMIC ENVIRONMENT
- FAST MUTUAL AUTHENTICATION



INFORMATION TECHNOLOGY



INTEGRAL ADAPTIVE AUTOPILOT FOR SPATIAL MANEUVERING OF AN UNMANNED AERIAL VEHICLE



Model of the complex for intelligent control of unmanned aircraft systems

Specification

The UAV autopilot provides a high dynamic accuracy in the implementation of complex trajectories with significantly curved sections of maneuvering in the vertical and horizontal planes. The UAV control system has been synthesized on the basis of essentially nonlinear dynamic systems of equations; the calculation of roll and pitch errors, the calculation of bank-to-turn maneuver; the formation of the dynamics of virtual control of roll, yaw, and pitch; the adjustment of the deflection angle of the ailerons, rudder, and altitude control

Areas of Application

The device is designed for being used in the systems for automatic flight control of unmanned aerial vehicles (UAVs), in the creation of new and the upgrade of existing autopilots for UAVs

Readiness Level.

Suggestions for Commercialization

IRL8, TRL8

Integration into customer's equipment

Advantages

Mutual use of various UAV control channels; cross-connections and compensation of mutual influence between control channels; improvement of the accuracy and reliability of the implementation of complex spatial flight trajectories; quick adaptation to significant changes in altitude and flight speed; maneuvering in vertical and horizontal planes with substantially curved sections; an increase in the number and improvement of efficiency of alternative traffic planning options

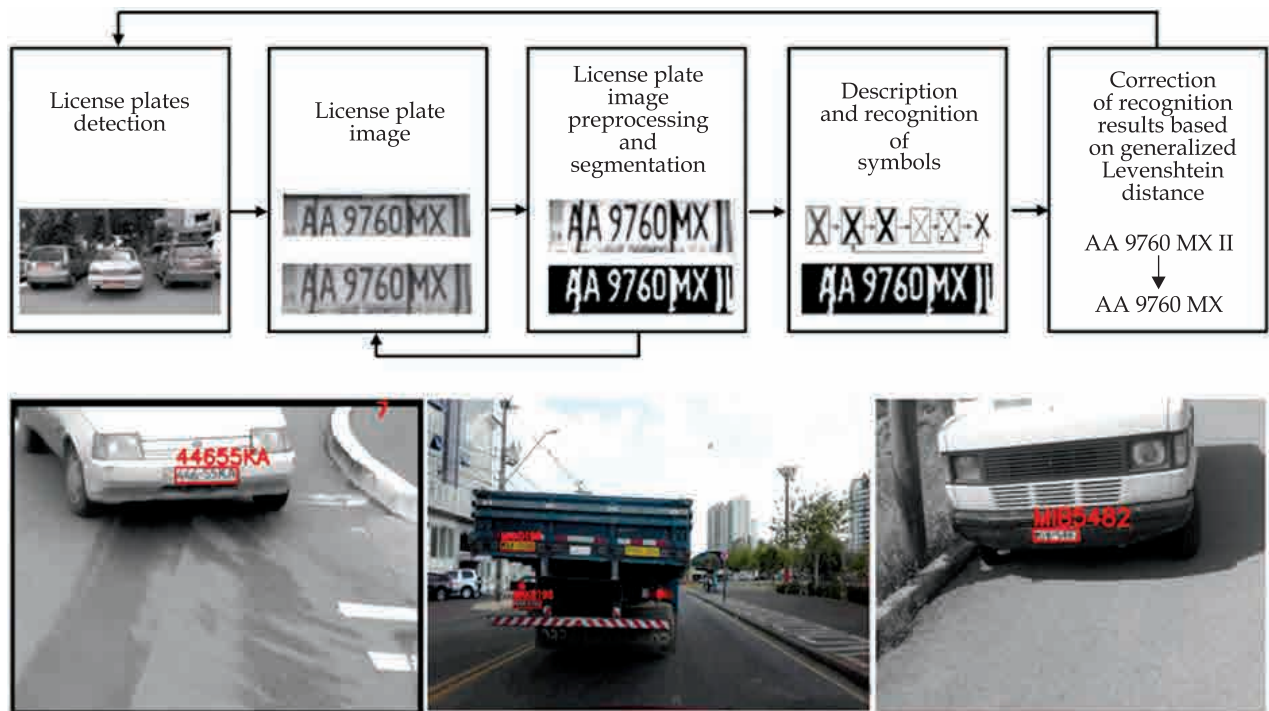
Intellectual Property Protection

IPR1, IPR3

Contact Information

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INFORMATION TECHNOLOGY FOR LICENSE PLATE RECOGNITION



Areas of Application

Automation systems for road fee and parking fee control, capture of road accidents, monitoring of road transportation, etc.

Advantages

In contrast to the existing analogs, the technology does not require large samples for training and significant time inputs for the adaptation to the recognition of new types of license plates

Intellectual Property Protection
IPR2

Specification

The technology enables the recognition of license plates with horizontal size above 65 pixels with accuracy of 97% for static images and up to 90% for video. The average recognition time is less than 50 ms and 140 ms for 800×600 and 1600×1200 pixel images, respectively

Readiness Level.
Suggestions for Commercialization
IRL3, TRL5
Customization, staff training

Contact Information

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POLYHEDRON COGNITIVE IT-PLATFORM



The interface of the research and educational resources cluster implemented by means of POLYHEDRON

Areas of Application

The platform is designed for processing big data, structuring unstructured distributed network information, establishing intertextual communications between documents for supporting the processes of forecasting and rational choice, creating information and analytical web solutions

Specification

The platform includes means of context-semantic and structural-linguistic analysis, classification and taxonomization of natural language text; generation of transdisciplinary ontologies; semantic search of lexical structures by linguistic processing of big data; ontology of the task of choice for information and analytical support of decision-making, multicriteria analysis and rating; linguistic cluster for searching semantically related information

Readiness Level.

Suggestions for Commercialization

IRL8, TRL9

The cluster of research and educational resources realized by means of *Polyhedron* is available at <https://polyhedron.stemua.science/>. Sale or subscriber support under license agreement

Advantages

Transdisciplinary integration of distributed information resources; interoperability of network information systems created according to different standards and technologies; the creation of ontological interactive documents; the detection of latent information; deep and machine learning; support for Semantic Web formats and protocols

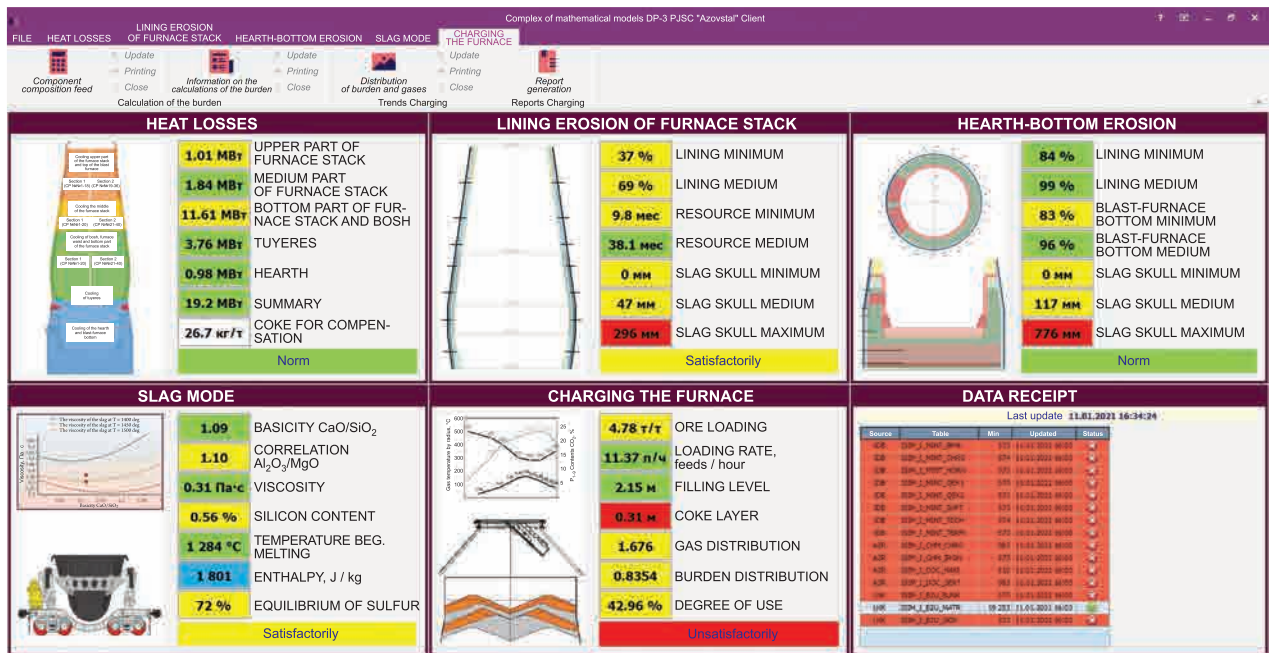
Intellectual Property Protection

IPR3

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PACKAGE OF MATHEMATICAL MODELS FOR BLAST MELTING AUTOMATIC CONTROL SYSTEMS



The main screen of the package of mathematical models

Areas of Application

Used in metallurgy for the production of cast iron in blast furnaces

Advantages

The product has no analogs. The mathematical models provide workshop process engineers with specific information about various technological processes and blast-furnace smelting regimes, about the technical conditions of the unit, which are not controllable by standard means, without additional processing of data received with the use of original algorithms, numerical methods, and transformations. The information obtained from the models is used to substantiate and adopt strategic and operational measures for the selection of efficient smelting regimes that provide the required level of productivity and cost effectiveness of smelting in the case of using pulverized coal fuel injection technology while maintaining the resource and ensuring the trouble-free operation of the blast furnace

Specification

The system provides control over: thermal performance, heat of the lining, and the formation of a skull in the furnace shaft; thermal losses in the furnace cooling system and coke consumption for their compensation; thermal performance, heat of the lining and the formation of a skull in the hearth; control and stabilization of the slag regime; model of furnace loading with charge materials. Implementation period: 3-6 months

Readiness Level.

Suggestions for Commercialization

IRL8, TRL8

Installation of the system, warranty service, staff training

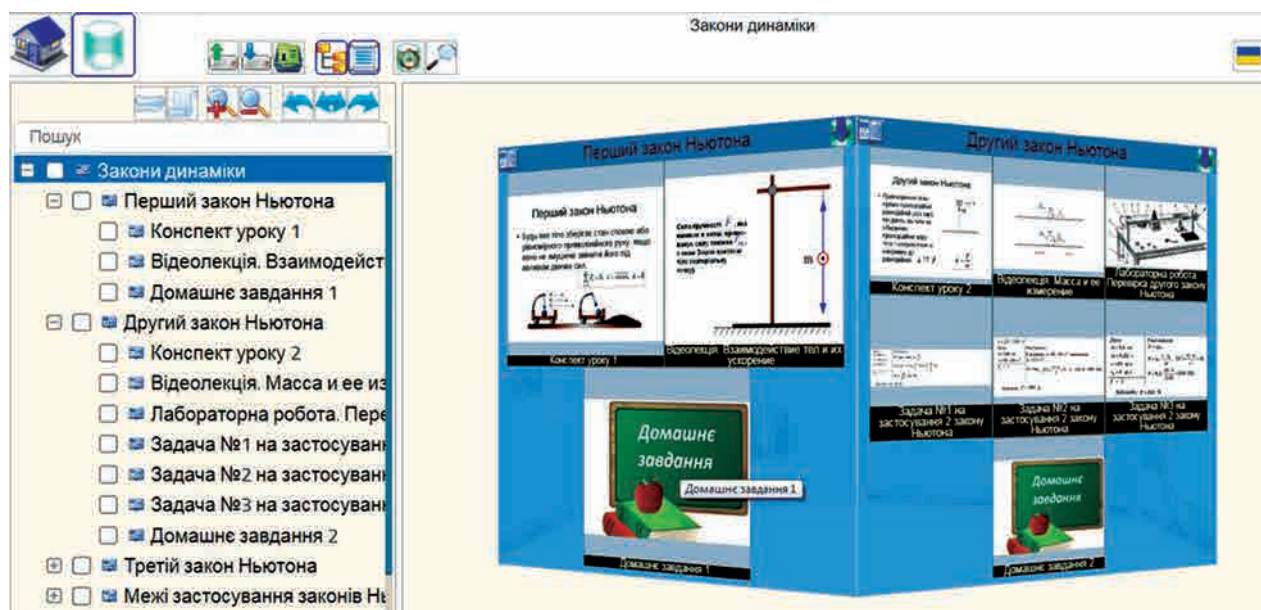
Intellectual Property Protection

IPR3

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EDITOR OF KNOWLEDGE BASE ONTOLOGICAL SCENARIOS WEB-SOFTWARE COMPLEX COMPUTER PROGRAM



Visualization of educational e-script

Specification

The educational scenarios are presented in the form of a set of framed data blocks connected in a prism. The package enables generating transdisciplinary ontologies, integrating or differentiating created knowledge base scripts into other scenarios that may be combined into new transdisciplinary knowledge bases in the format of xml-file

Advantages

The transdisciplinary integration of distributed information resources on the platform of this software package allows creating educational scenarios from any digitized information objects, such as books, reference books, textbooks, management documentation, curricula, training programs, information structures and resources of any process, templates, forms, web-sites and integrating these information structures into an integrated form of knowledge bases

Areas of Application

The software package is designed to create and visualize a variety of educational scenarios and knowledge bases in the form of educational and research tasks

Readiness Level.
Suggestions for Commercialization

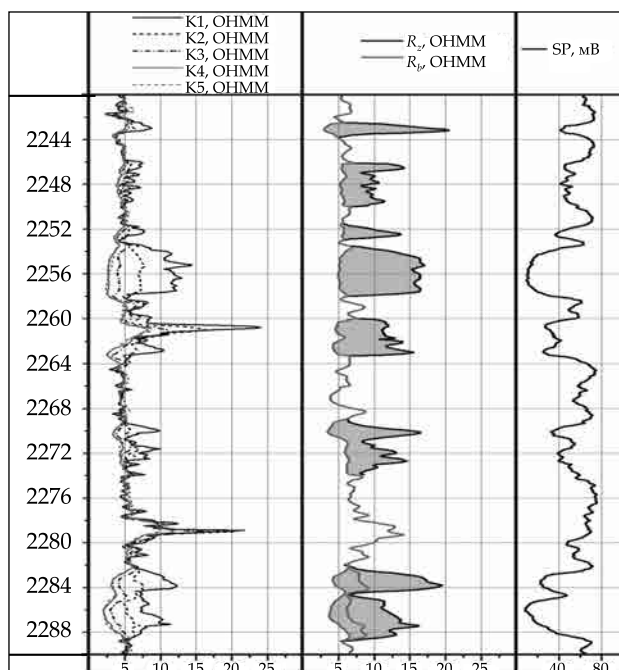
IRL8, TRL9
The system is freely available at
<http://work.inhost.com.ua>.
Custom files for tools and service installation,
as well as user training

Intellectual Property Protection
IPR3

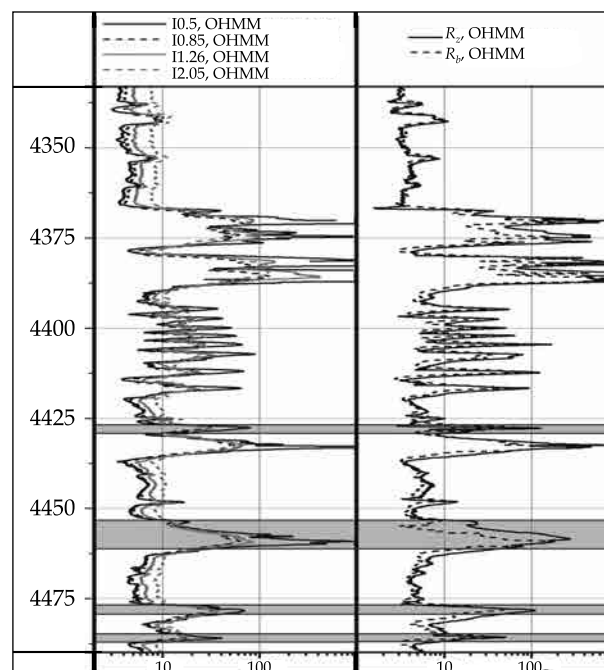
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SOFTWARE FOR SOLVING THE INVERSE PROBLEM OF IK-2020 MULTIPROBE INDUCTION SURVEY AND BKZ-2019 CONVENTIONAL ELECTRICAL SURVEY



Determination of the reservoir parameters and detection of reservoir beds with the use of BKZ-2019: K1 – K5 (OHMM) are probe measurements, R_z (OHMM) is resistance of the drilling mud filtration zone, R_b (OHMM) is resistance of the reservoir zone undamaged by drilling mud filtrate, SP (mV) is spontaneous polarization potential



Determination of the reservoir parameters and detection of reservoir beds, OHMM: I0.5, I0.85, I1.26, I2.05 are probe measurements, R_z (OHMM) is resistance of the drilling mud filtration zone, R_b (OHMM) is resistance of the reservoir zone undamaged by drilling mud filtrate

Specification

Operating system: at least,
Windows Vista, Windows 7-10

Readiness Level.

Suggestions for Commercialization

IRL7, TRL6

Support of sales in the geophysical survey market, for corporations of all forms of ownership

Intellectual Property Protection

IPR3

Areas of Application

Determination of geoelectric parameters of a three-layer reservoir model in different geological formations

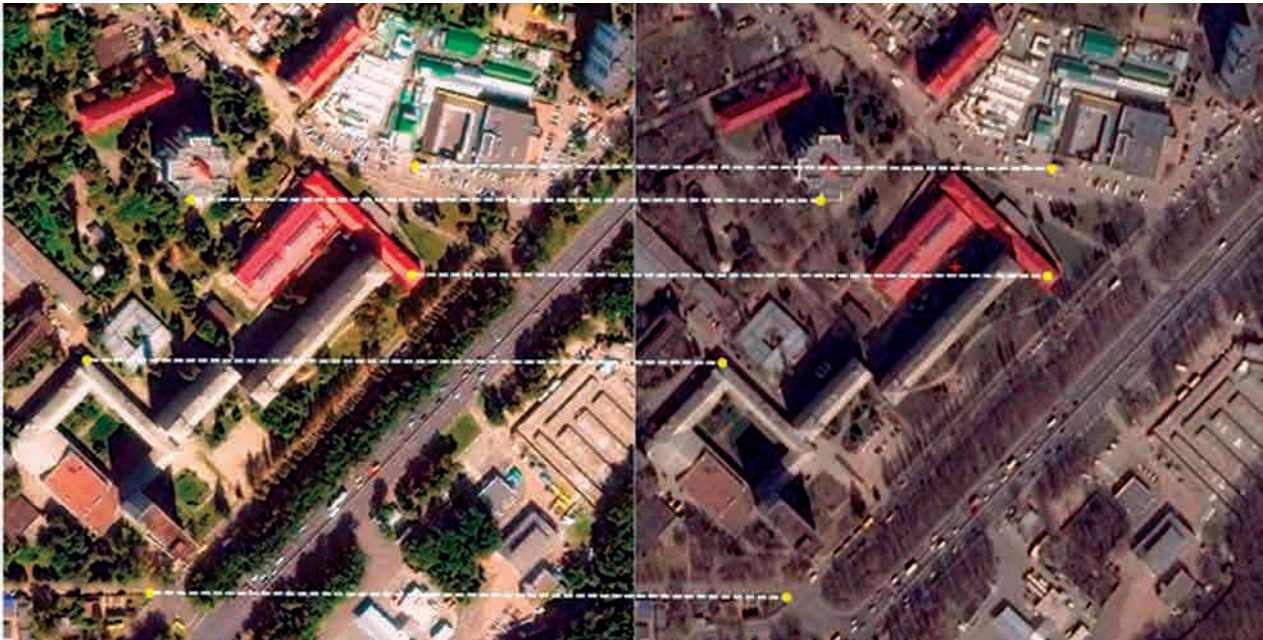
Advantages

Finding stable solutions to the inverse problems of the low-frequency induction survey through the use of IK-2020 or the conventional electrical survey BKZ-2019, which allow measuring the wellbore geoelectric parameters with a high accuracy. Online solving without the use of departure curves

Contact Information

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AUTONOMOUS UNMANNED AERIAL VEHICLE NAVIGATION SYSTEM BASED ON TOPOGRAPHIC CLUSTERING OF VISUAL IMAGES



Positioning with the use of an autonomous UAV navigation system

Areas of Application

Used in autonomous navigation systems of unmanned aerial vehicles

Advantages

Reducing the probability of false coincidences, increasing the accuracy of calculating the visual coordinates, determining the coordinates of ground objects with an accuracy up to 1 m, ensuring the sustainable operation of the navigation system of an unmanned aerial vehicle if there are no signals from navigation satellites or under spoofing attacks

Specification

Images from photo- and video cameras are processed by computer vision algorithms based on the *OpenCV* library. The image coincidence points with unconfirmed topographic properties are interpreted as false and excluded from the set, thereby increasing the reliability. Navigation calculations based on the visual images of the centers of topographic cluster stars with a maximum number of rays allows achieving a high accuracy in calculating coordinates. Database of key points is used to correct the accumulated errors of the system operation. Positioning error is up to 1 m

Intellectual Property Protection

IPR1, IPR3

Readiness Level.

Suggestions for Commercialization

IRL8, TRL8

Integration into customer's equipment

Contact Information

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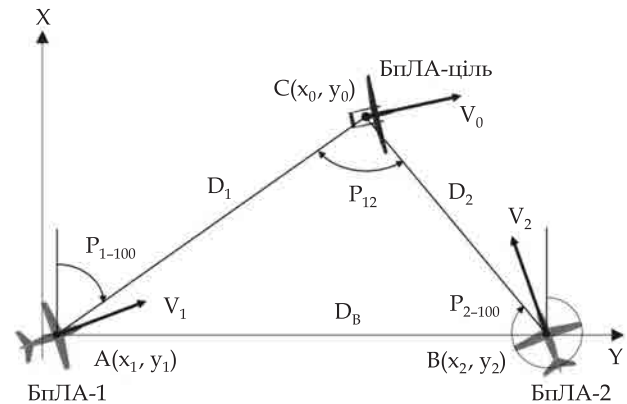
METHOD FOR OPTICAL-ACOUSTIC DIRECTION MEASUREMENT AND GROUP COUNTERACTION TO UNMANNED AERIAL VEHICLES

Areas of Application

The airspace control with the use of mobile optical-acoustic means of group counteraction to unmanned aerial vehicles

Specification

The method enables making and timely implementing informed decisions for effective protection of controlled airspace. The proposed method is based on the formation of a group of unmanned aerial vehicles, with each one determining its own coordinates; allows conducting the acoustic measurements, determining the base and angle of triangulation, maneuvering the unmanned aerial vehicles, and training the target intercept commands



Readiness Level.
Suggestions for Commercialization

IRL8, TRL8
Integration into customer's equipment

Advantages

Creating a synergy effect and ensuring the effectiveness and sustainability of the protection of controlled airspace; increasing the reliability of direction measurement, identification, classification, tracking, and risk assessment of UAV behavior; improving the virtual sensitivity of the acoustic measurements, the accuracy of calculating the coordinates and the parameters of a target; increasing the number and raising the effectiveness of alternative options for timely soft kill and / or destruction of the target

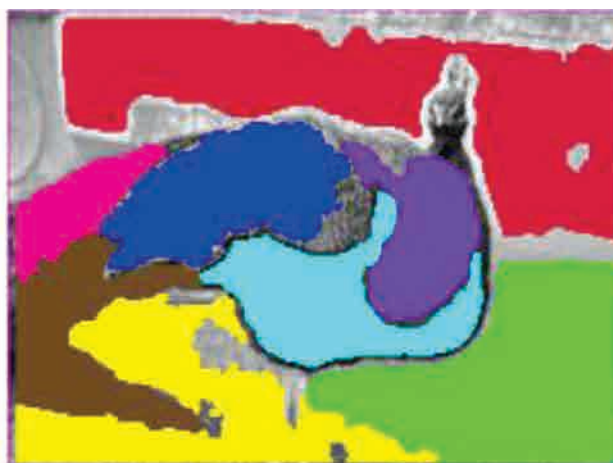
Intellectual Property Protection

IPR1, IPR3

Contact Information

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TEXTURE SEGMENTATION OF VISUAL IMAGES



An example of the texture segmentation of a peacock image

Areas of Application

Solving the problems of visual image analysis, separating objects from background and recognizing these objects, processing satellite photographs and medical images, tracking the objects

Advantages

The method does not require any a priori knowledge of the type of textures or the number of texture segments in the image. The segmentation results are clear and obvious

Specification

A universal procedure for the texture segmentation of any digital black-and-white images (both on-line and off-line), the peculiarity of which is the extraction of only homogeneous segments of fine-grained texture. First, the point of greatest textural homogeneity on the presented image is determined. The set of texture features of this point is considered a template that characterizes the texture of the segment. The point is used as a seed point of segment expansion until it reaches its boundaries. Further, the algorithm starts extracting the next segment

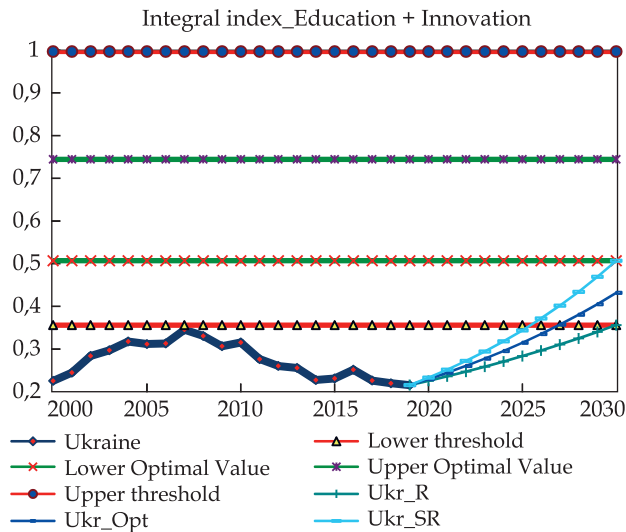
Intellectual Property Protection
IPR2

Readiness Level.
Suggestions for Commercialization
IRL3, TRL4
Customization

Contact Information

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TECHNOLOGY FOR IDENTIFYING AND STRATEGIZING THE LEVEL OF SUSTAINABLE DEVELOPMENT



Specification

The technology makes it possible to identify the current status of sustainable development, to develop strategic scenarios for sustainable growth based on the principle of “the future is determined by the trajectory into the future.” It is notable for the formalized definition of the vector of threshold values, the list and the severity of the treats and their impact; the multiplicative form of the integral index; the combined method for normalizing; the dynamic weights determined by the dominant component analysis, the sliding matrix, and the adaptive control methods

Areas of Application

Identifying the current state and substantiating strategic scenarios of sustainable development in the security dimension for countries, regions, economic activities, and corporations

Advantages

Unlike the existing analogs, the technology excludes subjective expert assessments. Instead of general phrases (to promote, to increase, to provide, etc.), the deliverables are the dynamics of quantitative values and the key macro indicators, the implementation of which ensures sustainable development. Monitoring the indicators and macro indicators is the best criterion for the effectiveness of sustainable development policy

Readiness Level.

Suggestions for Commercialization

IRL6, TRL6

The identification of the current status, the development of strategic scenarios for sustainable growth, the determination of the list and the severity of the threats and their impact; recommendations for overcoming the threats

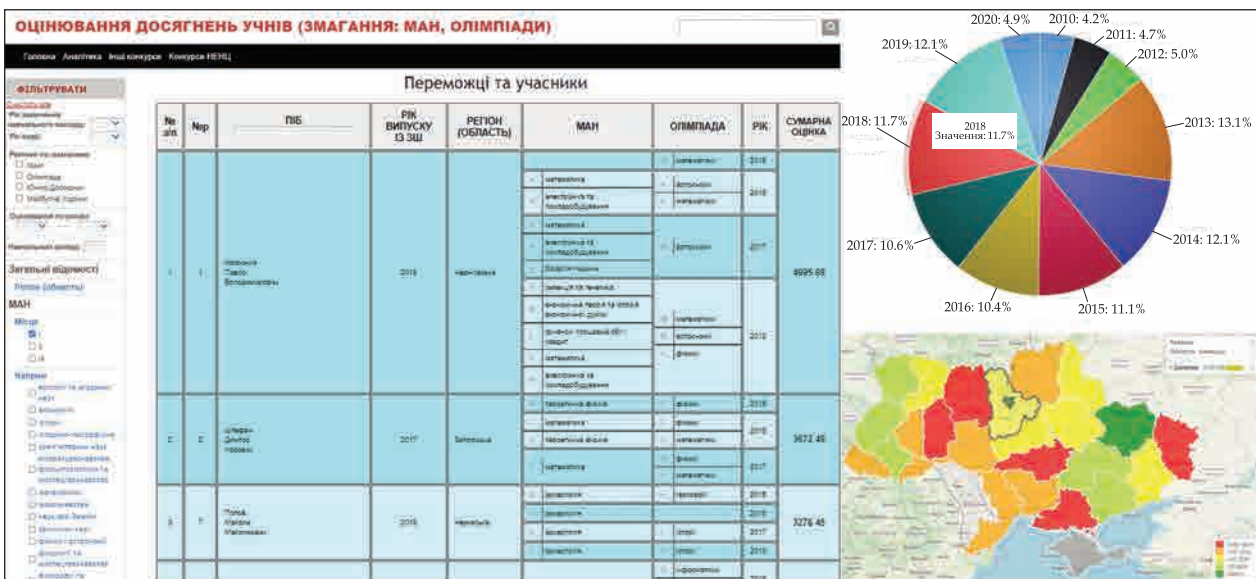
Intellectual Property Protection

IPR2

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TRANSDISCIPLINARY NETWORK-CENTRIC INFORMATION AND ANALYTICAL SYSTEM FOR THE ASSESSMENT OF STUDENT ACHIEVEMENTS



Specification

The system services provide the processing and aggregation of multi-format information arrays (the intellectual competitions protocols); display the results of the assessment and monitoring of student educational achievements in the form of rating table, graphs, diagrams; provide information and methodological support for the analytical activities of various user groups (education managers, students, their parents, teachers, researchers, media representatives, etc.)

Advantages

Research-based approach to data processing and analysis; availability, completeness (integrity), clarity, and consolidation of its presentation; continuity of the data update process; transparency and objectivity of the achievement assessment; a corruption-preventive approach; supporting the implementation of pedagogical research projects and the selection of science-minded enrollees

Areas of Application

The formation of a publicly available information and analytical resource for monitoring and assessing educational achievements of the students who, due to their intellectual abilities, deserve attention and support from the government

Readiness Level.
Suggestions for Commercialization

IRL8, TRL9
The system is available for free at <https://intellect.stemua.science/>
The development of various information and analytical systems; staff training

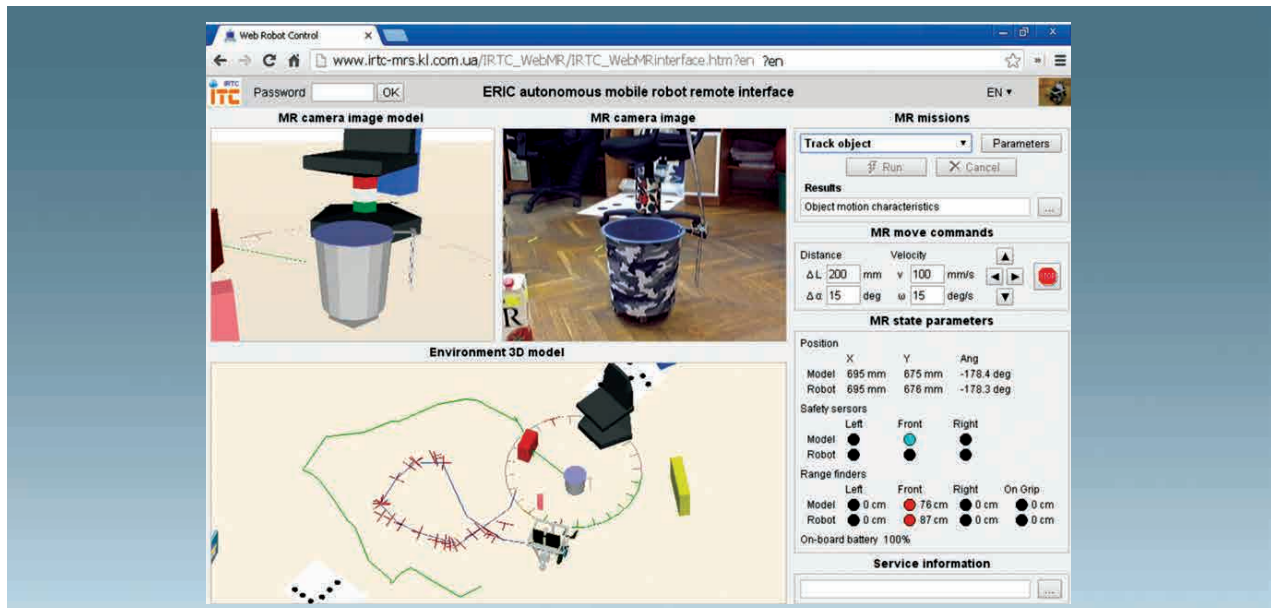
Intellectual Property Protection

IPR3

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PURPOSEFUL SELECTION OF APPROPRIATE ACTIONS BY AN AUTONOMOUS MOBILE ROBOT IN A DYNAMIC ENVIRONMENT



An example of graphical user interface

Areas of Application

The technology supports the autonomous operation of a mobile robot in the dynamic environment, while the robot is executing various tasks without user involvement. It may be used for equipping a wide range of mobile robots as assistants to medical staff and employees of social institutions, in education, service industry, etc.

Specification

The technology is implemented as additional software modules of mobile robot intelligent control system where fundamentally new approaches to the purposeful analysis of current operating conditions and the automatic formation of robot local goals and actions in a dynamic environment are used

Intellectual Property Protection
IPR2

Advantages

The ability to automatically select reasonable current actions in the undetermined dynamic environment significantly reduces user's involvement in robot control, which is a significant advantage over the well-known advanced robots

Readiness Level. Suggestions for Commercialization

IRL3, TRL4
Customization to the intelligent control systems of various autonomous mobile robots

Contact Information

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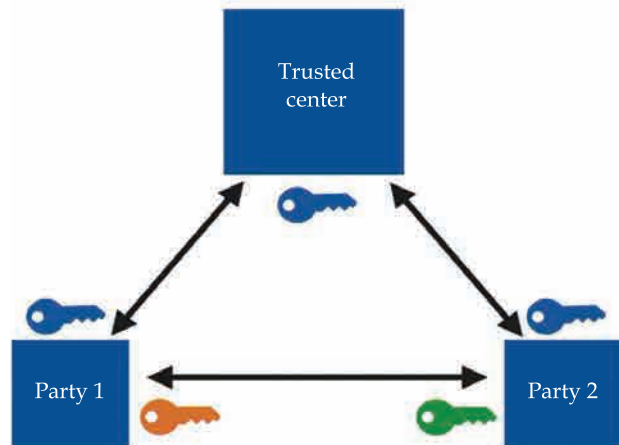
FAST MUTUAL AUTHENTICATION

Areas of Application

The cryptographic protocol for fast mutual identification of “friend-or-foe” type may be used in the systems where the members belong to the same coalition union (“smart home” from the Internet of Things, military coalitions, banking systems) and require reliable mutual authentication. The critical requirements are limited computational resources and minimal time of authentication

Specification

Three rounds of communications.
The authentication scheme belongs to zero-knowledge cryptographic systems. The members keep their own independent long-term private keys that are used in the process of authentication. the procedure requires a primary initialization with the involvement of a trusted authority that generates independent secret round keys. For authentication, the members shall demonstrate knowledge of their own secret keys without disclosing them and the ability to factorize a large number generated by the trusted authority. The security relies on well-known assumptions of difficulty of large number factorization and the existence of cryptographic one-way functions



Flowchart of a coalition group consisting of members 1 and 2, and a trusted authority

Advantages

Mutual authentication; simple and fast computation algorithms; mathematically proved security properties: completeness, soundness, and zero-knowledge

Intellectual Property Protection

IPR1

Readiness Level.

Suggestions for Commercialization

IRL4, TRL4
Customization

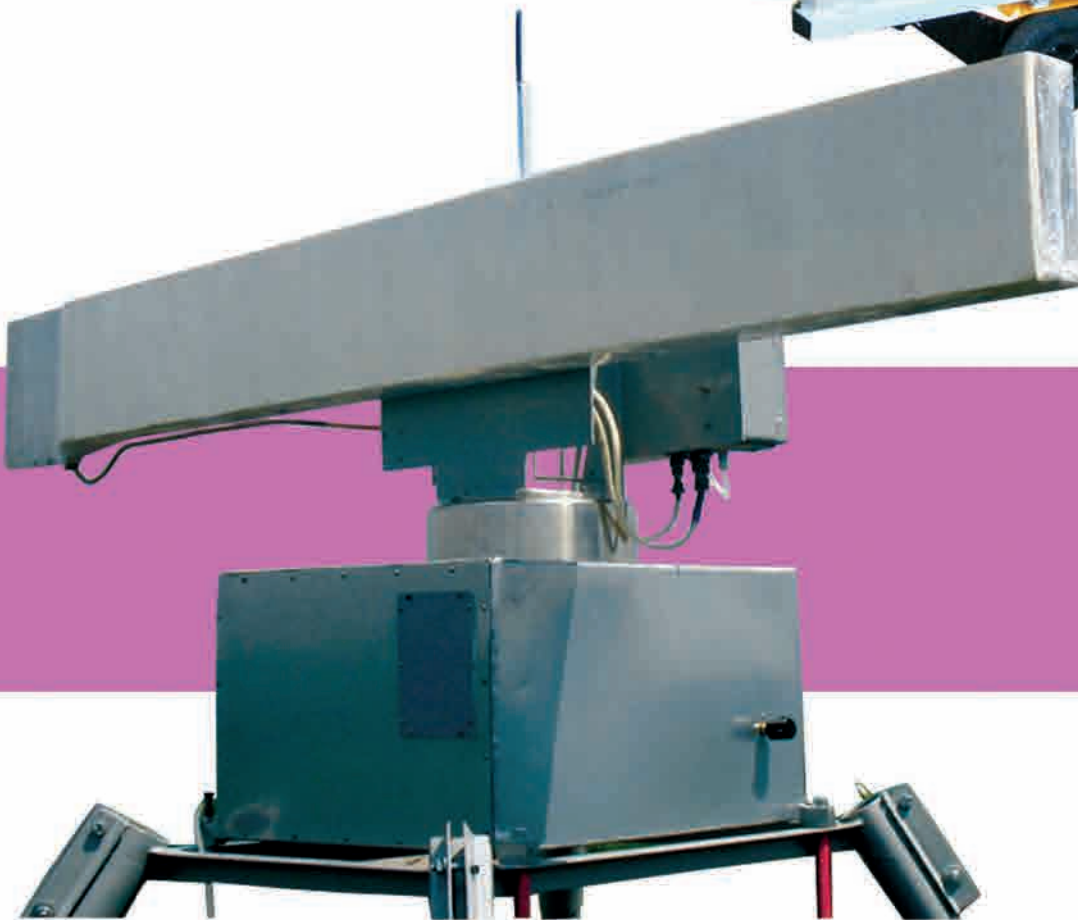
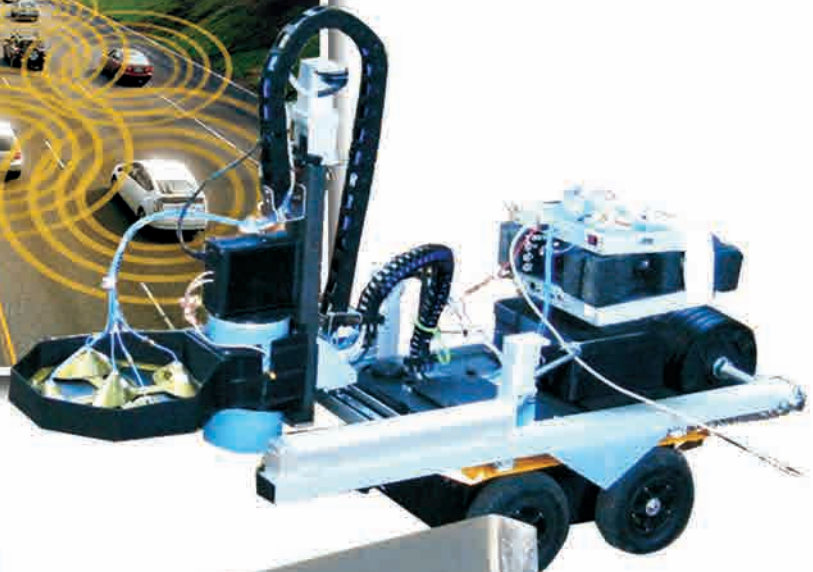
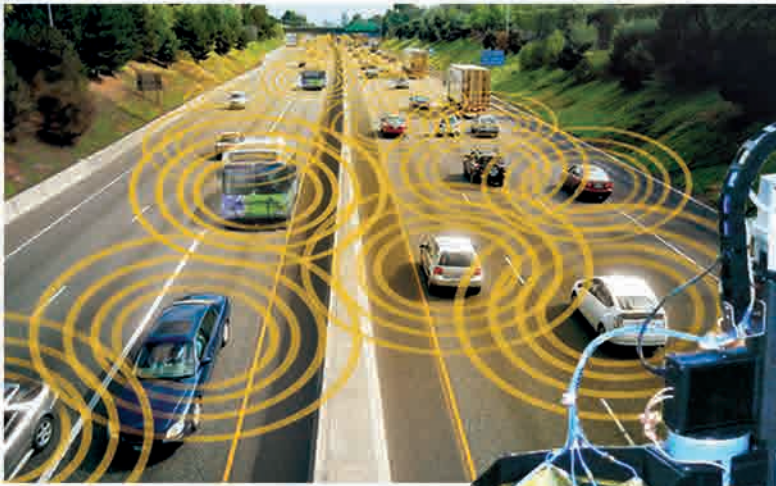
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- K_G-BAND DIFFRACTION TYPE ANTENNA FOR A CIRCULAR SURVEILLANCE RADAR STATION
- K_G-BAND ALL-AROUND SCANNING ANTENNA OF THE RESONANT TYPE
- W-BAND MULTI-BEAM DIFFRACTION TYPE ANTENNA
- ELECTROCHEMICAL MULTI-ELECTRODE SENSOR OF ATMOSPHERIC CORROSION RATE
- UWB IMPULSE RADAR WITH 1TX + 4RX ANTENNA SYSTEM
- ACOUSTIC LEVEL METER
- WORKING ELEMENTS FOR IONIZING RADIATION DETECTORS MADE OF DOPED SINGLE-CRYSTAL LITHIUM TETRABORATE Li₂B₄O₇
- SELF-ORGANIZING DSRC MIMO-SYSTEM FOR VEHICLES RADIOLOCATION AND VEHICLE-TO-VEHICLE DATA TRANSMISSION ON HIGHWAY
- THERMAL CONDUCTIVITY COEFFICIENT MEASUREMENT SYSTEM
- ATMOSPHERIC AIR POLLUTION MONITORING SYSTEM
- THREE-BAND RECEIVING C/X/K-BAND WAVEGUIDE SYSTEM
- ULTRASONIC METER OF FLUID LEVEL IN THICK-WALLED CLOSED STEEL TANKS



INFORMATION SENSORY SYSTEMS AND DEVICES



K_a-BAND DIFFRACTION TYPE ANTENNA FOR A CIRCULAR SURVEILLANCE RADAR STATION



Areas of Application

The antenna is to be used in radar systems with circular observation such as a radar for monitoring the operational situation at airports and port water

Specification

Operating frequency range, GHz	36
Dimensions, m	0.18×2
Gain, dB	42
Beam size in the azimuth plane	0.25
Side lobe level, dB	-18
Total loss, dB	3.4

Readiness Level. Suggestions for Commercialization

IRL6, TRL5
Customized design and production of a sample to start manufacture on a broader technological base; trial products may be marketed

Advantages

Flat configuration with radio transparent radome and low wind load.
High manufacturability and low manufacturing cost

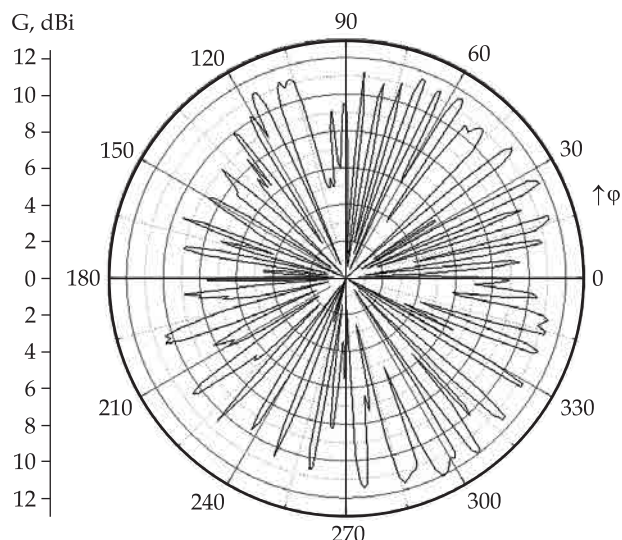
Intellectual Property Protection

IPR1

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K_a-BAND ALL-AROUND SCANNING ANTENNA OF THE RESONANT TYPE



Distribution of the antenna gain along the azimuthal coordinate



Appearance of the antenna

Areas of Application

The antenna is to be used in K_a-band radars and operational communication systems

Advantages

The proposed product is a small-sized K_a-band all-round scanning antenna with a relatively high gain at the resonant frequency. As compared with the existing analogs, it has a high gain in the circular scanning sector, a small size and a light weight

Specification

The antenna based on a segmental dielectric resonator provides a radiative emission within the azimuthal sector from 0° to 360°. According to the radiation pattern, 72 lobes are formed within the azimuthal sector from 0° to 360°. The width of each lobe at a level of -3 dB is 4°. The antenna gain in the lobes at the resonant frequency reaches 12 dB. By the elevation angle, the radiation pattern width is 100°. The diameter of the antenna is 80 mm, its height is 10 mm. The antenna mass is 0.2 kg

Intellectual Property Protection

IPR1, IPR2

Readiness Level.

Suggestions for Commercialization

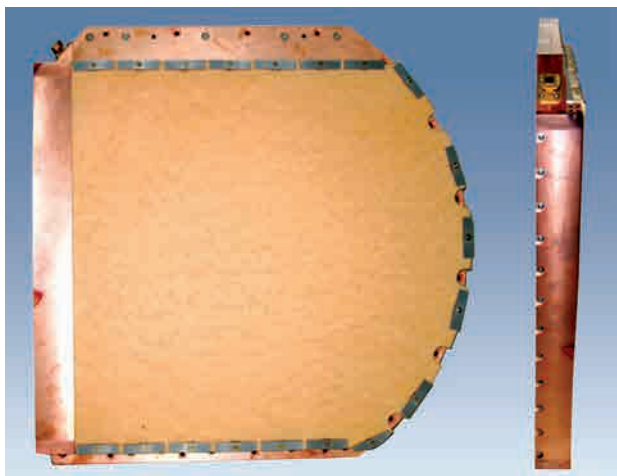
IRL6, TRL6

Custom design and manufacture of the antenna in a wide range of operating frequencies, from X- to W-waveband

Contact Information

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W-BAND MULTI-BEAM DIFFRACTION TYPE ANTENNA



Specification

The dispersion properties provide the ability to form a multi-beam pattern and frequency scanning

Frequency range, GHz	84 – 100
Gain, dB	43
Beam width	0.35
Side lobe level, dB	-18
Total loss, dB	3.2
Thickness, mm	<30

Areas of Application

The antenna is designed for passive (radiometric) systems to detect hidden weapons on human body. It may be used both in active and passive imaging and radar systems

Readiness Level.

Suggestions for Commercialization

IRL6, TRL5

Customized design and production of a sample to start manufacture on a broader technological base; trial products may be marketed

Advantages

The antenna beam in space is scanned at a fixed antenna position.

The multi-beam version of the antenna has a single output, a high manufacturability, and a low manufacturing cost

Intellectual Property Protection

IPR1, IPR3, IPR5

Contact Information

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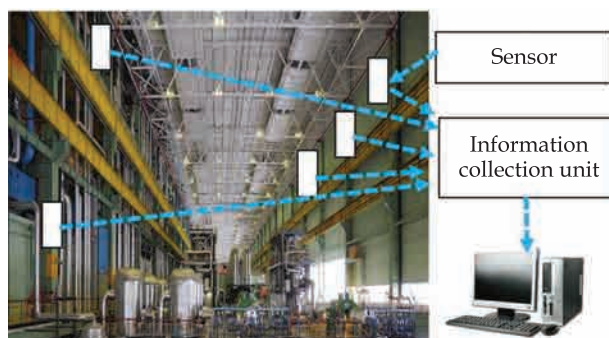
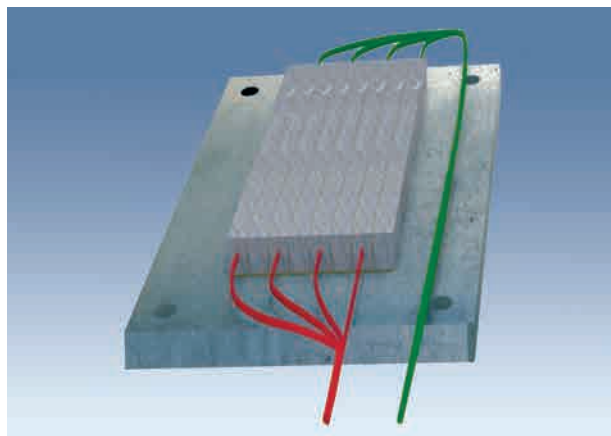
ELECTROCHEMICAL MULTI-ELECTRODE SENSOR OF ATMOSPHERIC CORROSION RATE

Areas of Application

The sensor allows the instant assessment of air corrosivity relative to metal structures of long-term use in corrodible areas in closed volumes, under conditions of the protection of the metal surface by coatings and a reduced relative air humidity for timely adjustment of protection efficiency

Specification

The range of corrosion rate measurements, mm/year	from 10^{-5} to 0.5
Measurement error, at most, %	20
Operating temperature range, °C	from 20 to 70
Relative humidity, %	from 75 to 100
Dimensions of the sensing element, mm	50 × 25 × 2



Scheme for monitoring of metal structure corrosion

Advantages

There are no analogs in Ukraine. The sensor is adapted for determining the corrosion rate at a low humidity, in the presence of a temperature gradient between the surface of the metal structure and atmospheric air during daily cycle and under a protective cover

Readiness Level. Suggestions for Commercialization

IRL5, TRL6
Manufacturing application, staff training

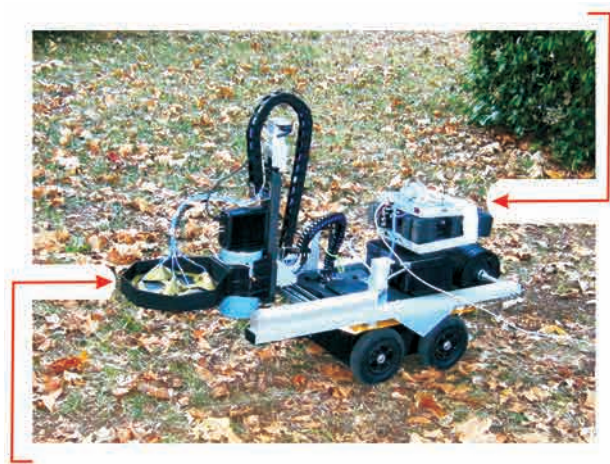
Intellectual Property Protection

IPR2, IPR3

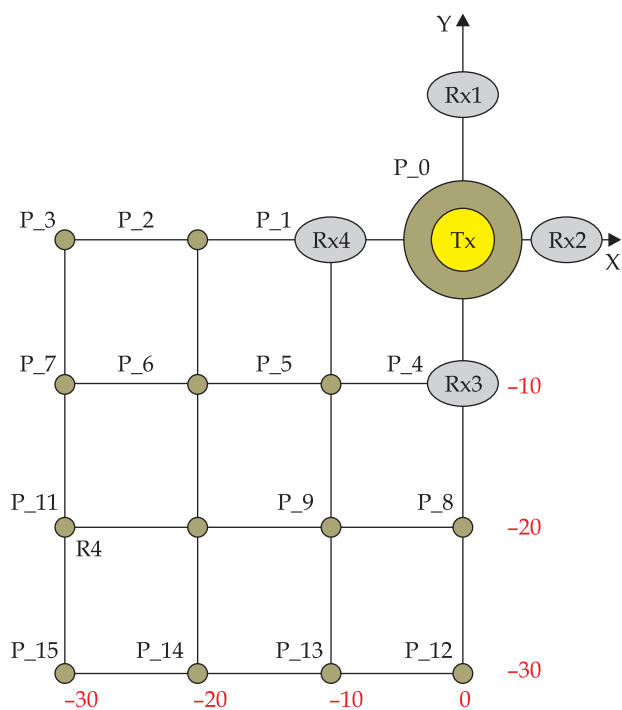
Contact Information

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UWB IMPULSE RADAR WITH 1TX + 4RX ANTENNA SYSTEM



UWB pulsed radar with 1Tx + 4Rx antenna system
on robotic platform UGO-1st



Location of objects relative to the antenna system

Areas of Application

Detection of underground objects

Specification

Strobe-type receiver

Detection range, cm from the surface
to a depth
20

Width of the inspected
lane, cm
40

Probing signal, ns pulse without
carrier
duration 0.4

Operating frequency, GHz from 0 to 2.4

Weight, kg 2

Advantages

Real-time monitoring of moving robotic platform. No mechanical scanning is required to locate a subsurface object. Variable sampling time and its optimization increase the signal / noise ratio. Analog accumulation as a result of reception expands the operating frequency band and increases the signal / noise ratio. Low cost

Readiness Level.

Suggestions for Commercialization

IRL5, TRL6

Upon request, the development and manufacture of appropriate system equipment

Intellectual Property Protection

IPR1

Contact Information

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ACOUSTIC LEVEL METER



Acoustic transducer with a flat acoustic wave AP-7T



Acoustic transducer with a spherical wave AP-70T

Areas of Application

Measuring the level of liquids and bulk objects, the level in two adjacent reservoirs, and the volumetric flow of liquids in gravity water line

Advantages

The operating modes (range finder, level meter) and the reservoir parameters are set with the use of built-in keyboard; the device is able to work with a stirrer in the tank; self-diagnosis of performance; no linear growth of the absolute error in the operating range

Specification

Dust-proof and explosion-proof design; acoustic transducers with temperature sensor and reference channel; upper and lower level alarms. Consists of acoustic transducer, upgraded processor measuring transducer, three-wire communication cable up to 400 m long

Operating range, m	0.5–30
Relative error, %	
рівнина	from 0.1
сипкі	to 5
Dead zone, m	0.2–0.7
Operating temperature range, °C	–30...+80
Output analog signal, mA	0-5,
	0–20, 4–20

Readiness Level. Suggestions for Commercialization

IRL7, TRL6

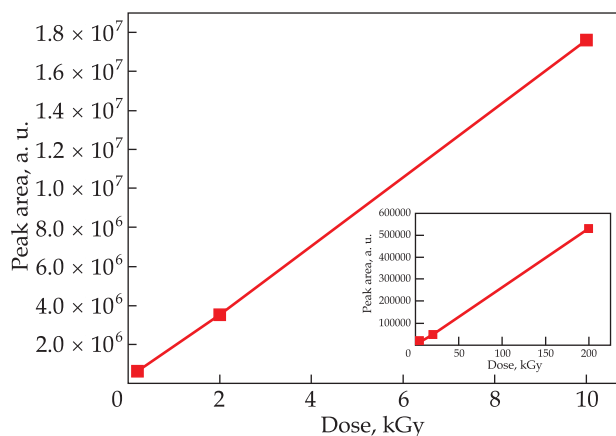
Upon request: manufacture, supply, installation, warranty, and staff training

Intellectual Property Protection IPR1

Contact Information

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WORKING ELEMENTS FOR IONIZING RADIATION DETECTORS MADE OF DOPED SINGLE-CRYSTAL LITHIUM TETRABORATE $\text{Li}_2\text{B}_4\text{O}_7$



Dose dependence of dosimetric peak of single-crystal $\text{Li}_2\text{B}_4\text{O}_7$:Cu detector

Areas of Application

For individual dosimetry of X-ray, gamma, neutron, and mixed radiation

Advantages

Separate measurement of the gamma and the neutron components of the absorbed dose of mixed gamma-and-neutron radiation; sensitivity 5 times higher than TLD-100 (LiF: Mg, Ti)

Specification

Single-crystal $\text{Li}_2\text{B}_4\text{O}_7$: Cu detector.

Dosimetric peak: thermoluminescent maximum at 270 °C, at a heating rate of 10 K/s.

Sample dimensions, mm $5 \times 5 \times 1$

Spectral maximum, nm 370–380

Linearity of dose dependence within the range

0.3 mGy – 10 kGy

Fading for 10 days at 25 °C, at the dosimetric peak, %

6

Readiness Level.

Suggestions for Commercialization

IRL6, TRL6

Manufacture of working elements for ionizing radiation detectors based on Cu- or Mn-doped single-crystal lithium tetraborate $\text{Li}_2\text{B}_4\text{O}_7$

Intellectual Property Protection

IPR1, IPR3

Contact Information

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+38 050 884 80 18, e-mail: romanova.iep@gmail.com

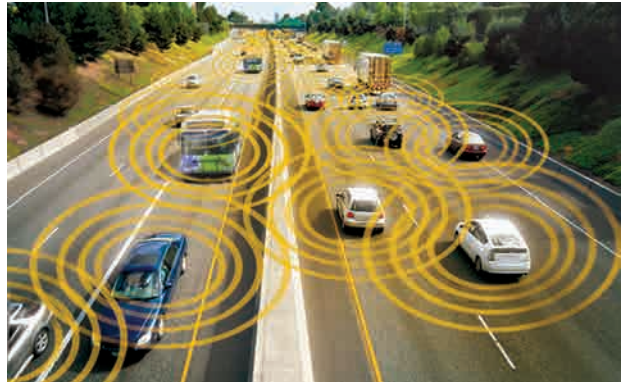
SELF-ORGANIZING DSRC MIMO-SYSTEM FOR VEHICLES RADIOLOCATION AND VEHICLE-TO-VEHI- CLE DATA TRANSMISSION ON HIGHWAY

Areas of Application

Vehicles monitoring and information exchange between the road users on highway

Specification

Frequency range, GHz	5.725—5.875
Number of lanes	8
Number of frequency channels	2
Channel bandwidth, MHz	74
Access method	S-CDMA
Spread-spectrum codes	CWS, UBPRS
Number of codes	128
Data transmission rate, Mbit/s	≥1,152
Throughput capacity of channel, Mbit/s	≥74
Synchronization	GPS



Intercommunication between vehicles on highway by means of the DSRC MIMO-system

Readiness Level. Suggestions for Commercialization

IRL5, TRL6
Development and manufacture of corresponding equipment of the system

Advantages

The DSRC MIMO-system has no world analogs. It provides a completely off-line operation of vehicle, without any base stations. Its distinguishing features are the combination of spatially code (S-CDMA) separation of channels, the chaotic waveform coding, and the new procedure for assigning code to every transport vehicle. Unique codes enable constructing a DSRC MIMO-system without the dedication of frequency or temporary channel for every vehicle and receiving data without search

Intellectual Property Protection

IPR2, IPR5

Contact Information

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THERMAL CONDUCTIVITY COEFFICIENT MEASUREMENT SYSTEM



Specification

Software for registration and processing of measurement information.

Range of thermal conductivity measurement, $W/(m \cdot K)$ 0.02 – 3.00

Limits of the allowed relative error of measurement, % ± 3

Operating temperature range, $^{\circ}C$ -40... +180

Sample size:

Dimensions, mm $200 \times 200 - 300 \times 300$

Thickness, mm 1 – 120

Areas of Application

Measurement of thermal conductivity and thermal resistance of insulating and building materials in the solid and bulk state DSTU B.V. 2.7-105-2000 and ISO 8301: 1991. Construction and production of building materials

Advantages

The measurement error decreases twice as compared with similar systems for measuring thermal conductivity of building materials; allows researching porous materials

Readiness Level.

Suggestions for Commercialization

IRL6, TRL6

Research, manufacture, and customization

Intellectual Property Protection

IPR2, IPR3

Contact Information

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ATMOSPHERIC AIR POLLUTION MONITORING SYSTEM



Measuring module of the air pollution monitoring system

Specification

Sensors: PMS7003, BME280, MH-Z19, ZE08-CH₂O, MICS-6814, RadKit, ZE03-SO₂, ZE25-O₃. Installation: ABS hull with 4 mounting holes.

Power supply 5B 2A
(USB-compatible)

Connection Wi-Fi-module

Dimensions
(without antenna), mm 155 × 120 × 50

Weight (basic configuration), g 275

The system operating conditions:

Air temperature, °C -20...+60

Humidity, % ≤95

Atmospheric pressure, kPa 94 – 106.7

AC supply voltage, V 220 ± 22

Current frequency, Hz 50 ± 0.5

Areas of Application

To measure pollutant concentrations (PM₁, PM_{2.5}, PM₁₀, CO, CO₂, CH₂O, NH₃, NO₂, SO₂, O₃, background radiation), oxygen and meteorological parameters (temperature, humidity, pressure) in the atmospheric air. To be used in power engineering, chemical industry, construction, mechanical engineering, metallurgy, transport, environmental protection

Readiness Level.

Suggestions for Commercialization

IRL8, TRL9

Custom manufacture and supply.

Partners for full-scale production and distribution wanted

Advantages

In comparison with analogs, the system has a modular structure, a large number of measuring parameters, is autonomous, compact, and easy-to-use

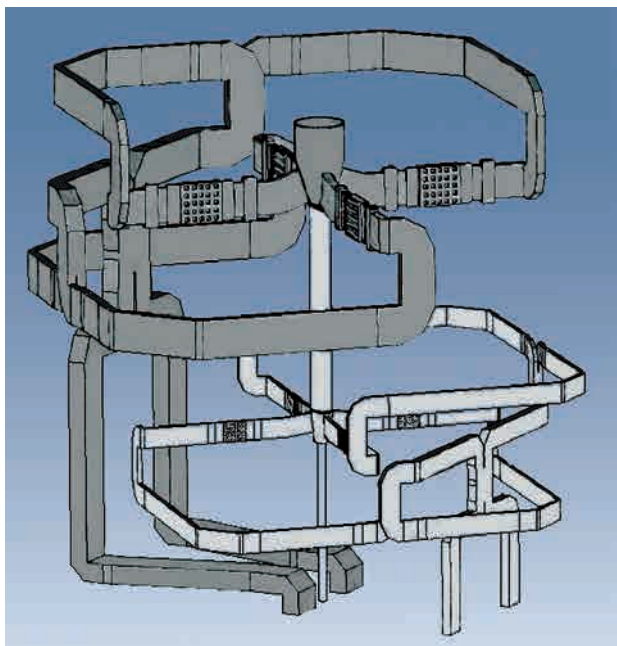
Intellectual Property Protection

IPR2, IPR3

Contact Information

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THREE-BAND RECEIVING C/X/K-BAND WAVEGUIDE SYSTEM



Areas of Application

The waveguide system of signal separation in radio telescope in three frequency bands on the left and right circular polarization channels has been designed by order upon request of the National Center for Spacecraft Control and Trials, the State Space Agency of Ukraine

Advantages

Creating a combined three-band waveguide system allows the simultaneous reception of signals with circular polarizations in three frequency bands, in contrast to the existing receiving systems operating in one or two bands

Specification

Description	Range		
	C	X	K
Relative operating frequency bands, %	<35	<27	<23
Isolation between the circular polarization outputs, dB, at least	-20	-20	-18
Insertion loss in the circular polarization separators at room temperature, dB, at most	0.25	0.35	0.4
Reflection coefficient for the circular polarization outputs, dB, at most	-15	-12	-15

Relative distance between the operating frequency bands,%, at least 35

Readiness Level. Suggestions for Commercialization

IRL6, TRL5
Custom design and manufacture
of appropriate system equipment

Intellectual Property Protection IPR1

Contact Information

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ULTRASONIC METER OF FLUID LEVEL IN THICK-WALLED CLOSED STEEL TANKS

Areas of Application

To measure the fluid level through the wall in steel tanks, in particular in railway tanks, oil and food pipelines, reactors of the chemical and food industries

Specification

The signals are processed and information is displayed with the help of a laptop.

Tank wall thickness, mm	5–20
Measurement duration, ms	0.1–1.0
Accuracy of level measurement, mm	2–3

Advantages

It has a 3–5 times higher measurement accuracy and better noise tolerance

Readiness Level. Suggestions for Commercialization

IRL4, TRL5
Custom design and manufacture of appropriate system equipment



Examples of application

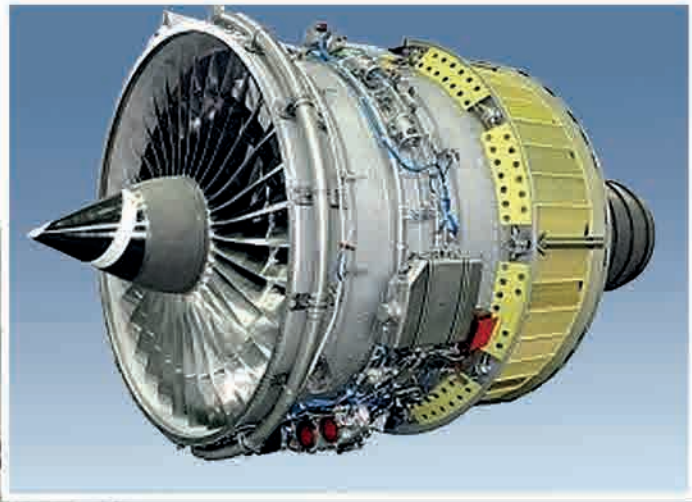
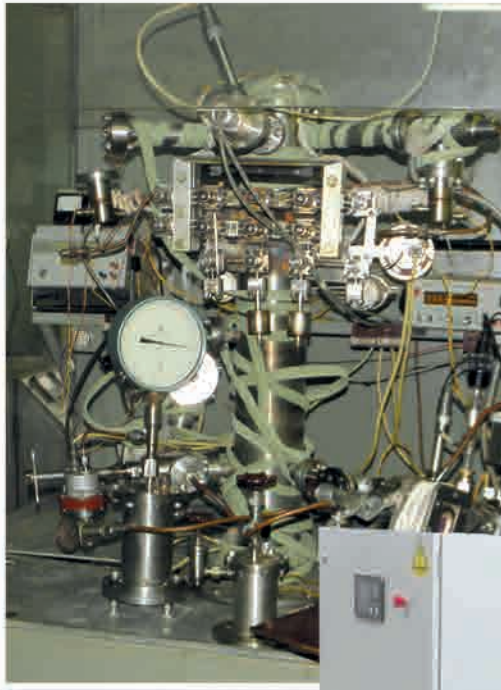
Intellectual Property Protection IPR2

Contact Information

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- AUTOMATED CONTROL SYSTEM BASED ON ACOUSTIC MONITORING FOR GAS JET MILLS
- IZR-21 COAL ASH ANALYZER (ASHMETER)
- STREAM OZONE™ METERS FOR MEASURING OZONE CONCENTRATION IN THE AIR
- HIGH-DOSE IMPLANTER FOR ION IMPLANTATION AND MODIFICATION OF MATERIALS
- HIGH-EFFICIENCY SOURCE OF NEGATIVE HYDROGEN IONS H⁻
- GAS POWER PLANTS AND COGENERATION UNITS
- LOCAL ULTRAHIGH-RESOLUTION OSCILLATOR
- FLYWHEEL MOTORS FOR SATELLITE ATTITUDE CONTROL SYSTEM
- DETONATION SYSTEM FOR SEPARATION AND REMOVAL OF ROCKET FAIRING SASHES
- DETONATION EXHAUST BURNER OF THE OPEN-CIRCUIT ROCKET ENGINE
- ION-PLASMA AND BEAM DEVICES FOR SURFACE REINFORCEMENT
- QUARTZ GAUGE FOR MEASURING THE THICKNESS OF VACUUM-COATED FILMS
- BENCH COMPLEX FOR TESTING DETONATION ROCKET ENGINES
- HEAT-RESISTANT NICKEL-BASED CAST ALLOY
- MAGNETRON EVAPORATOR WITH PERMANENT MAGNET-BASED SYSTEM FOR MAGNETIC FIELD DISBALANCING
- SMALL-SIZED SCINTILLATION GAMMA-SPECTROMETER
- BRIQUETTING EQUIPMENT WITH INCREASED SERVICE LIFE
- OZONLINE™ BARRIER DISCHARGE OZONE GENERATORS
- STREAM OZONE™ BARRIERLESS DISCHARGE OZONE GENERATORS
- PORTABLE MODULE FOR HEAT TREATMENT OF RAIL WELDED JOINTS
- CONVERSION OF DIESEL ENGINES INTO GAS-DIESEL AND GAS-PISTON ONES
- ENERGY ABSORPTION DEVICES FOR THE RAILCAR TRAIN PROTECTION IN THE CASE OF COLLISIONS (IN ACCORDANCE WITH THE REQUIREMENTS OF STANDARD OF UKRAINE EN 15227)
- COMBINED NOZZLES FOR PURGING A METAL BATH IN CONVERTER
- TEST BENCH FOR DETERMINING THE AERODYNAMIC LOADS ON THE TURBINE MACHINE AXIAL COMPRESSOR ROTOR BLADES IN A SUBSONIC FLOW
- STAND FOR QUASIOPTICAL RESEARCH SQR-0.1 4
- UNIVERSAL PRE-AMPLIFIER FOR GERMANIUM GAMMA DETECTORS
- INSTALLATION FOR FILLING GAS-DISCHARGE DEVICES WITH A MIX OF TRITIUM, ARGON, AND ELECTRONEGATIVE GAS

MECHANICAL ENGINEERING AND INSTRUMENT-MAKING



AUTOMATED CONTROL SYSTEM BASED ON ACOUSTIC MONITORING FOR GAS JET MILLS

Areas of Application

Jet mill load control and maintenance of the optimal grinding mode based on the analysis of acoustic signals from the grinding zone

Specification

The system consists of a unit for recording and analyzing the characteristics of acoustic signals, a control device for the loading hopper, which is connected to the control unit with an operating voltage of 60 V and a maximum current of 100 A. The signal registration frequency is 400 s⁻¹



Jet mill with control system (left)
Mill load control unit (right)

Advantages

There is no analog in Ukraine.
The acoustic signal control helps to respond online to changes in the concentration of material in the grinding zone, which increases the mill efficiency by 20%.
The system may be adapted for grinding materials with various properties and manufacturing products with various dispersion

Readiness Level.

Suggestions for Commercialization

IRL6, TRL6

Implementation into semi-industrial and small-sized industrial jet grinding plants, support of development and design of control system

Intellectual Property Protection

IPR3

Contact Information

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IZR-21 COAL ASH ANALYZER (ASHMETER)



Specification

Controlled remotely with the use of a smartphone on Android OS;
Bluetooth data transfer

Dimensions of the probe, m:

Length	0.8
Width	0.34
Diameter	0.05

Weight, kg 2.5
Ash measurement range, % 3 to 80

Measurement time,
set by the user, s

у діапазоні, с from 10
to 10000

Operating temperature range, °C

from -20
to + 40

Areas of Application

Designed for rapid measurement of coal ash content in stacks or vehicles by the radiometric method

The meter is resistant to mechanical and dynamic loads corresponding to the transportation conditions for N2 GOST 12997 group. The moisture content does not matter for device operation

Advantages

There are no commercial analogs in Ukraine. Measuring ash content takes a few minutes. Field measurements without bringing samples to a laboratory, which allows saving time

Readiness Level.

Suggestions for Commercialization

IRL6, TRL8
Custom manufacture

Intellectual Property Protection

IPR3

Contact Information

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STREAM OZONE™ METERS FOR MEASURING OZONE CONCENTRATION IN THE AIR



Stream Ozone™ meter for measuring ozone concentration in the air:
at the level of maximum permissible concentration (left) and up to 1000 ppm (right)

Areas of Application

Measurement and monitoring of ozone concentration in the air

Advantages

No analogs in Ukraine.
Monitoring of ozone concentration at the maximum permissible level for human.
Controllable operation of the ozone generator

Specification

The electrochemical method for measuring ozone concentration.
The operation range of ozone concentration meters, ppm: 0 ÷ 10, 0 ÷ 200, 0 ÷ 1 000, and 0 ÷ 5 000.
The optical method for measuring ozone concentration.
The operation range of the ozone concentration meter, ppm: 0 ÷ 100 000

Readiness Level.

Suggestions for Commercialization

IRL7, TRL9
Custom manufacture and sale

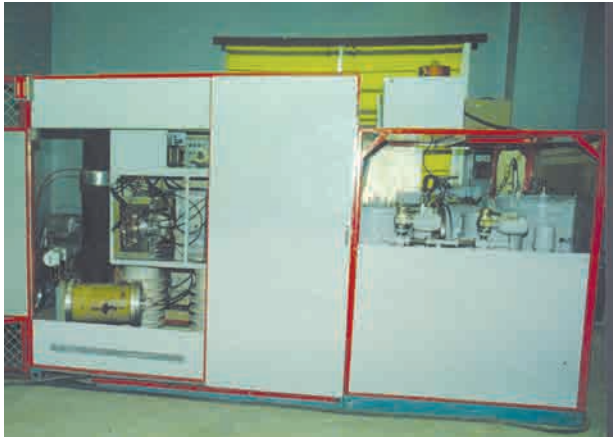
Intellectual Property Protection

IPR1

Contact Information

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HIGH-DOSE IMPLANTER FOR ION IMPLANTATION AND MODIFICATION OF MATERIALS



Areas of Application

Implantation of a material with ions of H, He, O, Ar, B, Be, Fe, Cr, Ni, Zr, Mo, W, etc.; simulation studies of radiation resistance of reactor materials with the use of ion beams in material science, semi-conductor engineering, and power engineering

Advantages

The ion implanter with ion beam mass separation is equipped with replaceable ion sources generating beams of single and double-charged gas and metal ions. Widely ranging ions, ion currents, and ion beam energies allow the effective use of the implanter for ion implantation, surface layer modification, and for the study of radiation resistance of constructional and zirconium alloys in reactor materials

Specification

Type of beam ions	H, He, O, Ar, B, Be, Fe, Cr, Ni, Zr, Mo, W
Ion current, μA	$10 \div 200$
Ion energy, keV	$20 \div 300$
Ion charge	+1, +2
Oil free vacuum, Pa	10^{-4}
Target temperature, $^{\circ}\text{C}$	$100 \div 500$
Radiation dose, ion/cm^2	up to 10^{18}
Dose rate during simulation experiments, dpa/sec	$0,1 \div 10^{-3}$
Radiation dose during simulation experiments, dpa	up to 500

Readiness Level.

Suggestions for Commercialization

IRL4, TRL6

Investors in manufacture wanted

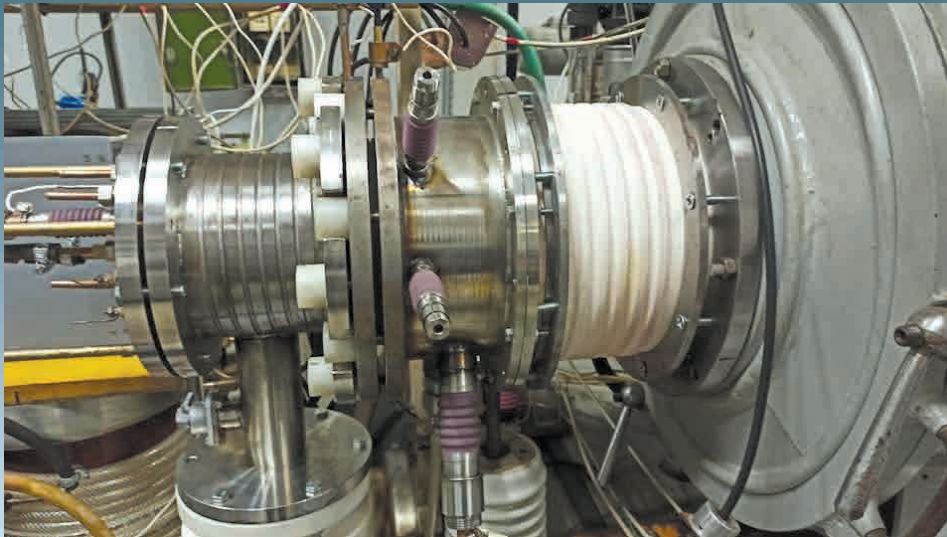
Intellectual Property Protection

IPR1, IPR2

Contact Information

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HIGH-EFFICIENCY SOURCE OF NEGATIVE HYDROGEN IONS H^-



Areas of Application

Used as ion accelerator injector in cyclotrons, synchrotrons, linear accelerators, accelerator for medical purpose, tandem accelerators in instrument-making and medical engineering

Specification

Discharge current, A	140
Ion current, μA	60
Ion current density, $\mu\text{A}/\text{cm}^2$	600
Pulse duration, ms	$0.4 \div 1.2$
Repetition rate, Hz	$1 \div 10$
Injection energy, keV	30
Gas flow rate, cm^3/pulse	0.025

Advantages

A cesium-free source with gas-inverse magnetron volumetric system for negative hydrogen ion generation. In plasma volume, near the emission aperture, the conditions for high current density of H^- are met through increasing flow of slow electrons in plasma adjacent to the emission aperture and through retaining them in this area due to the volumetric system for negative hydrogen ion generation with no any cesium vapor presence. The source has high emission and performance parameters

Readiness Level.

Suggestions for Commercialization

IRL5, TRL6
Manufacture of single samples of the source in-house or in cooperation with potential partners

Intellectual Property Protection

IPR1, IPR2

Contact Information

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GAS POWER PLANTS AND COGENERATION UNITS

Specification

Manufacture of gas-piston power plants and cogeneration units that can use a variety of combustible gases as fuel. Both open-type (on a frame) option and plants in special protective container may be manufactured. The additional options include a gas-handling unit, a heat utilization system, and systems for automatic start and synchronization with the network



Gas-piston power plant at the landfill. Open execution.
Fuel is a landfill gas

Parameter	Electric power, kW			
	50	100	200	300
The nature of current	Interchangeable, 3-phase, 400V, Hz			
Drive motor	YM3238M2	YM3238M2	DOOSAN P180LE	DOOSAN P222LE
Overall dimensions, mm				
Length	2300	2720	5220	5220
Width	×920	×1220	×1687	×1687
Height	×1370	×1850	×3400	×3400
Weight, kg	1700	2210	5700	5800

Readiness Level.
Suggestions for Commercialization

IRL8, TRL9
Custom manufacture, delivery,
warranty service, staff training

Areas of Application

Industrial enterprises that use its own backup power sources, as well as power plants based on internal combustion engines. Agricultural facilities, for utilization of biogas.
Landfills, for landfill gas utilization

Advantages

A wide range of gases may be used as fuel.
Ability to remotely monitor and control a modified engine

Intellectual Property Protection

IPR1

Contact Information

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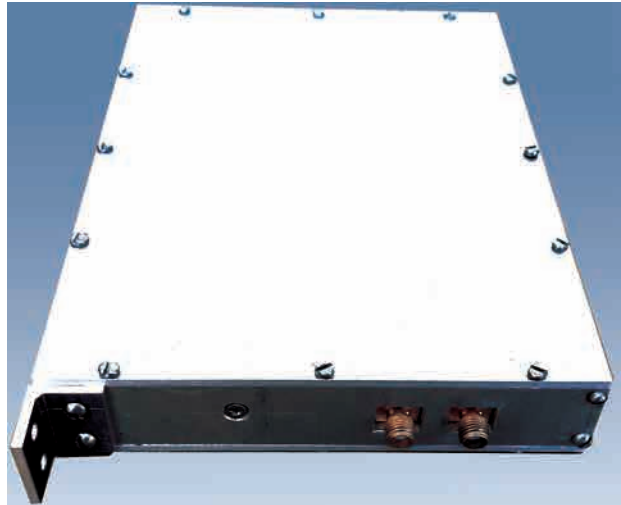
ULTRAHIGH RESOLUTION LOCAL OSCILLATOR

Areas of Application

Radio astronomical, radiophysical, and geophysical studies; narrowband receiving systems with an ultrahigh resolution; student training

Specification

Frequency range, MHz	3150,0000 – 3220,0000 (upon request, a device with other frequency ranges may be manufactured)
Output power, mW	1
Frequency step, Hz	0,0582 – 100
Frequency of the reference signal, MHz	5 or 10 (upon request, a device with other frequency of signal may be manufactured)
Size, mm ³	170 × 120 × 26



Readiness Level.
Suggestions for Commercialization

IRL5, TRL4
Custom manufacture

Advantages

Ultrahigh precision of output frequency

Intellectual Property Protection

IPR1

Contact Information

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FLYWHEEL MOTORS FOR SATELLITE ATTITUDE CONTROL SYSTEM



Flywheel motor with built-in control system (left), flywheel motor for three-axis satellite attitude control system, and three-axis satellite attitude control system (right)

Specification

Parameter	Flywheel motor with built-in control system	Flywheel motor for three-axis orientation system with remote control system
Kinetic moment, Nms*	0.0135	0.09
Speed range, rpm*	±6000	±6000
The accuracy of maintaining the speed of rotation, rpm	< 0.05	< 0.05
Maximum torque, Nm	0.0012	0.018
Power consumption at 6000 rpm, W	1	2
Maximum power consumption, W	0.05	0.15
Weight, kg	0,2	0.42
Overall dimensions, mm	Ø52 × 42	74 × 74 × 33
Static imbalance, mgm · mm	< 0.5	< 0.5
Dynamic imbalance, mgm · mm	< 0.6	< 0.6
Supply voltage, V*	2.6–3.6	2.6–3.6
Operating temperature, °C	–30 ...+50	–30 ...+50

* may be increased for larger satellites, upon request

Areas of Application

For *CubeSat* format nanosatellites attitude control and stabilization systems

Readiness Level.
Suggestions for Commercialization

IRL6, TRL6
Custom manufacture, delivery,
and warranty service

Advantages

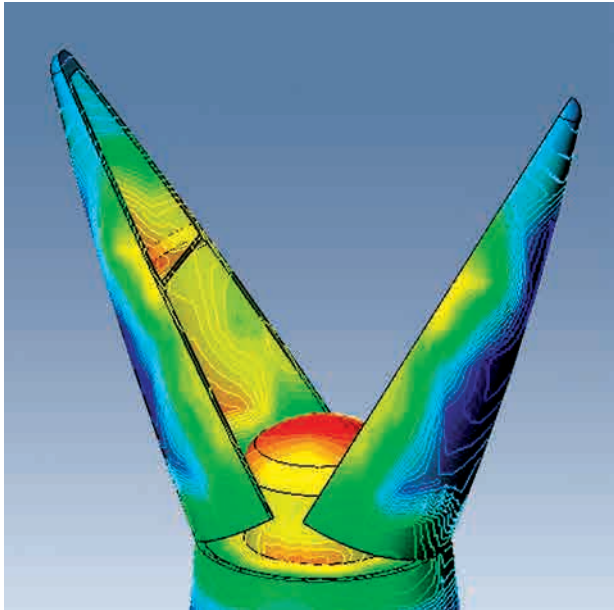
There are no analogs in Ukraine.
In contrast to foreign analogs,
the flywheel motors have a low specific power
consumption and the ability to operate from
a low-voltage power supply

Intellectual Property Protection
IPR2

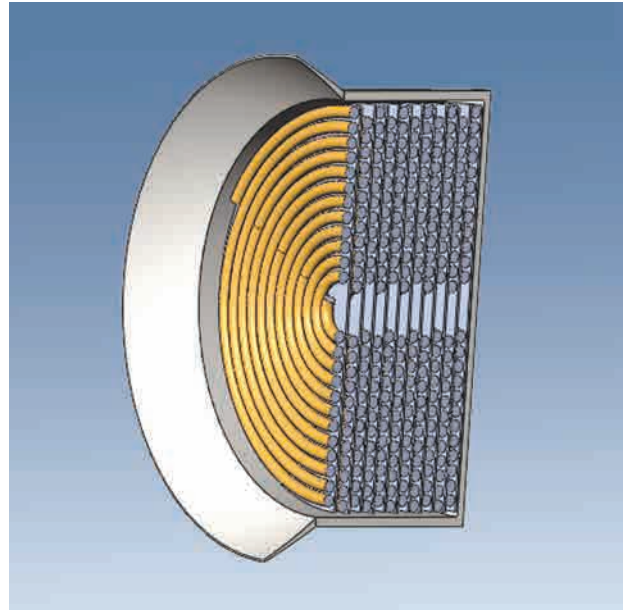
Contact Information

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DETONATION SYSTEM FOR SEPARATION AND REMOVAL OF ROCKET FAIRING SASHES



Isolines of pressure on the surface of the fairing sash when it is separated in the dense layers of the atmosphere



Solid propellant cord detonation engine

Areas of Application

Separation of the fairing into sashes and its safe removal from the rocket body

Stage of Development. Suggestions for Commercialization

IRL5, TRL5

Value engineering and design works with integration of the system into new objects of rocket equipment of various functions

Specification

The detonation system consists of solid propellant detonation rocket engines placed in a special compartment on each sash. To prevent the action of detonation products, the payload is covered with a membrane. The motors and sash fasteners are connected in one pyrotechnic system. When it is triggered, the mechanical connection between the sash and the rocket is lost and a pulse is given, as a result of which the sash opens and is removed from the rocket. The location of solid propellant detonation engines is optimized in relation to the payload, given the environmental conditions in which they are separated

Advantages

High reliability, relative simplicity, and affordable cost of construction. Ability to operate under high external aerodynamic loads

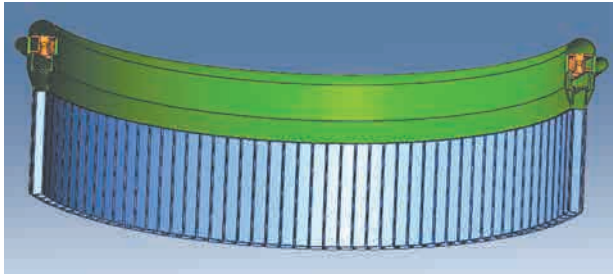
Intellectual Property Protection

IPR2

Contact Information

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DETONATION EXHAUST BURNER OF THE OPEN-CIRCUIT ROCKET ENGINE



Specification

The device allows increasing the specific impulse of the exhaust by 15–40%, in comparison with the existing schemes of the exhaust devices that use exhaust turbine gas in the open-circuit rocket engine. The plant weight adds only 10%

Areas of Application

Used in liquid fuel rocket engines in order to increase the specific impulse of the exhaust turbine gas

Advantages

Relative simplicity of the design, higher energy characteristics in comparison with the existing analogs, less harmful exhaust gases

Readiness Level.

Suggestions for Commercialization

IRL5, TRL5

License sale for patents on turbine gas afterburner circuit in detonation mode. Value engineering and design works with integration of the system in new power plants of rocket equipment

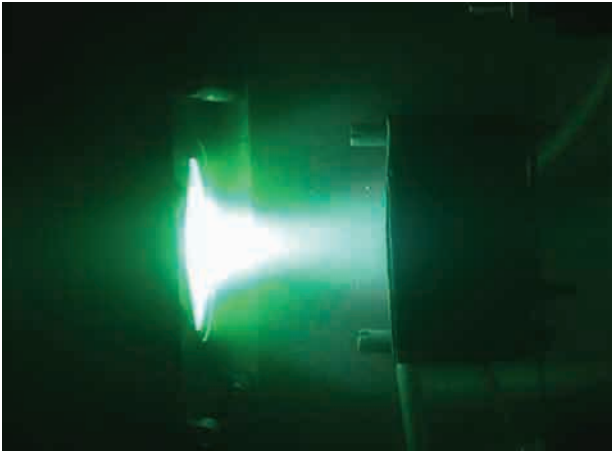
Intellectual Property Protection

IPR3

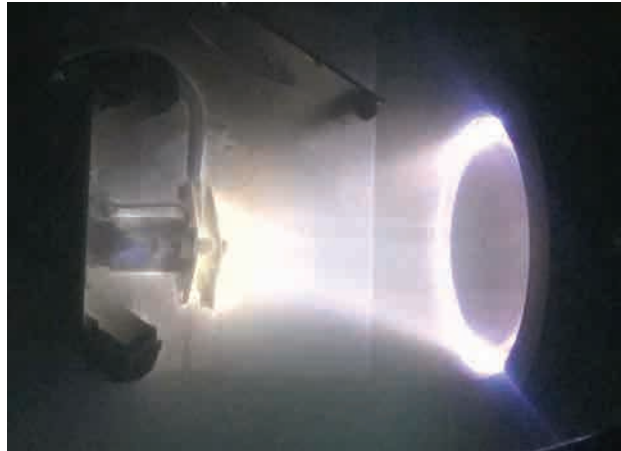
Contact Information

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ION-PLASMA AND BEAM DEVICES FOR SURFACE REINFORCEMENT



Planar unbalanced magnetron spraying system
PINbMRS50 as a source of gas ion flow



Focused source of energy gas ions PASH125

Areas of Application

Ion treatment for cleaning and activating the surface; forming a stream of sprayed material; assisting the coating process; forming a high-intensity flow of low-energy nitrogen ions for nitride implantation hardening of the surface

Advantages

There are no analogs in Ukraine.
Surface reinforcement in one continuous vacuum cycle by nitride hardening and subsequent nanocoating

Specification

The planar unbalanced magnetron device:

Cathode material utilization coefficient, %	2–2.5
Magnetron discharge power, kW	125
Discharge current density per cathode, mA/cm ²	10 ⁻⁴

The focused ion source type accelerator with ionic layer:

Focal length of the ion beam, mm	150
Diameter of the ion beam in focus, mm	40
Ion current density in focus, mA/cm ²	10–15
Energy of ions in focus, keV	up to 2.5

Readiness Level. Suggestions for Commercialization

IRL5, TRL5
Custom design of magnetron sprayers of various standard sizes

Intellectual Property Protection IPR3

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QUARTZ GAUGE FOR MEASURING THE THICKNESS OF VACUUM-COATED FILMS



Areas of Application

A quartz gauge for real-time monitoring and measuring the thickness of films coated in vacuum with various materials in material science, machine-building, and instrument-making

Advantages

There are no domestic counterparts. The quartz gauge for measuring thickness of vacuum-coated films is better fitted to operating with the equipment used in Ukraine as compared with foreign analogs, therefore no customization is required

Intellectual Property Protection
IPR2

Specification

Expected resolution of Ta_2O_5 film depth measurement, nm	0,1
Film thickness range, nm	0.1 – 999.9
Coating density range, g/cm ³	0.1 – 99.9
Quartz generator frequency, MHz	4 – 9.99
Dimensions of the gauge, mm	
Width	220
Height	65
Depth	165
Dimensions of the quartz crystal, mm	Ø14×(0.1 – 0.3)

Readiness Level.
Suggestions for Commercialization

IRL6, TRL6
Custom piece manufacture.
Partners for wholesale manufacture wanted

Contact Information

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BENCH COMPLEX FOR DETONATION ROCKET ENGINES TESTING

Areas of Application

Studying detonation combustion and its use in rocket engines to improve energy performance

Specification

The complex includes: a bench for the study of monofuel compositions for detonation devices, a bench for purging flat models of detonation rocket engines, and a bench for fire tests of detonation rocket engines. All benches contain a frame or plate for fixing models or prototypes of engines, a control system for pneumatic circuit elements, a data collection system and are placed in special protective structures. The complex allows testing detonation engines and devices with a thrust of 100 N to 6 kN running on gaseous fuel components and liquid monofuel. There is an option for making fire tests of solid rocket engines with a thrust up to 10 kN

Advantages

There are no analogs in Ukraine. The bench complex is used to study prototypes of detonation rocket engines and the peculiarities of the detonation process in gases and liquids

Readiness Level. Suggestions for Commercialization

IRL6, TRL6
Use in the design of new propulsion systems for space-related application



Bench for studying monofuel detonation devices and for conducting fire tests of solid propellant rocket engines



Bench for fire tests of detonation rocket engines



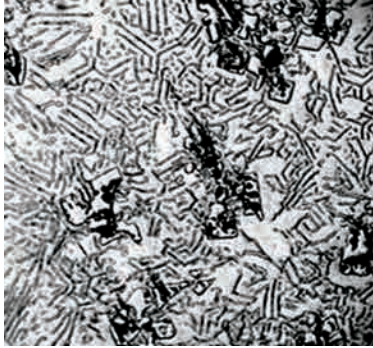
Bench for detonation rocket engine tests

Intellectual Property Protection
IPR2

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HEAT-RESISTANT NICKEL-BASED CAST ALLOY



Areas of Application

Protection from oxidation and wear;
repair of damaged parts of the turbine blades
of gas turbine engines. Manufacture of engines
for aviation and power engineering

Specification

Cast heat resistant nickel based alloy
that contains chromium, aluminium, tungsten,
rhenium, titanium, and carbon.
Titanium carbide fine particles volume
fraction ranges 12 – 13%, which ensures high
temperature strengthening of the alloy.
High heat resistance at a temperature of 1100 °C
is achieved due to a balanced chromium,
aluminium, and rhenium content.
Melting temperature is about 1340 °C.
The alloy is applied onto the blade
by any overlay technique

Advantages

Superior heat resistance at 1100 °C
as compared with the existing analogs,
in particular, XTH-62 and XTH-53 alloys.
Phase and structural stability up
to the temperature just below melting.
Alloy is ready for application in the as-cast
state without any additional heat treatment.
High casting properties. Simple and cost
effective manufacturing technology
as compared with the existing analogs.
Avoidance of process difficulties
in the course of the application onto the related
material of nickel turbine blade

Intellectual Property Protection
IPR3

Readiness Level.
Suggestions for Commercialization
IRL4, TRL7
Manufacture of customized cast products

Contact Information

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MAGNETRON EVAPORATOR WITH PERMANENT MAGNET-BASED SYSTEM FOR MAGNETIC FIELD DISBALANCING

Areas of Application

Making thin-film structures of various materials in material sciences, machine-building, and instrument-making (to improve the performance of parts and units)

Specification

Used in vacuum devices for applying protective coatings.

Material of magnet parts and disbalance system:

samarium-cobalt

Size of target with a sputtering material, mm

Diameter

60

Width

1–5

Target cooling

distilled water

Insulator material

Φ4

fluoroplastic

Dimensions

of the main nodes, mm

Anode

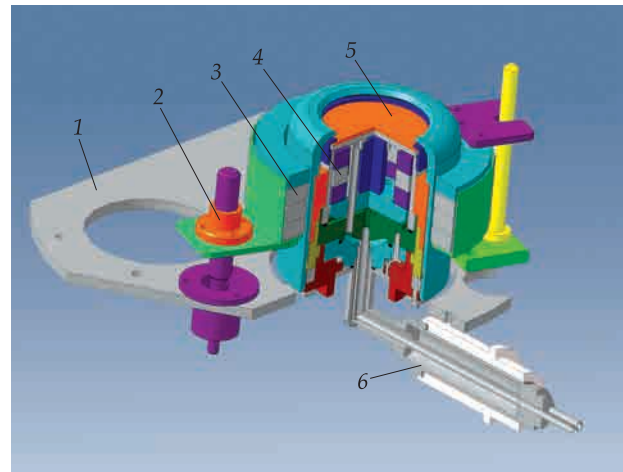
Ø90

Case of disbalance magnet

Ø127

Leak-proof vacuum inlet

Ø46



3D model of a magnetron evaporator with permanent magnet-based system for magnetic field disbalance: 1 – base; 2 – displacement mechanism; 3 – magnet disbalance system; 4 – magnetron magnet system; 5 – target with a sputtering material; and 6 – distilled water supply system

Readiness Level.

Suggestions for Commercialization

IRL6, TRL6

Manufacture of magnetron evaporator with permanent magnets-based system for magnetic field disbalance

Advantages

Enables the ion-stimulated formation of coatings from various materials with better tribological parameters and various functional purposes

Intellectual Property Protection

IPR2

Contact Information

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SMALL-SIZED SCINTILLATION GAMMA-SPECTROMETER



Areas of Application

For detecting man-made radionuclides (Cs137,134, Co-60, etc.) in food products and establishing the radiation class of building materials

Specification

Width, mm	180
Crystal NaI (Tl), mm	25 × 25
Energy registration range, keV	30 – 3000
Number of channels	1024
Resolution on the 662 keV line, %	at most 10
Measuring capacity (Marinelli vessel),	0.5
The thickness of the lead shield, mm	15 – 25
Weight, kg	12
IPC connection interface	USB, Windows 7 – 10
Minimum measured activity of Cs-137 per hour per sample, Bq	17

Advantages

There are no commercial analogs in Ukraine. The device may replace the spectrometer that has a more sensitive and expensive detection unit with a massive lead shield

Readiness Level. Suggestions for Commercialization

IRL6, TRL6
Custom manufacture

Intellectual Property Protection

IPR3

Contact Information

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BRIQUETTING EQUIPMENT WITH INCREASED SERVICE LIFE

Areas of Application

Briquetting peat, brown coal,
and lignin with a low bulk density
($\leq 0.5 \text{ g/cm}^3$)

Specification

High-pressure roller press with pressing
force up to 4000 kN, high productivity
(up to 50 t / h), and guaranteed durability
and service life, which may operate
in the mode of gravity feed
of the charge and be equipped
with an screw pre-press

Advantages

Reduces non-uniformity of stress distribution
by 10 ... 15 %, elastic aftereffect by 5 ... 10 %,
and density by 2 ... 4.5 % as compared
with analogs. Balanced distribution of loads
on the roll unit allows increasing
the service life of the press.

Rationally located relative to the line
of the roller centers, the hydraulic device
for protection of the press from overloads up
to 2500... 3000 kN has reduced dimensions
and metal consumption and meets
the requirements of reliability, safety,
and durability



Roller press with pre-compactor

Readiness Level.

Suggestions for Commercialization

IRL8, TRL8

Manufacture of press, delivery
and warranty services, personnel training

Intellectual Property Protection

IPR3

Contact Information

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OzonLine™ BARRIER DISCHARGE OZONE GENERATORS



OzonLine™ barrier discharge ozone generator (OzD 10/0.1)



Air & surface disinfection
by OzonLine OzD 10/0.1 ozone generator

Areas of Application

Ozone generation for disinfection of air, surfaces, and dispersed materials, in particular, for protection against COVID-19 spread, storage of vegetables and fruits, air treatment in production facilities and warehouses of food industry enterprises

Specification

Electric discharge type of ozone generation: atmospheric pressure barrier discharge; working gas of the ozone generator: atmospheric air; cooling agent: air; control: microprocessor.

Productivity (depending on the module), g/h	from 0.5 to 40
Supply voltage, V	220
Supply frequency, Hz	50
Power (depending on the module), kW	from 0.012 to 1.5

Advantages

Good price-quality ratio.
Guaranteed ozone generation productivity as compared with the barrier discharge prototypes. Availability of modes with different ozone generation productivity. Air ozone concentration meter may be optionally supplied. May operate in the mode below the maximum allowable ozone concentration for the working area. One-year warranty period

Readiness Level.
Suggestions for Commercialization

IRL7, TRL9
Custom manufacture and sale of products.
Marketing development

Intellectual Property Protection
IPR1

Contact Information

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Stream Ozone™ BARRIERLESS DISCHARGE OZONE GENERATORS

Areas of Application

Ozone generation for disinfection of air, surfaces, and dispersed materials, in particular, for protection against COVID-19 spread, storage of vegetables and fruits, air treatment in production facilities and warehouses of food industry enterprises. Systems for finish treatment of drinking and service water

Specification

The electric discharge type of ozone generation: atmospheric pressure barrierless discharge; working gas of the ozone generator atmospheric air.

Productivity
(depending on the module), g/h from 1 to 300

Power (depending
on the module), kW from 0.075 to 5

Operating mode 24/7

Advantages

Stable operation with the use atmospheric air (stable ozone generator productivity in the course of operation cycle). Humidity resistance (longer service life of electrodes and electric discharge when operating with the use of atmospheric air). Energy efficiency of ozone generation with the use of air. The air ozone concentration meter may be optionally supplied. May operate in the mode below the maximum allowable ozone concentration for the working area. Three-year warranty period

Intellectual Property Protection
IPR1



Ozone system for treatment of agricultural disperse products based on *Stream Ozone OzW50* (up to 100 gO₃/h) ozone generator



Ozone generator *Stream Ozone OzW5/9* (up to 8 gO₃/h)

Readiness Level.
Suggestions for Commercialization

IRL8, TRL9
Custom manufacture and sale of products.
Marketing development

Contact Information

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PORTABLE MODULE FOR HEAT TREATMENT OF RAIL WELDED JOINTS



Areas of Application

Portable module for heat treatment of rail weld joints made by the resistance butt welding technique

Advantages

The module may be used in the track conditions as part of mobile rail-welding trains and in the workshop conditions of rail-welding enterprises for the production of rail strings. Simple replacement of inductors, depending on the type of rail; uniform temperature distribution in rail elements; the formation of a uniform structure with a high grain score along the width of the heat-affected zone; increasing metal hardness along the joint line; reaching the metal hardness in the rail head hardening zone close to that of the base metal

Specification

Power supply current frequency, kHz	2.4
Power supply power, kW	160
Heating time of welded joints of R65 rails to 890 °C from 20 °C, s /	280
and from welding heat, s	180
Time of hardening of the rolling surface of the R65 rail, s	210
Working pressure in the air supply system, MPa	0.5
Cooling fluid consumption, l/min	10
Module weight, kg	65
Dimensions, mm	
Length	1020
Width	500
Height	650

May be used for heat treatment of tram rail weld joints

Readiness Level.

Suggestions for Commercialization

IRL5, TRL4

Working laboratory model ready for customization

Intellectual Property Protection

IPR3

Contact Information

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CONVERSION OF DIESEL ENGINES INTO GAS-DIESEL AND GAS-PISTON ONES

Areas of Application

Industrial enterprises that require the use of backup or own power sources, as well as drive power plants based on internal combustion engines.
Agricultural facilities, for biogas utilization.
Solid household waste landfills, for landfill gas utilization

Specification

Conversion of existing diesel engines with a capacity of 50 – 1000 kW without dismantling the existing fuel equipment and modifying the cylinder block.
The engine still may operate on diesel fuel.
Convertible both in gas-diesel and gas-piston engines



Drive motor of the compressor unit operating on natural gas (power 120 kW)

Advantages

A wide range of gases that may be used as fuel.
Optimization of engine operation for a given gas fuel composition.
Automation of engine production processes.
Ability to remotely monitor and control a converted engine

Readiness Level.

Suggestions for Commercialization

IRL8, TRL9

Conversion of diesel engines, delivery and warranty service

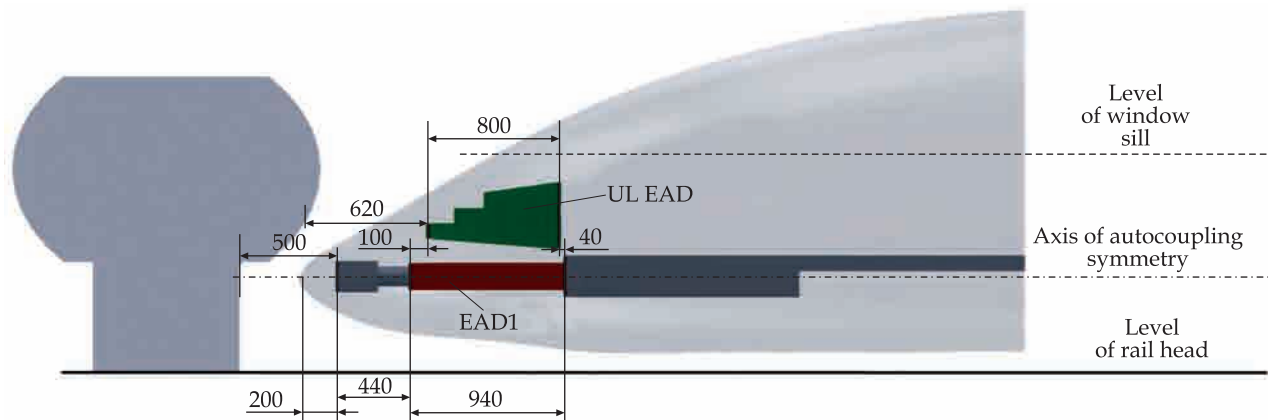
Intellectual Property Protection

IPR1

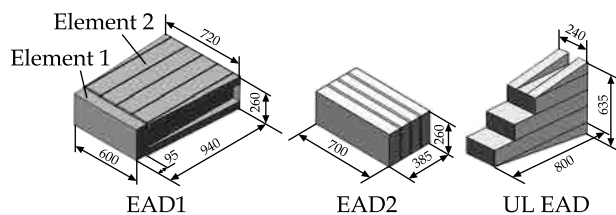
Contact Information

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ENERGY ABSORPTION DEVICES FOR THE RAILCAR TRAIN PROTECTION IN THE CASE OF COLLISIONS (IN ACCORDANCE WITH THE REQUIREMENTS OF DSTU EN 15227)



Interaction of the main car and a large vehicle in a collision



Areas of Application

Energy absorbing devices are used for improving safety of passengers and train staff and for mitigating severe consequences of accidents

Specification

Energy absorption device (EAD) 1 mounted at the level of the automatic coupler in the front parts of the main cars includes a box with a single-layer package of hexagonal cells inside (element 1) and a truncated pyramid of cells with triangular cells (element 2). EAD 2 for intercar connections is developed on the basis of element 1. The upper-level energy absorption device (UL EAD) for a front window sill of the main car has three steps in the form of element 2. Energy consumption of is 0.95 MJ for EAD 1, 0.3 MJ for EAD 2, and 0.12 MJ for UL EAD

Readiness Level. Suggestions for Commercialization

IRL8, TRL9
Simulation of the dynamics of train collisions in accordance with DSTU EN 15227, upon request. Development and selection of configuration parameters of energy absorption devices

Advantages

The devices are an original Ukrainian development that has successfully passed crash tests. The devices protect trains moving at a speed of up to 36 km/h in case of collision with a 80-ton freight car and trains moving at a speed up to 110 km/h in case of collision with 15-ton large vehicles at a crossing

Intellectual Property Protection IPR1

Contact Information

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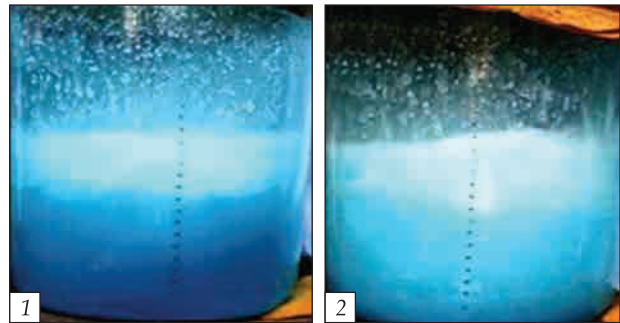
COMBINED NOZZLES FOR PURGING A METAL BATH IN CONVERTER

Areas of Application

Improving technical and economic indices
of converter steel production

Specification

A volumetric combination of an annular
slotted nozzle and a central cylindrical
(Laval) nozzle to create a main flow
that surrounds and shields the flow
from the annular slotted nozzle



Two-phase simulation of blowing:
1 – through a conventional tip,
2 – through a tip with combined nozzles

Advantages

A 15–20 % increase in the depth
of jet penetration, as compared with blowing
through a conventional nozzle, improves
interaction with liquid bath. The use
of combined nozzles with a recommended share
of slotted component promotes the active
formation of a stable foamed emulsion
on the bath surface and results in an increase
in the stirring activity during the blowing
from above, which is accompanied by
an increase in the yield of suitable liquid steel

Readiness Level.

Suggestions for Commercialization

IRL6, TRL5
Design of combined nozzles
in accordance with the requirements,
specifications for blowing modes

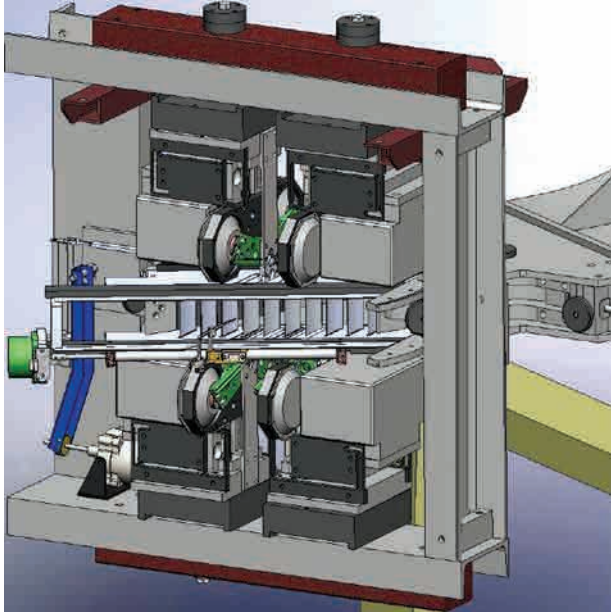
Intellectual Property Protection

IPR2

Contact Information

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TEST BENCH FOR DETERMINING THE AERODYNAMIC LOADS ON THE TURBINE MACHINE AXIAL COMPRESSOR ROTOR BLADES IN A SUBSONIC FLOW



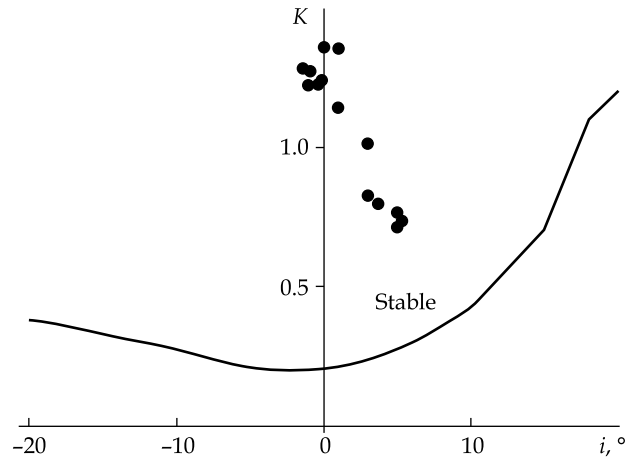
Test bench for determining the nonstationary aerodynamic loads on the blade airfoils vibrating in a flow

Specification

Four central blade cascade airfoils on which aerodynamic force L_A and moment M_A are measured; while vibrating, may do displacements x_n and y_n and their combinations with various phase shifts both between the airfoil and the displacements; the Mach number before the cascade reaches 0.7; length of the airfoils is 70 mm; reduced vibration frequency is up to 1.3

Advantages

There are no analogs in Ukraine. Allows obtaining data on the aerodynamic loads in a short time to establish the dynamic stability limit of the blade assemblies against subsonic flutter



Dependence of the dynamic stability limit of the first flexural vibration mode for the first stage blades of aircraft gas-turbine engine (TV3-117-SBM1) on the attack angle (• corresponds to reduced frequency of vibrations for different modes of the engine operation)

Areas of Application

Design of compressor stage rotor blades for gas-turbine engines and prevention of the subsonic flutter excitation of blade assemblies for gas turbine industry enterprises

Readiness Level. Suggestions for Commercialization

IRL7, TRL8
Conducting tests and predicting the dynamic stability of the blade assemblies for enterprises

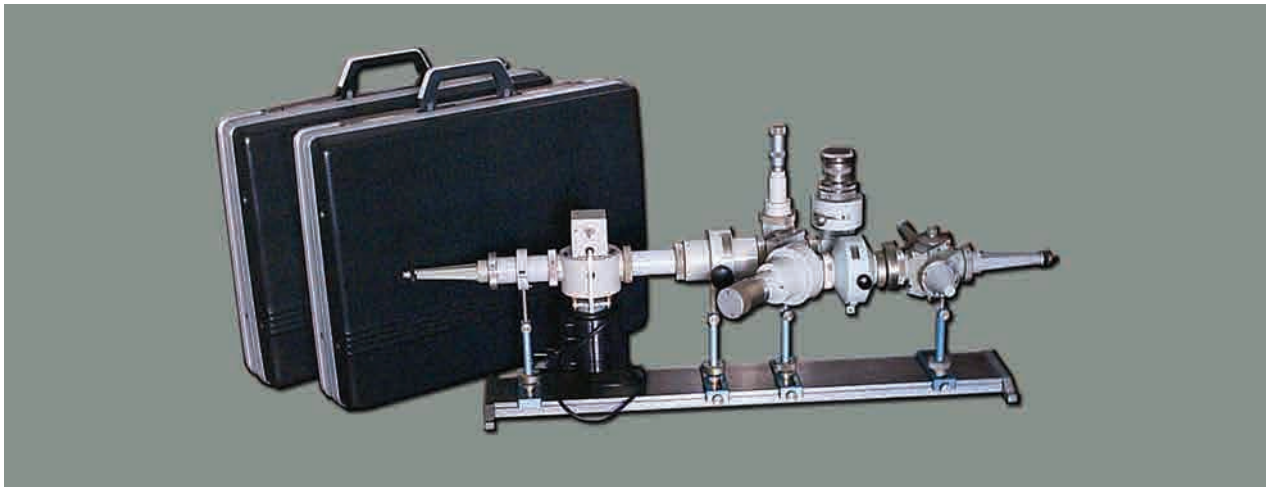
Intellectual Property Protection

IPR1, IPR3

Contact Information

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SQR-0.14 STAND FOR QUASIOPTICAL RESEARCH



Areas of Application

SQR-0.14 stand for quasioptical researches is designed for demonstrating the quasioptical methods of measurements in THz frequency region and for training students and researchers in radiophysics

Specification

The SQR-0.14 stand is based on hollow dielectric beam guide having a 20 mm circular cross-section in diameter. Working frequency is 0.14 THz. The stand enables the following measurements: reflection factor modulus and phase, wavelength by the Michelson interferometer method; polarization diagram by the rotary polarization analyzer method; dependence of the mirror reflection factor modulus on incidence angle of a wave reflected from flat surface of a sample

Readiness Level.

Suggestions for Commercialization

IRL7, TRL8

Manufacture, delivery, warranty service, and staff training

Advantages

There are no analogs

Intellectual Property Protection

IPR1, IPR3

Contact Information

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UNIVERSAL PRE-AMPLIFIER FOR GERMANIUM GAMMA DETECTORS



Areas of Application

Designed to convert and amplify charge pulses from gamma-ray detectors based on germanium-lithium crystals and crystals of particularly pure germanium into voltage pulses with a fast leading edge and an exponentially decreasing trailing edge, the amplitude of which is proportional to the charge collected from gamma spectroscopy detector with detector blocks based on high-purity germanium

Specification

Dimensions, mm:

Length	53
Width	61
Thickness (including elements on the board), mm	13

Weight, g 25

Maximum input load, imp /s at least, 5×10^4

Supply voltage, V ± 12

Integral nonlinearity of the transformation function, % at most 0.04

Output resistance, Ohm 50

Conversion factor, mV/MeV at least 200

Advantages

There are no commercial analogs in Ukraine. May be mounted in cryostats of the world leading manufacturers of germanium detectors *ORTEC*, *CANBERRA*, and *BSI*. As compared with the analogs of other manufacturers, it has a higher maximum input load, increased stability, and allows the use of a wide range of operational amplifiers. Easy to set up and maintain

Readiness Level. Suggestions for Commercialization

IRL6, TRL8
Custom manufacture

Intellectual Property Protection IPR3

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INSTALLATION FOR FILLING GAS-DISCHARGE DEVICES WITH A MIX OF TRITIUM, ARGON, AND ELECTRONEGATIVE GAS

Areas of Application

Designed for filling the vacuum volumes of electronic devices with a gas mix at the final stage of the production process: arresters, microwave antenna switches, neutron tubes, magnetrons without heating the cathodes, plasma relativistic microwave devices, and gas lasers. The installation is customizable

Specification

The installation may be connected with up to 4 electronic devices, allows pumping out to a vacuum of $1 \cdot 10^{-4}$ Pa; degassing with heating; filling and monitoring the gas components of tritium, argon, and electronegative gas within $(10^{-3} - 1)$ Pa. The device is disconnected by cold desoldering

Advantages

There are no analogs in Ukraine.
Enables gas mix component sensing control.
Economical in terms of tritium losses.
A high level of radiation safety and environment safety

Readiness Level. Suggestions for Commercialization

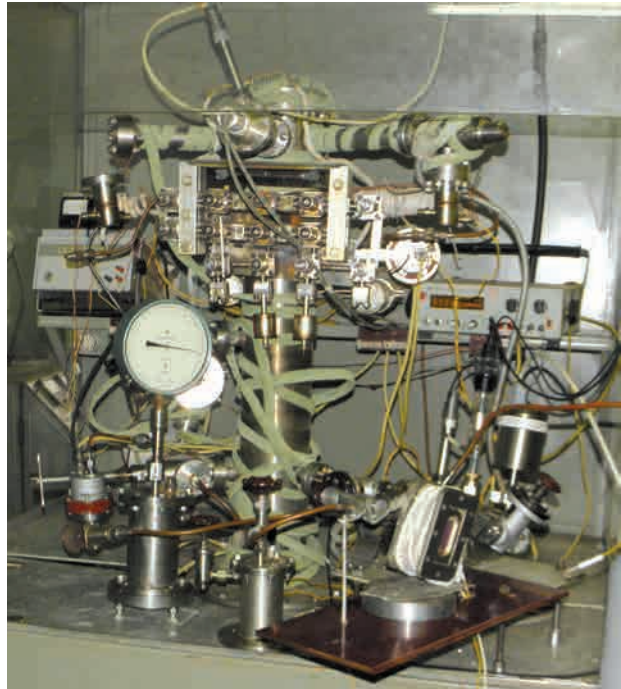
IRL8, TRL7
Custom manufacture

Intellectual Property Protection

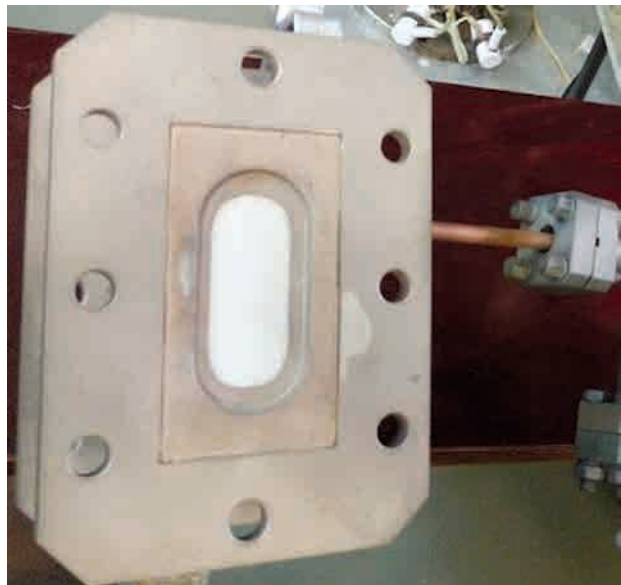
IPR3

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Installation for filling gas-discharge devices with a mix of tritium, argon, and electronegative gas



Gas-discharge device

- BIOCIDAL ADDITIVE FOR ANTIFOULING SHIP PAINTS
- BUTYLOLEATE BASED ON DOMESTIC RAW MATERIALS
- FIRE-RETARDANT COATING FOR STEEL STRUCTURES
- HYBRID TECHNOLOGY FOR MANUFACTURING FLAT THIN-WALLED BIMETALLIC AND THREE-LAYER PRODUCTS
- TWO-DIMENSIONAL (2D) MATERIALS WITH DIFFERENT ELECTRONIC PROPERTIES FOR ENERGY STORAGE AND CONVERSION DEVICES
- ELECTRON BEAM TECHNOLOGIES FOR ALLOYING AND CASTING
- WELDING MATERIALS FOR COMPLEX ALLOYED BRONZES
- ECOFIL-1(I) IMPREGNATED FIBROUS CHEMISORBENT OF ACID GASES WITH INDICATION OF ADSORPTION CAPACITY DEPLETION
- ECOFIL-2(II) IMPREGNATED FIBROUS CHEMISORBENT OF ALKALINE GASES WITH INDICATION OF ADSORPTION CAPACITY DEPLETION
- CATALYTIC SYSTEMS FOR THE CONVERSION OF BIOMASS INTO HIGH-VALUE PRODUCTS
- MHD-PLASMA PROCESS FOR OBTAINING REINFORCED ALUMINUM ALLOYS AND CAST PRODUCTS IN HIGH-TECH INDUSTRIES
- NON-DESTRUCTIVE DEPTH-SELECTIVE DIAGNOSTICS OF STRUCTURE MICRODEFECTS
- PARATELLURITE TeO_2 SINGLE CRYSTALS
- PROUSTITE Ag_3AsS_3 AND PYRARGYRITE Ag_3SbS_3 SINGLE CRYSTALS AND Ag_3AsS_3 - Ag_3SbS_3 SOLID SOLUTIONS ON THEIR BASE
- SINGLE CRYSTALS OF THALLIUM (I) THIOINDATE TYPE TlInS_2 , TlInSe_2 , TlGaSe_2 , AND $\text{TlIn}(S_{1-x}\text{Se}_x)_2$ SOLID SOLUTIONS
- ORGANO-INORGANIC (HYBRID) AND INORGANIC HALIDE PEROVSKITES FOR LIGHT SOURCES
- FILM-FORMING MATERIAL BASED ON STABILIZED CVD-COMPOSITE GERMANIUM - ZINC SULFIDE
- METHOD FOR OBTAINING MICROCRYSTALLINE CELLULOSE FROM PLANT WASTE
- METHOD FOR OBTAINING ORGANO-MINERAL PHOSPHORUS-CONTAINING FERTILIZERS FROM SLUDGE OF MUNICIPAL SEWAGE AERATION STATIONS AND PLANT WASTE ASH
- TECHNOLOGIES FOR PLASMA AND REAGENT PROCESSING OF NONFERROUS ALLOYS
- TECHNOLOGIES FOR FERROUS AND NONFERROUS ALLOY CASTINGS PRODUCTION BY THE LOST FOAM CASTING METHOD
- TECHNOLOGY FOR PRODUCTION OF STONE-CAST CORROSION- AND HEAT-RESISTANT PRODUCTS
- TECHNOLOGY FOR ROLLING FROM ALUMINUM-BASED ALLOYS BY THE TWO-ROLL CASTING METHOD
- TECHNOLOGY FOR PRODUCTION OF HIGHLY WEAR-RESISTANT RAILWAY WHEELS
- TECHNOLOGY FOR ELECTRO-SLAG WELDING OF TITANIUM ALLOYS
- TECHNOLOGY FOR OBTAINING HIGH-PURITY AMORPHOUS SILICON DIOXIDE FROM PLANT RAW MATERIALS
- ETHYL ACETATE PRODUCTION TECHNOLOGY
- TECHNOLOGY FOR PRODUCTION OF CAST PRODUCTS FROM SPECIAL ALLOYS WITH THE USE OF NEW THERMOSTABLE MODIFIED REFRACTORY MOLDING MATERIALS
- PROPYLENE OXIDE PRODUCTION TECHNOLOGY
- TECHNOLOGY FOR PLASMA-INDUCTION GROWTH OF ULTRA-LARGE SINGLE CRYSTALS OF REFRACTORY METALS
- TECHNOLOGY FOR HEAT TREATMENT OF SPARINGLY ALLOYED STEELS FOR THE MANUFACTURE OF HIGH-STRENGTH PIPE ROLLING TOOLS
- NSFM-T-1 TRIFUNCTIONAL NONWOVEN SORPTION-FILTERING MATERIAL
- EQUIPMENT FOR STUDYING CORROSION OF MATERIALS UNDER THE INFLUENCE OF RADIATION AND STATIC AND CYCLIC DEFORMATION IN SUPERCRITICAL CONVECTION WATER LOOPS
- CHA-I CHEMOSORBENT-AMPHOLYTE OF PROLONGED ACTION WITH DYNAMIC ABSORPTION CAPACITY DEPLETION INDICATION

CONSTRUCTION AND FUNCTIONAL MATERIALS TECHNOLOGY



BIOCIDAL ADDITIVE FOR ANTIFOULING SHIP PAINTS



a



b

Painted steel bars after 228 days of exposure to fresh water in Dnipro River: reference coating based on ship paint (a) and coating that contains 10 % wt of biocidal additive (b)

Areas of Application

Protective coatings for underwater steel structures and hydraulic facilities in fresh and sea water

Specification

Fine infusible powder of white color; water solubility is 0.015 g/100 ml, acute toxicity (LD_{50} 96 hours) to freshwater hydrobionts: 0.7 mg/l for *Daphnia magna*; 17 mg/l for *Danio rerio* (zebrafish). The biocidal additive at a weight content of 10% provides a high resistance of protective coatings to biofouling

Advantages

There are no analogs in Ukraine. As compared with conventional antifouling agents, it shows much lower ecotoxicity (more than one order of magnitude). May be introduced into the appropriate paint compositions as a fine pigment

Readiness Level. Suggestions for Commercialization

IRL3, TRL3
Custom manufacture of small batches.
Partners for mass production wanted

Intellectual Property Protection IPR3

Contact Information

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BUTYLOLEATE BASED ON DOMESTIC RAW MATERIALS

Areas of Application

Used as a plasticizer and a substance to increase the water resistance of materials in organic synthesis in the production of rubber and polymeric materials, as a solvent in the paint industry, as a lubricant in the textile industry, etc.

Specification

Homogeneous transparent colorless or yellow liquid with a kinematic viscosity of 3.5–6.5 mm²/s, an acid value of at most 0.50 mg KOH/g, and improved antioxidant stability

Advantages

Cheaper as compared with the existing analogs. The processing technology excludes the formation of acid waste, which increases the environment friendliness of production

Readiness Level. Suggestions for Commercialization

IRL4, TRL4
Custom manufacture of small batches.
Partners for mass production wanted

Intellectual Property Protection IPR3

Contact Information

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FIRE-RETARDANT COATING FOR STEEL STRUCTURES



The exterior of coated steel structure



Steel pillar protected by the fire-retardant coating:
before and after the fire tests

Intellectual Property Protection
IPR3

Areas of Application

In the construction industry, to increase the fire resistance rate of steel structures and to ensure standardized level of fire safety of buildings and structures

Specification

Fire endurance limit ranges within 30 – 120 min for steel structures with sectional factor of $250 - 90 \text{ m}^{-1}$ provided the coating thickness is 4 – 5 mm; service life is 15 years or longer in Type Y conditions (ETAG-018) indoor or in semi-exposed facilities protected from atmospheric precipitation; biological resistance and minimal harmful effects on the environment due to optimal toxicity vs biodegradation balance

Advantages

Reduction in harmful factors for people and the environment during thermal decomposition of the coating in a fire due to the absence of halogen flame retardants or derivatives of boric acid; reduction in the smoke formation; reduction in the cost of fire-retardant treatment by an average of 25 – 30% due to the use of cheap intumescent paint, extended service life, and improved product application parameters; in terms of fire-retardant efficiency (120 min), the coating does not have any analogs of domestic production

Readiness Level. Suggestions for Commercialization

IRL5, TRL4

Partners to organize mass production and sale of the finished product wanted

Contact Information

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HYBRID TECHNOLOGY FOR MANUFACTURING FLAT THIN-WALLED BIMETALLIC AND THREE-LAYER PRODUCTS

Areas of Application

Used for extending the service life of parts of machines operating in extreme conditions in the mining, metallurgical, aviation, energy and other industries by obtaining new wear-resistant bimetallic and three-layer products

Specification

The technology is based on the use of pre-induction heating of the solid substrate under a layer of oxygen-proof coating before pouring the melt of wear-resistant cast iron, in order to ensure the formation of a reliable transition diffusion zone between different metals. The technology allows the manufacture of products weighing from 0.3 to 10 kg

Advantages

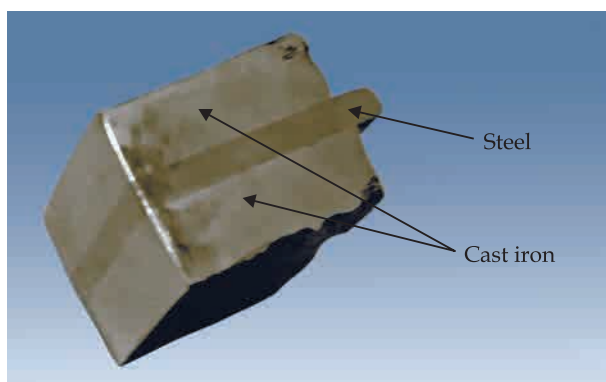
Expands possibilities for obtaining critical bimetallic and three-layer products with improved physical and mechanical properties and 2–3 times extended service life in conditions of intense abrasive and shock-abrasive wear and for manufacturing bimetallic products with a 3–5 mm thick steel substrate

Readiness Level. Suggestions for Commercialization

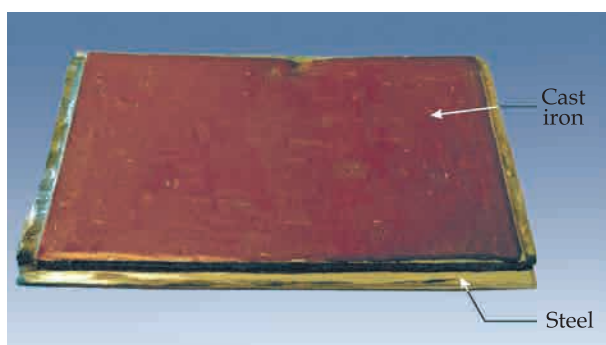
IRL6, TRL6
Partners for technology commercialization wanted. Custom manufacture of small batches of ingots

Contact Information

Sviatoslav Hnyloskurenko, Institute of Physics and Technology of Metals and Alloys of the NAS of Ukraine, +38 044 424 12 50, e-mail: expo@ptima.kiev.ua



Three-layer blank for the manufacture of aircraft brake units



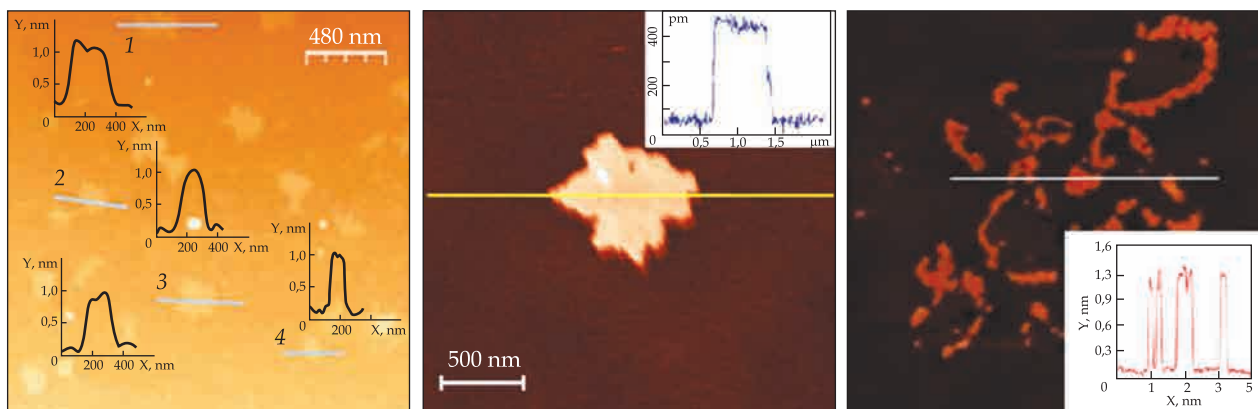
Bimetallic armored lining



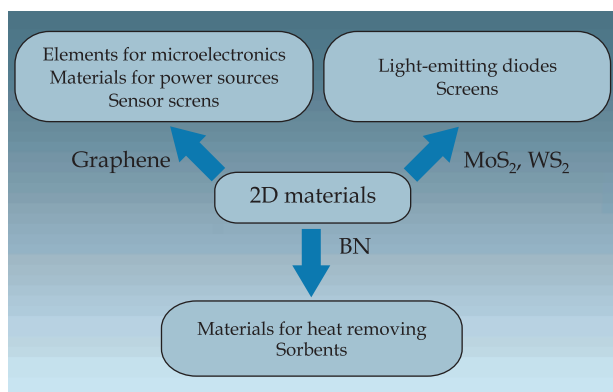
Bimetallic hammer

Intellectual Property Protection IPR3

TWO-DIMENSIONAL (2D) MATERIALS WITH DIFFERENT ELECTRONIC PROPERTIES FOR ENERGY STORAGE AND CONVERSION DEVICES



Images of nanoparticles of graphene oxide, graphene, MoS₂ obtained by AFM



Examples of the use of 2D materials

Readiness Level. Suggestions for Commercialization

IRL3, TRL3

Custom manufacture of small batches of 2D material selected by the customer.
Searching for partners to test the suitability of 2D materials for the use in energy storage and conversion devices on an industrial scale

Intellectual Property Protection

IPR2, IPR3

Contact Information

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Areas of Application

Used in energy storage and conversion devices of the new generation: conductors (graphenes with varying degree of doping with heteroelements), semiconductors (transition metal dichalcogenides, carbon nitride, etc.), dielectrics (graphene oxide, boron nitride, etc.)

Specification

2D materials are doped graphenes and graphene oxide, metal dichalcogenides, carbon and boron nitrides, etc. with a lateral nanoparticle size of 50–2000 nm and a thickness of 1–10 molecular or atomic layers. The content of heteroatoms in doped graphene reaches 10%. The particles are dispersed in an organic solvent or in water at a concentration of 0.05–3 mg/ml

Advantages

Due to its simplicity and versatility, the original mechanochemical method enables quick and cheap production of 2D materials based on various substances, which are as good as the known analogs in terms of physical properties

ELECTRON BEAM TECHNOLOGIES FOR ALLOYING AND CASTING

Areas of Application

Obtaining high-purity castings from refractory and highly reactive alloys for the needs of mechanical engineering, aerospace, shipbuilding, energy industry, and medicine. Obtaining complex alloys, cast composites, and special ligatures for a wide range of alloys

Specification

Vacuum technology for remelting and refining metals and alloys with an electron beam and electromagnetic stirring of melt. Enables the production of castings weighing from 0.5 to 20 kg

Advantages

Remelting highly reactive and refractory metals and alloys, including Ti and Zr alloys. Obtaining finished and semi-finished cast products from titanium and its alloys with mechanical properties at a level of the deformed metal. Almost waste-free production of castings

Readiness Level. Suggestions for Commercialization

IRL6, TRL8

Partners for technology commercialization wanted. Custom manufacture of small batches

Contact Information

Svyatoslav Gnyloskurenko, Institute of Physics and Technology of Metals and Alloys of the NAS of Ukraine, +38 044 424 12 50, e-mail: expo@ptima.kiev.ua

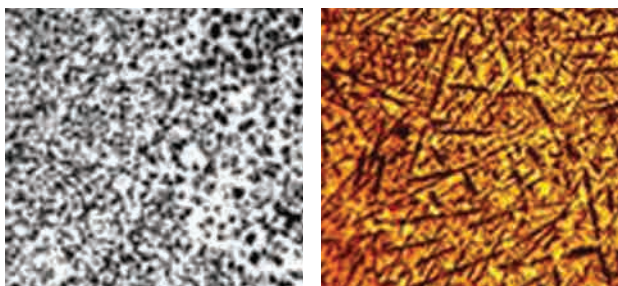


Ti and Zr castings produced by the electron-beam technology

Intellectual Property Protection

IPR1, IPR2, IPR3

WELDING MATERIALS FOR COMPLEX ALLOYED BRONZES



Microstructure of bronzes deposited on low-alloy steel $\times 50$:
a) aluminum bronze BrAlFeNiMn;
b) high-tin bronze BrSnP10-1

Specification

The chemical composition of the metal weld with the use of developed complex-alloyed materials

Areas of Application

Welding, remedy of defects by welding, casting and surfacing of complex-alloyed bronzes on steel

Advantages

Increase in mechanical (by 15...25%) and especially antifrictional properties (1.5...2.1 times) in comparison with foundry bronzes of the same chemical composition. Saving scarce non-ferrous metals

Aluminum bronzes	Type of welding material		Chemical composition of the weld metal (average values). %					Welding method
			Al	Mn	Ni	Fe	Cu	
Aluminum bronzes	Powder wire		7.5	0.56	0.75	2.1	remainder	MIG. SAW
			8.5	0.7	0.8	2.2		
			9.9	0.85	1.2	3.0		
			8.9	10.7	1.5	2.6		
	Composite flux-cored wire		8.2	1.1	2.0	2.8		
			6.5	9.8	1.8	2.5		
	Coated electrodes		≥ 7.5	2.0	1.0	—		MMA

Tin bronzes	Type of welding material		Chemical composition of the weld metal (average values). %				Welding method
			Sn	P	Mn	Cu	
Tin bronzes	Powder wire		9.5–10.5	0.4–0.5	—	remainder	TIG. SAW
	Coated electrodes	AHBO-1	6.0–8.0	0.2–0.5	0.6–0.9		MMA
		AHBO-2	9.0–11.0	0.5–0.8	0.5–0.8		

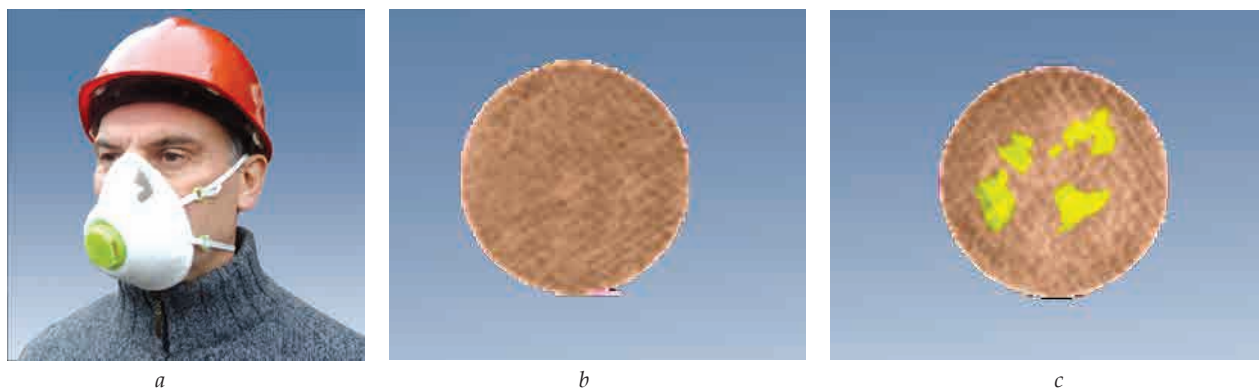
Intellectual Property Protection
IRP3

Readiness Level.
Suggestions for Commercialization
IRL6, TRL6
Custom manufacture and delivery

Contact Information

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ECOFIL-1(I) IMPREGNATED FIBROUS CHEMISORBENT OF ACID GASES WITH INDICATION OF ADSORPTION CAPACITY DEPLETION



Example of the use of *Ecofil-1(I)* impregnated fibrous chemisorbent of acid gases with absorbing capacity depletion indicator as material for gas mask element with visual determination of time of penetration of acid gases contained in the air of working area into the submask space.

a — *Eol* gas and dust respirator (Specification 28.2-01530125-037:2015); *b* — original *Ecofil-1(I)*; *c* — indication of time of acid gas leakage into submask space

Areas of Application

For production of fibrous sorption and filtering materials of which gas masks elements (GME) are made; these elements are used for equipping gas cleaning equipment, in particular, respirators for protection against toxic acid gases (SO_2 , SO_3 , SiF_4 , HF, HCl, and Cl_2) and vapors

Specification

Enables timely visual determination a “depletion” of GME dynamic absorption capacity in the course of absorbing acid gases and vapors, which makes it possible to set norms of the use of GME. The socio-economic effect is achieved due to preventing occupational diseases and saving chemisorption material, as well as reducing the number of staff to monitor the effectiveness of respirators

Advantages

Visual indication of “depletion” of dynamic absorption capacity allows timely replacement of expensive GME respirators without the help of additional devices and their further use

Readiness Level. Suggestions for Commercialization

IRL8, TRL7
Custom manufacture and supply.
Searching for partners for upgrading equipment, marketing, and launching serial production

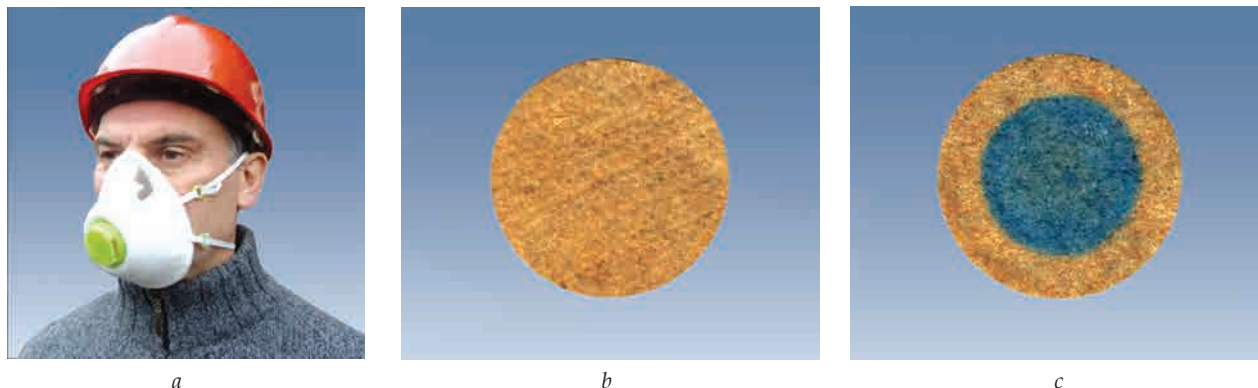
Intellectual Property Protection

IPR1, IPR3

Contact Information

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ECOFIL-2(I) IMPREGNATED FIBROUS CHEMISORBENT OF ALKALINE GASES WITH INDICATION OF ADSORPTION CAPACITY DEPLETION



Example of the use of *Ecofil-2(I)* impregnated fibrous chemisorbent of alkaline gases with absorbing capacity depletion indicator as material for gas mask element with visual determination of time of penetration of alkaline gases contained in the air of working area into the submask space. *a* – Eol gas and dust respirator (Specification 28.2-01530125-037:2015); *b* – original *Ecofil-2(I)*; *c* – indication of time of acid gas leakage into submask space

Areas of Application

For production of fibrous sorption and filtering materials of which gas masks elements (GME) are made; these elements are used for equipping gas cleaning equipment, in particular, respirators for protection against toxic alkaline gases (NH_3 , organic amines) and vapors

Specification

Enables timely visual determination a “depletion” of GME dynamic absorption capacity in the course of absorbing acid gases and vapors, which makes it possible to set norms of the use of GME. The socio-economic effect is achieved due to preventing occupational diseases and saving chemisorption material, as well as reducing the number of staff to monitor the effectiveness of respirators

Advantages

Visual indication of “depletion” of dynamic absorption capacity allows timely replacement of expensive GME respirators without the help of additional devices and their further use

Intellectual Property Protection

IPR1, IPR3

Readiness Level.

Suggestions for Commercialization

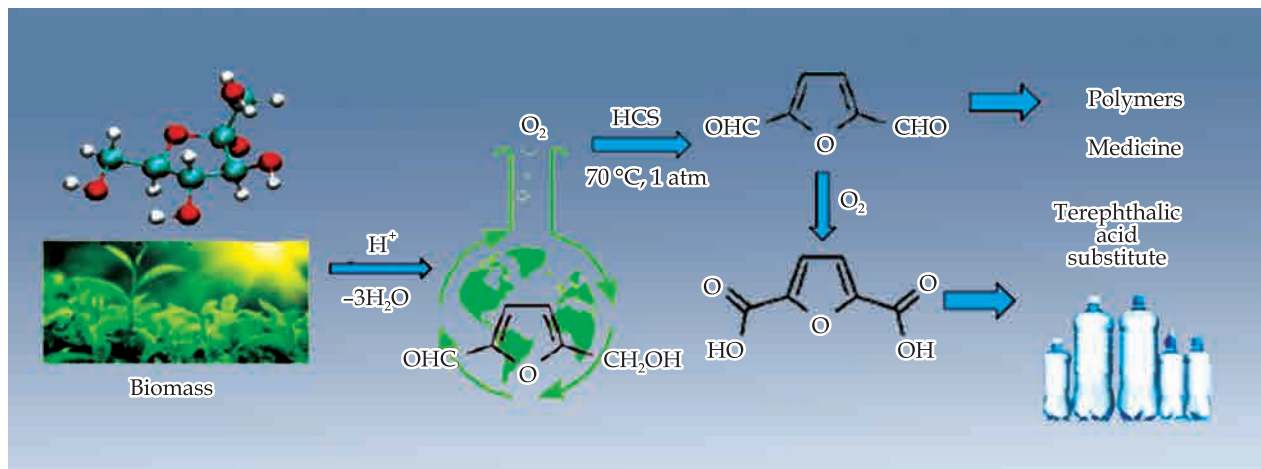
IRL8, TRL7

Custom manufacture and supply. Searching for partners for upgrading equipment, marketing, and launching serial production

Contact Information

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CATALYTIC SYSTEMS FOR CONVERTING BIOMASS INTO PRODUCTS WITH HIGH ADDED VALUE



Conversion of biomass-derived substrates into products with high added value, catalyzed by hybrid systems based on organo-catalysts and transition metal compounds

Areas of Application

Technology for transforming biomass into compounds with high added value, which can be used as a base (monomers) to design new products and replace materials synthesized by oil- or coal-chemistry

Specification

High catalytic activity at low temperatures (up to $80\text{ }^\circ\text{C}$) for oxidation processes that usually occur at $150\text{--}400\text{ }^\circ\text{C}$; selectivity of the process, ensuring maximum compliance with the requirements of "green" chemistry during its implementation

Advantages

Low price and availability of catalytic system components; efficiency in oxidation processes, where the main agent is molecular oxygen - the cheapest "green" oxidant; possibility of modifying the components of the catalytic system depending on the initial conditions; created materials are highly biodegradable in natural conditions

Readiness Level.

Suggestions for Commercialization

IRL4, TRL3

A batch of catalyst can be made to order, advice on its use in technological processes can be provided. Technology for the oxidation of biomass-derived substrates using the catalytic system is being developed

Intellectual Property Protection

IPR3

Contact Information

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MHD-PLASMA PROCESS FOR OBTAINING REINFORCED ALUMINUM ALLOYS AND CAST PRODUCTS IN HIGH-TECH INDUSTRIES



Reaction chamber with working plasmatron (idling mode)
for treatment of aluminum alloys



MHD-plasma treatment of liquid aluminum alloy
in the casting magnetodynamic plant

Areas of Application

Preparation and dosed pouring
of structural, composite, and functional
aluminum alloys into molds and crystallizers,
obtaining critical cast wares

Specification

The technology is based on combining
thermal & forced action of plasma and
electromagnetic fields on melt. The principle
is realized in casting magnetodynamic plant
having a capacity of 630 kg aluminum melt
and a total electric power of up to 70 kW.
The plant is equipped with plasmatron having
an electric power of up to 10 kW for deep
treatment of melts by gas & reagent mediums
and submerged plasma

Advantages

The offered technology and equipment
has no analogs in the world. It enables
the refinement of structure, an increase
in the strength of cast metal (by 20–30%)
and ductility (2–3 times), and economical
consumption of energy and materials

Readiness Level. Suggestions for Commercialization

IRL5, TRL4
Custom manufacture and staff training

Intellectual Property Protection

IPR1, IPR2, IPR3, IPR4

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NON-DESTRUCTIVE DEPTH-SELECTIVE DIAGNOSTICS OF STRUCTURE MICRODEFECTS

Areas of Application

Used in research instrument-making, nanoindustry, and microelectronics, to study defects in the structure of single crystals

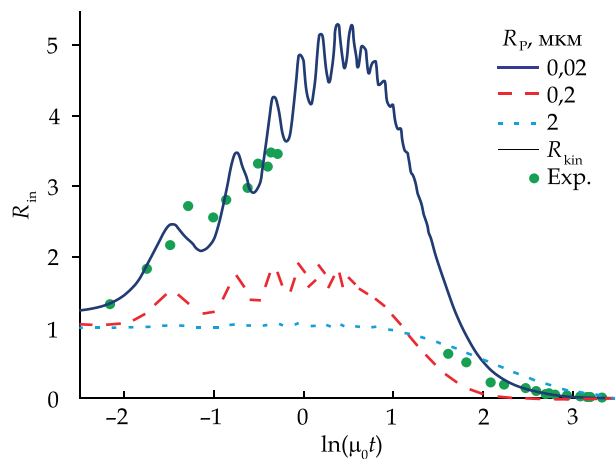
Specification

Sensitivity to microdefects
(by concentration
or volume fraction)

$10^{-8} - 10^{-6}$

Samples single crystal
wafers, mm

up to $50 \times 50 \times 5$



Theoretical (curves) and experimental (markers) dependences of the normalized total integrated intensity of dynamic diffraction (R_{kin}) vs. the thickness of Si single crystals with microdefects of different sizes R_P (the Laue diffraction, reflex (220), MoK_α radiation, $L_H = 0.018$). Line $R_{kin} = 1$ corresponds to the case of kinematic diffraction, when the integrated intensity is not sensitive to the defect parameters

Advantages

The transition from the conventional kinematic pattern to the dynamical scattering pattern allows diagnostics without destruction of object; the sensitivity to structural imperfections increases by 4–6 orders of magnitude; numerous structural parameters may be simultaneously detected; the diagnostics of fast processes; and a significant simplification of methods

Readiness Level.
Suggestions for Commercialization

IRL3, TRL3
Custom research. Sale of licenses
to equipment manufacturers

Intellectual Property Protection
IPR3

Contact Information

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PARATELLURITE (TeO_2) SINGLE CRYSTALS



Areas of Application

Used in the manufacture of working elements for acousto-optic devices, in particular, modulators, light deflectors, and delay lines

Specification

Single crystals of a high optical quality with a diameter up to 45 mm and up to 60 mm long; acousto-optic quality index $M_2 = 1143.8 \times 10^{-15} \text{ s}^3/\text{kg}$ in the case of isotropic interaction of linearly polarized optical waves with transverse acoustic wave

Advantages

The highest acousto-optic quality index in the visible spectral range, as compared with the existing analogs

Intellectual Property Protection

IPR1, IPR3

Readiness Level.

Suggestions for Commercialization

IRL6, TRL6

Custom manufacture of small batches of paratellurite TeO_2 single crystals; manufacture of single-crystal working elements with customized parameters (size, crystallographic orientation, and degree of mechanical processing)

Contact Information

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PROUSTITE (Ag_3AsS_3), PYRARGYRITE (Ag_3SbS_3) SINGLE CRYSTALS AND $\text{Ag}_3\text{As}_{1-x}\text{Sb}_x\text{S}_3$ SOLID SOLUTIONS BASED ON THEM

Areas of Application

For frequency converters, elements of acousto-optic devices, and other devices for the infrared spectral range

Specification

High-optical quality single crystals:

Proustite (Ag_3AsS_3)

Diameter, mm	10–50
Length, mm	20–80

Pyrargyrite (Ag_3SbS_3)

Diameter, mm	10–30
Length, mm	20–50

$\text{Ag}_3\text{As}_{1-x}\text{Sb}_x\text{S}_3$ solid solutions

($x = 0.1; 0.2; 0.3; 0.4; 0.5; 0.6; 0.7; 0.8; 0.9$)



Proustite (Ag_3AsS_3) single crystals

Readiness Level.

Suggestions for Commercialization

IRL6, TRL6

Custom manufacture of small batches of single crystals and solid solutions

Intellectual Property Protection

IPR1, IPR3

Advantages

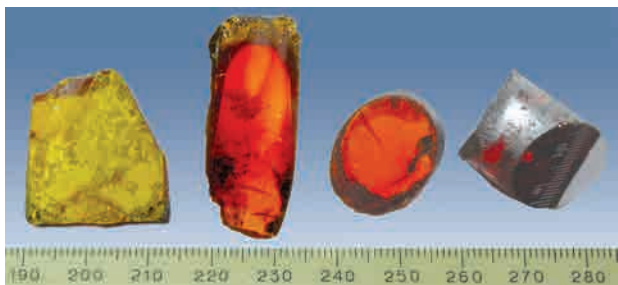
Property	Ag_3AsS_3	Ag_3SbS_3
Range of transparency, μm	0.6–13	0.7–14
Absorption coefficient in the transparency range, cm^{-1}	0.1–0.5	0.5–0.8
Acoustooptic quality index, s^3/g (0001)	310×10^{-18}	
Pyroelectric coefficient, CGSE units		4×10^4

As compared with the existing analogs, it is suitable for manufacturing IR acousto-optic devices

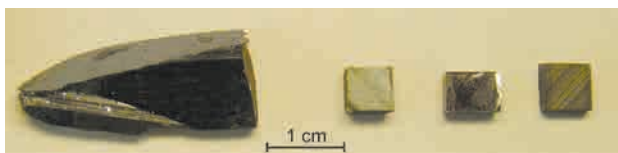
Contact Information

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SINGLE CRYSTALS OF THALLIUM (I) THIOINDATE TYPE (TlInS_2 , TlInSe_2 , TlGaSe_2) AND $\text{TlIn}(\text{S}_{1-x}\text{Se}_x)_2$ SOLID SOLUTIONS



TlInS_2 , $\text{TlIn}(\text{S}_{0.95}\text{Se}_{0.05})_2$, $\text{TlIn}(\text{S}_{0.90}\text{Se}_{0.10})_2$
and $\text{TlIn}(\text{S}_{0.85}\text{Se}_{0.15})_2$ (single crystals (from left to right))



TlInSe_2 single crystals and prepared oriented samples
with faces perpendicular to the a , b and c directions;
 b axis and $[101]$ and $[1\bar{0}1]$ directions; c axis and $[110]$
and $[1\bar{1}0]$ directions



TlGaSe_2 single crystals and prepared oriented samples with
faces perpendicular to various crystallographic directions

Areas of Application

For working elements in devices of functional electronics, in particular, for pressure and temperature gauges, pyroelectric detectors of electromagnetic radiation, and thermal storage elements

Specification

Single crystals and solid solutions up to 20 mm in diameter and up to 50 mm long

Advantages

In comparison with the existing analogs, these crystals possess strong anisotropy of physical properties due to quasi-two-dimensionality; semiconductor properties; variable temperature range of the ferroelectric phase

Intellectual Property Protection
IPR1

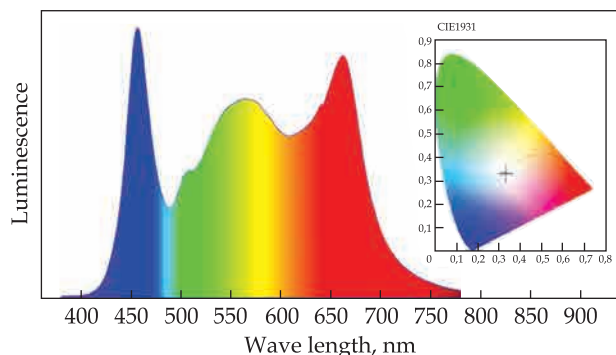
Readiness Level.
Suggestions for Commercialization

IRL6, TRL6
Custom manufacture of small batches
of single crystals and solid solutions

Contact Information

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ORGANO-INORGANIC (HYBRID) AND INORGANIC HALIDE PEROVSKITES FOR LIGHT SOURCES



Emission spectrum of white LEDs based on perovskites

Areas of Application

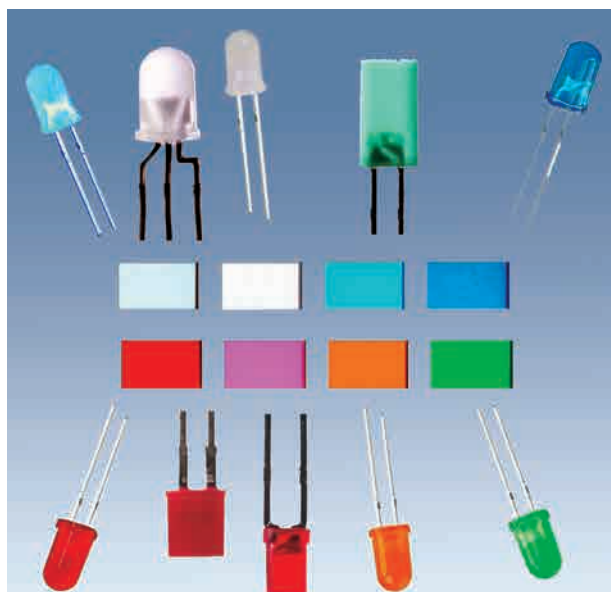
Creation of sources of white light for light emitting diodes, as well as light sources from blue to red for wide range of applications

Specification

Luminescence quantum yield higher than 70%;
luminescence spectrum width of ~ 25 nm;
high resistance to environment effects

Advantages

As compared with existing analogs, the proposed materials have a high purity of luminescence color and color rendering index of white LEDs up to 98. At the same time, their production is cheaper and more environment friendly



The use of perovskites for preparation of LEDs

Readiness Level. Suggestions for Commercialization

IRL3, TRL3
Custom manufacture of small batches.
Searching for partners for testing the industrial feasibility of the materials for the use in the light sources

Intellectual Property Protection IPR3

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FILM-FORMING MATERIAL BASED ON STABILIZED CVD-COMPOSITE GERMANIUM-ZINC SULFIDE



Germanium plates (a wedge and lenses) coated with $\text{Ge}-\text{ZnS}-\text{B}_2\text{O}_3$ material

Areas of Application

For creation of thin-film coatings on germanium optical elements for the devices that operate in the infrared range

Specification

The thin-film coatings obtained from the CVD-composite germanium-zinc sulfide composite have high optical properties and performance, particularly, the mechanical durability of 0 group (about 20,000 rotations before the appearance of scratches)

Readiness Level.

Suggestions for Commercialization

IRL7, TRL6

Sale of license. Custom manufacture

Advantages

The material has no world analogs. The use of coatings from the developed material in optical elements makes it possible to increase the mechanical durability, climatic stability and optical transparency of the elements

Intellectual Property Protection

IPR3

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METHOD FOR OBTAINING MICROCRYSTALLINE CELLULOSE FROM PLANT WASTE



Areas of Application

Production of microcrystalline cellulose (MCC) for food and pharmaceutical industry

Specification

The method for obtaining MCC by conversion of plant biomass with an over 90% yield of the target product. The obtained MCC is notable for a high crystallinity index of 0.75–0.8 and a polymerization number less than 300

Advantages

In contrast to the existing world technologies, this one-stage process method allows minimizing the use of mineral acids and waste. The process is designed for non-wood raw materials

Readiness Level.

Suggestions for Commercialization

IRL5, TRL4

Searching for partners to launch the mass production

Intellectual Property Protection

IPR1

Contact Information

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METHOD FOR OBTAINING ORGANO-MINERAL PHOSPHORUS-CONTAINING FERTILIZERS FROM SLUDGE OF MUNICIPAL SEWAGE AERATION STATIONS AND PLANT WASTE ASH



Areas of Application

Obtaining fertilizers from waste of various origins to improve the mineral, in particular phosphorus, nutrition of cereals, sunflower, etc.

Specification

The method includes the dehydration of sludge from excess sludge of aeration stations, the effective detoxification and disinfection, and the addition of processed vegetable waste and humic component

Advantages

The method not only addresses environmental issues, but also allows obtaining complex organo-mineral fertilizers of prolonged action from wastes of different origins, which ensure crop yields at the level of existing analogs. The obtained fertilizers are made of local raw materials, do not require long-distance transportation and may be used in the surrounding farms

Readiness Level.

Suggestions for Commercialization

IRL5, TRL4

Searching for partners to launch mass production

Intellectual Property Protection

IPR1

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TECHNOLOGIES FOR PLASMA AND REAGENT PROCESSING OF NONFERROUS ALLOYS

Areas of Application

Obtaining nonferrous alloys for the manufacture of products for mechanical engineering, automotive and aerospace industries

Specification

Deep plasma jet treatment of melts in vacuum with high-temperature inert and active gases and modification by powder materials.
Gas consumption is 0.2–0.5 m³, electricity consumption is up to 15 kWh per ton of treated metal

Advantages

Reducing non-metallic inclusions 2–2.3 times, hydrogen content by 70–80% (in aluminum alloys). Increasing strength of cast metal by 14–26%, relative elongation 1.3–1.6 times; Economical consumption of energy and materials.
Reducing the negative impact of heredity of charge materials on the structure and properties of cast products allows the use of low-grade charge and scrap metal to obtain high-quality cast metal



Vacuum-plasma device for melt refining



Immersing a plasma jet into the melt for refining

Intellectual Property Protection

IPR1, IPR2, IPR3

Readiness Level.

Suggestions for Commercialization

IRL6, TRL6

Transfer of technology with a license.

Custom manufacture of small batches

Contact Information

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TECHNOLOGIES FOR FERROUS AND NONFERROUS ALLOY CASTINGS PRODUCTION BY THE LOST FOAM CASTING METHOD



Types of castings made by the new technology



Automated casting complex for the lost foam technology implementation with 3000 ton/year capacity

Areas of Application

For obtaining a high accuracy and guaranteed quality of 0.1...1000 kg castings from ferrous and nonferrous alloys for mining, engineering, metallurgical, agricultural, and defense industries

Specification

The technology covers a full cycle of manufacturing individual parts and structures, including the preparation of molding materials, foamed models, the melting and pouring of alloys into molds and the obtainment of final products having a weight of 0.1...1000 kg; the accuracy corresponds to the 3rd – 5th class; the surface roughness ranges within 3.2 – 6.3 microns. It is possible to organize production line with a capacity of 100 to 10,000 tons per year

Advantages

This technology is resource-saving and environment friendly; it provides for using both the developed unique process equipment and the equipment for environment protection, in particular a plant for afterburning of gases and thermal regeneration of the molding compound

Readiness Level. Suggestions for Commercialization

IRL8, TRL9

Development the project on demand for production of castings and constructions, supply equipment and personnel training. Manufacturing small batches of casting on customer demand

Intellectual Property Protection

IPR1, IPR2, IPR3

Contact Information

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TECHNOLOGY FOR PRODUCTION OF CORROSION- AND HEAT-RESISTANT CAST STONE WARE

Areas of Application

The production of cast ware with a high corrosion and electrochemical resistance for metallurgical, foundry and chemical industries

Specification

The melting and casting technology aims at obtaining cast stone ware with a crystalline phase content of over 90% and a heat resistance of up to 1300 °C, based on fluorophlogopite, from the following components: oxides of silicon, aluminum, magnesium, potassium, calcium, and zirconium



Intermediate ladle for melting high-purity aluminum, made with the use of the developed technology

Advantages

Unlike the existing technology, this one allows obtaining cast stone ware that may be used for a long time at a high temperature and in aggressive environments



Cast stone ware that are stable in melts of salts with chlorine content

Readiness Level.
Suggestions for Commercialization

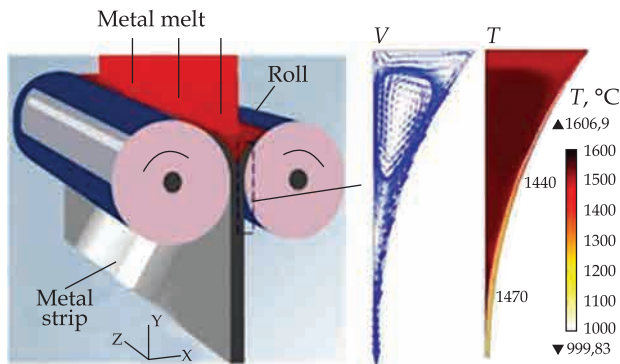
IRL6, TRL6
Transfer of technology under license.
Custom manufacture of small batches

Intellectual Property Protection
IPR1, IPR3

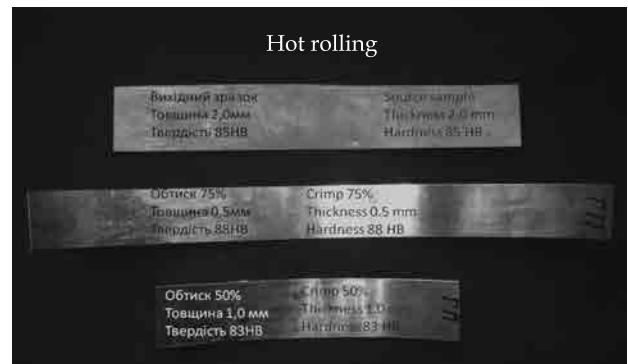
Contact Information

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TECHNOLOGY FOR ROLLING FROM ALUMINUM-BASED ALLOYS BY THE TWO-ROLL CASTING METHOD



Process flowchart of two-roll casting with the distribution of the flow of molten metal in the inter-roll space



Strip samples with mechanical properties indicated, obtained by two-roll casting with further hot rolling

Areas of Application

Production of thin aluminum strip, in particular from high-strength aluminum alloys for machine-building, aviation, rocket-and-space, and food industries

Specification

The technology for obtaining a metal strip or sheet directly from the melt by combining the crystallization of the metal and its subsequent plastic deformation in one operation; allows the production of 1–5 mm thick aluminum strips and sheets

Advantages

In contrast to the conventional technologies for obtaining rolled products from aluminum alloys, this one allows reducing the energy consumption (3–7 times), the production cycle (down to 15 minutes), the harmful emissions (down to 90%), and the processing line length (down to 50 m)

Intellectual Property Protection

IPR2

Readiness Level.

Suggestions for Commercialization

IRL6, TRL6

Partners in technology commercialization wanted

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TECHNOLOGY FOR PRODUCTION OF HIGHLY WEAR-RESISTANT RAILWAY WHEELS

Areas of Application

Production of all-rolled wheels from high-carbon low-alloy steel for railway transport

Specification

The developed composition of steel for railway wheels and the conditions of their thermal hardening provide the following mechanical properties:

σ_{B} , MPa ≥ 1100

δ , % ≥ 14.0

Ψ , % ≥ 15.0

Hardness in the rim cross section, HB 321 – 415

Surface hardness, HB 341 – 415

The wheels comply with ASTM class M107 / M108. Designed for the operation under the conditions of light braking and high axle loads, have increased wear resistance



Readiness Level.

Suggestions for Commercialization

IRL8, TRL8

TOR for the conditions of heat treatment of railway wheels and the composition of steel for their manufacture.

Sale of patents for chemical composition and heat treatment conditions as an option

Advantages

Choosing the optimal chemical composition of steel for railway wheels and improving the conditions of their heat treatment increase wear resistance by ~10% and resistance to peeling by ~65% as compared with class C wheels according to ASTM M107 / M108 (light braking conditions and high loads)

Intellectual Property Protection

IPR3

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TECHNOLOGY FOR ELECTRO-SLAG WELDING OF TITANIUM ALLOYS



Welding of titanium plates



Appearance of welds



Weld seam and macrostructure

Areas of Application

Welding thick (40 – 400 mm) parts and assemblies of titanium and its alloys to make butt, corner, and T-joints

Specification

Welding is made by vertical seams in one pass without beveling. The maximum thickness of the weld metal at the joint is 400 mm with a maximum seam length of up to 2 m and a welding gap of 22 – 30 mm. For a thickness of 120 mm, the welding speed is 2 – 2.5 m/h

Advantages

The technology enables welding ultra-thick products in one pass without beveling; high welding productivity; dense structure of the weld metal without pores, inclusions, incomplete fusion, and other defects; no evaporation in the course of welding of alloying components. The use of bulky and expensive vacuum chambers is not required

Readiness Level.

Suggestions for Commercialization

IRL5, TRL7

Sale and implementation of technology, manufacture support, custom welding

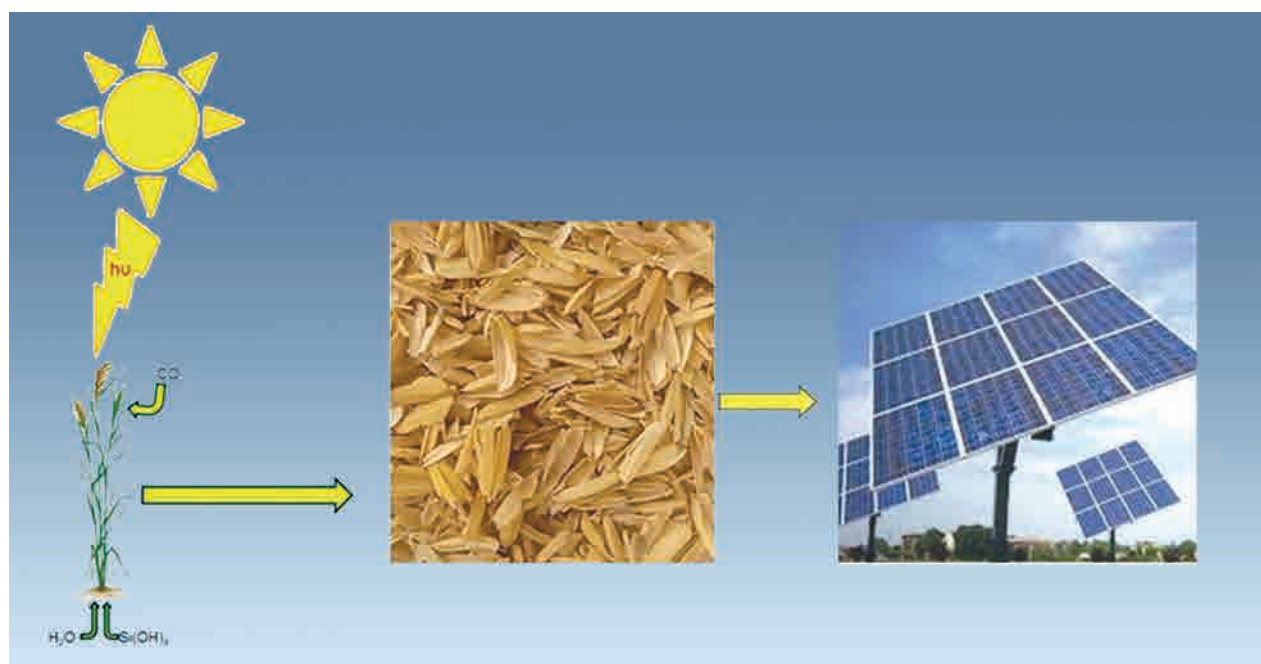
Intellectual Property Protection

IRP1, IRP2

Contact Information

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TECHNOLOGY FOR OBTAINING HIGH-PURITY AMORPHOUS SILICON DIOXIDE FROM PLANT RAW MATERIALS



Areas of Application

Obtaining high-purity amorphous biogenic silicon dioxide for microelectronics, in particular, for the manufacture of solar panels; for the production of sorbents for medicine and chromatography, etc.

Specification

The integrated technology of vegetable waste processing has the following stages: the preparation of raw materials for further processing; the thermal decomposition of biomass; the fractionation of ash residue formed after heat treatment, for obtaining high-purity silicon dioxide (99.9995 – 99.9998%) with a particle size of 8 – 50 nm

Advantages

In contrast to the world-known technologies for the processing of vegetable waste, most of which are energy-oriented, this one involves the simultaneous production of high-purity SiO_2 and high-energy gas that may be used for industrial purposes. Technology is waste-free

Readiness Level. Suggestions for Commercialization

IRL6, TRL6
Technology transfer. Partners
for the launching mass production wanted

Intellectual Property Protection

IPR3

Contact Information

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ETHYL ACETATE PRODUCTION TECHNOLOGY



Areas of Application

Production of commercial ethyl acetate

Specification

Vapor-phase catalytic conversion
of ethanol to ethyl acetate
in a fixed reactor with a fixed catalyst bed
Process parameters:

Temperature, °C	240
Pressure, MPa	0.4–0.6
Selectivity for ethyl acetate, %	up to 98
Productivity (ethyl acetate), kg / t _{cat} / h	440

Advantages

Unlike the existing technologies,
this one does not require the use
of corrosive acetic and sulfuric acids.
Processing 1 000 kg ethanol gives 970 m³
hydrogen additionally, which results
in reduced energy consumption

Readiness Level.

Suggestions for Commercialization

IRL7, TRL7

The technology has been developed jointly
with *Techinservice Production Group LLC*.
Transfer of license, process documentation,
support in plant design and construction,
delivery of equipment and catalyst,
and start of 20 000 t / year plant

Intellectual Property Protection

IPR3, IPR5

Contact Information

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TECHNOLOGY FOR PRODUCTION OF CAST PRODUCTS FROM SPECIAL ALLOYS WITH THE USE OF NEW THERMOSTABLE MODIFIED REFRACTORY MOLDING MATERIALS

Areas of Application

The production of critical castings
and high quality castings from special alloys
for power engineering and shipbuilding

Specification

The technology allows the production
of high-precision ceramic molds, rods,
filters for foundry production in conditions
of high-temperature liquid metal
(up to 2000 °C), which resist thermal shock



Ceramic mold obtained from a corundum-based
mix modified with aluminum powder (left),
and blade blocks manufactured
at Zoria – Mashproekt gas turbine plant

Advantages

Unlike the existing analogs, the products made
of new modified refractory molding materials
have a strength that is by 15 – 20% higher.
Their use makes it possible to obtain high-
quality products with a minimum thickness
of the modified layer at the metal – refractory
material interface and increases the yield
of suitable casting by 10 – 15%

Readiness Level.

Suggestions for Commercialization

IRL6, TRL6

Custom manufacture of molds, rods,
and filters. Sale of license

Intellectual Property Protection

IPR1, IPR2, IPR3

Contact Information

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PROPYLENE OXIDE PRODUCTION TECHNOLOGY



Areas of Application

Production of commercial propylene oxide

Specification

Liquid-phase reaction of propylene with hydrogen peroxide in acetonitrile in a flow reactor with a fixed catalyst bed
The process parameters are as follows

The process parameters:

Temperature, °C	50
Pressure, MPa	2.8
Selectivity toward propylene oxide (PO), %	98
PO purity, %	99.97

Advantages

For the first time, unlike the operating installations, acetonitrile is used instead of toxic methanol



Readiness Level.

Suggestions for Commercialization

IRL9, TRL9

The technology has been developed jointly with *Techinservice Production Group LLC* and tested on the existing facility that has a capacity of 2700 t PO / year.

Transfer of license, process documentation, support in plant design and construction, delivery of equipment and catalyst, and start of 100 000 t / year plant

Intellectual Property Protection

IPR3, IPR5

Contact Information

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TECHNOLOGY FOR PLASMA-INDUCTION GROWTH OF ULTRA-LARGE SINGLE CRYSTALS OF REFRACTORY METALS

Areas of Application

Growing ultra-large oriented tungsten and molybdenum single crystals in the form of plates or cylinders from the liquid phase

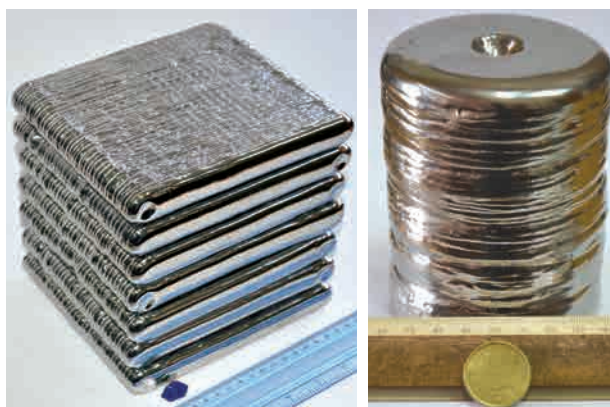
Specification

The single crystals are grown in plasma-induction plants, in a controlled atmosphere.

Power of pilot plants, kW	330
Dimensions of single crystals:	
Flat crystals, mm	170 × 20 × 250
Cylindrical crystals (diameter), mm	85
Productivity, kg/h	1



Plasma induction plant for growing single crystals of refractory metals



Tungsten single crystals: the flat one with dimensions 170 × 20 × 160 mm (left) and the cylinder-shaped one with a diameter of 85 mm (right)

Advantages

The formation of 1.5 times lower temperature gradients in the body of crystals, as compared with other methods for growing single crystals of refractory metals from the liquid phase; no need for continuity of the process of growing single crystals; the production of the largest structurally advanced single crystals of commercial-purity tungsten and molybdenum

Intellectual Property Protection

IPR1, IPR3

Readiness Level.

Suggestions for Commercialization

IRL4, TRL4

Technology introduction and production support; design, supply, and maintenance of equipment; production of tungsten and molybdenum single crystals shaped as ingots

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TECHNOLOGY FOR HEAT TREATMENT OF SPARINGLY ALLOYED STEELS FOR THE MANUFACTURE OF HIGH-STRENGTH PIPE ROLLING TOOLS



Piercing mill mandrel

Advantages

The use of sparingly alloyed steel 25X2M1Φ after heat treatment according to the designed conditions makes it possible to extend life of the pipe-rolling tool more than twice, as compared with that of the tool made of alloy steel 20XH4ΦA

Areas of Application

The manufacture of piercing mill mandrels from sparingly alloyed steels with extended service life

Specification

The recommended heat treatment conditions allow extending life of the mandrels made of conventional 20XH4FA steel and of the recommended 25X2M1F steel

Mandrel material	Heat treatment conditions	Endurance, pcs
20XH4ΦA	Existing	35
	Proposed	102
25X2M1Φ	Existing	58
	Proposed	220

Readiness Level.

Suggestions for Commercialization

IRL8, TRL8

Specifications for the conditions of heat treatment of piercing mill mandrels and recommendations on the composition of steel for their manufacture

Intellectual Property Protection

IPR3

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NSFM-T-1 TRIFUNCTIONAL NONWOVEN SORPTION-FILTERING MATERIAL

Areas of Application

The manufacture of nonwoven sorption-filtering materials for making gas mask elements (GME). These elements are used for gas cleaning equipment, in particular, for respirators protecting from toxic acid (SO_2 , SO_3 , SiF_4 , HF, HCl, and Cl_2) and alkaline (NH_3 and organic amines) gases and vapors, as well as from vapors of organic compounds

Specification

Simultaneous protection against acid and alkaline gases and vapors, as well as vapors of organic compounds. The socio-economic effect is the prevention of occupational diseases

Advantages

The material is able to capture simultaneously acid and alkaline gases and vapors, as well as vapors of organic compounds. There are no world analogs

Readiness Level.

Suggestions for Commercialization

IRL6, TRL6

Custom manufacture of small batches. Partners for upgrading the production facilities, launching the serial production and marketing wanted

Intellectual Property Protection

IPR1, IPR3

Contact Information

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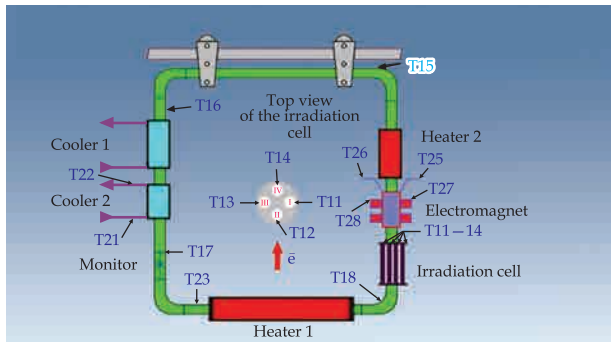
a



b

Example of the use of NSFM-T-I trifunctional nonwoven sorption-filter material for anti-gas element.
a – multifunctional filtering respirator MFR (Specifications TU U 28.2-01530125-051:2021),
b – gas- and dust-proof element for MFR respirator, which protects from airborne particles of different origins (dust, smoke, fog), toxic acid and alkaline gases and vapors, as well as vapors of organic compounds

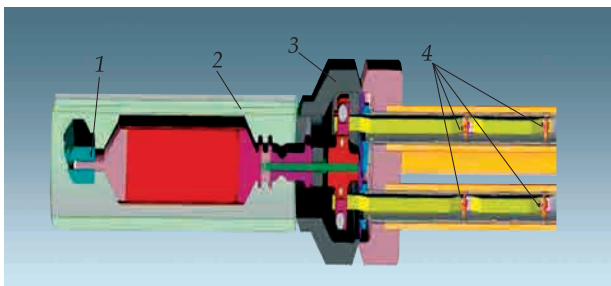
EQUIPMENT FOR STUDYING CORROSION OF MATERIALS UNDER THE INFLUENCE OF RADIATION AND STATIC AND CYCLIC DEFORMATION IN SUPERCRITICAL CONVECTION WATER LOOPS



Supercritical water convection loop (SCWCL)
(e is electron beam, T is thermocouple)



SCWCL location in the bunker room of the LPE-10 electron linear accelerator



The upper part of the four-channel irradiation chamber
(1 – magnetic core guide; 2 – the magnetic core chamber;
3 – the transition chamber; 4 – the eccentrics that deform the samples)

Intellectual Property Protection
IPR2

Areas of Application

The study of surface corrosion of statically and dynamically stressed samples under the influence of water in subcritical and supercritical states and electrons with an energy of 10 MeV

Specification

The four-channel chamber provides the ability to irradiate samples with electrons having an energy of 10 MeV.

Internal diameter of the channels, mm	10
Outer diameter, mm	14
Length, mm	280
Pressure of supercritical water in the channels at a temperature of up to 400 °C, MPa	25
Mass flow rate, g/s	up to 70
Duration of samples deformation, s	0.33 – 1

To study the corrosion of materials under mechanical stress, special cassettes that provide controllable strain and stress of the samples have been created

Advantages

Testing the promising materials for next-generation nuclear reactors in supercritical state water under mechanical stress and irradiation; there are no world analogs

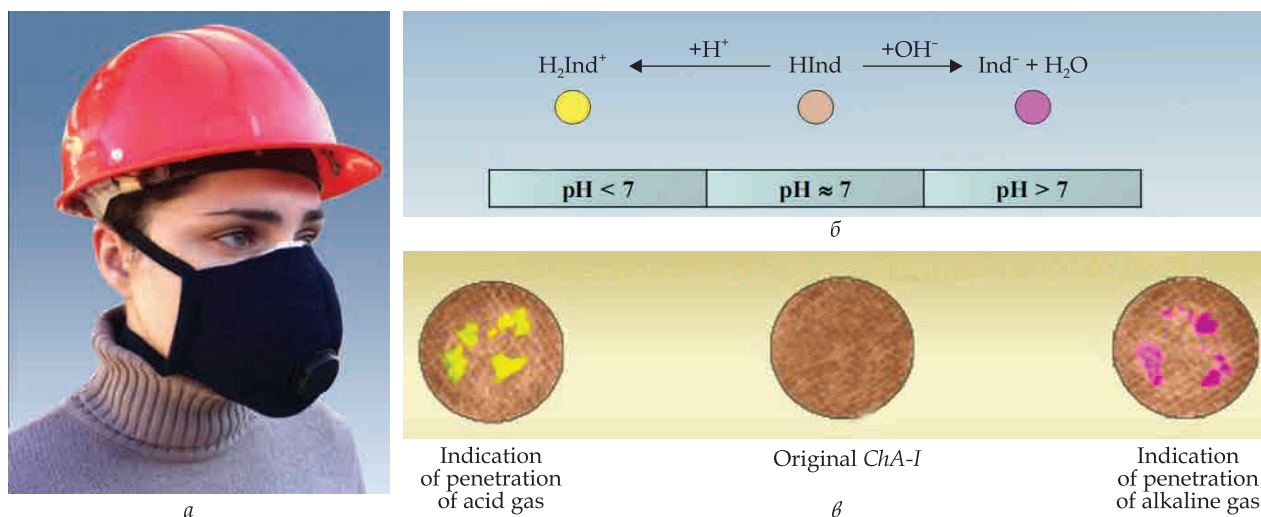
Readiness Level.
Suggestions for Commercialization

IRL6, TRL4
Testing customer's materials in the laboratory conditions

Contact Information

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CHA-I CHEMOSORBENT AMPHOLYTE OF PROLONGED ACTION WITH DYNAMIC ABSORPTION CAPACITY DEPLETION INDICATION



Example of the use of ChA-I chemisorbent ampholyte of prolonged action with indicator of "depletion" of dynamic absorbing capacity as material for anti-gas element with the determination of time of penetration of acid or/and acid alkaline gases and vapors from the air in the working area into the submask space.

a — gas and dust respirator LUR (Specifications TU U 28.2-01530125-049:2018); *b* — mechanism of indication of "depletion" of dynamic absorbing capacity; *c* — visual indication of penetration

Areas of Application

The production of sorption-filtering fibrous materials for making gas masks elements (GME) to be used in gas cleaning equipment, in particular, respirators for protection against toxic acid or/and alkaline gases and vapors

Specification

Visual indication of "depletion" of the dynamic absorption capacity of GME in the course of absorption of acid or/and alkaline gases and vapors, which allows efficient use of GME. The socio-economic effect includes preventing occupational diseases, saving chemisorption material, as well as reducing the number of staff to monitor the effectiveness of respirators

Advantages

Visual indication of the "depletion" of dynamic absorption capacity allows the timely replacement of expensive GME of the respirators and provides their further use without additional devices. There are no world analogs

Readiness Level. Suggestions for Commercialization

IRL6, TRL6
Custom manufacture of small batches. Partners for upgrading the production facilities, launching the serial production and marketing wanted

Intellectual Property Protection

IPR1, IPR3

Contact Information

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- AUTONOMOUS ELECTRIC TRANSPORT OF A SMALL CLASS FOR VARIOUS INDUSTRIES
- AUTONOMOUS POWER SUPPLY SYSTEMS USING RENEWABLE ENERGY SOURCES
- AUTONOMOUS AND NETWORK CHARGING SYSTEMS FOR ELECTRIC VEHICLES USING RENEWABLE ENERGY SOURCES
- ATLAS OF ENERGY CAPACITY OF RENEWABLE ENERGY SOURCES IN UKRAINE
- DRUM DRYER WITH DYNAMIC ADJUSTMENT OF THE DRUM TILT ANGLE
- WIND PUMP
- GAS BURNERS FOR THE HEATING SYSTEMS OF STEEL LADLES STANDS OF METALLURGICAL WORKS
- GEOTHERMAL AIR CONDITIONING SYSTEM WITH FAN COIL
- GEOTHERMAL CIRCULATING HEAT STATION
- PRODUCTION OF SEALED INDUSTRIAL LEAD-ACID BATTERIES
- REVERSE HYDRAULIC UNIT FOR MICRO-PUMPED STORAGE HYDROELECTRICITY STATION
- ELECTRODE MATERIALS FOR SUPERCAPACITORS
- ELECTRIC DISCHARGE EQUIPMENT FOR OBTAINING A WATER-COAL SUSPENSION
- CAPACITIVE HEAT ACCUMULATOR
- CATALYSTS FOR HYDROGEN PRODUCTION FROM BIOETHANOL
- VALVE-ADJUSTABLE LEAD-ACID VRLA BATTERIES
- COBALT-NITROGEN-CARBON OXYGEN REDUCTION ELECTROCATALYSTS FOR LOW-TEMPERATURE FUEL CELLS AND METAL-AIR POWER SOURCES
- COMPLEX FOR COMPOSITE BIO- AND PEAT FUEL PRODUCTION
- PEROVSKITE STRUCTURE COMPOSITE BASED MATERIALS WITH HIGH DIELECTRIC CONSTANT
- UVT-1 METROLOGICAL COMPLEX
- EQUIPMENT FOR THERMAL DISPOSAL OF PHENOLIC WATER AND OTHER LIQUID HARMFUL IMPURITIES
- BURNERS FOR MODERNIZATION OF METALLURGICAL EQUIPMENT
- BURNERS FOR HEATING SYSTEM OF ROTARY KILNS
- FRONT-END SEAL FOR HIGH-PRESSURE CYLINDER OF POWERFUL STEAM TURBINE
- BAP – 1.5 BLOWN AIR PREHEATER
- SOFTWARE FOR DETERMINING THE OPTIMAL SETTINGS THE UNDER-FREQUENCY LOAD SHEDDING (UFLS) OF POWER SYSTEMS
- INDUSTRIAL ENERGY-PARK WITH THE USE OF RENEWABLE ENERGY SOURCES
- PUMP-TURBINE FLOW PART FOR 80–120 m HEADS
- RECONSTRUCTION OF NDISTU-5 BOILERS
- LANDFILL BIOGAS COLLECTION AND UTILIZATION SYSTEM
- BULK MATERIAL DEFROSTING SYSTEM IN RAILWAY CARS
- THERMAL ENERGY STORAGE SYSTEMS
- ALLOY FOR HYDROGEN STORAGE
- CREATION OF SERIAL PRODUCTION FOR THE MANUFACTURE OF LITHIUM-ION BATTERIES AND RECHARGEABLE BATTERIES
- HIGH-SPECIFIC POWER SUPERCAPACITORS
- HEAT GENERATOR ON VEGETABLE ORIGIN FUEL
- MWH MODULAR WATER TUBE HEAT-RECOVERY EXCHANGER
- NEW GENERATION TUBE HEAT EXCHANGER ON PROFILED PIPES
- DEVICE FOR NEUTRALIZATION OF THE CONDENSATE FROM GAS COMBUSTION PRODUCTS BY THE NON-REAGENT METHOD
- OXIDATIVE PYROLYSIS INSTALLATION

POWER ENGINEERING AND ENERGY EFFICIENCY



SMALL AUTONOMOUS ELECTRIC TRANSPORT FOR VARIOUS INDUSTRIES



Samples of small class electric cars produced

Areas of Application

Passenger electric mini-cars, sanitary electric cars, small cargo electric cars, small city electric buses, and special electric cars for military purpose

Specification

Small vehicles with a speed of 60 – 90 km/h and a distance on one charge of up to 130 km; Electric trucks with a capacity of up to 1.2 tons; city electric buses with a capacity of up to 12 passengers, etc.

Advantages

Simple design, the vehicle is equipped with relatively cheap lead-acid traction batteries

Intellectual Property Protection
IPR3

Readiness Level.
Suggestions for Commercialization

IRL8, TRL7

Partners for the launch of serial production and marketing of finished products wanted

Contact Information

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AUTONOMOUS POWER SUPPLY SYSTEMS USING RENEWABLE ENERGY SOURCES



Wind solar power supply systems

Areas of Application

Power supply systems for autonomous facilities located far from power lines; the equipment of energy-generating facilities for units of the Ministry of Emergencies, the Armed Forces of Ukraine, and the National Guard

Specification

Autonomous systems of small powering engineering, which have a capacity from 1 to 30 kW and are equipped with storage batteries: autonomous solar energy systems (SES), autonomous wind power plants (WPP) and integrated (or hybrid) wind solar energy systems (WSES)

Advantages

Autonomous power systems are based on a modular principle that, due to the appropriate set of SES, wind turbines, and accumulators, allows quickly equipping the power plants of a certain capacity, given the geographical location of the power-generating facility and the solar energy to wind energy ratio

Readiness Level.

Suggestions for Commercialization

IRL8, TRL7

Partners for the launch of serial production and marketing of finished products wanted

Intellectual Property Protection

IPR3

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AUTONOMOUS AND NETWORK CHARGING SYSTEMS FOR ELECTRIC VEHICLES USING RENEWABLE ENERGY SOURCES



Areas of Application

Wind and solar energy systems for charging hybrid electric cars with an electric energy storage system and universal chargers supporting modern electric car charging protocols

Specification

Hybrid charging systems based on renewable energy sources with a power capacity up to 50 kW are designed to operate both stand-alone and connected to the integrated power smart system (smart-grid)



General view and operation of the wind and solar charging station



Electrical storage system of the station

Advantages

The control system of the charging complex provides optimization of the level of accumulated energy for fast charging of electric vehicles given their routes, traffic density, current state of battery charge, intensity of local wind generation, charge reserve in batteries at a given and neighboring stations. Equipping the charging stations with wind solar modules and smart grids connected to a single power scheduling system enables smoothing out uneven wind generation and consumption peaks and providing additional services for common networks, such as frequency stabilization

Readiness Level. Suggestions for Commercialization

IRL7, TRL6

Partners for the launch of serial production and marketing of finished products wanted

Intellectual Property Protection
IPR3

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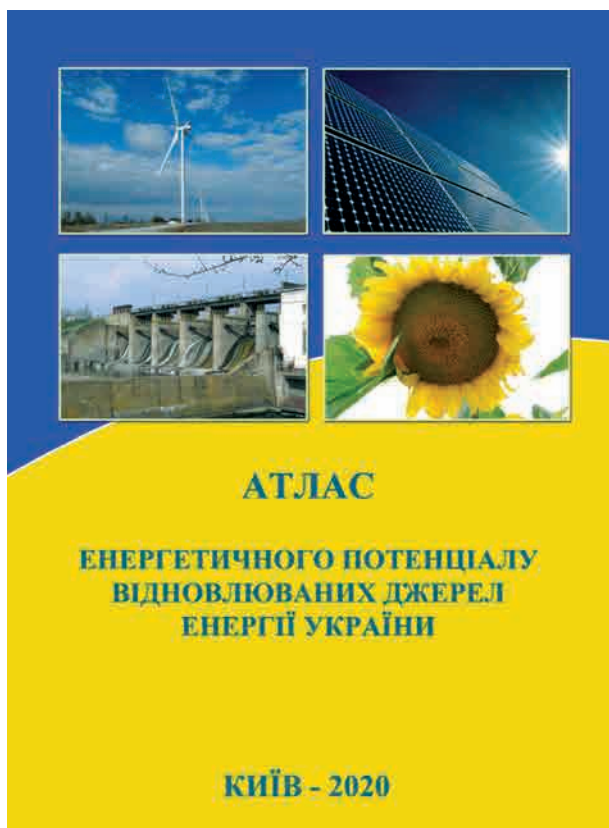
ATLAS OF ENERGY CAPACITY OF RENEWABLE ENERGY SOURCES IN UKRAINE

Areas of Application

Research, exploration, and design works for developing and implementing renewable energy equipment and its mastering by teachers, graduate students, and students of higher educational establishments, as well as for employees of central and regional authorities dealing with problems of the development of low-carbon economy in Ukraine

Specification

It represents the indicators of technically achievable renewable energy potential in Ukraine (wind, solar, small hydropower, biomass, geothermal energy) that can be implemented using modern technology. Information on the energy potential of "green" hydrogen production in Ukraine is provided



Advantages

The information and analytical system for assessing the energy capacity of renewable energy of Ukraine is a single information environment with interconnected cartographic and digital data, reference and methodological support. For the first time, information on the energy capacity of "green" hydrogen production in Ukraine has been available. This is especially relevant for the possibility of implementing carbon-free energy in Ukraine

Readiness Level.
Suggestions for Commercialization

IRL7, TRL8
Sale of copies of the Atlas or updated data for individual regions

Intellectual Property Protection
IPR1

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DRUM DRYER WITH DYNAMIC ADJUSTMENT OF THE DRUM TILT ANGLE



Areas of Application

High-temperature drying of the biomass of plant and wood origin for its use in technologies for the production of biofuels or granular feed in power engineering and agriculture

Readiness Level.

Suggestions for Commercialization

IRL5, TRL4

Custom design, manufacture, and supply of equipment

Specification

Temperature of drying agent, °C	250–450
Initial moisture content in raw materials, %	70–40
Final moisture content of the product, %	8–10
Average fraction size, mm	0.5–5
Drum tilt adjustment	–3° to +3°
Specific heat consumption of moisture, kJ/kg	from 4700 to 5200
Productivity in terms of end product, kg/h	1000–1800
Consumption, kWh/t:	
thermal energy	950
electric energy	4
Dimensions, m	13 × 4 × 2

Intellectual Property Protection

IPR3

Advantages

In comparison with the domestic analogs, this device allows expanding the range of adjusting the moisture content to 30–85 kg moisture / (m³ h) and increasing the energy efficiency up to 24%

Contact Information

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WIND PUMP



Areas of Application

Lifting water from different water sources for autonomous or backup water supply and for irrigation of crops

Specification

Nominal productivity at a wind speed of 5 m/s and a lifting height of 28 m, m ³ /h	1.2
Maximum height of water rise, m	up to 40
Rotor diameter, m	2.4
Rotor angular speed, s ⁻¹	10.5
Height to the rotor axis, m	10.6
The weight of the installation net of foundations and pressure pipes. kg	600

Advantages

Automatic protection against emergency wind gusts, adaptability to wind conditions of Ukraine by average annual wind speed



Prototype wind pump
(the Polubotky Village, Chernihiv Oblast)

Readiness Level. Suggestions for Commercialization

IRL5, TRL6
Specification for industrial design and author's supervision

Intellectual Property Protection IPR3

Contact Information

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GAS BURNERS FOR THE HEATING SYSTEMS OF STEEL LADLES STANDS OF METALLURGICAL WORKS



Specification

The use of the burners ensures the achievement of the maximum thermal capacity of 1.4 MW at a natural gas consumption of 140 m³/h., power adjustment range is 1: 5.

The emissions of nitrogen oxides NO_x reduced to $\alpha = 1.0$ amount to 212 mg / m³, those of carbon monoxide are 0.0216 vol. %

Areas of Application

Heating of steel ladle stands in order to ensure the stability of combustion, uniform heating of the lining and to reduce the consumption of natural gas

Advantages

In contrast to the existing heating systems for steel ladles, this one allows achieving stable and complete combustion of natural gas within the internal space of the industrial ladle and an increase by 50 – 100 °C in the heating temperature of the working layer of the lining after heating; uniform heating of the lining while keeping a difference of temperature on its surface at 50 °C, at most; 20% savings in natural gas

Readiness Level.

Suggestions for Commercialization

IRL8, TRL9

Custom manufacture, delivery, commissioning, warranty service, and staff training. The term of manufacture and delivery of burners is 2 months

Intellectual Property Protection

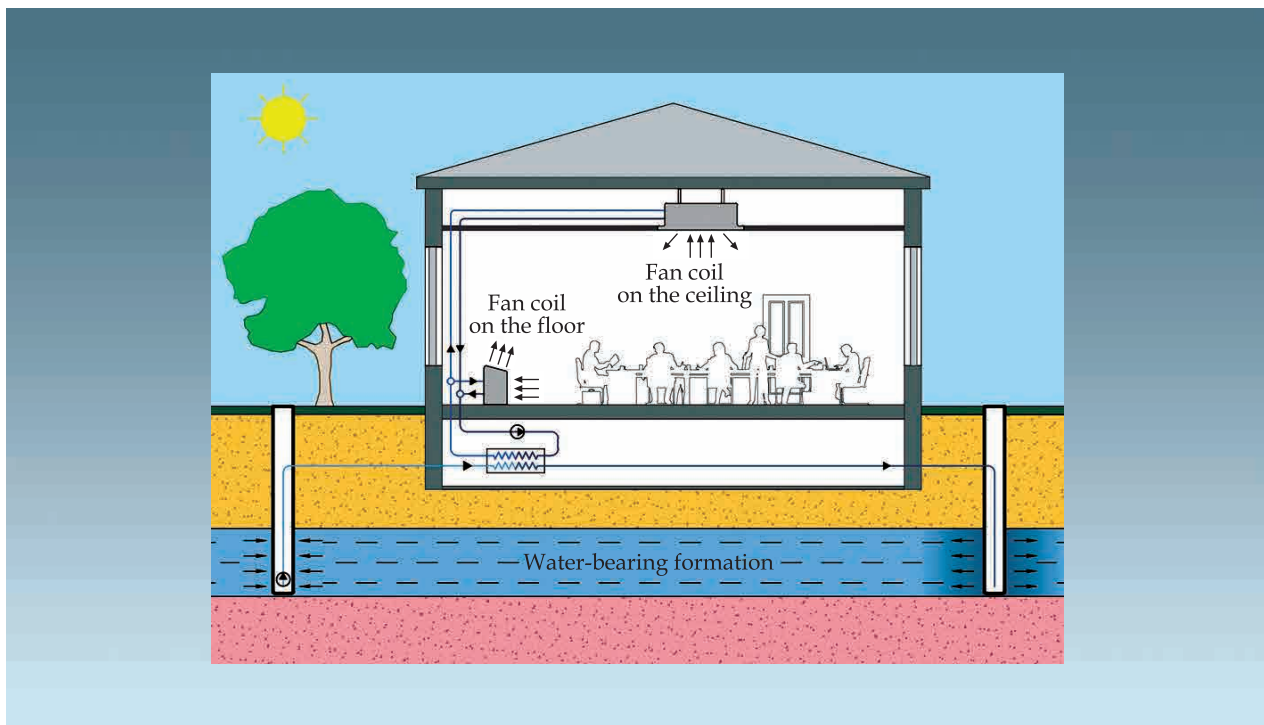
IPR3

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GEOTHERMAL AIR CONDITIONING SYSTEM WITH A FAN COIL



Flowchart of the geothermal air conditioning system with a fan coil

Areas of Application

To create comfortable living conditions for people in social and domestic facilities through the use of groundwater from the upper horizons

Specification

Fan coil as device for air cooling	
Power, kW	25 – 100
Floor area, m ²	500 – 10000
Number of wells	2 and more
Flow rate of a single well, m ³ /h	2 – 5
Groundwater temperature, °C	8 – 12

Advantages

As good as the world analogs.
Saves up to 90% of electricity during the operation of the air conditioning system.
No emissions of pollutants into the atmosphere

Readiness Level. Suggestions for Commercialization

IRL6, TRL8
Design works and engineering support

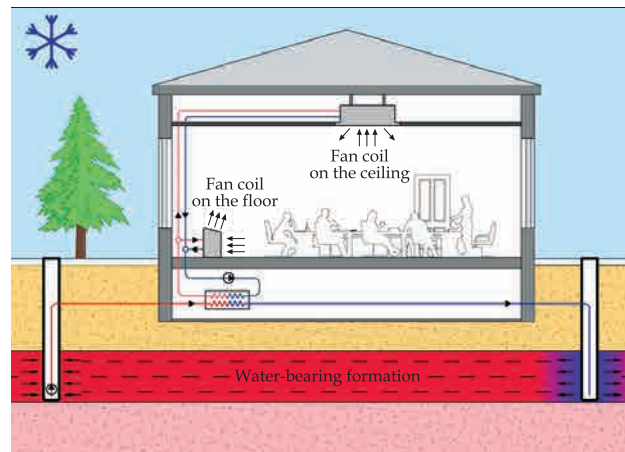
Intellectual Property Protection

IPR3

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GEOHERMAL CIRCULATING HEAT STATION



Flowchart of a geothermal circulating thermal power plant

Specification

Number of wells	2–4
Flow rate of a single well, m ³ /h	55–100
Geothermal water temperature, °C	65–90
Reservoir pressure, MPa	1.2
Thermal plant capacity, MW	1.5–3.5

Areas of Application

For efficient heat supply of socio-cultural and agricultural facilities

Readiness Level.
Suggestions for Commercialization

IRL6, TRL8
Specification for industrial production of geothermal plant, author's supervision

Advantages

There are no analogs in Ukraine. Geothermal circulating thermal power plant does not require fossil fuels, is environment friendly and enables reducing greenhouse gas emissions. The use of circulation technology extends the life of the geothermal station

Intellectual Property Protection

IPR3

Contact Information

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PRODUCTION OF SEALED INDUSTRIAL LEAD-ACID BATTERIES

Areas of Application

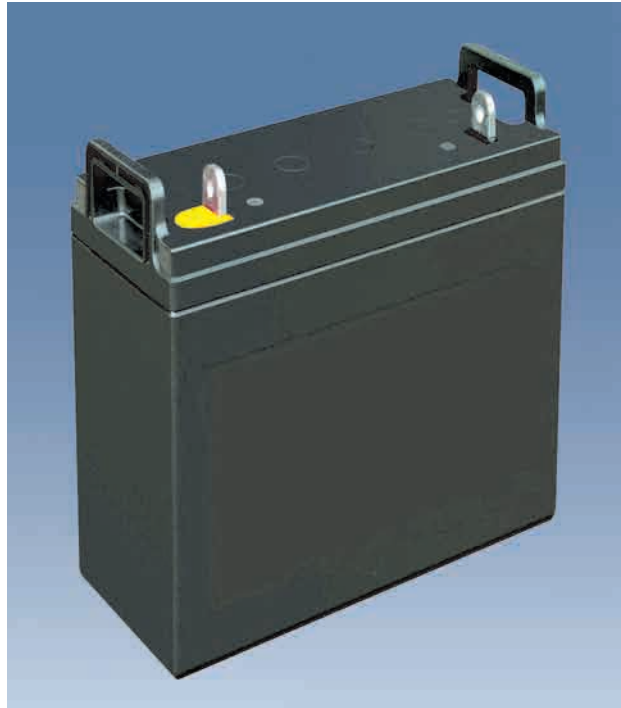
Energy sources for critical facilities, including the defense ones

Specification

Industrial stationary and traction batteries (cells) with liquid or bound electrolyte, a voltage of 2 V, and a capacity of 7 to 3000 A · h; block batteries consisting of these cells, with a voltage ranging from 6 to 80 V

Advantages

Autonomous, universal, reliable, cheaper as compared with foreign counterparts, due to the use of new engineering solutions



Readiness Level.
Suggestions for Commercialization

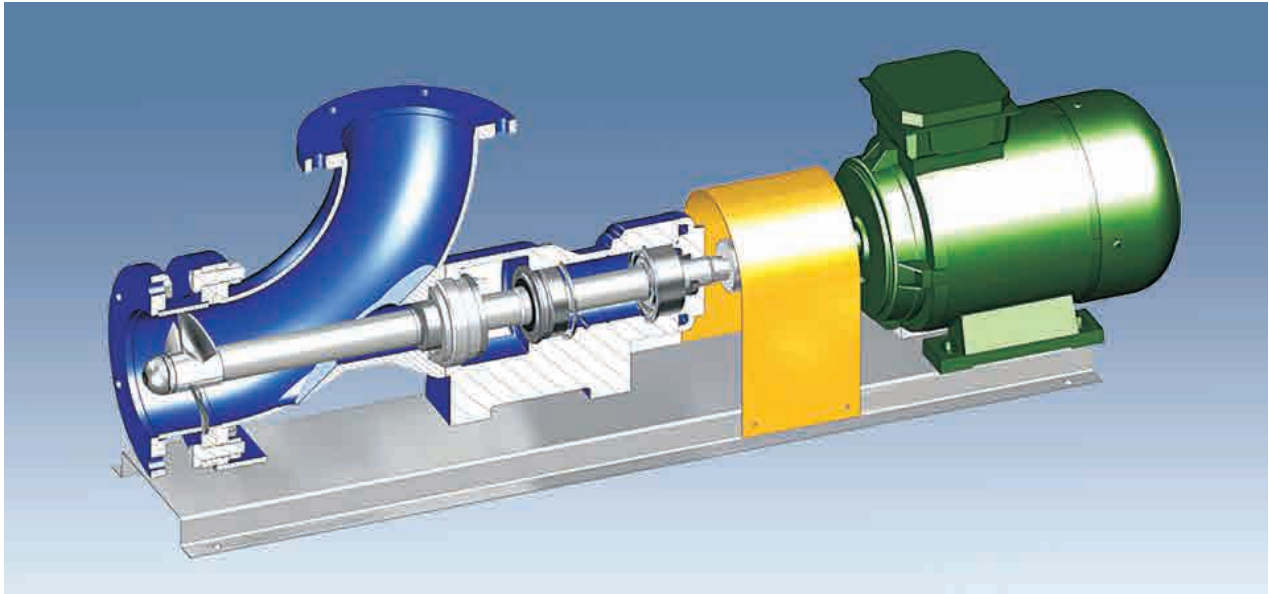
IRL8, TRL7
Partners for the launch of serial production
and marketing of finished products wanted

Intellectual Property Protection
IPR3

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REVERSE HYDRAULIC UNIT FOR MICRO-PUMPED STORAGE HYDROELECTRICITY STATION



Areas of Application

To storage energy of wind and photovoltaic plants in autonomous low-power grids and to balance electricity flows between consumers as well as to cover a deficit or a surplus of electricity in local grid

Specification

Power unit, kW	5–100
Water supply, m ³ /s	0.1–0.5
Water head, m	4–30

Readiness Level. Suggestions for Commercialization

IRL6, TRL5
Custom calculation of the pump and motor design parameters; specifications and procedures; R&D support, staff training

Intellectual Property Protection

IPR2

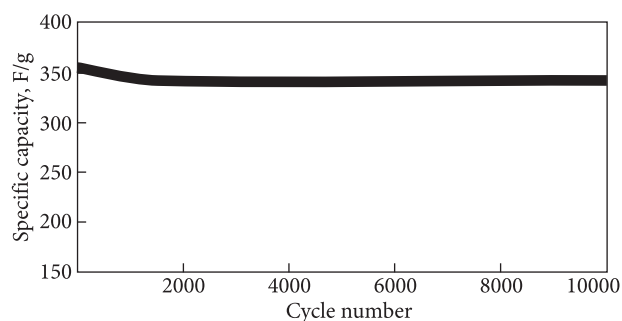
Advantages

The hydro pumped storage technology for renewable sources has a cheaper specific cost and higher energy intensity, in comparison with the conventional electrochemical technology based on batteries. The hydraulic unit is based on the serially manufactured vane pump and asynchronous pole-changing motor. At a high speed, the motor serves as a drive for the pump to accumulate water into the tank. Under the pressure of the accumulated water, the pump works in the turbine mode, and the engine operates as generator, at a low speed of rotation. Does not require pre-design and manufacture

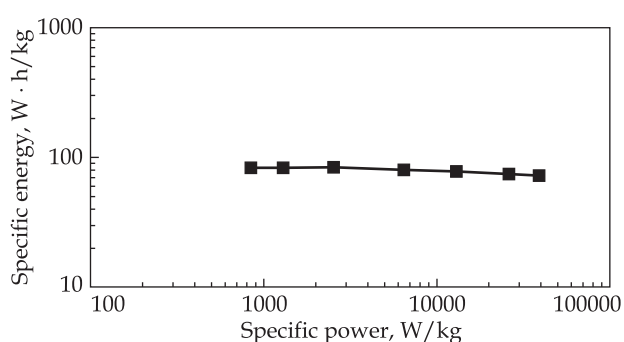
Contact Information

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+38 044 206 28 09, e-mail: renewable@ukr.net

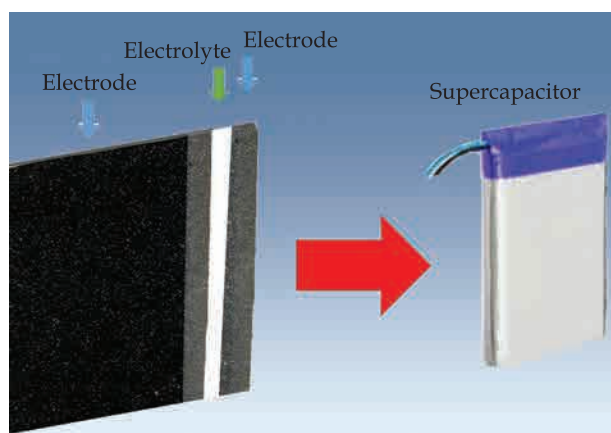
ELECTRODE MATERIALS FOR SUPERCAPACITORS



Charge-discharge cycling of the asymmetric supercapacitor based on 2D material



Dependence of specific energy on specific power (Ragone plot) of the asymmetric supercapacitor based on 2D material



The use of electrode material for the creation of supercapacitor

Areas of Application

Creation of electrodes for symmetric supercapacitors

Specification

Materials are based on conductive polymers and two-dimensional (2D) particles for the creation of electrodes for supercapacitors. Specific electrode capacity is up to 900 F/g in the range of potentials from 0.2 to 1.0 V vs Ag/AgCl; charge/discharge current is up to 50 A/g; retains 96% of capacity after 10 000 charge/discharge cycles; specific energy is ~100 W·h/kg, power is ~50 kW/kg

Advantages

As compared with the analogs, the supercapacitor based on the proposed electrode materials may operate at high charge/discharge currents, has a high stability of charge/discharge cycling, high specific energy and power. Due to the absence of organic solvents, the supercapacitor based on the mentioned materials is less toxic and fire-hazardous as compared with the existing analogs

Intellectual Property Protection

IPR2, IPR3

Readiness Level.

Suggestions for Commercialization

IRL3, TRL6

Custom manufacture of small batches. Partners for testing the suitability for serial production and assessing the prospects for industrial manufacture wanted

Contact Information

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ELECTRIC DISCHARGE EQUIPMENT FOR OBTAINING A WATER-COAL SUSPENSION



The process of WCS burning

Areas of Application

To obtain water-coal fuel suspensions with at least 96% of particles having a size from 0 to 70 μm

Intellectual Property Protection
IPR3

Specification

Productivity of one discharge channel, m^3/h	1.2–1.5
Specific energy consumption, kWh/t	~30
Nominal stored energy, kJ	2.5
Total power, $\text{kV} \cdot \text{A}$	5

Advantages

One-stage process of obtaining a stable water-coal suspension; ecological purity of the process of preparation and combustion of water-coal suspension by increasing the completeness of combustion of the obtained water-coal suspension and reducing the sulphur content to less than 1%; any brand of coal, including waste, dust or lignite are suitable for the preparation of water-coal suspension; fine disintegration of coal with much lower (up to twice) energy consumption.

The equipment has no analogs in Ukraine and throughout the world

Readiness Level.

Suggestions for Commercialization

IRL7, TRL6

Custom manufacture, warranty service, and staff training

Contact Information

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CAPACITIVE HEAT BATTERY



Capacitive heat battery



"Warm core"

Specification

Thermal power, kW	0.1–0.3
Temperature range, °C	35–95
Heat productivity, kW · h	50
Charging time, h	1–2
Discharge time, h	4–6
Loaded weight, kg	220
Battery volume, l	1500
Dimensions:	
Diameter, m	1.0
Height, m	2.0

Areas of Application

Accumulation and storage of thermal energy, for domestic and industrial needs

Advantages

As compared with the existing analogs, this battery has a higher specific heat capacity of the storage component (by 30%, on average); the integration of the battery into the heating system reduces fuel consumption by 10% and harmful emissions into the environment by 10%. It may be installed in autonomous facilities with a heating area of 1000 to 3000 m²

Readiness Level.

Suggestions for Commercialization

IRL7, TRL7

Custom manufacture, supply and maintenance, staff training

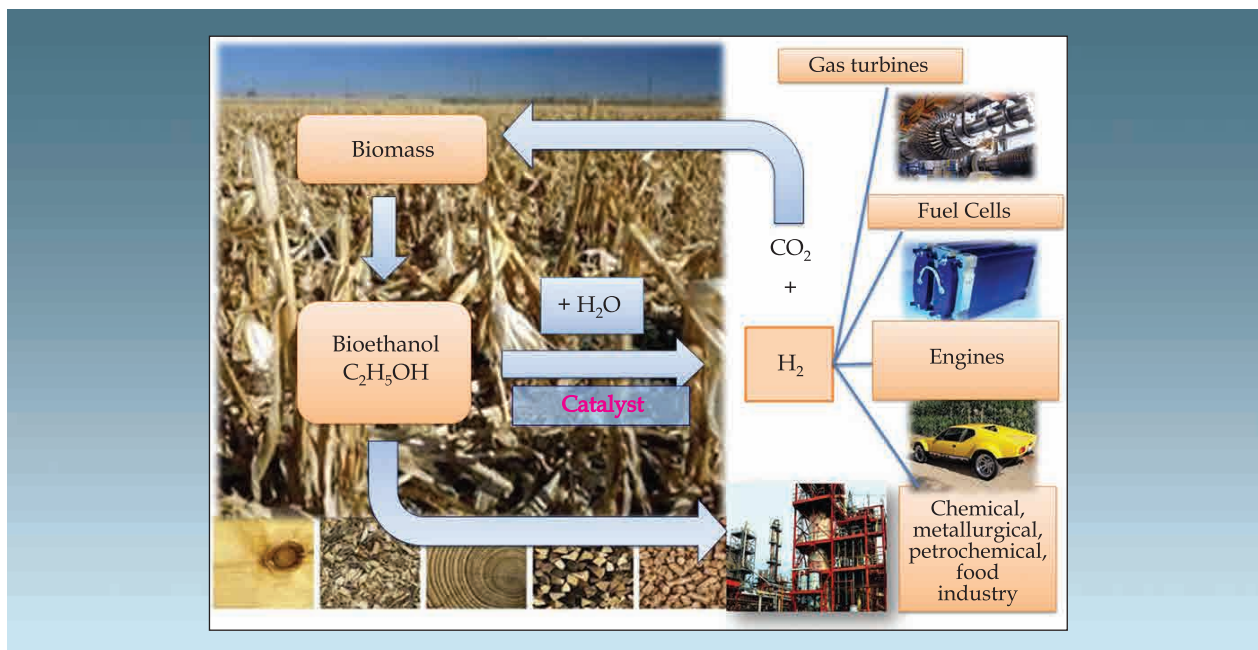
Intellectual Property Protection

IPR 2

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CATALYSTS FOR PRODUCTION OF HYDROGEN FROM BIOETHANOL



Flowchart of hydrogen production by steam reforming of bioethanol

Specification

Oxide granulated catalysts based on metal ferrites of the spinel structure. The catalysts provide a complete conversion of bioethanol within the temperature range 550–650 °C at a gas flow rate of 4000–5000 h⁻¹ with a hydrogen yield of 80–94% and a productivity in terms of hydrogen production of 500 l · h⁻¹ · kg⁻¹

Advantages

The proposed catalysts enable the production of hydrogen with a purity as good as that of the industrial hydrogen produced by the conventional method. At the same time, a high degree and selectivity of ethanol conversion are achieved. The catalysts are resistant to carbonization and do not require additional hydrogen consumption for reducing the active metal phase; they are cheaper than the analogs based on precious metals

Areas of Application

Hydrogen production from renewable resources as an alternative to processes with the use of fossil fuels

Readiness Level. Suggestions for Commercialization

IRL4, TRL4
Searching partners for pilot testing of the catalyst for production of hydrogen from bioethanol and assessing the prospects of industrial production of hydrogen with the use of the catalysts

Intellectual Property Protection IPR3

Contact Information

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VALVE-ADJUSTABLE LEAD-ACID VRLA BATTERIES

Areas of Application

Energy sources for all industries, emergency services, including the Ministry of Emergencies and the Red Cross, as well as the Armed Forces of Ukraine

Specification

Starter lead-acid batteries with connected electrolyte (VRLA), a voltage of 12 V, and a capacity from 40 to 225 A · h

Advantages

The batteries meet the most advanced market requirements for such products; do not require special handling conditions, have a high resistance to self-discharge and deep discharges; are completely explosive-safe and environment friendly; have increased energy capacity, reliability, service life, and are fully recyclable



Readiness Level.

Suggestions for Commercialization

IRL8, TRL7

Partners for the launch of serial production and marketing of finished products wanted

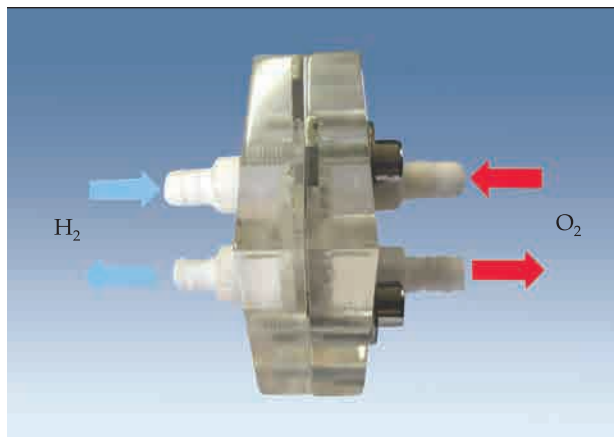
Intellectual Property Protection

IPR3

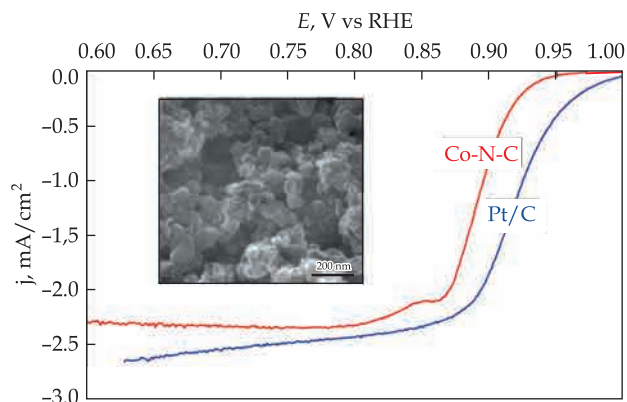
Contact Information

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COBALT-NITROGEN-CARBON OXYGEN REDUCTION ELECTROCATALYSTS FOR LOW-TEMPERATURE FUEL CELLS AND METAL-AIR POWER SOURCES



Model of a fuel cell with the use of Co-N-C oxygen reduction electrocatalyst



Electrochemical oxygen reduction on commercial Pt/C catalyst and Co-N-C catalyst prepared with the use of a deep eutectic solvent. Insert: SEM image of Co-N-C catalyst

Specification

Oxygen reduction electrocatalysts obtained by pyrolysis of cobalt-containing compounds based on nitrogen-containing conjugated polymers or deep eutectic solvents. Oxygen reduction start potential (E_{onset} vs. RHE) is $\sim 0.97 - 0.99$ V (1.0 M NaOH) and $0.79 - 0.81$ V (0.5 M H_2SO_4); half-wave potential ($E_{1/2}$ vs. RHE) is $\sim 0.87 - 0.89$ V (1.0 M NaOH) and $0.67 - 0.69$ V (0.5 M H_2SO_4)

Advantages

As compared with the analogs, these catalysts are characterized with higher E_{onset} and $E_{1/2}$ in alkaline electrolytes, simplicity and a low cost of production, the absence of precious metals in their composition, high stability in the process of long operation, and tolerance to methanol and CO

Areas of Application

Electrodes and materials for decreasing oxygen reduction overvoltage in low-temperature fuel cells and metal-air power sources

Readiness Level. Suggestions for Commercialization

IRL4, TRL3
Custom manufacture of samples.
Partners for testing the suitability for serial production of the electrocatalysts and assessing the prospects for industrial manufacture wanted

Intellectual Property Protection

IPR1, IPR2

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COMPLEX FOR COMPOSITE BIO- AND PEAT FUEL PRODUCTION



Fuel pellets (pine wood) with surface (left) and bulk (right) polymerization of biomass

Specification

Complex:

Type of raw materials: agricultural waste, wood

Productivity of technology, t/h 1.0–2.5

Power consumption, kWh/t

Thermal energy 950–1100

Electric energy 130–150

Dimensions, m 40 × 30 × 8

The resulting fuel:

Mechanical strength of pellets, % 98–99

Bulk density of pellets, kg/m 700–750

Moisture resistance increases
5–7 times

Heat of combustion, MJ/kg 16.5–17.5

Areas of Application

Production of granular biofuel
for the use in boiler equipment
of public utilities and industrial sector

Readiness Level.

Suggestions for Commercialization

IRL4, TRL4

Design documentation, the creation
of new and the upgrade of the existing
production facilities, custom manufacture
of equipment for basic stages of production

Advantages

As compared with the existing analogs,
the specific consumption of thermal
energy decreases by 7.5–14%,
that of electricity is lower by 8–16%

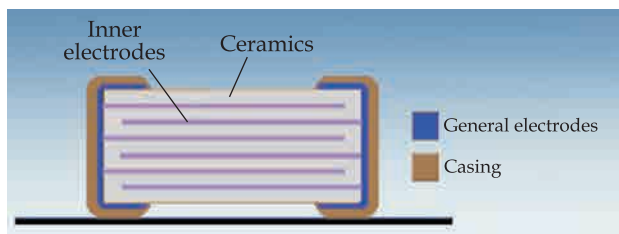
Intellectual Property Protection

IPR3

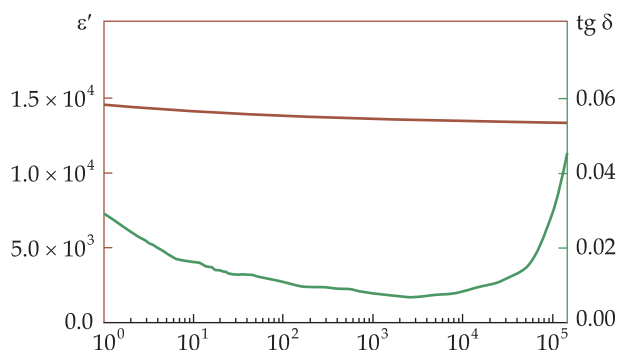
Contact Information

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PEROVSKITE STRUCTURE COMPOSITE BASED MATERIALS WITH HIGH DIELECTRIC CONSTANT UV-T-METROLOGICAL COMPLEX



The structure of multilayer ceramic capacitor



Permittivity and dielectric loss of material based on oxides of transition metals

Areas of Application

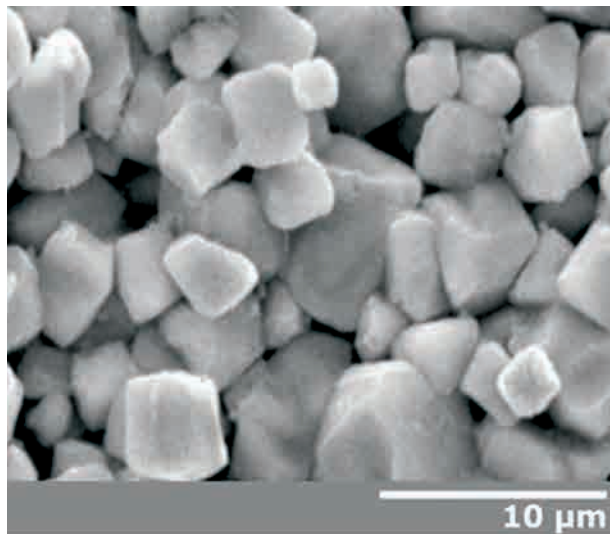
To be used for creating solid-state devices for energy storage and microminiaturizing electronic circuits that operate in the low and medium frequency ranges

Specification

Materials based on spontaneously polarized systems, $T = 20\text{ }^{\circ}\text{C}$.

Frequency	Dielectric constant	Dielectric loss
1 kHz	14 000	0.01
1 MHz	14 000	0.3

Intellectual Property Protection
IPR1, IPR2



Typical microstructure of the capacitor material

Advantages

A relatively low sintering temperature. A high dielectric constant. A relatively low dielectric loss. The obtained ceramic materials may be used for producing multilayer ceramic (MLC) capacitors with characteristics similar to the products manufactured by *Murata Manufacturing* [1, 2]. Due to the use of the developed impurities, these ceramic materials are sintered at a temperature that is lower by 100–200 °C as compared with the industrial analogs (from 1300 °C)

Readiness Level.
Suggestions for Commercialization

IRL7, TRL7
Custom manufacture of capacitor materials, testing of their parameters, delivery

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UVT-1 METROLOGICAL COMPLEX



Areas of Application

Determination of metrological properties of means for measuring the surface heat flux. It may be used at certification centers, calibration and testing laboratories of the construction, energy, and aerospace industries

Specification

Показник	I	II	III
Measurement range, W/m ²	1–50	$2 \cdot 10^1 - 2 \cdot 10^3$	$1 \cdot 10^4 - 2 \cdot 10^5$
Extended uncertainty in subranges (U), %	0.6	0.6	0.7

Advantages

In comparison with the existing metrological complexes, it has 10 times wider range of reproducible values of surface heat flux density; allows the examination of both contact, and contactless means of measurement; provides the reproduction of a measurement unit with an accuracy that meets the international standards

Intellectual Property Protection
IPR3

Readiness Level.
Suggestions for Commercialization

IRL6, TRL6
Manufacture and customization

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EQUIPMENT FOR THERMAL NEUTRALIZATION OF PHENOLIC WATER AND OTHER HARMFUL LIQUID IMPURITIES



Areas of Application

Thermal neutralization of phenolic water and other liquid harmful impurities of oil refining and chemical enterprises

Specification

Neutralization by heat treatment of liquid harmful impurities sprayed with water, with the use of devices for combustion of gaseous fuel. The nominal thermal capacity of the device for thermal neutralization is 2500 MW; the specific gas consumption is 3–5 m³/kg; the pressure of phenolic water (or other liquid harmful impurities) is 0.6 MPa; the temperature in the furnace chamber is 1000 °C

Advantages

As compared with the known methods for high-temperature disposal of phenolic water at oil refineries, in this case, the only material used is waste gas from oil refining that is usually burned in flares, which allows significant savings by avoiding the use of diesel fuel, water vapor and the construction of specially configured furnaces

Readiness Level.

Suggestions for Commercialization

IRL8, TRL9

Custom manufacture, commissioning, warranty service of equipment and staff training

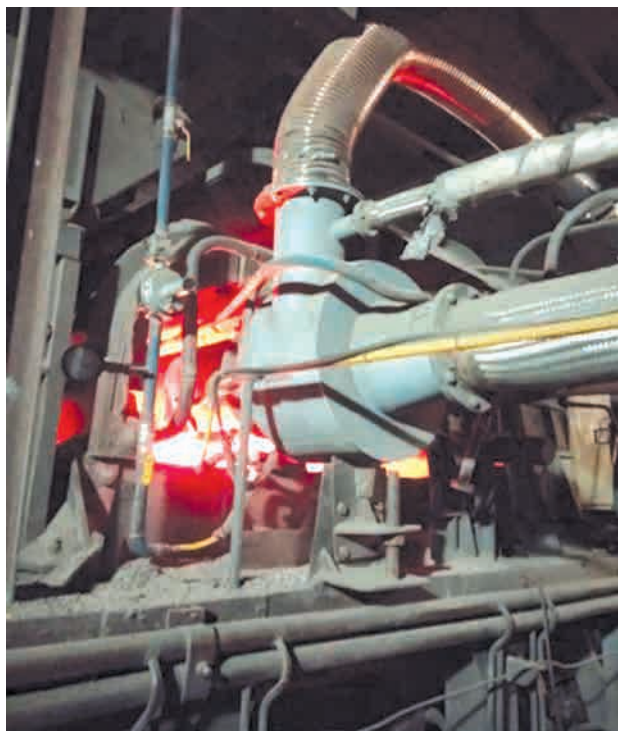
Intellectual Property Protection

IPR3

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BURNERS FOR MODERNIZATION OF METALLURGICAL EQUIPMENT AREAS OF APPLICATION



Gas burner MGP-2.0 on the sintering machine KM-14



High-speed gas burner GNB-1500 before immersion into a 250-ton bucket

Areas of Application

For reducing natural gas consumption during the operation of metallurgical equipment

Specification

Burner	MGP-2.0	GNB-1500
Fuel, gas	mix of coke and blast furnace gas	natural gas
Power, MW	2.0	1.5
Adjustment range	1:5	1:5
Harmful emissions, ppm:		
CO	≤ 20	≤ 10
NO _x	≤ 40	≤ 40
Gas pressure, kPa	3.0	3.0
Air pressure, kPa	5.0	3.0

Advantages

Reduced natural gas consumption by more than 1 million m³; intensified limestone firing process; reduced harmful gas emissions

Readiness Level.

Suggestions for Commercialization

IRL8, TRL9

Manufacture, delivery, installation, commissioning, warranty service, and staff training

Intellectual Property Protection

IPR3

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BURNERS FOR HEATING SYSTEM OF ROTARY KILNS



Burner with adjustable torch parameters



Gas-air ramp

Areas of Application

For saving fuel and improving the product quality during the roasting of ores, refractory materials, and lime in rotary kilns

Advantages

A uniform temperature distribution in the high-temperature zone of the furnace; the regulation of temperature distribution in the working space; the intensification of heat transfer, directly from the torch to the material and indirectly through the masonry; increasing efficiency and fuel savings by 5–15%

Specification

The heating system includes burners with adjustable torch parameters, igniters, control and safety automation, a mechanism for turning and moving the burner. The nominal heat capacity of the burners is 30–35 MW; the maximum air consumption is 4500 m³/h; the emissions of nitrogen oxides (reduced to $\alpha = 1.0$; NO₂) is 180 mg/m³

Readiness Level. Suggestions for Commercialization

IRL8, TRL9
Custom manufacture of burners, commissioning, staff training

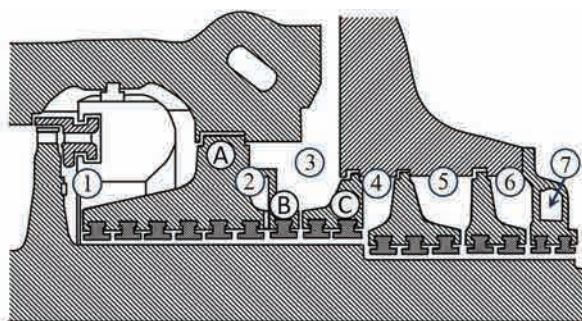
Intellectual Property Protection

IPR3

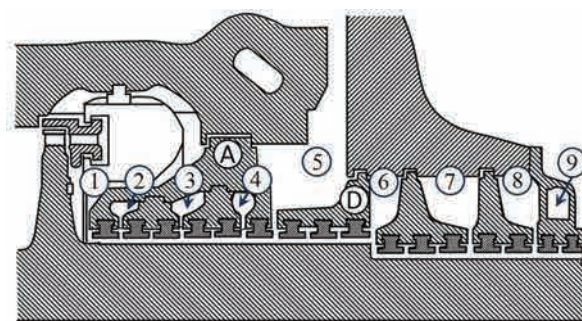
Contact Information

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FRONT-END SEAL FOR HIGH-PRESSURE CYLINDER OF POWERFUL STEAM TURBINE



Original design of the front-end seal:
A, B, C – turbine high-pressure cylinder body clips;
1 – 7 – steam supply chambers



Proposed design of the front-end seal:
A, D – turbine high-pressure cylinder body clips;
1 – 9 – steam supply chambers

Areas of Application

The creation of new and upgrade of the existing high-power steam turbines for high and medium pressure cylinders for reducing the rotor wear in the turbine cylinders, in the places of high stress concentration in the area of the front-end seal and increased reliability

Advantages

As compared with the existing analogs, the new design of the front-end seal for high-pressure cylinder of powerful steam turbine allows the uniform heating of the rotor and the reduction of the thermal stresses arising at the stage from the supply of steam to the seals to the rotor push, in the case of cold start

Intellectual Property Protection

IPR3

Readiness Level.

Suggestions for Commercialization

IRL8, TRL7

Design calculations and predesign works

Specification

High-pressure rotor (HPR)
of the steam turbine K-325-23.5

Parameters	Front-end seal design of the high-pressure rotor (HPR)	
	Original design	Proposed design
Steam parameters at the inlet to the HPR in the case of cold start:		
pressure, kPa	130	130
temperature, °C	180	180
Number of steam supply chambers	7	9
Number of cold starts	150	>10000
Maximum stress:		
in the elastic formulation of the problem, MPa	584	234
given plasticity, MPa	551	256

Contact Information

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BAP-1.5 BLOWN AIR PREHEATER



Heat-recovery exchanger BAP-1.5 behind the boiler with a heating capacity of 0.63 MW

Areas of Application

For improving environment sustainability and recovering waste heat from boilers with a heating capacity of 0.67 MW by heating and humidifying the blown air

Specification

Heating capacity, MW	0.1
Consumption of exhaust gases, m ³ /h	1500
Excess air ratio in gases	1.35
Exhaust gas temperature, °C:	
at the inlet	200
at the outlet	75
Air consumption, m ³ /h	1360
Air temperature, °C:	
at the inlet	10
at the outlet	60
Dimensions, mm:	
Length	1616
Width	940
Height	2840
Weight, kg	992
Increase in the coefficient of the use of fuel heat CUFH, %	10 – 12
Reduction in nitrogen oxide emissions, %	50 – 60
Pay-back period, years	up to 3

Advantages

Autonomous from an external consumer of heat energy. As compared with the existing analogs and heaters of other types, this heater has lesser weight, dimensions, and aerodynamic resistance; better reliability of gas and air paths

Readiness Level.
Suggestions for Commercialization

IRL7, TRL5
Custom manufacture, delivery, installation, commissioning, and staff training

Intellectual Property Protection
IPR 3

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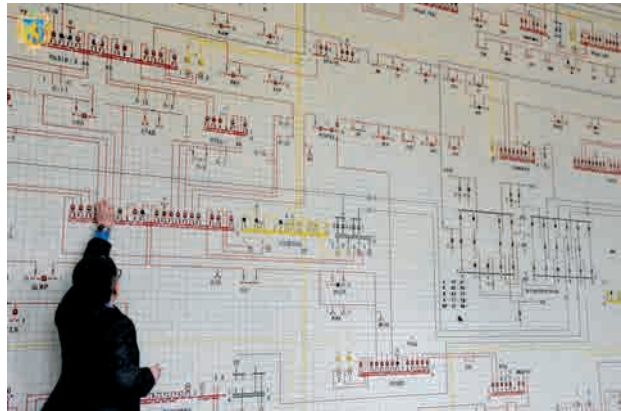
SOFTWARE FOR DETERMINING THE OPTIMAL SETTINGS OF THE UNDER-FREQUENCY LOAD SHEDDING (UFLS) OF POWER SYSTEMS

Areas of Application

Improving the efficiency of under-frequency load shedding (UFLS) systems

Specification

The software is used at the level of distribution network operators. The frequency relay settings may be calculated according to the regulatory requirements for any UFLS system as established by the transmission system operator, national operator or association of national transmission system operators. Windows 7 or higher is required to run the program



Advantages

As compared with the available means for determining the settings of the UFLS system relay, the proposed software allows adjusting the relay given the load variability by feeders during the year and the varying nature of power generated by renewable energy sources, in compliance with the applicable regulations

Readiness Level. Suggestions for Commercialization

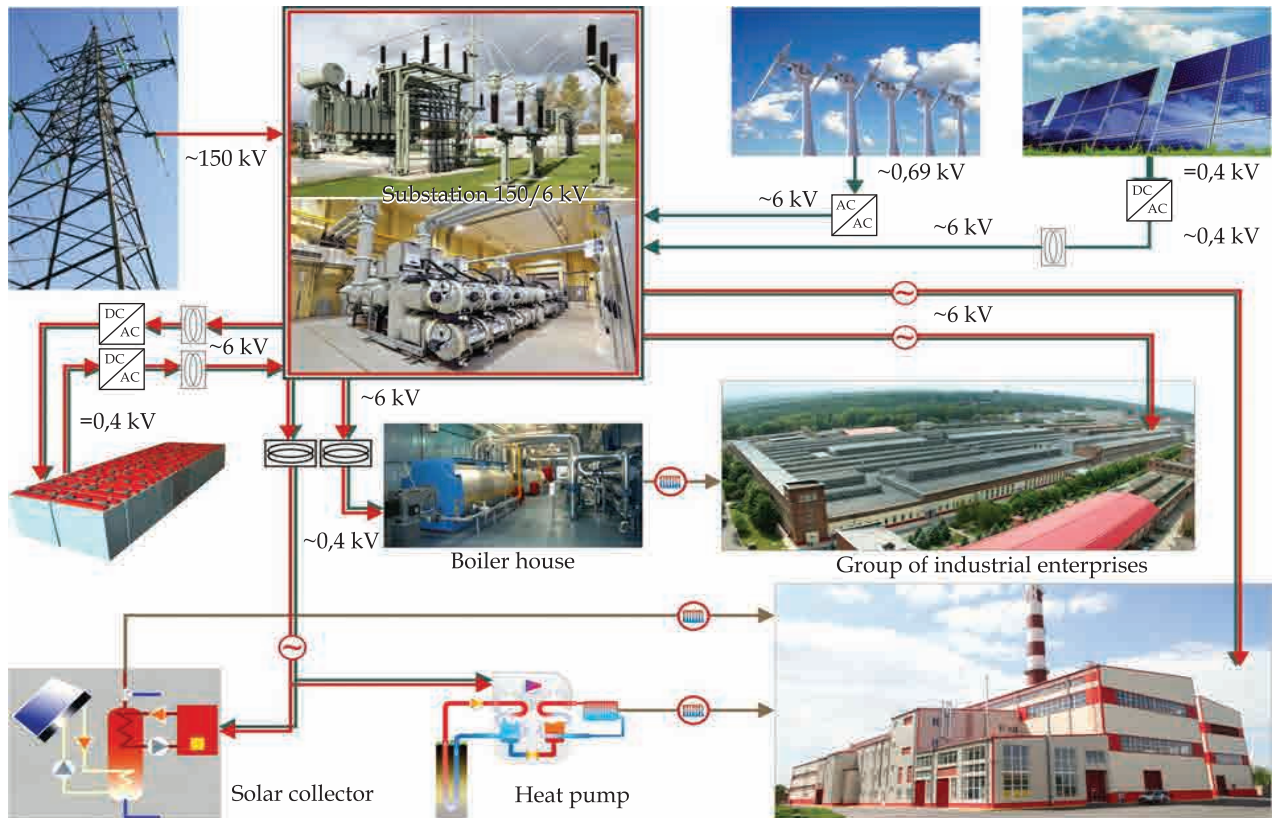
IRL7, TRL8
Sale of software. Calculations of settings for UFLS system relay

Intellectual Property Protection IPR3

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INDUSTRIAL ENERGY-PARK WITH THE USE OF RENEWABLE ENERGY SOURCES



Conceptual flowchart of energy park

Areas of Application

Power supply system for a complex of new and existing enterprises

Specification

Allows the use of nonconventional energy sources (wind turbines, photovoltaic modules, solar collectors and heat pumps) in combination with external power supply and cogeneration, when the renewable sources generate both electricity and heat

Advantages

Quality assurance and reliability of energy supply; reduced consumption of electricity and natural gas by enterprises from external power systems

Readiness Level. Suggestions for Commercialization

IRL7, TRL6
Creation of customized energy park

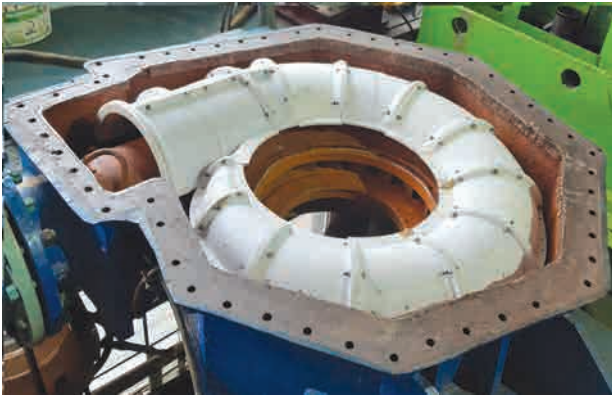
Intellectual Property Protection

IPR3

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PUMP-TURBINE FLOW PART FOR 80—120 M HEADS



Spiral case



Runner

Areas of Application

Design and implementation
of PSP flow parts for 80—120 m heads

Specification

Model code	Model diameter, D_1 , m	Quantity of blades, Z	Turbine mode			Pump mode				Specific speed (optimal)	
			Q_1 , m^3/s	n_1 , min^{-1}	η , %	Q_2 , m^3/s	n_2 , min^{-1}	η , %	σ_{\min}	n_{ST}	n_{SH}
OPO120/5247	0.35	9	0.570	81.0	88.0	0.56	93.2	87	0.30	209.5	254.3

Readiness Level.

Suggestions for Commercialization

IRL8, TRL8

Custom design, manufacture
and research on the hydrodynamic stand
of the pump-turbine flow part model
for 80—120 m heads, in accordance }
with all requirements of the IEC 60193

Advantages

The flow part has high energy characteristics
corresponding to the world standards
in a wide range of operating conditions;
in the generator mode, it significantly exceeds
the efficiency of the known hydraulic units
in the entire operation range

Intellectual Property Protection

IPR1, IPR2

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RECONSTRUCTION OF NDISTU-5 BOILERS



Mounted hearth burners in NDISTU-5 boiler



Additional convective surfaces for NDISTU-5 boiler

Areas of Application

For raising the efficiency of natural gas boilers by increasing the output-input ratio up to 93 – 95% and heat productivity up to 1 Gcal /h

Specification

Reconstruction of NDISTU-5 boilers through installing convective heating surfaces and replacing burners

Readiness Level.

Suggestions for Commercialization

IRL8, TRL9

Custom manufacture, delivery, installation, commissioning, warranty service, and staff training.

The term of production of boiler reconstruction elements and their installation is 3 months

Advantages

The average savings of natural gas is about 250 thousand nm³/year

Intellectual Property Protection

IPR3

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LANDFILL BIOGAS COLLECTION AND UTILIZATION SYSTEM

Areas of Application

The extraction and utilization of landfill gas for generating electricity and producing biomethane and commercial carbon dioxide; its use as fuel in public utilities and for industrial purposes

Specification

At a well system capacity of 600 m³/h, landfill gas production reaches about 1 MW. The payback period of the complex of equipment for gas production and electricity generation is 1.5 years; the service life is 15 years

Advantages

Reduction of greenhouse gas (methane and carbon dioxide) emission and risk of fires



Landfill gas processing complex with a capacity of 1 MW



Gas power plant based on an internal combustion engine with a capacity of 185 kW

Readiness Level. Suggestions for Commercialization

IRL8, TRL9

Organization of custom construction of a complex, erection supervision, staff training

Intellectual Property Protection IPR1

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SYSTEM FOR DEFROSTING BULK MATERIALS IN RAILWAY CARS



Garage defroster for simultaneous defrosting of ore in 12 railway cars



The garage defroster interior with radiant pipes and screens

Areas of Application

Defrosting of bulk materials in railway cars by means of low-temperature radiating pipes and screens

Specification

Garage defroster enables defrosting of bulk materials in 12 railway cars by keeping the temperature of material layer in the cars under 5 °C. The interior of the garage defroster is equipped with a system of radiating pipes with screens, which provide the thermal regime of optimal radiation and the preservation of the car bodies and sliding bearings of wheelsets

Advantages

Easy to maintain and reliable; low operating and capital costs, high efficiency due to low temperature of flue gases leaving the working circuit: operation on different types of fuel; minimal heat loss from premises; reduction of time and human resources for unloading; prevention of production downtime

Readiness Level. Suggestions for Commercialization

IRL8, TRL9
Custom manufacture, delivery, installation, commissioning, warranty service, and staff training

Intellectual Property Protection

IPR3

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THERMAL ENERGY STORAGE SYSTEMS

Areas of Application

Mobile thermal accumulator for storage and transfer of thermal energy for heating residential, industrial, and other facilities

Specification

Thermal power, MW	0.5 – 0.8
Temperature range, °C	35 – 95
Heat productivity, kW · h	1200
Charging time, h	4 – 6
Discharge time, h	10 – 12
Operating weight, kg	17500
Volume, l	12000
Dimensions, m	
Width	2
Height	3
Depth	6



View from outside and from inside

Advantages

The use of industrial waste heat, renewable energy sources, and local fuels; reduction in primary energy consumption by 5%, fuel consumption by 10%, and harmful emissions by 10%

Readiness Level.
Suggestions for Commercialization

IRL8, TRL7
Custom manufacture, supply, maintenance, and staff training

Intellectual Property Protection
IPR2

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ALLOY FOR HYDROGEN STORAGE



The initial state of the alloy



The hydrogenation product



The most promising area to use this material

Areas of Application

Material for safe storage and transportation of hydrogen in the bound state

Specification

Hydrogen capacity, wt. %	2.10
Hydrogenation pressure, MPa	0.23–0.6
Hydrogenation temperature, °C	15–25
Incubation period, min	2–10
Temperature at which all hydrogen is released, °C	300

Advantages

The proposed material does not require long-term heat or mechanical treatment and is used in the cast state. The alloy has increased hydrogen capacity, improved kinetic parameters of sorption and desorption of hydrogen, as well as a cheaper cost of the final product

Readiness Level. Suggestions for Commercialization

IRL3, TRL4
Custom manufacture of small batches of alloy ingots (up to 2 kg).
Partners for mass production wanted

Intellectual Property Protection
IPR3

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SERIAL MANUFACTURE OF LITHIUM-ION BATTERIES AND RECHARGEABLE BATTERIES



Existing production areas for the launch of the manufacture of lithium-ion batteries

Areas of Application

Energy sources for electric vehicles, electricity storage systems, telecommunications and communication systems, military equipment and national defense and security facilities, aerospace equipment

Specification

Lithium-ion batteries with a voltage of 2.4–4.0 V and a capacity 10–150 A · h

Advantages

The batteries may form the capacity required by the consumer. To date, there have been no mass-produced batteries of this kind in Ukraine. The offered products are cheaper and have as good quality as the foreign analogs

Intellectual Property Protection
IPR2

Readiness Level.
Suggestions for Commercialization
IRL7, TRL6
Partners to create mass production wanted

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HIGH-SPECIFIC POWER SUPERCAPACITORS



Specification

Module-type supercapacitors.
The capacitance of single 2.7V cells ranges within 200 – 3500 F.

To step up the voltage, the single cells are connected in series to form the following modules:

Voltage, V	12 – 200
Power density, kW/kg	30 – 50
Operating conditions, °C	from –40 to +70

Charging time: a few seconds
(depends on the charger power only)

Areas of Application

Energy accumulation and generation of high-power pulses in electric transport, electric welding, wind power stations, etc.

Advantages

The supercapacitors significantly exceed the counterparts in terms of power density; do not require maintenance and special cooling during charging or discharging; fire-proof, explosion-proof

Readiness Level.

Suggestions for Commercialization

IRL6, TRL6

Custom manufacture of samples for testing; partners to start industrial scale supercapacitor production wanted

Intellectual Property Protection

IPR3, IPR5

Contact Information

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HEAT GENERATOR ON VEGETABLE ORIGIN FUE



Heat generator on a drum dryer of mineral fertilizers (Berezan)

Areas of Application

Source of drying agent in the process of drying bulk materials (sand, mineral fertilizers, limestone, refractory clay, sawdust, milling peat) in drum dryers, in the energy, agro-industrial and construction industries

Advantages

Unlike the existing heat generators, this one has the ability to vary the parameters of the drying agent by temperature and composition in a wide range; two-stage process of fuel combustion, environment friendliness, design simplicity, low metal consumption, and low cost

Intellectual Property Protection

IPR2

Specification

Fuel: wood waste (chips), agro-industrial (vegetable origin, pellets), wood industry waste
The dimensions of the heat generator are determined by the heat liberation rate of the combustion mirror of solid fuel burners and the diameter of the drum dryer.

Completeness of combustio	up to 1.0
Heat liberation rate of the combustion mirror, MW/sq. m.	3.0–8.0

Readiness Level.

Suggestions for Commercialization

IRL8, TRL7

Custom manufacture, given the fuel for thermal power; supply and its warranty service, service personnel training

Contact Information

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MWH MODULAR WATER TUBE HEAT-RECOVERY EXCHANGER



MWH heat-recovery exchanger for glass furnace

Advantages

Modular design, high heat output and compactness, self-cleaning of working surfaces and the possibility of additional removal of incrustation with compressed air

Intellectual Property Protection

IPR 2

Areas of Application

It is used to recover the heat of exhaust gases from glass-making furnaces by heating water from heating and hot water supply systems of glass-blowing enterprises

Specification

Heating capacity, MW	0.2–3.5
Water temperature, °C:	
at the inlet,	at least 50
at the outlet,	at most 95
Exhaust gases temperature, °C:	
at the inlet	250–550
at the outlet	150–200
Aerodynamic resistance, Pa	200–600
Hydraulic resistance, kPa	50–200
Consumption	
of exhaust gases, kg/s	1.5–15
Consumption of water, kg/s	2–20
Dimensions, mm:	
Length	1200–3200
Width	1500–3000
Height	2000–4500
Weight, kg	2000–20000
Increase in the fuel heat	
use coefficient of furnace, %	5–15
Payback period, years	up to 1

Readiness Level.

Suggestions for Commercialization

IRL7, TRL5

Custom manufacture, design documentation for the installation and commissioning of the exchanger and staff training

Contact Information

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NEW GENERATION TUBE HEAT EXCHANGER ON PROFILED PIPES

Areas of Application

To equip individual heating points of multi-storey buildings, other residential and industrial buildings

Specification

Thermal power, kW	up to 350
Operating temperature, °C	95
Operating pressure, MPa	1.6
Dimensions:	
diameter, mm	250
length, m	1.2
Weight, kg	50

Advantages

High heat transfer coefficient, reduced salt incrustations due to the self-cleaning effect

Readiness Level.
Suggestions for Commercialization

IRL4, TRL5
Custom manufacture.
Partners for mass production wanted



New-generation tube heat exchanger on profiled pipes



Heat exchanger mounted and installed

Intellectual Property Protection
IPR2

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DEVICE FOR NEUTRALIZATION OF THE CONDENSATE FROM GAS COMBUSTION PRODUCTS BY THE NON-REAGENT METHOD



Areas of Application

Neutralization of condensate obtained from flue gases of hot water and steam condensing boilers without the use of chemical reagents; deep degassing of liquids

Specification

Productivity, l/h	450
pH of the source condensate,	at least 4.2
pH of the neutralized condensate,	at least 6.0
Dimensions, mm	750 × 800 × 1100
Weight, kg	300
Approximate heat output of the boiler, MW	10

Readiness Level.

Suggestions for Commercialization

IRL6, TRL5

Partners for manufacture wanted

Advantages

Reuse of neutralized condensate in the process of water pretreatment for supply to boiler. No need for neutralization reagents. Rational use of water resources. No contaminated products of wastewater neutralization

Intellectual Property Protection

IPR1, IPR2, IPR3

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OXIDATIVE PYROLYSIS PLANT

Areas of Application

Used for obtaining biochar from various agrobiomass, forestry waste, and energy crops, which may be used as activated carbon, fuel, and soil structure improver; carbonization of bones and manure of animals, thermal recycling of litter poultry manure to obtain organic phosphorus-potassium fertilizer

Specification

Periodic operating mode

Cycle duration, h	2–4
Retort volume, l	100
Weight of equipment, kg	150
Overall dimensions, mm	1500 × 700 × 700



Oxidative pyrolysis plant design



Samples of carbonized organic residues

Advantages

There are no analogs. The plant is mobile, operates in autothermal mode, and does not require additional energy; enables environment friendly conversion of organic waste. Thanks to its simple design, the plant is easy operating in the conditions of small farming enterprises

Readiness Level.
Suggestions for Commercialization

IRL5, TRL5
Custom design and manufacture

Intellectual Property Protection
IPR3

Contact Information

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- CU TEP-SB AUTOMATIC LIGHT PETROLEUM PRODUCT COLOR ANALYZER
- FATTY FOOD WASTE BIOCOMPONENT OF DIESEL ENGINE FUELS
- GREASE FOR FRICTION UNITS OF PROCESS EQUIPMENT
- METHOD FOR OBTAINING 2-ETHYL-1-HEXANOL FROM ETHANOL

FUEL AND LUBRICANT MATERIALS AND TECHNOLOGIES



CU TEP-SB AUTOMATIC LIGHT PETROLEUM PRODUCT COLOR ANALYZER



Specification

The measurement error meets international standards ASTM D156, DSTU ISO 2049-2015, etc.

Range of light petroleum product colors, the Saybolt scale color units	from -16 to +30
Analyzer continuous operation time, h	at most, 8
Signal measurement time, s	at most, 30
Power consumption at the operating supply voltage, W	at most, 1.0
Power voltage from AC mains	220 V, 50 Hz
Dimensions, mm	at most, 250×250×150
Weight, kg	at most, 1.5

Areas of Application

Designed for automatic control of color of light petroleum products (motor and aviation fuel, jet fuel, kerosine oils, petroleum wax and medicinal oils) during purification and storage, in accordance with international standards ASTM D156, DSTU ISO 2049-2015, etc.

Readiness Level. Suggestions for Commercialization

IRL7, TRL6
Custom manufacture, supply,
and warranty service of the device
and staff training

Advantages

Unlike the existing visual devices and high-cost foreign analogs, the automatic analyzer provides the necessary accuracy, is simple, reliable, easy to operate and does not require special staff training

Intellectual Property Protection IPR2

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FATTY FOOD WASTE BIOCOMPONENT OF DIESEL ENGINE FUELS



Areas of Application

As a component of diesel fuel
or as biodiesel fuel in the pure form
for automobile and tractor diesel engines

Specification

Colorless or light yellow homogeneous
transparent liquid that has a content
of fatty acid esters of at least 96.5%;
the kinematic viscosity at 40 °C ranges
within 3.5–5.0 mm²/s, the acid number
is at most 0.50 mg KOH/g;
improved antioxidant stability

Advantages

Environment friendly biodiesel.
As compared with the existing analogs,
it has a cheaper cost, better lubrication
properties and performance
at low temperature

Readiness Level. Suggestions for Commercialization

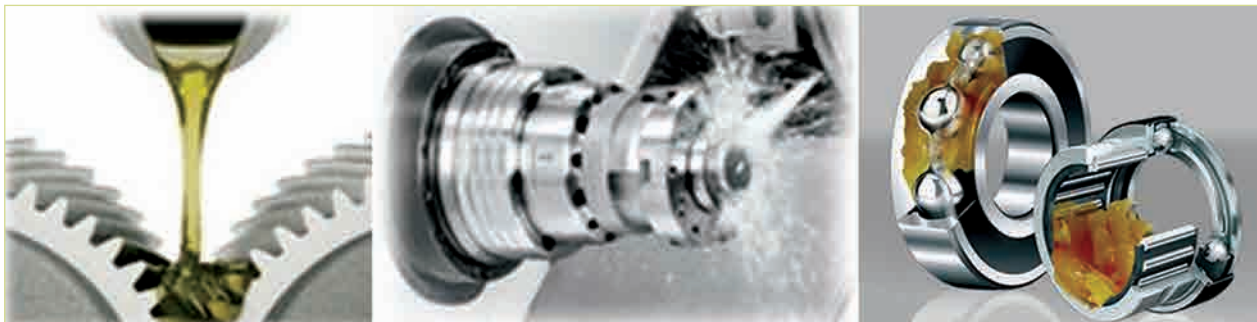
IRL4, TRL4
Custom manufacture of small batches.
Partners to organize mass production wanted

Intellectual Property Protection IPR3

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GREASE FOR FRICTION UNITS OF PROCESS EQUIPMENT



Areas of Application

Lubrication of friction units of metallurgical equipment operating in the range from $-30\text{ }^{\circ}\text{C}$ to $+160\text{ }^{\circ}\text{C}$ at high speeds, in contact with corrosive environments

Specification

Grease-like homogeneous mass colored from light yellow to brown; the dropping point is $225\text{ }^{\circ}\text{C}$; the penetration at $25\text{ }^{\circ}\text{C}$ ranges within $265 - 295\text{ m} \cdot 10^{-4}$; the critical load is 921 N ; ensures improved antioxidant stability and protects metal surfaces of friction units from corrosion

Advantages

The grease is characterized by resistance to water, aggressive environments, has improved protective properties, increased mechanical and thermal oxidative stability. In terms of mechanical stability, the grease significantly exceeds the known analogs; does not soften and leak during operation

Intellectual Property Protection IPR3

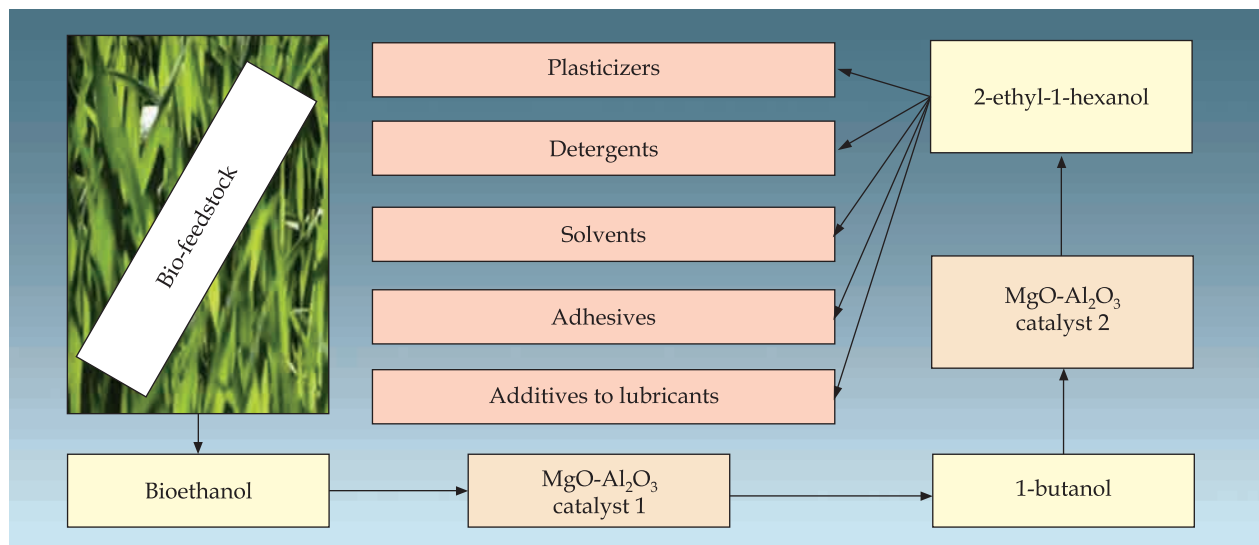
Readiness Level. Suggestions for Commercialization

IRL5, TRL6
Custom manufacture of small batches.
Partners for mass production wanted

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METHOD FOR OBTAINING 2-ETHYL-1-HEXANOL FROM ETHANOL



Flowchart of 2-ethyl-1-hexanol production from ethanol

Areas of Application

Industrial synthesis of 2-ethyl-1-hexanol for production of plasticizers, environment friendly detergents, solvents, adhesives, additives to lubricants and oils from (bio)ethanol

Specification

Two-stage catalytic method for obtaining 2-ethyl-1-hexanol from ethanol. Ethanol vapor flows through a layer of the catalyst at 250 – 400 °C and atmospheric pressure, with subsequent formation of 1-butanol and 2-ethylhexanol

Advantages

In contrast to the existing 3-stage industrial method of 2-ethyl-1-hexanol production from raw oil, with the use of different catalyst at each stage, the proposed method allows obtaining 2-ethyl-1-hexanol from bioethanol in two stages, in gaseous phase, with the use of similar catalysts and renewable raw materials; this process is notable for lower quantity of by-products and higher ecological cleanliness

Readiness Level.

Suggestions for Commercialization

IRL3, TRL4

Custom manufacture.

Partners for the creation of a pilot plant and testing of the process in industrial production conditions wanted

Intellectual Property Protection

IPR3

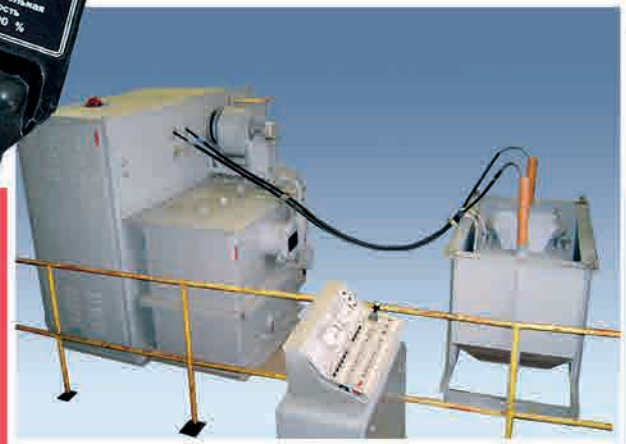
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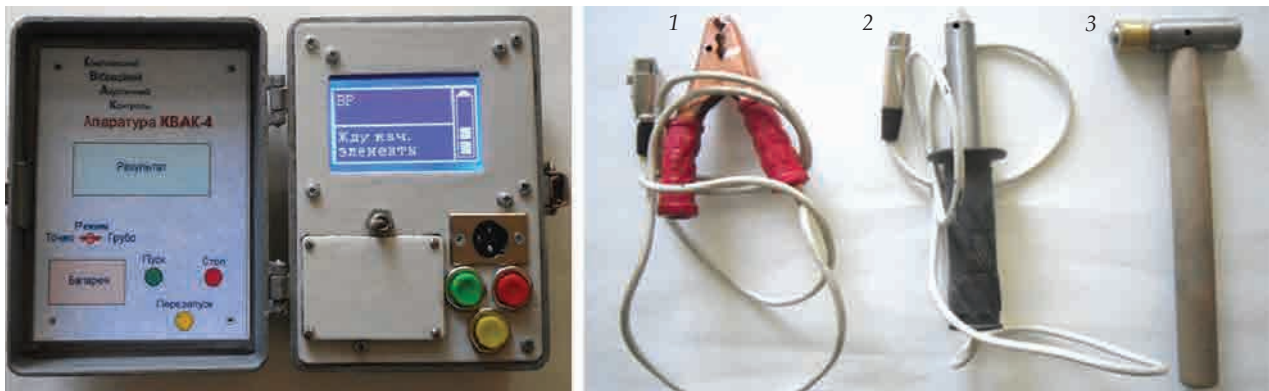
- KVAK-4 NON-DESTRUCTIVE SHOCK-WAVE MONITORING EQUIPMENT
- ELECTRIC DISCHARGE EQUIPMENT FOR SELECTIVE DISINTEGRATION OF MILL TAILINGS OF MULTIMETAL AND OTHER ORES
- METHOD FOR MEASURING THE COAL METAMORPHISM DEGREE
- METHOD FOR ESTIMATING THE STRESS-STRAIN STATE OF SOLID MASS IN MINE FACE
- METHOD FOR MULTISPECTRAL SATELLITE IMAGERY APPLICATION IN SEARCHING FOR BURIED INTRUSIVE STRUCTURES
- MDR-6 DIFFERENTIAL MINE MICROMANOMETER
- METHOD FOR BREAKING COMPLEX-STRUCTURED STRONG ROCKS IN MINES
- EXPLOSION ENERGY SEPARATION OF BLOCKS FROM ROCK MASS
- TECHNOLOGY FOR PREPARATORY WORKS IN HIGH-STRESS ROCK MASS WITH THE USE OF EXPLOSION ENERGY
- TECHNOLOGY FOR PROCESSING RAW AMBER
- TECHNOLOGY FOR ASSOCIATED METHANE RECOVERY WHILE MINING COAL SEAMS
- TECHNOLOGY FOR EXPLOSION ENERGY DESTRUCTION OF COMPLEX-STRUCTURED STRONG ROCKS



TECHNOLOGIES AND EQUIPMENT FOR EXPLORING, ESTIMATING, AND EXTRACTING MINERALS



KVAK-4 NON-DESTRUCTIVE SHOCK-WAVE MONITORING EQUIPMENT



KVAK-4 equipment (1 – clamping sensor for recording anchor vibrations, 2 – contact sensor for recording arbitrary structures vibrations, 3 – vibration exciter)



Control of the anchor strength in mine conditions

Areas of Application

Rapid non-destructive in-situ anchor strength assessment with the use of the shock-wave method followed by statistical data processing to increase the reliability of measurement results

Readiness Level. Suggestions for Commercialization

IRL7, TRL6
Custom manufacture, delivery, and warranty service of the equipment; staff training

Specification

Range, ms	0 – 999
Resolution, ms	0.1
Frequency bandwidth, Hz	200 – 1500
Minimum input signal level, V	0.2
Supply voltage, V	6.0 – 9.0
Maximum current, mA	100
Dimensions, mm	90 × 125 × 155
Mass, kg	1.7

Advantages

As compared with the modern existing counterparts, the KVAK-4 equipment has higher measuring speed and ergonomics; the measuring results are obtained directly on site without the need for additional data processing in laboratory conditions; lower cost of a complete equipment set

Intellectual Property Protection

IPR2, IPR3

Contact Information

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ELECTRIC DISCHARGE EQUIPMENT FOR SELECTIVE DISINTEGRATION OF MILL TAILINGS OF MULTIMETAL AND OTHER ORES



Prototype device on the stand

Areas of Application

To increase the degree of extraction of useful components from waste beneficiation of multimetal and other ores

Specification

Productivity of one discharge channel, t/h	≤1
Specific energy consumption, kWh/t	15
Total power, kV · A	10

Readiness Level. Suggestions for Commercialization

IRL5, TRL6
Custom manufacture, warranty service of the equipment, staff training

Advantages

The most complete liberation of mineral aggregates with the formation of free grain components for their further separation by flotation methods. The equipment has no analogs in Ukraine and worldwide. As compared with the conventional mechanical method for the preparation of ore raw materials for flotation, with electric discharge disintegration of polymetallic ore beneficiation waste, this method allows increasing the extracted quantity of valuable materials:

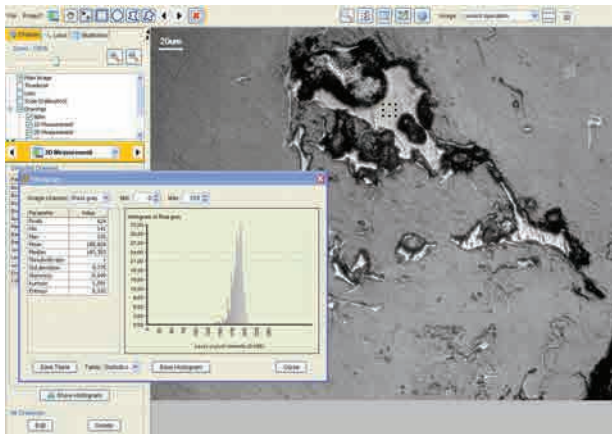
silver	up to 80
gold	up to 160
copper	up to 125
zinc	up to 75

Intellectual Property Protection IPR3

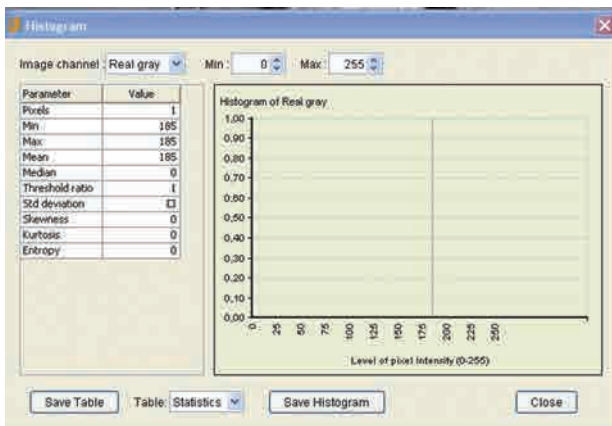
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METHOD FOR MEASURING THE COAL METAMORPHISM DEGREE



Micrograph of the lump section surface in the *Jmicrovision* software



Pointwise gray shade intensity of macerals in the *Jmicrovision* software

Areas of Application

Used for determining the degree of coal metamorphism

Specification

Optical spectroscopy with the use of MBI-11 and HB 200 video-optical complex, followed by digital computer processing of microphotographs of coal substance samples in lump sections. To characterize the degree of coal metamorphism, a new index of gray shade intensity is used for processing of photographic images of the lump sections of coal samples

Advantages

Operability and simplicity, as compared with the widely used vitrinite reflectance methods for determining the degree of coal metamorphism. The method may also be applied to assess the recoverability of coals and to estimate their maceral composition

Readiness Level.
Suggestions for Commercialization

IRL6, TRL6
Determination of the degree of coal metamorphism of customer's samples

Intellectual Property Protection
IPR1

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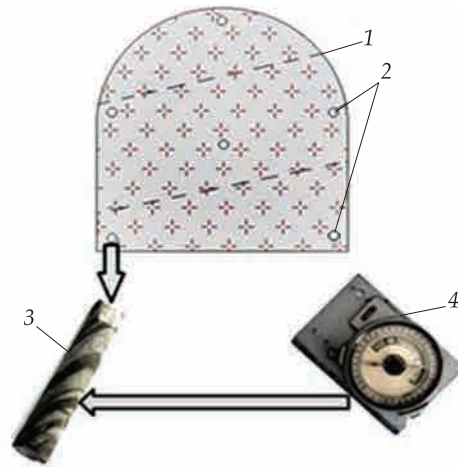
METHOD FOR ESTIMATING THE STRESS-STRAIN STATE OF SOLID MASS IN MINE FACE

Areas of Application

Determining the direction of main cracks that correspond to maximum compressive stresses. The method helps to substantiate the placement of hole bore charges in the area of the expected redistribution of stresses during production

Specification

The efficiency of the method is achieved by drilling in the characteristic cross-sectional areas of exploratory wells and selecting oriented cores, based on which the magnitude and direction of the main compressive stresses (1, 2, and 3) in the place of laying and in the course of preparatory works may be determined in laboratory conditions



Mining (1) in ore deposit block with drill exploration of wells (2) and oriented core (3) with a mining compass (4)

Advantages

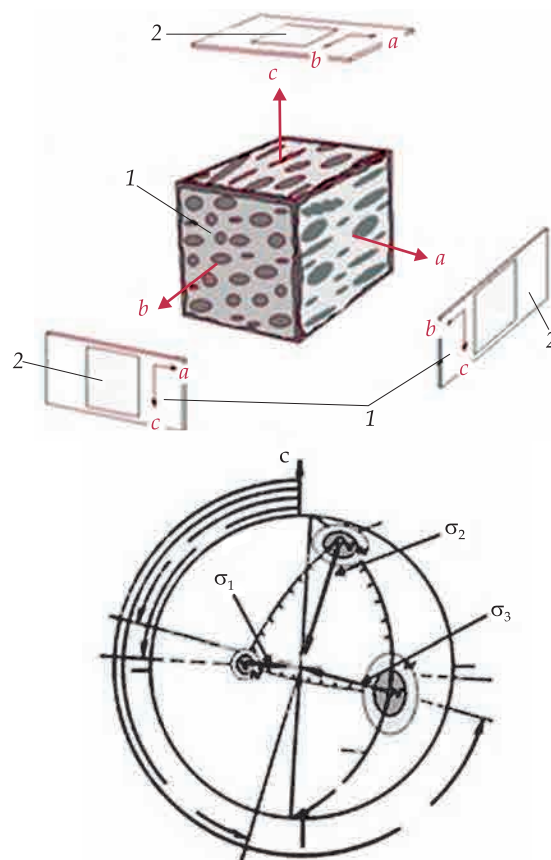
Raising the efficiency of destruction of tense rocks by explosive charges in the cross section of the mine, increasing the speed of tunnel driving, improving the quality of rock crushing, reducing the specific cost of explosives and means of initiation

Readiness Level. Suggestions for Commercialization

IRL8, TRL8
Partners for industrial production wanted

Intellectual Property Protection

IPR3

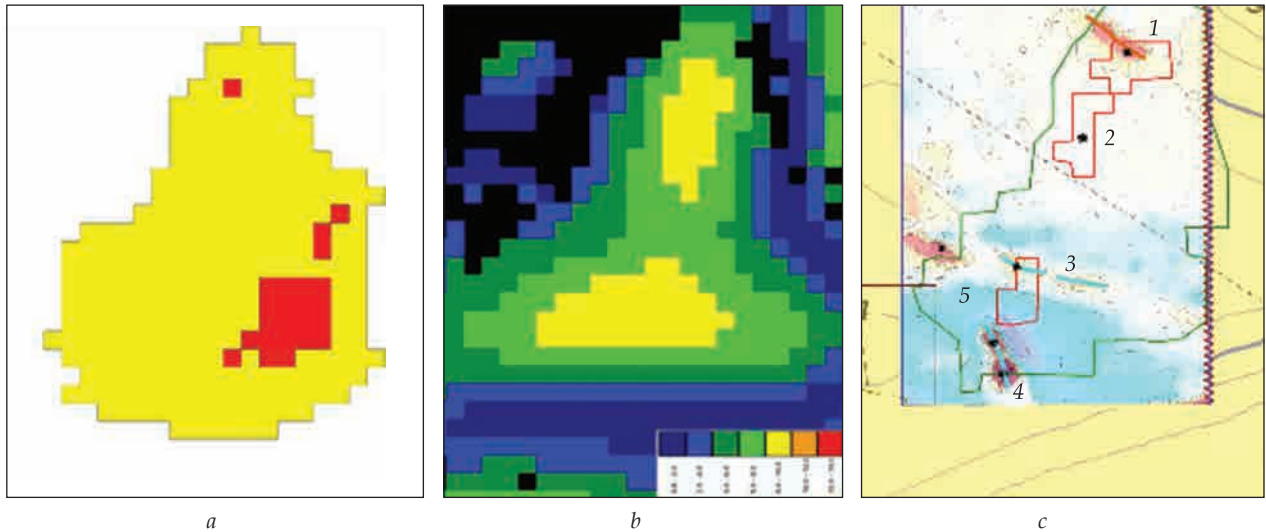


Cross sections (1) of which petrographic sections (2) (above) are made and the diagram of the maxima of vectors of main compressive stresses (σ_1 , σ_2 and σ_3)

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METHOD FOR MULTISPECTRAL SATELLITE IMAGERY APPLICATION IN SEARCHING FOR BURIED INTRUSIVE STRUCTURES



Intrusive structures detected by the method of temperature anomalies with the use of:

a – RX anomaly detection; *b* – analyzing window; *c* – mapped according to the results of detailed geophysical survey

Areas of Application

Identification of prospective areas for exploring buried intrusive structures associated with primary mineral deposits

Specification

Satellite data application for land surface temperature analysis, structural interpretation, and morphostructural analysis. Identification of prospective areas for further geological survey

Advantages

Improved accuracy of identification of buried intrusive bodies, as compared with the conventional methods, cheaper cost of geological exploration due to a decrease in the scope of geophysical survey

Readiness Level.

Suggestions for Commercialization

IRL5, TRL6

Remote sensing survey for commercial and state-owned geological companies

Intellectual Property Protection

IPR1

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MDR-6 DIFFERENTIAL MINE MICROMANOMETER

Areas of Application

Designed for operative high-precision air pressure difference measurements, remote sensor temperature and relative air humidity measurements in mines of all categories of explosiveness

Specification

Measurement range:

differential pressure, Pa	0 – 6000
temperature, °C	0 – 60
relative humidity, %	10 – 90

LSB Unit:

differential pressure, Pa	1
temperature, °C	0.1
relative humidity, %	0.1

Limits of absolute error, at most:

differential pressure, Pa, where dP is the measured pressure difference	$+(2 + 0.002dP)$
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Duration of measurement, s, at most:

differential pressure, Pa	30
temperature, °C	120
relative humidity, %	60

Current from the supply

voltage at 5 V, mA, at most:

differential pressure, Pa	20
temperature, °C	2.0
relative humidity, %	2.0

Weight, kg, at most

0.6

Power supply: four AA (A316),
galvanic cells



Readiness Level.
Suggestions for Commercialization

IRL7, TRL7
Custom manufacture

Advantages

The MDR-6 micromanometer has better accuracy of pressure difference measurements, as compared with the existing domestic and foreign analogs

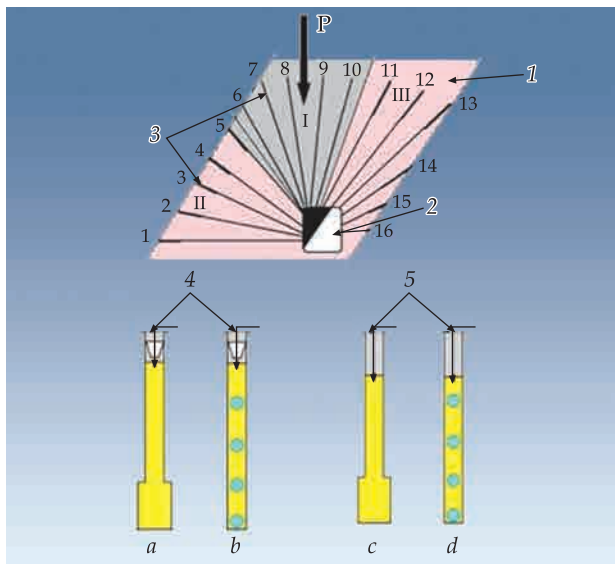
Intellectual Property Protection

IPR1, IPR3

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METHOD FOR BREAKING COMPLEX-STRUCTURED STRONG ROCKS IN MINES



Technology of blasting works in the ore deposit block:
 1 – rock massif; 2 – preparatory development;
 3 – explosive wells in the block; 4 – structure of explosive charges in ascending wells (*a* – continuous with a crater expansion at the well ends, *b* – with variable cross-section of cumulative action); 5 – structure of explosive charges in downhole wells (*c* – continuous with a crater expansion at the well end, *d* – with variable cross-section of cumulative action with the mouth sealed with gasket);
 I – the area of heavy rock pressure; zones of location of rocks in the block of ore deposit: II – the lying zone; III – the hanging zone



Satellite location of the ore deposit block where blasting operations are performed, with sensors to measure seismic oscillations of the soil

Intellectual Property Protection
 IPR3

Areas of Application

Used for breaking minerals in strong and heavy-duty tense rocks of complex structure in uranium and iron ore mines

Specification

Identification of the sections made of oriented rock samples, the main systems of microcracks, and their spatial position based on which the intensity and direction of propagation of the prevailing rock pressure may be determined. In these zones, downhole wells are drilled; in these wells, there are formed charges with a variable cross-section of cumulative action; in the hanging and lying sides, there are drilled boreholes where there are formed continuous charges with a crater expansion at the ends in the zone of tensile stresses, the zone of blasting with deceleration from cutting charges in the area of the predominant rock pressure; and boreholes in a checkerboard pattern in the area of tensile stresses

Advantages

Improving the operation of explosive charges in fan wells ensures the destruction of ore deposits in a block with uniform crushing of solid rocks; reducing the specific cost of explosives, raising the efficiency of the explosion and the productivity of crushing and sorting complexes and trucks

Readiness Level.
 Suggestions for Commercialization

IRL8, TRL8
 Partners for industrial manufacture wanted

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EXPLOSION ENERGY SEPARATION OF BLOCKS FROM ROCK MASS

Areas of Application

Improving the efficiency of separating the granite blocks from rock mass

Specification

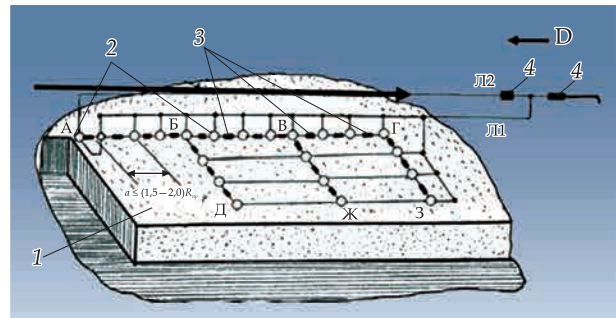
The method is based on determining the orientation of the vertical split plane of granite in the block given the physical and mechanical properties of rocks used to calculate the parameters of blasting in quarries for the extraction of natural block stone



Technology for block separation from the rock mass: drilling of holes in the block

Advantages

Accurate determination of the orientation of the vertical split plane and the angles between the directions of the formed systems of cracks from explosion in block



Rock separation scheme: rock block (1), boreholes (2), retarders between boreholes (3), linear retarders between detonation cords during the detonation transfer to explosive charges located in the block to be separated (4)

Readiness Level. Suggestions for Commercialization

IRL8, TRL8
Partners for industrial production wanted

Intellectual Property Protection IPR3

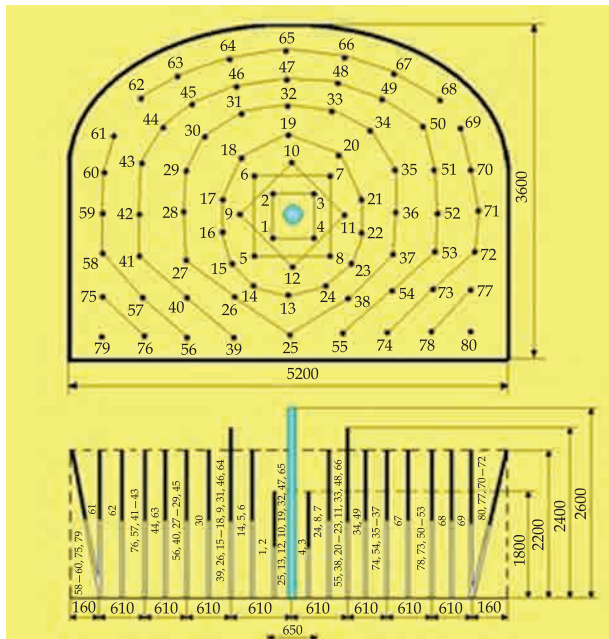


Appearance of an exploded block

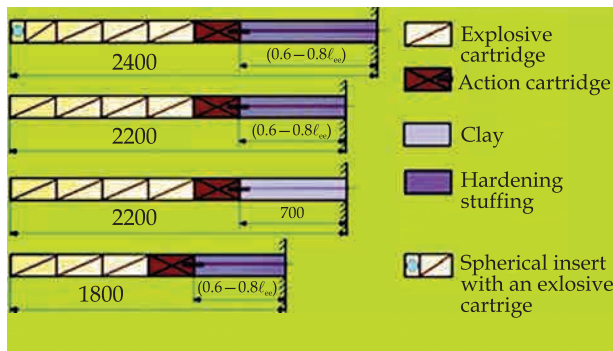
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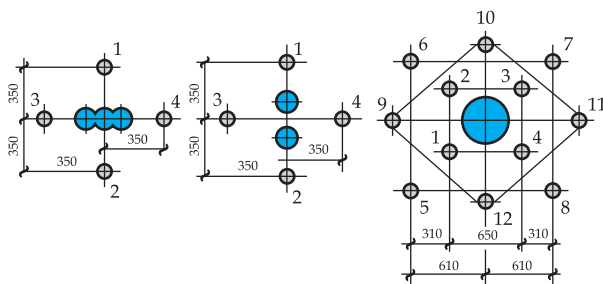
TECHNOLOGY FOR PREPARATORY WORKS IN HIGH-STRESS ROCK MASS WITH THE USE OF EXPLOSION ENERGY



a



b



c

Specifications for drilling and blasting works (a); preparatory excavations and configuration of borehole charges (b); cuts with compensation well (c)

Areas of Application

Used for making a cut in strong stressed rocks by explosion energy

Specification

The technology is based on new methods for forming a cut by introducing additional free holes into the cut structure (wells of increased diameter and borehole charges. The cut is formed by blasting charges in a three-tiered cylindrical or prismatic gradient cut with deceleration, starting with the charges of cumulative action of the 3rd tier and ending with the charges of the 1st and 2nd tiers on the compensation well

Advantages

Due to the redistribution of static stresses in the course of works, the technology allows increasing the depth and volume of the cut, the speed of penetration, and the quality of crushing as well as reducing the specific costs of explosives and blasting agents

Readiness Level.

Suggestions for Commercialization

IRL8, TRL8

Partners for industrial production wanted

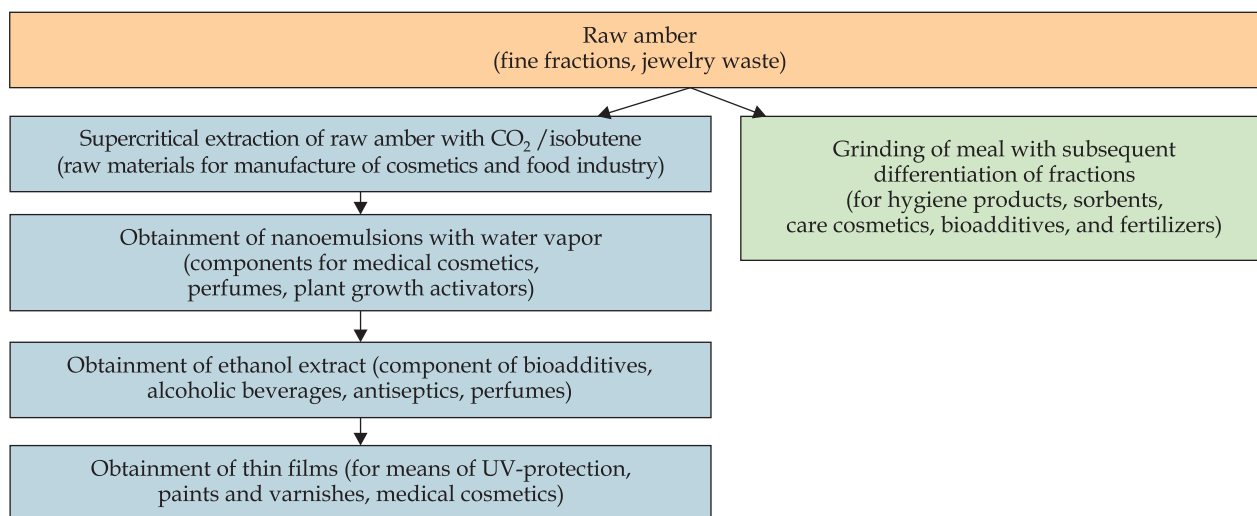
Intellectual Property Protection

IPR3

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TECHNOLOGY FOR PROCESSING RAW AMBER



Stages of the extraction of biologically active ingredients from raw amber



New formulations of cosmetic products with the use of fine amber grist and CO₂ extract of amber. Experimental batches of products are produced by perfume & cosmetics companies *Harmonieet Expressions* and *Mladna* (Kyiv, Ukraine)

Areas of Application

Used for obtaining biologically active compounds from amber to create innovation products in medicine, cosmetology, and crop production

Specification

100% waste-free processing of primary raw amber (waste from the jewelry industry and non-jewelry-grade raw materials)

Advantages

Three-stage technology for the extraction of amber by polar and low-polar solvents; increases the base price of raw amber, at least, by 200%; used in the production of innovation amber-based products: supercritical CO₂ extract, ethyl concentrate, "oil in water" nanoemulsion, UV-protective film, and fine grist

Readiness Level.

Suggestions for Commercialization

IRL5, TRL4

Custom manufacture of small batches of innovation products from amber. Investors and partners to organize industrial production wanted

Intellectual Property Protection

IPR3

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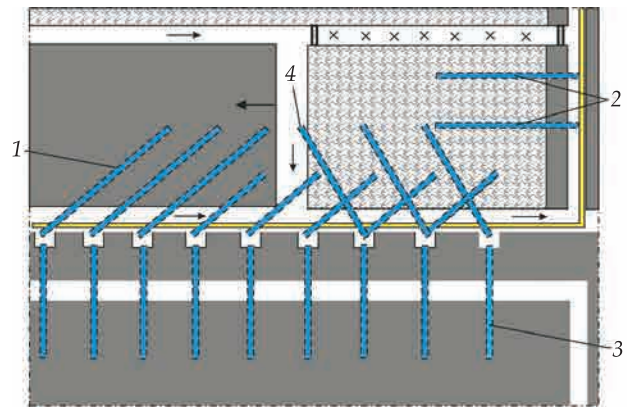
TECHNOLOGY FOR ASSOCIATED METHANE RECOVERY WHILE MINING COAL SEAMS

Areas of Application

Associated methane production from the coal mass in the course of pillar mining

Specification

The technology involves advanced and current extraction of methane with the use of wells drilled from underground mine workings. Methane is extracted in the two stages: during the preparation of extraction pillars, to ensure the safety of mining, and in the course of mining



Scheme of methane production from coal mass

Type of well	Methane extraction coefficient
Towards the breakage face (1)	0.3
From the flank (2)	0.1
Towards the converged gas-bearing layers of the adjacent extraction pillar roof (3)	0.5–0.6
Following the breakage face (4)	0.5
Total coefficient of complex methane extraction	0.8–0.9



Power plant for methane utilization

Advantages

The technology prevents depressurization of degassing wells after drilling, provides high methane content in the gas-air mix, high load on breakage faces of coal seams in terms of gas factor, increases the safety of miners, and reduces gas emissions into the atmosphere

Readiness Level.

Suggestions for Commercialization

IRL6, TRL6

Feasibility study and marketing research

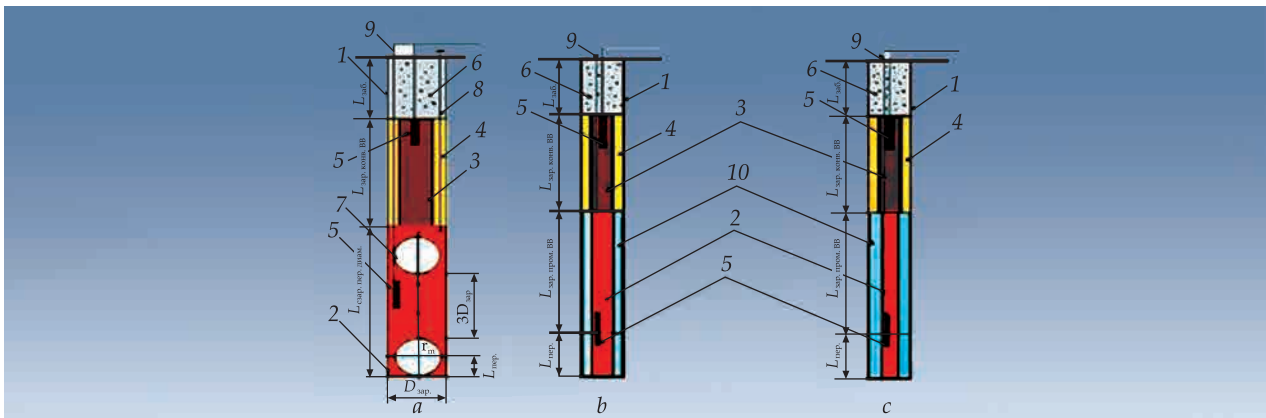
Intellectual Property Protection

IPR1, IPR3

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TECHNOLOGY FOR EXPLOSION ENERGY DESTRUCTION OF COMPLEX-STRUCTURED STRONG ROCKS



Configuration of combined well charges: *a* – variable cross section; *b* – square prism cross section; *c* – triangular prism cross section (1 – well; 2 – TNT + AC mix explosive charge; 3 – section of DKRP-4 conversion explosive; 4 – pyroxylin powder; 5 – initiator; 6 – stuffing; 7 – spherical insert; 8 – cord for connecting spherical cavities, 9 – *Impulse* non-electric initiation system, 10 – inert gap)

Areas of Application

Improving the quality of crushed mass, reducing the yield of substandard, oversized and dusty fractions in quarries, and reducing the cost of drilling and blasting works

Specification

The technology aims at increasing the share of explosion energy, which goes for destroying the rock mass, due to its redistribution in the charges with a variable cross-section, given the structure and anisotropy of physical and mechanical properties of the rock mass



Charging wells in block

Readiness Level.
Suggestions for Commercialization

IRL8, TRL8
Partners for industrial production wanted

Intellectual Property Protection
IPR3

Advantages

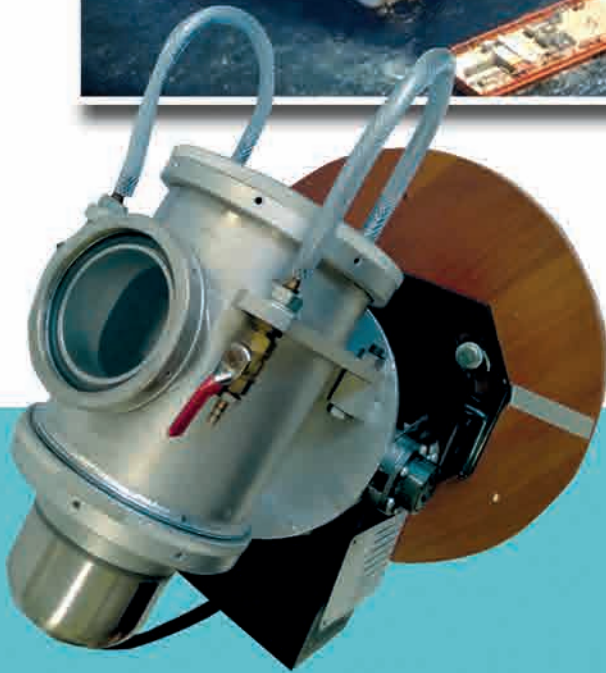
Comprehensive data on the nature of the crack-tectonic structure of the rock mass help to simplify calculating the parameters of drilling and blasting works

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- MULTI-BARRIER PROTECTIVE PACKAGING FOR DISPOSAL OF SALT MELT OF UKRAINIAN NPPS WITH LIGHT WATER REACTORS (WWER)
- GRANDETOX BIOSORBENT FOR CLEANING SOILS FROM PESTICIDE POLLUTION
- EXTERNAL ELECTRODE FOR DECONTAMINATION AND TREATMENT OF METAL SURFACES
- HIGHLY EFFICIENT FISH-PASS FACILITIES AT SMALL HYDROPOWER PLANTS
- HYBRID NANOCOMPOSITES OF CONDUCTING POLYMERS FOR ENVIRONMENT PROTECTION
- DETECTORS FOR REGISTRATION OF ALPHA AND ALPHA-BETA RADIATION
- COMPLEX OF SPACECRAFT ONBOARD RESEARCH EQUIPMENT FOR DIAGNOSTICS OF THE NEAR-EARTH PLASMA
- METHOD FOR RESTORING THE SEA LEVEL INDICATORS
- METHOD FOR SATELLITE MONITORING AND ASSESSMENT OF OPEN-CAST MINE LAND RESTORATION QUALITY
- MOBILE UNIT FOR HIGHLY DISPERSED SORBENT PRODUCTION BASED ON THERMALLY EXPANDED GRAPHITE
- ASSESSMENT OF THE TOXICITY, BIOAVAILABILITY, AND MIGRATION CAPABILITY OF POLLUTANTS IN HYDROECOSYSTEMS
- PLASMA-CHEMICAL PLANT FOR DEEP UTILIZATION OF LIQUID RADIOACTIVE WASTE
- POLYMER-INORGANIC MAGNETIC ADSORBENTS FOR CLEANING WATER SURFACES FROM TOXIC ORGANIC SUBSTANCES
- ROTOR-TYPE INDUSTRIAL AERATION-AND-OXIDATION PLANT
- ROTARY MILL SEPARATOR
- RAPID-RESPONSE RADIATION CONTROL SYSTEM BASED ON UNMANNED AERIAL VEHICLE
- SORBENT FOR REMOVAL OF RADIONUCLIDES
- TECHNOLOGY FOR NEUTRALIZATION OF PERSISTENT ORGANIC POLLUTANTS
- PLANT FOR LIQUID RADIOACTIVE WASTE TREATMENT BASED ON NANOCOMPOSITE SYNTHESIS

ECOLOGY AND ENVIRONMENT PROTECTION



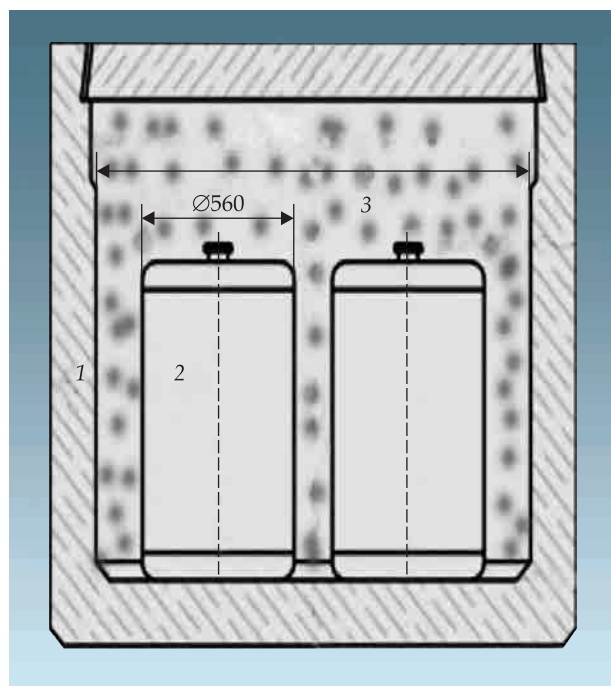
MULTI-BARRIER PROTECTIVE PACKAGING FOR DISPOSAL OF SALT MELT OF UKRAINIAN NPFS WITH LIGHT WATER REACTORS (WWER)

Areas of Application

Used for the disposal of salt melt
in near-surface storage facilities
without its treatment

Specification

The package for disposal of salt melt and conditioned vat residue consists of outer shell (universal reinforced concrete container UZZK TU U 29.2-26444970-005); 4 barrels of KRO-200 with salt melt inside the container; the remaining volume of the container is filled with the conditioning product of the vat residue in the form of alkaline cement with a salt content of 25%; the total weight of the package is approximately 12470 kg; the dose rate on the surface of the package does not exceed 2 mSv/h



Packaging scheme: 1 – reinforced concrete container
2 – KRO-200 container with a salt melt
3 – conditioned vat residue

Advantages

There are no analogs for solving
the problem of salt melt disposal

Readiness Level.
Suggestions for Commercialization

IRL3, TRL2
Customization of technology

Intellectual Property Protection
IPR2

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GRANDETOX BIOSORBENT FOR CLEANING SOILS FROM PESTICIDE POLLUTION



Seeds germinated in clean soil (a), in pesticide-contaminated soil (b), in soil decontaminated with *Grandetox* (c)



Maize cobs from areas contaminated with pesticides (a) and decontaminated with *Grandetox* (b)

Areas of Application

Soil decontamination from pesticides

Specification

It is a composition of porous materials of plant origin for sorption of pesticides and a complex of natural microorganisms fixed on their surface, which decompose the absorbed pesticides into ecologically inert compounds. It consists of wheat straw as an active absorber of pesticides, a carrier of MOD, and a source of laccase enzyme that initiates the destruction process; peat as a preservative MOD, xeroprotector, and source of organic supply; bagasse as a source of polysaccharides and an effective moisture retainer; adapted destructive microorganisms of natural origin for pesticide decomposition. The destructive activity reaches 90% in water and soil systems

Readiness Level. Suggestions for Commercialization

IRL6, TRL6
Manufacture of experimental batches up to 1000 kg. Partners for large-scale production wanted

Advantages

High destructive activity against such pesticides as *Betanex*, *Caribou*, *Pyramine-turbo*, *Nurel-D*, and many others

Intellectual Property Protection

IPR1, IPR3

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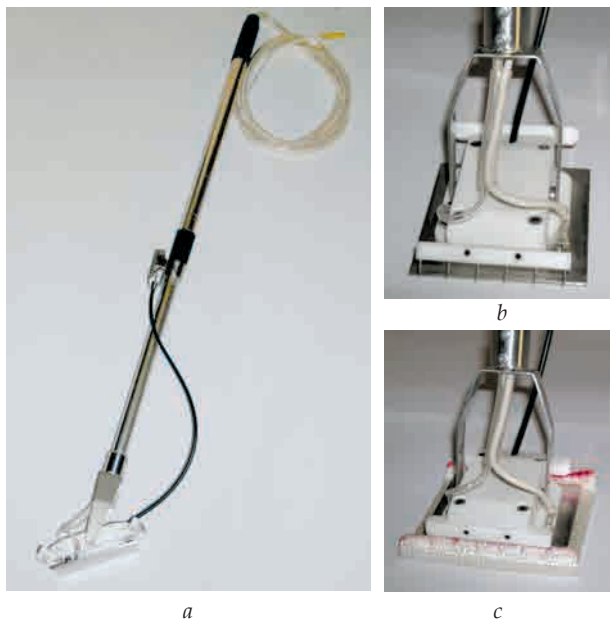
REMOTE ELECTRODE FOR DECONTAMINATION AND TREATMENT OF METAL SURFACES

Areas of Application

For removing the radionuclides from metal surfaces of process equipment; removing rust and color variability from metal surfaces; polishing; electroplating

Specification

The device allows the operation in DC, AC, and alternating polarization modes. DC: a standard current source with power of up to 80 W (voltage up to 4.0 V; amperage up to 20 A); AC: an alternating current source with industrial frequency (50 Hz, 220 V) up to 2.5 kW; electrode working surface: according to customer requirements and characteristics of the object to be treated. The electrode weight is up to 1.5 kg. No limitations of the size of surface to be treated



General view of the remote electrode (a) and the working area without porous material (b) and with it (c)

Readiness Level. Suggestions for Commercialization

IRL6, TRL6
Custom manufacture of equipment,
support and staff training

Advantages

Allows process operations without limitations on the overall dimensions of the surface that is subjected to electrochemical processing; does not require dismantling of the equipment and / or its separate parts from the place of operation; does not require bulky stationary baths to perform process operations; notable for low specific consumption of solutions and electricity due to small (up to $5 \cdot 10^{-3}$ m) interelectrode distances; allows the accumulation of radionuclide contamination in small quantities of porous materials suitable for long-term storage or regeneration; ensures the safety of service personnel; has no analogs

Intellectual Property Protection

IPR3

Contact Information

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HIGHLY EFFICIENT FISH-PASS FACILITIES AT SMALL HYDROPOWER PLANTS



Fish-pass facility on the Terek River (Georgia) built designed by the Institute of Hydrobiology



Measuring a fish specimen that has passed through a fish-pass facility

Advantages

There are no analogs in Ukraine.
The configuration of the fish-pass facility allows salmon and carp fish to spawn in upper rivers and bottom-dwelling macroinvertebrates to migrate

Intellectual Property Protection
IPR1, IPR2, IPR3

Areas of Application

To ensure upstream (spawning) and downstream (feeding) migrations of fish and natural migration of macroinvertebrates on rivers regulated by dams

Specification

The hydraulic structure is a channel that connects the upper tail water with the lower one. In this channel, the speed of water flow slows such as fish and macroinvertebrates are able to overcome the oncoming flow

Readiness Level.
Suggestions for Commercialization

IRL7, TRL9
Custom design of fish-pass facilities and monitoring of their efficiency

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HYBRID NANOCOMPOSITES OF CONDUCTING POLYMERS FOR ENVIRONMENT PROTECTION



Areas of Application

Used in sensors of volatile harmful compounds

Specification

Binary powders of black or dark green core-shell nanoparticles are sensitive to the content of harmful substances (ammonia, volatile organic compounds, etc.) in the air within the range of 1 – 1000 ppm

Advantages

The core-shell morphology of the nanoparticles provides 2–5 times higher sensory responses as compared with pure conducting polymer

Intellectual Property Protection

IPR1, IPR3

Readiness Level.

Suggestions for Commercialization

IRL4, TRL4

Custom design and organization of production

Contact Information

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DETECTORS FOR REGISTRATION OF ALPHA AND ALPHA-BETA RADIATION



Alpha and alpha-beta detectors operating as counters (left), Alpha-beta detector operating as spectrometer (right)

Areas of Application

Dosimetry, radiometry of gaseous, liquid, and solid environment, etc.
Radiation control of the environment

Advantages

The detectors have no analogs in Ukraine; may operate both as counters and spectrometers for signal registration

Specification

The parameters of alpha and alpha-beta detectors in the counting mode:

Sensitivity, ^{239}Pu , irradiation, pulse $\cdot \text{s}^{-1}/\text{particle} \cdot \text{min}^{-1} \cdot \text{cm}^{-2}$	>0.15
Heterogeneity of sensitivity over the area, %	± 0.15
Pulse rise time (0–100%) ^{239}Pu , irradiation, ns	55–60
Pulse drop time (1/e), ^{239}Pu irradiation, μs	1.7–1.8
Pulse rise time (0–100%), $^{90}\text{Sr} - ^{90}\text{Y}$ irradiation, ns	60–65
Pulse drop time (1/e), $^{90}\text{Sr} - ^{90}\text{Y}$ irradiation, ns	270–280

The parameters of alpha-beta detectors in the spectrometric mode:

Alpha-beta ratio	>0.85
Registration efficiency (4π), ^{239}Pu irradiation, %	>35
Sensitivity, ^{239}Pu irradiation, pulse $\cdot \text{s}^{-1}/\text{particle} \cdot \text{min}^{-1} \cdot \text{cm}^{-2}$	> 0.3
Heterogeneity of sensitivity over the area, ^{239}Pu irradiation, %	± 0.15
Sensitivity, $^{90}\text{Sr} - ^{90}\text{Y}$ irradiation, pulse $\cdot \text{s}^{-1}/\text{particle} \cdot \text{min}^{-1} \cdot \text{cm}^{-2}$	>0.28
Heterogeneity of sensitivity over the area, $^{90}\text{Sr} - ^{90}\text{Y}$ irradiation, %	± 0.15
Minimum detecting activity, ^{239}Pu irradiation, Bq	<0.03
Minimum detecting activity, $^{90}\text{Sr} - ^{90}\text{Y}$ irradiation, Bq	<0.15

Readiness Level.
Suggestions for Commercialization

IRL7, TRL7

Custom manufacture, delivery, and warranty service of detectors

Intellectual Property Protection
IPR2

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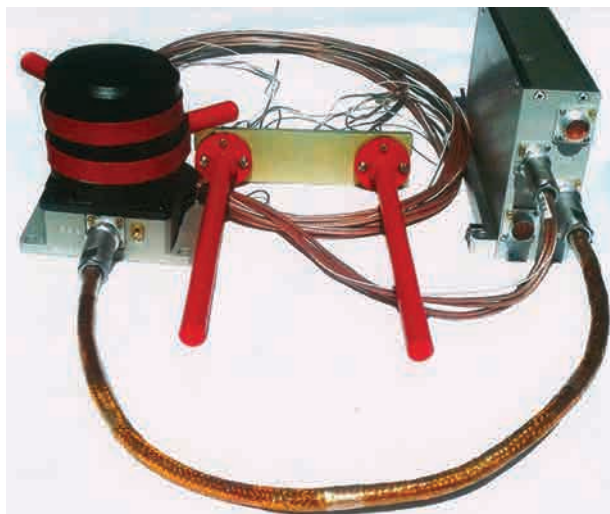
COMPLEX OF SPACECRAFT ONBOARD RESEARCH EQUIPMENT FOR DIAGNOSTICS OF THE NEAR-EARTH PLASMA

Areas of Application

Onboard monitoring and control of near-Earth plasma parameters

Specification

The equipment consists of a detector of neutral particles (two-channel pressure probe DN), a detector of charged particles (two mutually orthogonal electric cylindrical probes DE), and a unit for data collection. Power supply is 4.1 W, devices weight is 1.25 kg, maximum amperage is 1.2 μ A



Equipment module of *Sich-2-30* spacecraft

Advantages

There is no analog in Ukraine. It allows determining the complex of kinetic parameters of neutral and charged particles, as well as the electric field strength of the near-Earth plasma. May determine ionosphere characteristics

Readiness Level.

Suggestions for Commercialization

IRL8, TRL8

The equipment has been installed on *Sich-2-30* spacecraft. Custom research

Intellectual Property Protection

IPR3

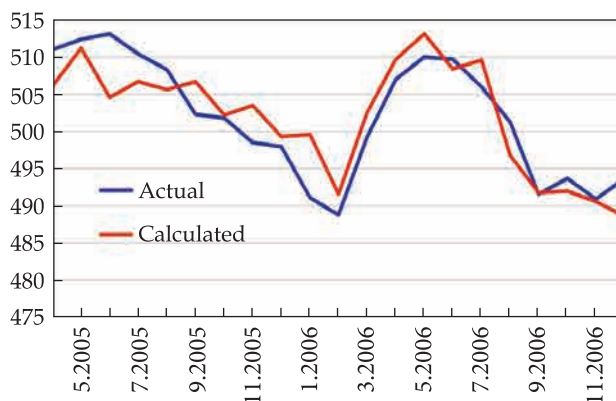
Contact Information

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METHOD FOR RESTORING THE SEA LEVEL INDICATORS



Location of Primorske, Zmiinyi Island, and Chornomorske observation stations



Time dependence of the sea level on the Zmiinyi Island station

Areas of Application

Monitoring variable hydrodynamic processes in the north-western part of the Black Sea; detecting anomalous phenomena resulting from global and regional climate changes; controlling the ecological situation on the coast for ensuring the safety of port industrial and recreational complexes

Specification

The method for indirect obtainment of the necessary hydrometeorological information. The average absolute error of the method is 0.06 cm

Advantages

There are no analogs. The method allows restoring the missing indicators of sea level, has socio-economic significance for all coastal areas of the Black Sea, primarily to ensure the sustainability of the marine facilities used

Readiness Level. Suggestions for Commercialization

IRL6, TRL6
Custom works on the restoration of missing sea level indicators

Intellectual Property Protection IPR2

Contact Information

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METHOD FOR SATELLITE MONITORING AND ASSESSMENT OF OPEN-CAST MINE LAND RESTORATION QUALITY



Poor quality land restoration in Verkhne-Irshynske ilmenite-zirconium ore deposit

Areas of Application

Remote inspection of land restoration quality of abandoned mining concession objects; verification of land restoration for compliance with applicable laws and standards

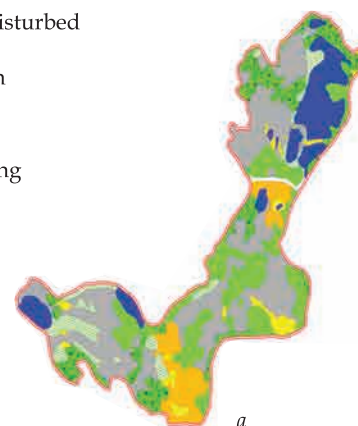
Specification

The method is based on processing optical and radar satellite images. It includes a scale for the evaluation of technical and biological reclamation in accordance with applicable government standards. The outcome are maps or geographic information systems

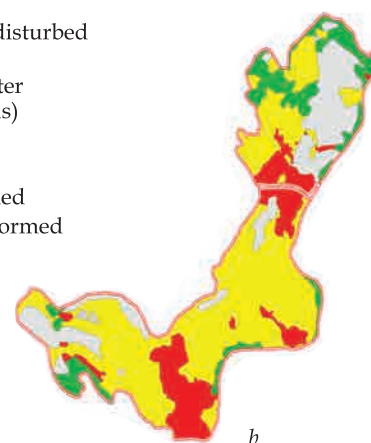
Advantages

The main advantage of the method is its cheapness due to the use of medium resolution satellite imagery provided by U.S. Geological Survey and European Space Agency for free

- The boundaries of disturbed land as of 2006
- Self-sown vegetation
- Reforested areas
- Sand wastes including iron oxides
- Flattened out areas
- Clay sediments
- Waterbodies
- Wetlands



- The boundaries of disturbed land as of 2006
- No assessment (water bodies and wetlands)
- Well-performed
- Satisfactory-performed
- Unsatisfactory-performed



Surface objects map (a) and land reclamation quality map (b) of Verkhne-Irshynske ilmenite-zirconium ore deposit

Readiness Level. Suggestions for Commercialization

IRL5, TRL6
Custom works on land restoration quality inspection

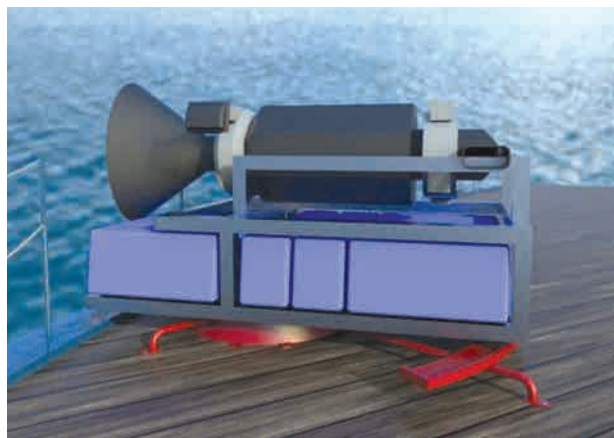
Intellectual Property Protection

IPR1

Contact Information

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MOBILE UNIT FOR HIGHLY DISPERSED SORBENT PRODUCTION BASED ON THERMALLY EXPANDED GRAPHITE



3D-model of the device for production of highly dispersed sorbent on the basis of thermally expanded graphite and visualization of its use



Device for producing highly dispersed sorbent based on thermally expanded graphite

Areas of Application

Elimination of accidental spills of oil and petroleum products in surface water bodies

Specification

Weight is 70 kg; productivity is 100 kg/h; dimensions are 60×70×100 cm; warmup period is 1 min; uses cheap domestic raw material (graphite)

Readiness Level.

Suggestions for Commercialization

IRL6, TRL5

Custom manufacture, supply, warranty service, and staff training

Advantages

As compared with the analogs, the device is small, has a high mobility, and is highly productive due to the use of superhigh frequency magnetic module and low power consumption; may be used directly at the accident site; no harmful emissions; the mobile unit may be scaled for its further use in ports, on tankers, and oil platforms

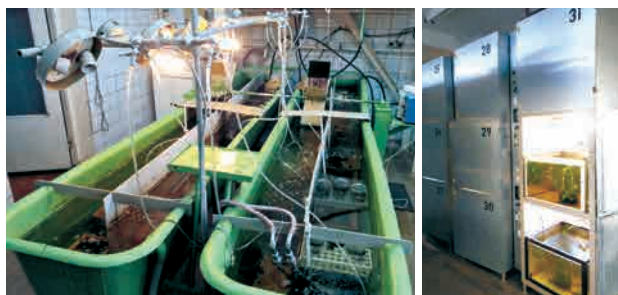
Intellectual Property Protection

IPR1, IPR2, IPR4

Contact Information

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ASSESSMENT OF THE TOXICITY, BIOAVAILABILITY, AND MIGRATION CAPABILITY OF POLLUTANTS IN HYDROECOSYSTEMS



Experimental systems (microcosms) and chambers with controlled aquatic parameters

Areas of Application

Used for assessing the pollution of water bodies by toxic substances; predicting the processes of chemical transformation and bioavailability of toxic substances under variable environment conditions; developing the approaches for minimizing the risks of contaminant impact on the ecology of hydroecosystem and its biotic component

Specification

The presented method includes:

- devices and methods for measuring the toxicity of water and bottom sediments with the use of aquatic organisms of different systematic groups
- methods for classifying toxic pollutants;
- experimental systems (micro-and meso-cosms) for studying the toxic and genotoxic effects of the modelled environment on test organisms of different trophic levels under variable environment conditions

Intellectual Property Protection
IPR1, IPR3



Test objects of different systematic groups for the assessment of toxic and genotoxic impact

Advantages

As compared with the analytical methods: rapid, cost-effective, and integrated method (the response of organisms of different systematic groups at different levels of the organization); the ability to predict the effect on aquatic ecosystems under variable environment conditions

Readiness Level.
Suggestions for Commercialization

IRL4, TRL5
Custom manufacture of devices, research, staff training

Contact Information

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PLASMA-CHEMICAL PLANT FOR DEEP UTILIZATION OF LIQUID RADIOACTIVE WASTE



Plasma chemical plant for deep utilization of liquid radioactive waste

Areas of Application

For cleaning and utilizing liquid radioactive waste and removing organic contaminants

Specification

Productivity in terms of treated water, l / h	at least 10
Overall dimensions, mm	at most 1800×600×600
Weight, kg	at most 100
Power supply system:	
Voltage, V	380 ± 10 %;
Frequency, Hz	50 ± 0.5 %
Power, kW	at most 20

Advantages

Generating nanocomposite oxidants directly in the liquid treatment zone; combining the process of aeration, generation of oxidants and the treatment of liquid in one reactor reduces the cost of the process; smaller number of chemical reagents and consumables reduces operating costs and ensures its environment safety; the modular structure of the device allows it to be configured for different capacities and chemical storages of liquid waste; the possibility of using standard components of both domestic and foreign production

Intellectual Property Protection
IPR3

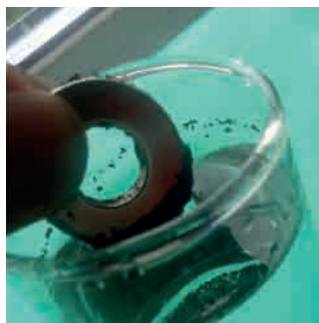
Readiness Level.
Suggestions for Commercialization

IRL7, TRL6
Custom manufacture, supply,
warranty service, and staff training

Contact Information

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POLYMER-INORGANIC MAGNETIC ADSORBENTS FOR CLEANING WATER SURFACES FROM TOXIC ORGANIC SUBSTANCES



a



b

Adsorbent on the surface of water (*a*) and its removal by a magnet (*b*)



a



b

Environmental impacts of oil spills (*a*) and their elimination (*b*)

Areas of Application

For removing oil and petroleum products from water surfaces (oil refining industry, water transport)

Specification

Adsorption capacity is up to 2 g/g, depending on the type of petroleum products; the size of particles reaches 2 mm

Advantages

The adsorbents are obtained from natural cheap and available raw materials. As opposed to the carbon materials, the synthesis method does not provide any carbonization that requires thermal treatment under high temperature, in an inert atmosphere. The adsorbent may be easily removed from water surface with a magnet, the waste material may be utilized by combustion. The utilization causes no release of toxic substances

Readiness Level. Suggestions for Commercialization

IRL3, TRL4
Partners for sorbent production wanted.
Custom manufacture of pilot batches

Intellectual Property Protection

IPR1, IPR3

Contact Information

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ROTOR-TYPE INDUSTRIAL AERATION-AND-OXIDATION PLANT



Industrial rotor-type aeration-and-oxidation plant

Areas of Application

Used to purify water from iron, manganese, hydrogen sulfide, carbon dioxide; to adjust the pH value in accordance with Sanitary Standards and Regulations 2.2.4-171-10 *Hygienic Requirements for Drinking Water for Human Consumption*. For municipal enterprises, water supply systems, water treatment departments of the industrial enterprises

Specification

Productivity, m ³ /h	20 – 40
Specific energy consumption, kWh/m ³	2.57
Dimensions, mm	2850×1365×1560

Readiness Level.

Suggestions for Commercialization

IRL7, TRL6

Виготовлення на замовлення,
постачання, гарантійне обслуговування

Advantages

In comparison with the existing aeration methods, in this case, the oxygen dissolution rate increases 3 – 4 times, the energy consumption decreases by 30 – 35%, and the cost is cheaper by 20 – 25%

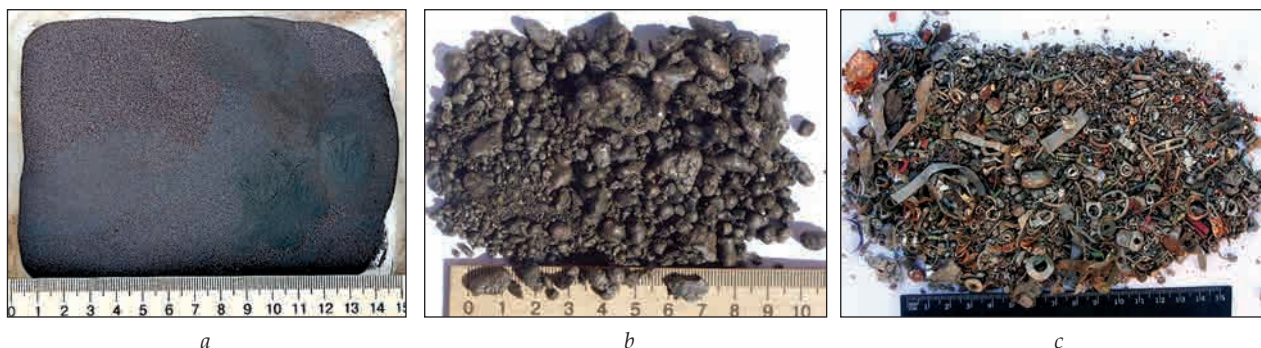
Intellectual Property Protection

IPR3

Contact Information

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ROTARY MILL SEPARATOR



Products obtained with the use of the mill separator: *a* – iron ore concentrate from dump hematite quartzites; *b* – iron from metallurgical slag; *c* – nonferrous and precious metals from electronics waste

Areas of Application

For processing solid industrial waste

Specification

Production of metals and alloys from electronic scrap, slag of ferrous and nonferrous metallurgy, waste of incinerators, energy companies, mining and ore beneficiation, etc. The equipment is compact, mobile, has a modular structure

Readiness Level.

Suggestions for Commercialization

IRL8, TRL7

Custom manufacture, service, and staff training

Advantages

The equipment is better than the existing analogs. Allows receiving metals and concentrates of high purity without the use of water, flotation, chemical reagents, and heating; environment friendly. There is no processing waste. Payback period is 6–8 months

Intellectual Property Protection

IPR3

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RAPID-RESPONSE RADIATION CONTROL SYSTEM BASED ON UNMANNED AERIAL VEHICLE



Specification

High accuracy of the detection and identification of radiation sources; the monitoring and quality operational radiation control guarantee the prevention of radiation accidents.

High resolution gamma radiation detection system, %	0.7
Overall dimensions, mm	at most 1500×800
Weight, kg	at most 15

Areas of Application

For creating advanced technical means for the operative detection and identification of radioactive sources of nuclear fuel cycle facilities

Readiness Level.
Suggestions for Commercialization

IRL7, TRL6
Custom manufacture, supply, and warranty service of the plant, staff training

Advantages

There are no analogs in Ukraine. Better than the foreign counterparts in terms of sensitivity, energy resolution, information support; contains a full cycle of works: search, detection, and identification of radiation sources

Intellectual Property Protection
IPR3

Contact Information

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SORBENT FOR REMOVAL OF RADIONUCLIDES

Areas of Application

For removing cesium and strontium radionuclides from return, sewage, and wastewater of nuclear power plants and radiochemical industry

Specification

Size of mechanically strong granules or pieces, mm	1–5
Distribution coefficients under static conditions:	
Kr (cesium)	>1600
Kr (strontium)	>11000
Reduction in the total content of radionuclides 1000–10 000 times	



Advantages

Due to the mechanical strength and granulation the sorbent may be used in the sorption columns. A high porosity of the sorbent and the presence of specific sorption sites provide the rapid absorption of radionuclides with a high selectivity. The sorbent is inexpensive; the synthesis technology is simple

Intellectual Property Protection

IPR1, IPR3

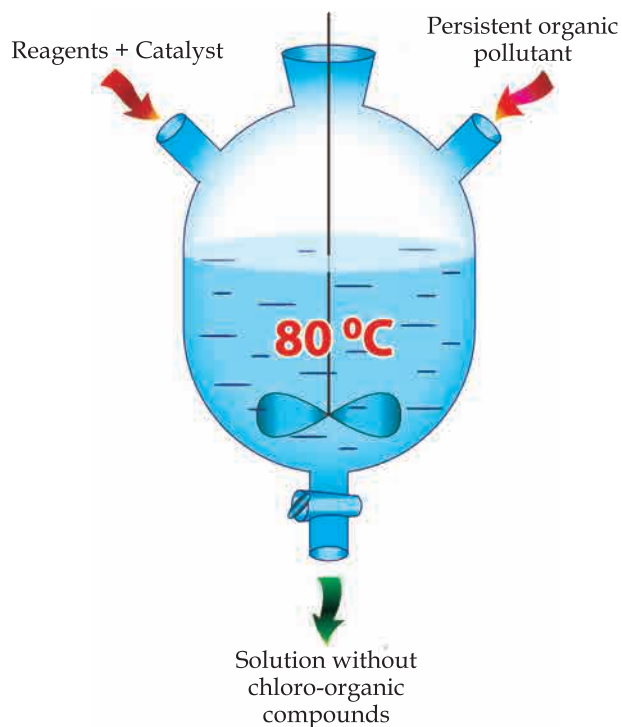
Readiness Level. Suggestions for Commercialization

IRL6, TLR6
Custom manufacture of small batches.
Partners for industrial production wanted

Contact Information

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TECHNOLOGY FOR NEUTRALIZATION OF PERSISTENT ORGANIC POLLUTANTS



The process of persistent organic pollutant neutralization

Areas of Application

For utilizing the illicit pesticides (hexachlorobenzene, dioxins, polychlorinated biphenyls, DDT, DDE) to preserve environment

Specification

High catalytic efficiency (optimally, TON 180000 and TOF 7500 h⁻¹).
temperature range of the process, °C, at most 80
amount of catalyst, mol.% up to 0.01
Environment safe process; recoverability of solvent and conversion of persistent organic pollutants into known low-toxic products; the use of standard equipment

Readiness Level.

Suggestions for Commercialization

IRL6, TRL5
Custom manufacture of catalyst batches.
Investors and partners to organize mass production of the product wanted

Advantages

The technology has no direct analogs in the world, is more energy efficient as compared with the existing ones, and allows avoiding the use of volatile product absorbers; simplifies the process and allows the direct absorption and disposal of harmful substances

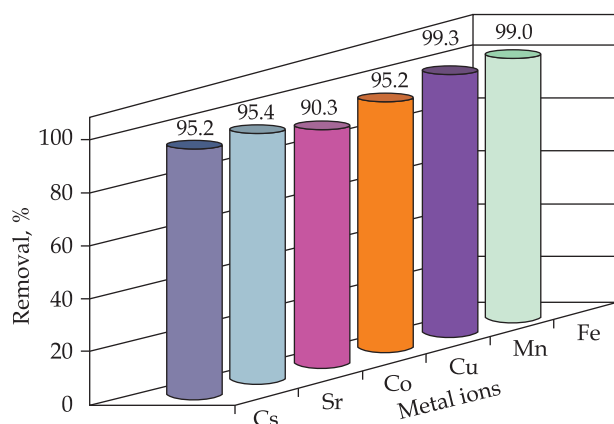
Intellectual Property Protection

IPR3

Contact Information

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PLANT FOR LIQUID RADIOACTIVE WASTE TREATMENT BASED ON NANOCOMPOSITE SYNTHESIS



The results of research on wastewater treatment

Areas of Application

For treating liquid radioactive waste of nuclear fuel cycle facilities and multicomponent man-made contaminated solutions

Advantages

There are no analogs in Ukraine; a significant reduction in radioactive waste; a significant decrease in the amount of salt melt; the replacement of obsolete equipment with modern one for decontamination of solutions, their purification, as well as compaction into a solid phase for further disposal



Reactor of the plant for liquid radioactive waste treatment based on nanocomposite synthesis

Specification

A liquid radioactive waste treatment plant containing cations of different rocks, colloids, and complexing agents with the use of silicon magnetite nanocomposite $\text{SiO}_2 / \text{Fe}_3\text{O}_4$ has been developed

Overall dimensions, mm,	at most, 800×700×2100
Weight, kg	at most, 80
Power supply system:	
Voltage, V	380/220 ± 10%
Frequency, Hz	50 ± 0.5%
Power, kW	at most, 5

Intellectual Property Protection
IPR3

Readiness Level.
Suggestions for Commercialization

IRL7, TRL6
Custom manufacture, supply, and warranty service of the plant, staff training

Contact Information

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- ☒ MEDICHRONAL DRUG FOR ALCOHOL TOXICITY MEDICATION
- ☒ ANTITHROMBOTIC CALIX[4]ARENES
- ☒ MULTIFUNCTIONAL LOW TEMPERATURE PLASMA STERILIZER WITH ULTRASONIC CAVITATION
- ☒ BIOACTIVE INORGANIC CERAMICS
- ☒ CALMIVID-M VITAMIN AND MINERAL COMPLEX FOR OSTEOPOROSIS TREATMENT
- ☒ ELECTROCHEMICAL MULTISENSORS OF OXYGEN AND TOXIC ELEMENTS
- ☒ MEDICAL DRUG FOR THE TREATMENT OF HUMAN HEPATITIS C
- ☒ ALFACOGNITIN DIETARY SUPPLEMENT FOR IMPROVING COGNITIVE FUNCTION IN HUMANS
- ☒ MEDICAL DRUG FOR THE PREVENTION AND TREATMENT OF INFECTIONS CAUSED BY HERPES SIMPLEX VIRUS (TYPES 1 AND 2)
- ☒ PROTECTIVE MEDICAL CLOTHING FOR SHORT-TERM USE
- ☒ IMMUNODIAGNOSTIC TEST SYSTEM FOR QUANTIFYING D-DIMER IN HUMAN BLOOD PLASMA
- ☒ IMMUNODIAGNOSTIC TEST SYSTEM FOR QUANTIFICATION OF SOLUBLE FIBRIN IN HUMAN BLOOD PLASMA
- ☒ AI-RHYTHMOGRAPH INTELLECTUAL SMARTPHONE SOFTWARE
- ☒ AI REABILITOLOG INFORMATION TECHNOLOGY FOR PLANNING AFTER-STROKE LOCOMOTOR REHABILITATION
- ☒ A SET OF INFORMATIVE BIOMARKERS FOR PROGNOSTICATING THE CLINICAL COURSE OF THE BASAL MOLECULAR SUBTYPE OF BREAST CANCER
- ☒ CALCIUM AND STRONTIUM COMPLEXES WITH DIPHOSPHONIC ACIDS FOR THE TREATMENT AND PREVENTION OF SYSTEMIC OSTEOPOROSIS
- ☒ COMPREHENSIVE PERSONAL PROTECTIVE EQUIPMENT
- ☒ CARBOGEMOSTAT HEMOSTATIC COMBINED MEDICATION
- ☒ LIGHTWEIGHT ANTI-DUST RESPIRATOR
- ☒ SANOFLU DRUG FOR THE PREVENTION AND TREATMENT OF INFLUENZA
- ☒ BANDAGE MATERIAL OF COMPLEX PROTEOLYTIC ACTION WITH IMMOBILIZED SERRATIOPEPTIDASE
- ☒ EXTRACELLULAR LECTIN WITH ANTITUMOR AND CYTOTOXIC ACTION
- ☒ RESPIRATOR
- ☒ MOVEMENTTESTSTROKE (PC) SPECIALIZED SOFTWARE MODULE FOR INFORMATION ASSISTANCE IN THE DIAGNOSTICS OF MOTOR FUNCTIONS
- ☒ COVERALLS FOR EVERYDAY CLOTHES AND SKIN PROTECTION OF WORKERS AGAINST SMELLY AND TOXIC GASEOUS AND VAPOROUS SUBSTANCES OF VARIOUS ORIGINS
- ☒ METHOD FOR ENZYMATIC PRODUCTION OF OXYGEN
- ☐ METHOD FOR INHIBITING FIBRIN POLYMERIZATION BY SYNTHETIC PEPTIDES THAT IMITATE FRAGMENTS OF FIBRIN(OGEN)SUPERCOIL DOMAIN
- ☐ METHOD FOR OBTAINING AUTOLOGOUS REGENERATIVE FIBRIN GEL AND REAGENT KIT FOR THE GEL PREPARATION
- ☐ METHOD FOR PREPARATION OF AUTOLOGOUS PLATELET-RICH PLASMA WITH A PLATELET CONTENT OVER 1 MILLION/ μ l
- ☐ METHOD FOR PROGNOSTICATING THE COURSE OF DISEASE IN PATIENTS WITH ENDOMETRIOID-TYPE ENDOMETRIAL CANCER (ECE) (THE 1st AND THE 2nd STAGES)
- ☐ TERAHERTZ LASER SYSTEM FOR BIOMEDICAL RESEARCH
- ☒ ENZYME-LINKED IMMUNOSORBENT ASSAY FOR QUANTIFYING FUNCTIONALLY ACTIVE DIPHTHERIA TOXIN
- ☒ MEBIVID PHARMACEUTICAL COMPOSITION FOR THE TREATMENT OF BONE DISEASES

PHARMACEUTICALS AND MEDICAL DEVICES



MEDICHRONAL DRUG FOR ALCOHOL TOXICITY TREATMENT

Areas of Application

For preventing alcohol intoxication;
abstinence therapy; removing physical
dependence in chronic alcoholism;
hangover therapy; preventing alcoholism

Specification

Medichronal is a unique multi-component anti-alcohol medication that affects the main pathogenetic mechanisms of alcoholism, normalizes ethanol metabolism, and detoxifies the body, stimulates the central nervous system activity in patients. The production has been already launched



Advantages

High therapeutically effective both in terms of the number of patients who have quit drinking alcohol dependence and the duration of post-treatment remission; no side and harmful effects for the recommended doses

Readiness Level.

Suggestions for Commercialization

IRL9, TRL9

Partners for expansion of production and marketing wanted

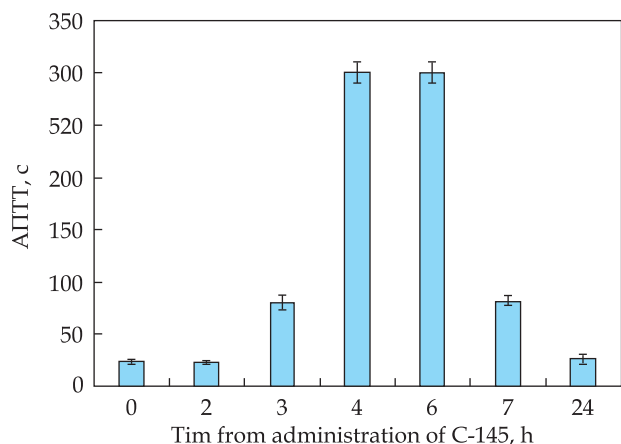
Intellectual Property Protection

IPR3

Contact Information

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ANTITHROMBOTIC CALIX[4]ARENES



Time of blood plasma clotting induced by APTT-reagent in mice, before and after administration of calix[4]arene (12 mg/kg of body weight). The maximum anticoagulant effect is observed after 4 hours of administration

Areas of Application

Used for the manufacture of antithrombotic drugs used in the treatment of diseases accompanied by a high risk of intravascular thrombosis

Specification

The calix[4]arenes and its sodium salt specifically affect blood clotting by inhibiting the fibrin polymerization and the formation of fibrin clot pattern. At monomeric fibrin polymerization, the inhibition constants IC_{50} are equal to $1.0 \cdot 10^{-6}$ M and $2.5 \cdot 10^{-6}$ M, respectively; the toxicity (LD_{50}) is 780 mg/kg for oral administration (low toxic substances). Preclinical trials have been done

Advantages

As compared with the foreign counterparts, these substances act at the final stage of blood clotting, which is fibrin polymerization; have high antithrombotic activity; nontoxic at low doses

Readiness Level.

Suggestions for Commercialization

IRL6, TRL6

Partners for clinical trials and further industrial production wanted

Intellectual Property Protection

IPR3

Contact Information

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MULTIFUNCTIONAL LOW-TEMPERATURE PLASMA STERILIZER WITH ULTRASONIC CAVITATION

Areas of Application

Instrument sterilization in medicine,
cosmetology, and veterinary
Producing disinfectant solutions from water

Specification

Consumables: ordinary or distilled water;
sterilization of objects sensitive to high
temperature.

Sterilization chamber volume, l	0.5 – 100
Sterilization time, min	up to 30
Sterilization temperature, °C	up to 25 (room temperature)



OzonLine multifunctional low-temperature plasma sterilizer prototype (0.5 liter)

Advantages

Has no counterparts; may be used for various levels of instrument disinfection, in addition to sterilization; produces ozone-saturated water (liquid solution for disinfection), gaseous ozone for air disinfection; provides disinfection of hands, surfaces, and air; no harmful chemical waste; requires air, water, and electricity for disinfection or sterilization



OzonLine multifunctional low-temperature plasma sterilizer prototype (5 liters)

Readiness Level.
Suggestions for Commercialization

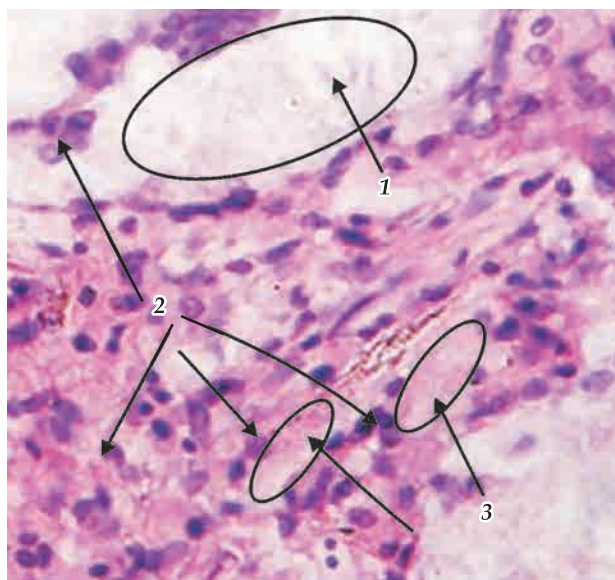
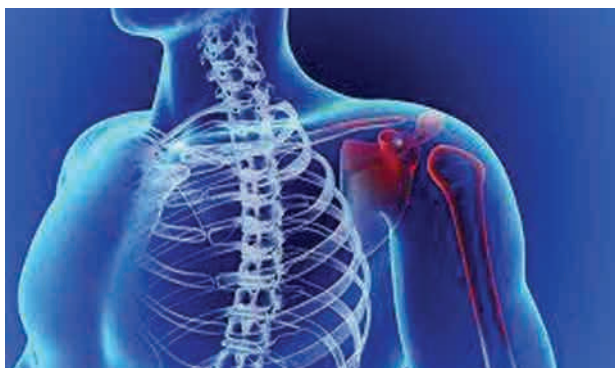
IRL3, TRL6
Investments in certification, manufacture, and
marketing wanted

Intellectual Property Protection
IPR1

Contact Information

Serhii Pugach, National Science Center Kharkov Institute of Physics and Technology
of the NAS of Ukraine, +38 057 335 68 43, e-mail: pugach@kipt.kharkov.ua

BIOACTIVE INORGANIC CERAMICS



Formation of new bone tissue in a rabbit bone defect filled with granules of nanostructured bioactive inorganic ceramic:
1 – remnants of the resorbent material, 2 – osteoblasts,
3 – new bone tissue

Areas of Application

The proposed material is suitable for the use as an implantation material with oncoprotective and antiseptic properties; accelerates the regeneration of bone tissue

Specification

The material is a nanosized powder with a high specific surface area of up to $250 \text{ m}^2/\text{g}$. The nanostructured form increases the adhesion speed and strength, facilitates the biotransformation of the material implanted into bone tissue defects and, accordingly, accelerates the restoration of bone tissue. The material has passed the initial stage of testing on animals

Advantages

After implantation into a bone defect, as a result of material resorption, a layer of calcium-deficient hydroxyapatite is formed on its surface. It firmly binds the implant to the bone; the ions of the doping components are released into the environment and display their inherent biological properties. The main advantage is the presence of such doping elements as Ga and Ge, the biological properties of which include suppression and overcoming of malignant tumors of various etymologies, including those resistant to known chemotherapy drugs

Intellectual Property Protection
IPR3

Readiness Level.
Suggestions for Commercialization

IRL4, TRL3
Partners for clinical trials with subsequent pharmaceutical production wanted

Contact Information

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CALMIVID-M VITAMIN AND MINERAL COMPLEX FOR OSTEOPOROSIS TREATMENT

Areas of Application

In pharmacology and medicine, for the treatment of osteoporosis and the prevention of diseases related to bone-thinning

Specification

The *CALMIVID-M* consists of balanced doses of vitamin D₃ and mineral components for the optimal physiological effect on the human body. Vitamin D₃ is stabilized by a complex with protein, which significantly increases its shelf life (up to 5 years) and prevents the formation of toxic oxidation products, reduces the impact of gastrointestinal detergents on vitamin D₃ and increases its bioavailability. There are no alternatives in Ukraine. Preclinical studies have been completed. The process documents and analytical requirements have been prepared



Advantages

The product surpasses the existing foreign counterparts in terms of therapeutic effect on the structural and functional state of bone tissue and epiphyseal cartilage; stability of vitamin D₃; bioavailability of calcium ions; effect on the normalization of phosphorus metabolism in the body

Readiness Level.

Suggestions for Commercialization

RL5, TRL5

Partners for clinical trials and industrial production wanted

Intellectual Property Protection

IPR3

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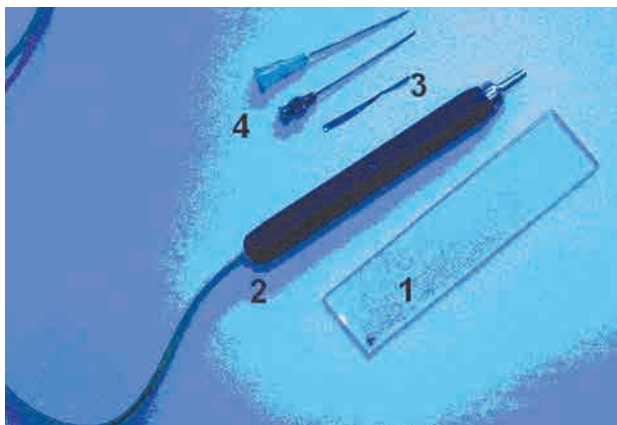
ELECTROCHEMICAL MULTISENSORS OF OXYGEN AND TOXIC ELEMENTS



a



b



c

Pilot samples of electrochemical multisensors of oxygen and toxic elements (Se, Pb, Cd, Cu) for measurements in small volumes of biological fluids (a); for the use in conditions where there are no limitations on the fluid volume (b); components of the multisensor (c): 1 – glass plate with a conductive layer of SnO_2 ; 2 – holder of the microelectrode; 3 – microelectrode strip; 4 – microelectrode needle

Intellectual Property Protection
IPR3

Areas of Application

For rapid measurement of the content of oxygen and toxic elements (Se, Pb, Cd, Cu), both for the treatment of acute poisoning by toxic elements and for the storage of biologically active liquids, the processing of biological waste, the monitoring of oxygen content in natural and artificial reservoirs, the rapid detection of toxic elements in liquids in the areas of emergency, including the areas of military conflicts and man-made disasters

Specification

Sensitivity to dissolved oxygen, mg / l	$3-6 \cdot 10^{-3}$
Sensitivity to toxic elements, mg / l	$2-4 \cdot 10^{-3}$
Measurement accuracy, %	4–5
Measurement speed, s	10–15
Overall dimensions of sensor elements, mm	$100 \times 50 \times 50$
For small volumes, mm	$80 \times 10 \times 10$

Advantages

As compared with the existing analogs, these sensors do not have an oxygen permeable membrane, which allows the minimization of size, quick action, and high sensitivity

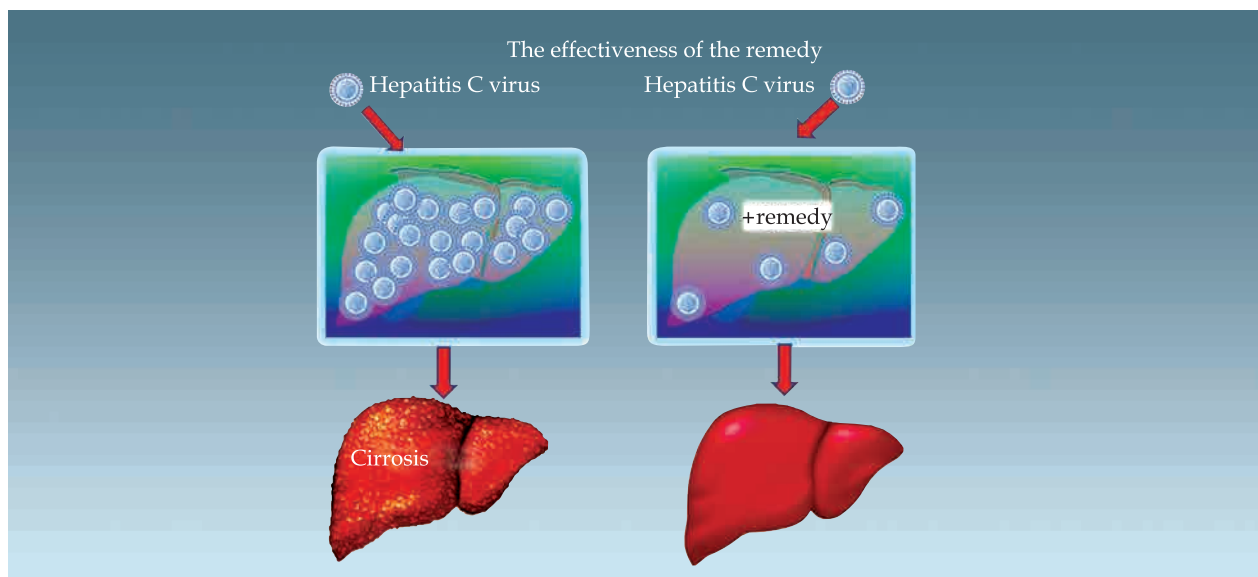
Readiness Level. Suggestions for Commercialization

IRL3, TRL3
Partners for mass production wanted;
custom manufacture of small batches

Contact Information

Gennady Kolbasov, Vernadsky Institute of General and Inorganic Chemistry of the NAS of Ukraine,
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MEDICAL DRUG FOR THE TREATMENT OF HUMAN HEPATITIS C



Areas of Application

Medical drug for the treatment of human hepatitis C

Specification

Effective and safe antiviral drug with a combined antiviral and hepatoprotective action for the treatment of human hepatitis C; inhibits for 100% the reproduction of human hepatitis C virus in hepatitis C virus-transfected cells at an active ingredient concentration of 10^{-6} M to 10^{-9} M. The active ingredient has a complex of powerful pharmacological and biological properties: membrane-protective, antioxidant, adaptogenic, anti-allergic, anti-inflammatory, hypoglycemic, angioprotective. The drug is the winner of Invention 2020 Ukrainian-wide competition in Pharmaceuticals nomination. Preclinical trials have been completed

Intellectual Property Protection

IPR3

Advantages

Unlike the foreign analogs, the drug has a potent antiviral effect against human hepatitis C virus; no toxic and side effects; no preservatives, stabilizers, and other excipients

Readiness Level. Suggestions for Commercialization

IRL7, TRL4
Partners for clinical trials with subsequent industrial production wanted

Contact Information

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ALFACOGNITIN DIETARY SUPPLEMENT FOR IMPROVING COGNITIVE FUNCTION IN HUMANS



Areas of Application

To improve cognitive functions,
in particular memory, in humans;
to treat and to prevent various pathologies,
including post-COVID syndrome with cognitive
impairment, as well as birth defects

Specification

*Alphacognitin's ingredients are cofactors of
the enzymatic reactions involved in several
homocysteine metabolism pathways,
which most effectively reduce homocysteine
levels and, at the same time, contribute
to the improvement of cognitive functions*

Advantages

As compared with the foreign analogs,
the dietary supplement ensures homocysteine
metabolism in several ways; accelerates
homocysteine metabolism and normalizes
its level in blood plasma; improves memory
and memorization; lowers blood pressure;
is effective, safe, and affordable

Readiness Level.

Suggestions for Commercialization

IRL7, TRL7

Custom manufacture of small batches
of the dietary supplement.

Partners for mass production wanted

Intellectual Property Protection

IPR3

Contact Information

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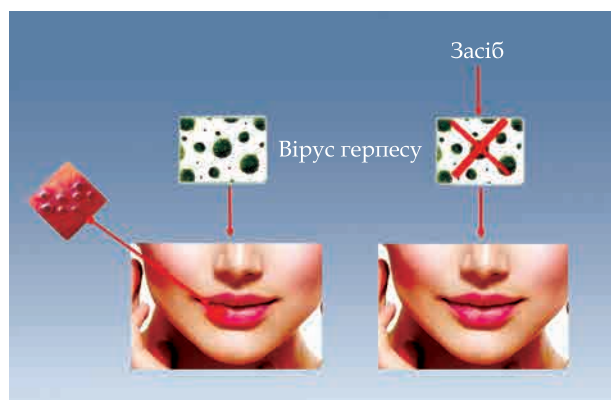
MEDICAL DRUG FOR THE PREVENTION AND TREATMENT OF INFECTIONS CAUSED BY *HERPES SIMPLEX* VIRUS (TYPES 1 AND 2)

Areas of Application

For preventing and treating the infections caused by *herpes simplex* viruses of types 1 and 2 in all age groups

Specification

Highly effective and safe antiherpetic agent: at a concentration of $1 \cdot 10^{-6} - 1 \cdot 10^{-9}$ M active substance has a high antiherpetic effect with a chemotherapeutic index of $1 \cdot 10^3$ with respect to the reproduction of herpes simplex virus of types 1 and 2 in the cell culture. The active substance is an active component of cell membranes with a complex of pharmacological and biological properties, including membrane-protective, antioxidant, adaptogenic, antiallergic, and angioprotective ones. The preclinical trials are in progress



Readiness Level. Suggestions for Commercialization

IRL7, TRL6
Partners for clinical trials with subsequent launch of commercial production wanted

Advantages

Unlike the known world analogs (*Amixin, Neovir, Viferon, Larifan, Panavir, Virolex, Valavir, and Herpevir*), the drug is chemically stable in the environment and has a high antiherpetic activity; has no toxic side effects on the body; is suitable for all age groups

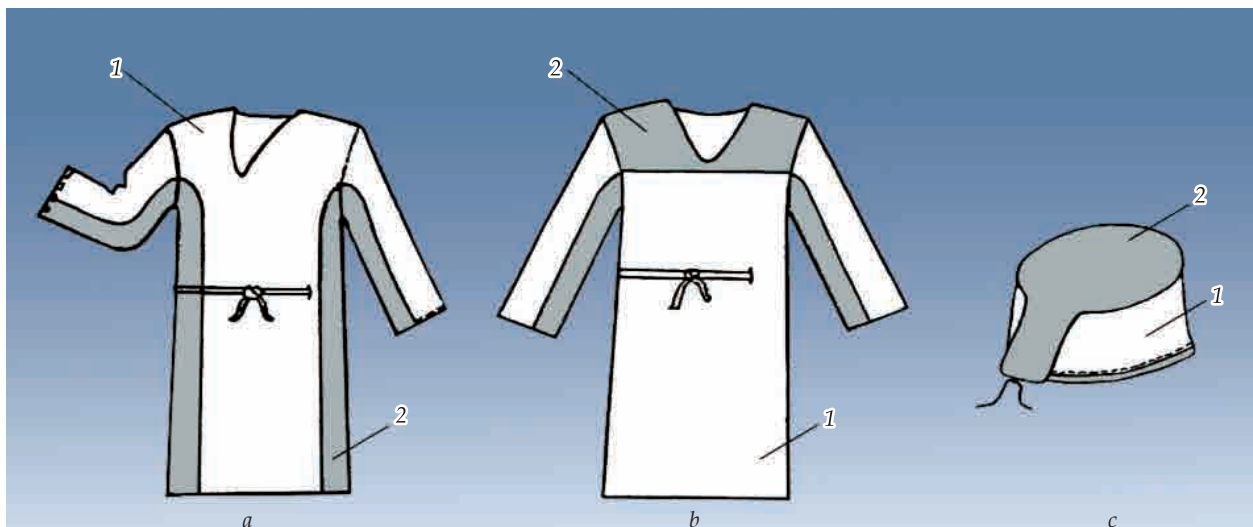
Intellectual Property Protection

IPR3

Contact Information

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PROTECTIVE MEDICAL CLOTHING FOR SHORT-TERM USE



Protective medical clothing for short-term use: *a, b* — lab coats, *c* — a piece of headwear made of non-woven material (1) with inserts of cotton fabric (2)

Areas of Application

For protecting the environment from the particles released from user's skin and protecting users from the effects of harmful environmental factors

Specification

Provides the optimum condition, physiological comfort, and a microclimate; convenience and comfort during the use, especially at considerable load on human organism; the use of unified patterns allows making products for different functional purposes: lab coats, suits, overalls, jackets, hats, etc.

Advantages

Improved hygienic properties, increased comfort due to the use of low-density cotton fabric inserts (80 g/m³)

Intellectual Property Protection

IPR1, IPR3

Readiness Level. Suggestions for Commercialization

IRL8, TRL8
Custom manufacture.
Partners for the upgrade of equipment, advertising campaign, and market expansion wanted

Contact Information

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IMMUNODIAGNOSTIC TEST SYSTEM FOR QUANTIFYING D-DIMER IN HUMAN BLOOD PLASMA

Areas of Application

Early diagnosis of the risk of thrombosis in humans to prevent heart attacks, strokes, thrombosis and thromboembolism;
monitoring of antithrombotic therapy;
use in clinical and diagnostic laboratories

Specification

The test system is a convenient set of components for quantifying D-dimer by ELISA with the use of highly specific D-dimer monoclonal antibodies of our own production, without cross-reacting them with fibrinogen and fibrin in the presence of other plasma proteins.

High sensitivity of D-dimer determination (30 ± 6 ng / ml); the specificity is 98%; the test time is 3 hours.

The industrial prototypes have been tested in specialized clinics



Readiness Level. Suggestions for Commercialization

IRL6, TRL7
Partners for the launch of commercial production wanted

Advantages

There are no analogs in Ukraine and the CIS countries. Like a few world analogs, the test system provides a high sensitivity of D-dimer determination; automatic quantification of D-dimer; short test time; long time of components storage; simplicity and reliability

Intellectual Property Protection

IPR3

Contact Information

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IMMUNODIAGNOSTIC TEST SYSTEM FOR QUANTIFICATION OF SOLUBLE FIBRIN IN HUMAN BLOOD PLASMA



Advantages

There are no analogs in Ukraine and the CIS countries. Like a few world counterparts, the test system provides a high sensitivity of soluble fibrin determination; automatic quantification of soluble fibrin; short test time; long time of storage of test system components; simplicity and reliability

Areas of Application

Early diagnosis of the risk of thrombosis in humans to prevent heart attacks, strokes, thrombosis, and thromboembolism; monitoring of antithrombotic therapy; use in clinical and diagnostic laboratories

Specification

Convenient set of components for the quantitative determination of soluble fibrin by ELISA with the use of highly specific to fibrin desAA and desAABB monoclonal antibodies of our own production. Provides a high sensitivity for the determination of soluble fibrin $0.5 \pm 0.1 \mu\text{g} / \text{ml}$; the specificity is 98%; the test time is 3 hours. The industrial prototypes have been tested in specialized clinics

Readiness Level. Suggestions for Commercialization

IRL6, TRL7
Partners for the launch of commercial production wanted

Intellectual Property Protection

IPR3

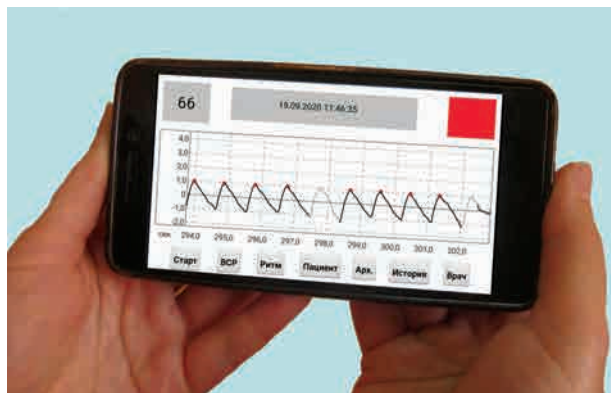
Contact Information

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AI-RHYTHMOGRAPH INTELLECTUAL SMARTPHONE SOFTWARE

Areas of Application

To be used in medical, educational, sports facilities, as well as at home and in the field for operational assessment of the body's adaptive reserves; for mass preventive medical surveys; for obtaining additional diagnostic information during exercise tests; for monitoring the functional state of the organism in dynamics



Specification

Consists of software application that runs on smartphones with *Android* operating system. Provides the automatic processing of photoplethysmogram and the determination of statistical and spectral characteristics of heart rate variability. Only the built-in camera and flashlight are used for getting information. The test time is 1 min

Advantages

Unlike the existing analogs, the software does not require any additional technical means for registration of photoplethysmogram. The use of intelligent computational algorithms ensures a high reliability and accuracy of test results

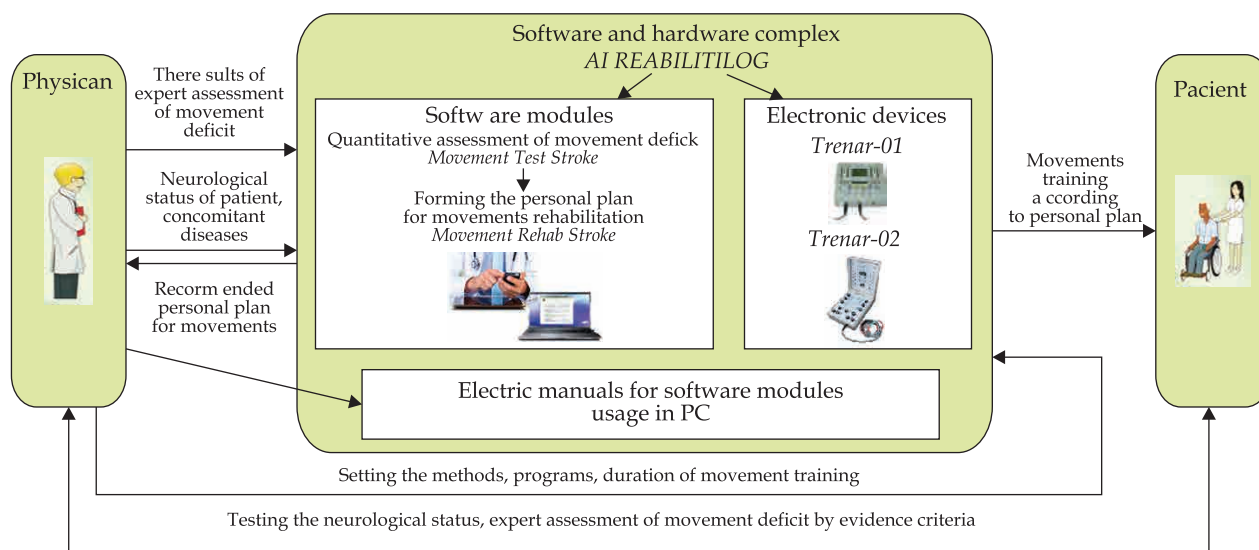
Intellectual Property Protection
IPR2

Readiness Level.
Suggestions for Commercialization
IRL6, TRL4
Custom supply of the software, staff training

Contact Information

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AI REABILITOLOG INFORMATION TECHNOLOGY FOR PLANNING AFTER-STROKE LOCOMOTOR REHABILITATION



User's interaction with AI REABILITOLOG software and hardware complex and the patient

Areas of Application

Information assistance in making diagnostic and therapy decisions for motor activity restoration after stroke at medical institutions and rehabilitation centers

Readiness Level. Suggestions for Commercialization

IRL7, TRL6
Software configuration, staff training; customization

Intellectual Property Protection

IPR2, IPR3

Specification

AI REABILITOLOG technology combines artificial intelligence tools: software modules for quantitative assessment of motor activity disorder *MovementTestStroke* (PC), for developing a personal plan of exercises for locomotor system by *TRENAR®* devices for its rehabilitation *MovementRehabStroke* (PC), and electronic manuals for the use of these modules

Advantages

There are no analogs. AI REABILITOLOG forms a recommended personal plan of exercises for patient's locomotor system based on the results of the assessment of its disorder and the general condition of the patient, makes it possible to adjust this plan by physician and to store information in the Database. This helps to reduce the physician's error in decision-making and the disability risk, to prevent complications, and to increase the rehabilitation effectiveness

Contact Information

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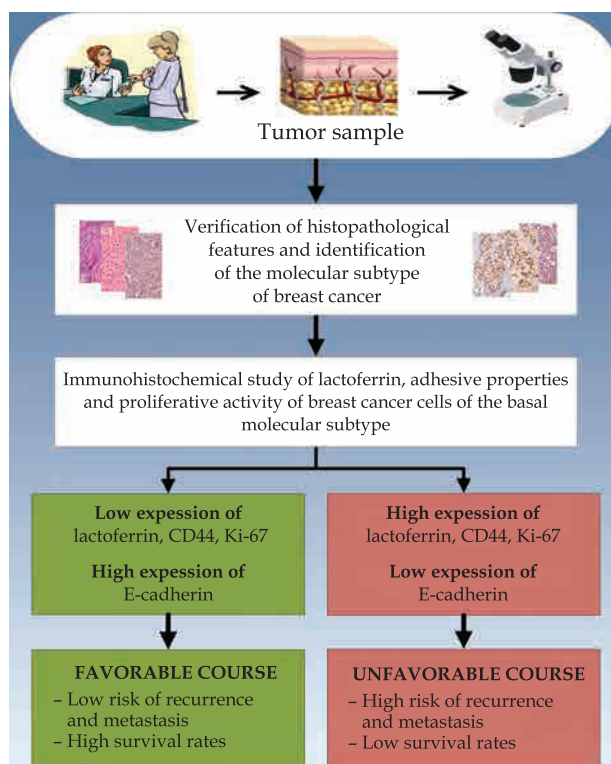
INFORMATIVE BIOMARKERS FOR PROGNOSTICATING THE CLINICAL COURSE OF THE BASAL MOLECULAR SUBTYPE OF BREAST CANCER

Areas of Application

For the objective assessment of the tumor malignancy degree and the prediction of the likelihood of recurrence and metastasis in patients with basal molecular subtype of breast cancer (BC). For the needs of practical medicine, in particular for the optimization of the clinical course in women with the basal molecular subtype of BC

Specification

The panel of biomarkers consists of lactoferrin that is an iron-binding glycoprotein with a wide range of biological properties; the adhesion markers are CD44, E-cadherin, and Ki-67 proliferation antigen, which reflects the clonal heterogeneity of cells in different tumors and in population of tumor cells of a particular patient and the relationship between the cells. Taken together, the indicators allow determining the capacity for tumor progression. The biomarkers have been introduced into clinical practice of oncological centers of Ukraine



Algorithm for predicting the clinical course of the basal molecular subtype of breast cancer

Advantages

In Ukraine, there are no analogs of the method of prognosis for a certain set of informative biomarkers. The proposed panel uses the molecular criteria that reflect metabolic, invasive, migratory, and proliferative changes in tumor cells, i.e. the biological activity of a particular tumor, indicating the likelihood of recurrence and metastasis, which meets the modern requirements of personalized oncology

Readiness Level. Suggestions for Commercialization

IRL7, TRL6
Personalized prediction of the clinical course of the basal molecular subtype of breast cancer with the use of the proposed panel of informative biomarkers

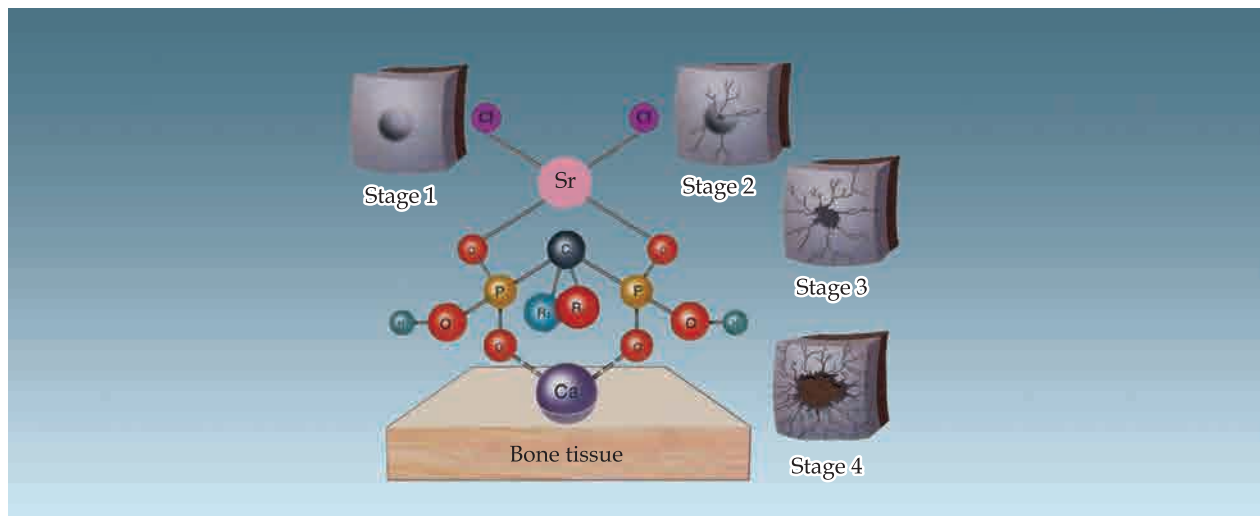
Intellectual Property Protection

IPR1, IPR3

Contact Information

Tetyana Pyatchanina, RE Kavetsky Institute of Experimental Pathology, Oncology and Radiobiology of the NAS of Ukraine, +38 044 259 01 67, e-mail: tanya_pyatchanina@ukr.net

CALCIUM AND STRONTIUM COMPLEXES WITH DIPHOSPHONIC ACIDS FOR THE TREATMENT AND PREVENTION OF SYSTEMIC OSTEOPOROSIS



The principle of the medicines action

Areas of Application

For treating systemic osteoporosis, preventing bone metastases in cancer, improving the biochemical properties of functionalized ceramic implants for bone reconstruction after surgery

Specification

Complexes of calcium and strontium with diphosphonic acids are new compounds that contain calcium and strontium. The simultaneous presence of diphosphonic acid, calcium and / or strontium provides a synergistic effect that enables using the drug at all stages of osteoporosis and preventing the formation of bone metastases in cancer

Advantages

Has a high antiresorptive activity, increases the bone mineral density and saturation, allows reducing the duration of administration and the drug dose 1.5 times, has no side effects. Works at all stages of the disease and improves the biochemical properties of functionalized ceramic implants for bone repair

Intellectual Property Protection
IPR2

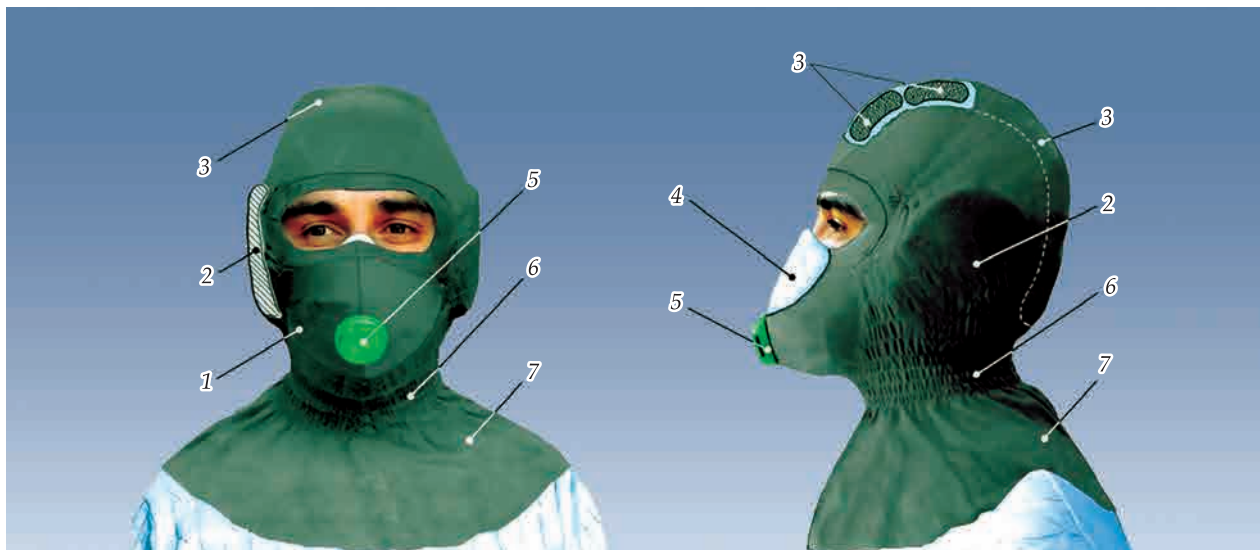
Readiness Level.
Suggestions for Commercialization

IRL3, TRL3
Partners for clinical trials, organization of production, and marketing wanted

Contact Information

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COMPREHENSIVE PERSONAL PROTECTIVE EQUIPMENT



Comprehensive personal protective equipment consisting of balaclava (1), noise canceling elements (2), thermocompensating elements (3), Snijok Gas/Dust half-mask-respirator (4), exhalation valve assembly (5), shirt band (6), cape (7)

Areas of Application

Simultaneous protection of the respiratory organs from airborne particles of various origin, gases and vapors, the hearing organs from high noise and elevated temperature due to protective elements located in fronto-occipital and ears area

Specification

Meets the requirements for gas and dust protection (type and class FMGas1P2); provides reducing temperature of the head surface and protects from increased level of noise

Advantages

Allows reducing the cost of the respiratory and hearing protection due to the use of replaceable protective elements. The neck obturator provides a guaranteed tight fit of the equipment to the neck

Readiness Level.

Suggestions for Commercialization

IRL7, TRL7

Custom manufacture and supply.

Partners for advertising and marketing campaign wanted

Intellectual Property Protection

IPR1, IPR3

Contact Information

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CARBOGEMOSTAT HEMOSTATIC COMBINED MEDICATION



Pilot samples of anti-bleeding agent in the form of gauze and wipe (on the left)

Areas of Application

Used to rapidly stop acute vascular, capillary, and parenchymal bleeding. Suitable for the use in clinics, in field conditions, and at home, as part of individual first aid kits of various profiles

Advantages

CARBOGEMOSTAT hemostatic combined tool surpasses the international counterparts CELOX (EU) and QuikClot (USA) as it effectively stops heavy bleeding; rapidly stops bleeding in patients with hemophilia; has anti-edematous, anti-inflammatory, analgesic, and antimicrobial action

Specification

CARBOGEMOSTAT consists of the two functional components: the activator of blood clotting and the sorbent dressing based on highly activated carbon materials for medical purposes, which serves as a matrix for immobilization of enzyme activator, while maintaining its sorption, disinfectant, and wound healing properties. The clinical trials have started

Readiness Level. Suggestions for Commercialization

IRL6, TRL6
Partners for commercial production wanted

Intellectual Property Protection

IPR3, IPR4

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LIGHTWEIGHT ANTI-DUST RESPIRATOR

Areas of Application

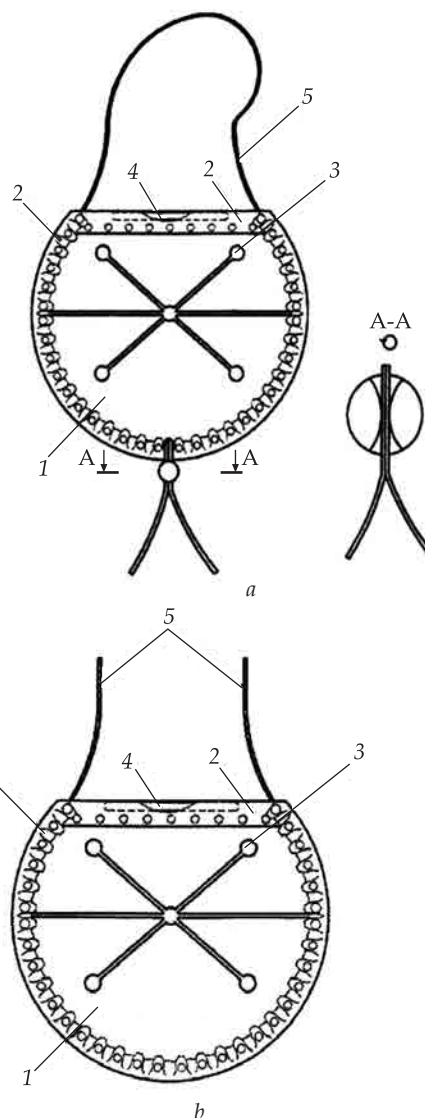
For the protection of respiratory system against airborne or air-dust aerosols of various origins (including bioaerosols)

Specification

Meets the requirements for personal anti-aerosol respiratory protection FFP2 in accordance with EN 149:2017

Advantages

Suitable for users with different face size, quick adjustment; may be combined with eye protection devices



Lightweight anti-dust respirator
(a – modification 1, b – modification 2)
consisting of filter element (1); obturator (2); struts (3);
clamping plate (4); and elastic cord (5)

Readiness Level.

Suggestions for Commercialization

IRL8, TRL8

Custom manufacture. Partners for the market expansion and advertising campaign wanted

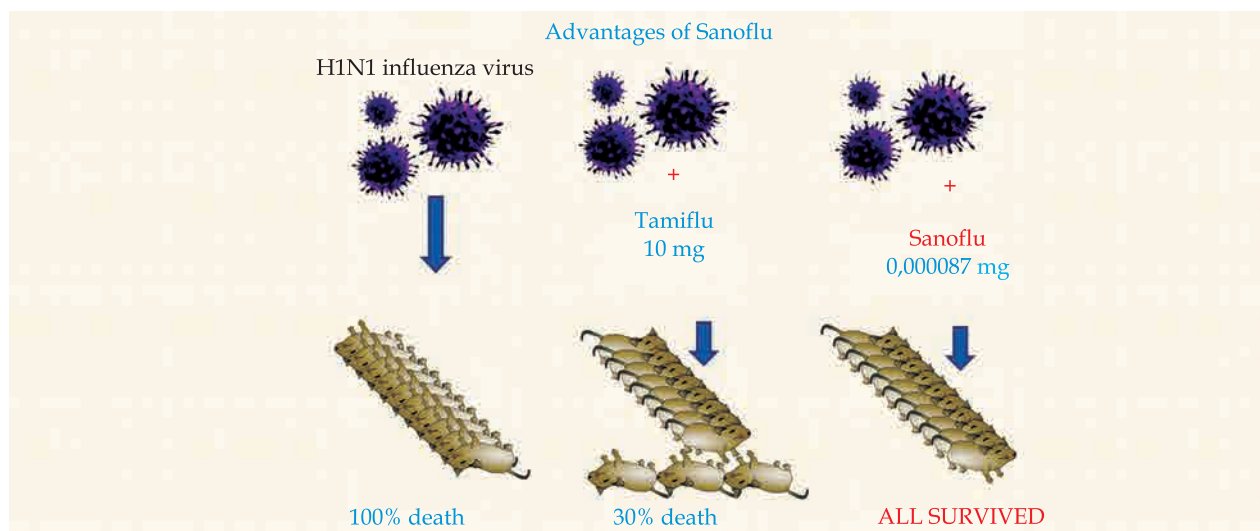
Intellectual Property Protection

IPR1, IPR3

Contact Information

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SANOFLU DRUG FOR THE PREVENTION AND TREATMENT OF INFLUENZA



Areas of Application

For the prevention and treatment of influenza

Specification

SANOFLU has antineuraminidase, interferon-inducing, and anti-hemagglutinating effect against H1N1 influenza infection, blocks the surface glycoproteins of influenza virus, induces the production of gamma and alpha interferons, protects cells from atypical proliferative activity. The anti-influenza effectiveness is 100% at a dose of 0.2 ml 10^{-9} M for therapy and at a dose of 0.2 ml 10^{-8} M for prophylaxis. The preclinical studies are in progress

Advantages

The product surpasses the foreign counterparts; prevents the influenza virus from entering the cell; prevents viral particles from spreading inside the body; retains its antiviral activity for a long time (5 days) surpassing well-known *Oseltamivir* (commercial name *Tamiflu*); prevents complications (pneumonia); does not contain preservatives, stabilizers or other additives; has adaptogenic properties; is effective and safe: does not have toxic and side effects

Readiness Level.
Suggestions for Commercialization

IRL7, TRL4
Partners for clinical trials and further industrial production wanted

Intellectual Property Protection
IPR3

Contact Information

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BANDAGE MATERIAL OF COMPLEX PROTEOLYTIC ACTION WITH IMMOBILIZED SERRATIOPEPTIDASE

Areas of Application

Medical material with antimicrobial action for the healing of wound and the treatment of skin lesions, in particular wounds and burns

Specification

Biocompatible polymer material with antimicrobial and complex proteolytic activity, prolonged action, long-term storage, in the form of gauze wipes having a size of 10×10 cm and an activity of 20–25 units/dm²



Advantages

Unlike the existing analogs, the material is characterized by a pronounced proteolytic, collagenolytic, fibrinolytic, anti-edematous, anti-inflammatory antimicrobial action; hydrolyzes necrotized tissues

Readiness Level.

Suggestions for Commercialization

IRL6, TRL7

Custom manufacture of small batches.

Partners for mass production wanted

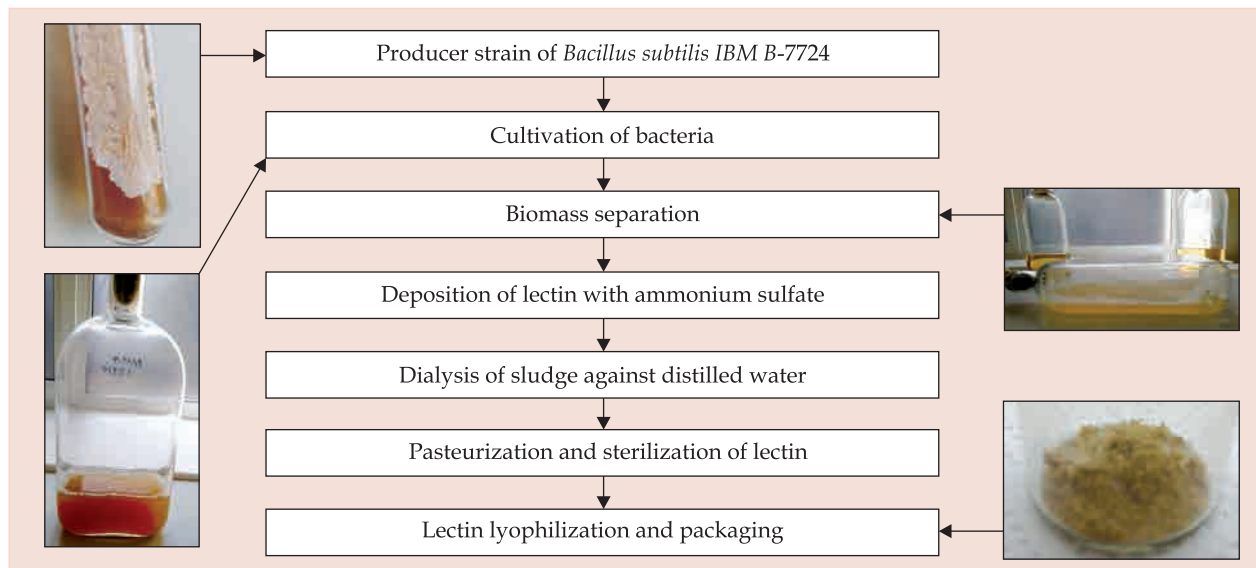
Intellectual Property Protection

IPR3

Contact Information

Tetiana Mikhaylova, Bogatsky Physico-Chemical Institute (PCI) of the NAS of Ukraine,
+ 38 048 793 70 53, e-mail: office.physchem@nas.gov.ua

EXTRACELLULAR LECTIN WITH ANTITUMOR AND CYTOTOXIC ACTION



Biotechnological process of obtaining *Bacillus subtilis* IBM B-7724 extracellular lectin

Areas of Application

For the needs of clinical oncology,
in particular for antitumor biotherapy

Specification

Extracellular lectin isolated from culture fluid *B. subtilis* IMB B-7724 — glycoprotein with a molecular weight of 18.0–20.0 kDa; thermostable; highly specific to sialic acids; low toxic; has *in vitro* cytotoxic activity to tumor cells of different histogenesis (sarcoma 37, Ehrlich adenocarcinoma, B-16 melanoma, Lewis lung carcinoma, cells of lines L 1210, HL60, K562)

Advantages

Low toxicity of the obtained extracellular lectin and its high specificity to sialic acids that are present in large quantities in tumor cells of various origins allow us to consider lectin a promising means of antitumor biotherapy both as a separate substance and as part of antitumor vaccines

Intellectual Property Protection
IPR1

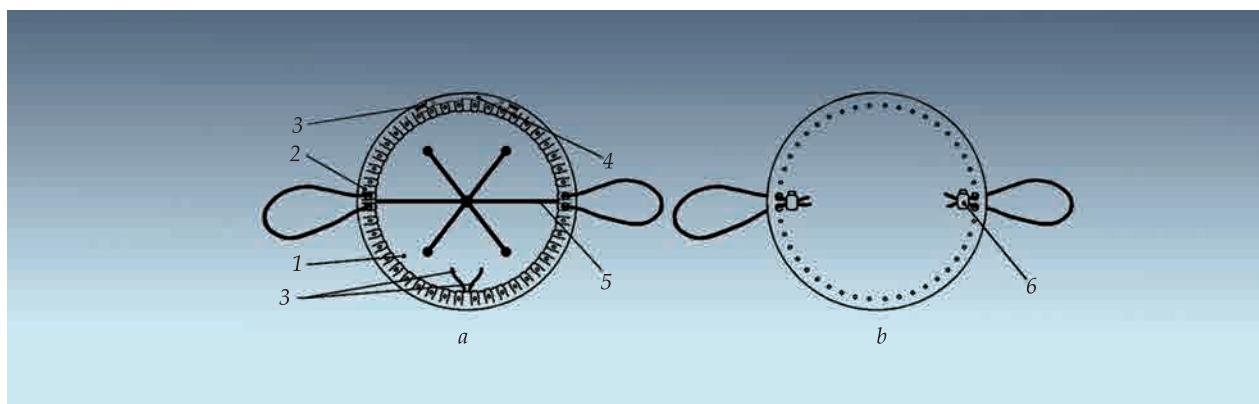
Readiness Level. Suggestions for Commercialization

IRL3, TRL2
Custom production of lectin, study of its physicochemical properties and biological activity *in vitro* and preclinical tests *in vivo*

Contact Information

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RESPIRATOR



Respirator: *a* – inner side of the respirator, 1 – filter half-mask, 2 – obturator, 3 – elastic cord, 4 – aluminum plate, 5 – strut; *b* – outer side of the respirator, 6 – clamp

Areas of Application

For the protection of respiratory system against airborne or air-dust aerosols of various origins (including bioaerosols)

Specification

Meets the requirements for personal air-dust respiratory protection FFP2 in accordance with EN 149:2017

Advantages

Unlike the well-known Lepestok respirator, this one has a headband that consists of two pieces of elastic cord of certain length, the ends of which are stretched from the inner to the outer side of half-mask through holes at the ends of the strut horizontal axes. The size is fixed by means of clamps. This allows adjusting the fasteners of respirator, quickly putting it on and off

Readiness Level.

Suggestions for Commercialization

IRL8, TRL8
Custom manufacture and supply.
Partner for the expansion of the sales market and the organization of advertising campaign wanted

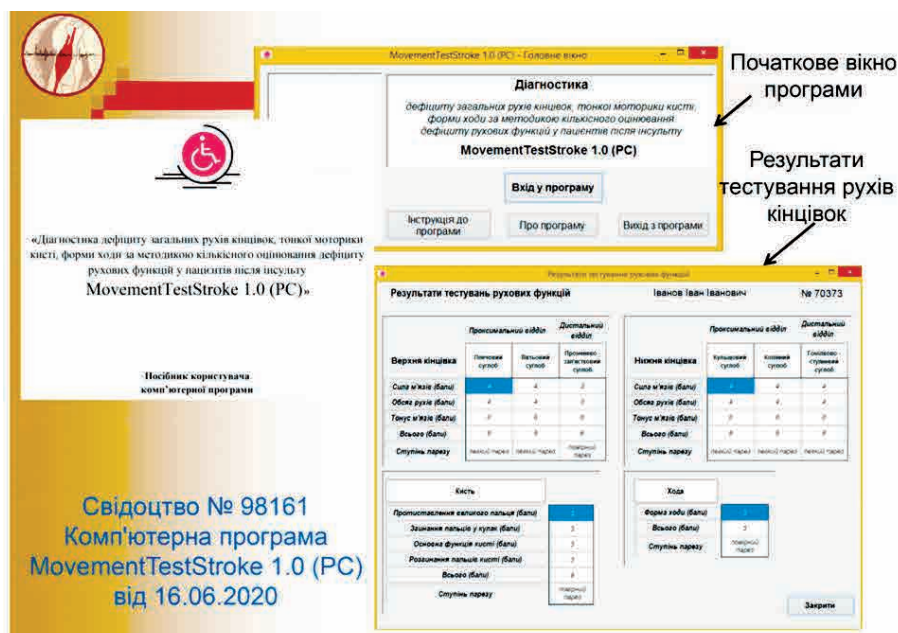
Intellectual Property Protection

IPR1, IPR3

Contact Information

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MOVEMENTTESTSTROKE (PC) SPECIALIZED SOFTWARE MODULE FOR INFORMATION ASSISTANCE IN THE DIAGNOSTICS OF MOTOR FUNCTIONS



Areas of Application

The quantitative assessment of motor function disorder of limbs, particularly after stroke, and the effectiveness of motor function restoration as a result of rehabilitation for medical institutions, rehabilitation centers, and in home conditions

Specification

Combines the motor function disorder assessment subsystem, the database, and the electronic manual for the use of program on PC. Provides storage, processing, and monitoring of the motor function state in dynamics

Advantages

Unlike the known analogs, the application of an expanded range of criteria and the unification of quantitative assessment of limb motor function disorder, hand's fine motor skills, walk, muscle hyper- and hypotone, storage in the database, and display of the assessment results on the interface help to reduce diagnostic errors, to detect disorders that are not taken into account in the conventional motor function diagnostics, and to prevent complications

Readiness Level. Suggestions for Commercialization

IRL7, TRL6
Customization of software, staff training

Intellectual Property Protection

IPR2, IPR3

Contact Information

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COVERALLS FOR PROTECTING EVERYDAY CLOTHES AND SKIN OF WORKERS FROM SMELLY AND TOXIC GASEOUS AND VAPOROUS SUBSTANCES OF VARIOUS ORIGINS

Areas of Application

For protecting clothing and skin of workers from smelly and toxic gaseous and vaporous substances of various origins

Specification

Made with the use of a composite material; the front layer is a durable breathable cloth made of synthetic or/and natural fibers; inside, the cloth is covered with point-glued layer of granular adsorbent or chemisorbent (granules of activated carbon or ion exchanger); the reverse layer is a light breathable cloth that duplicates the granular sorbent

Advantages

In comparison with other types of overalls, the product provides the absorption of smelly and toxic gaseous substances of various origins



Readiness Level. Suggestions for Commercialization

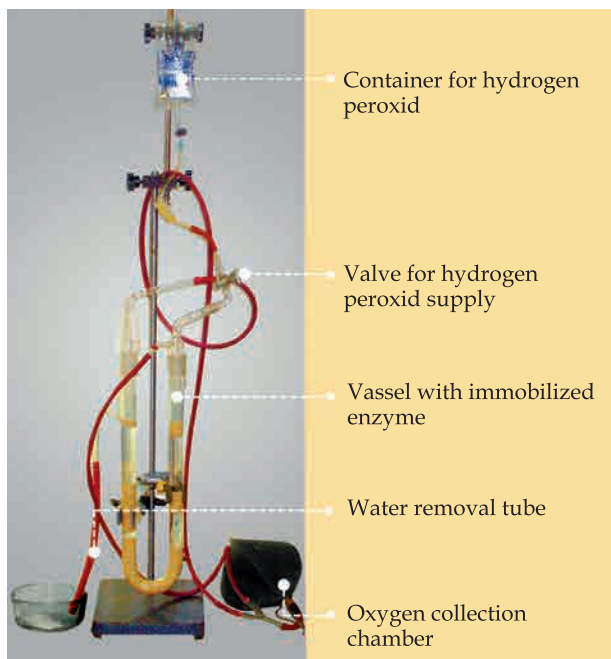
IRL7, TRL7
Custom manufacture and supply.
Partners for the organization
of advertising campaign
and commercial production wanted

Intellectual Property Protection IPR1, IPR3

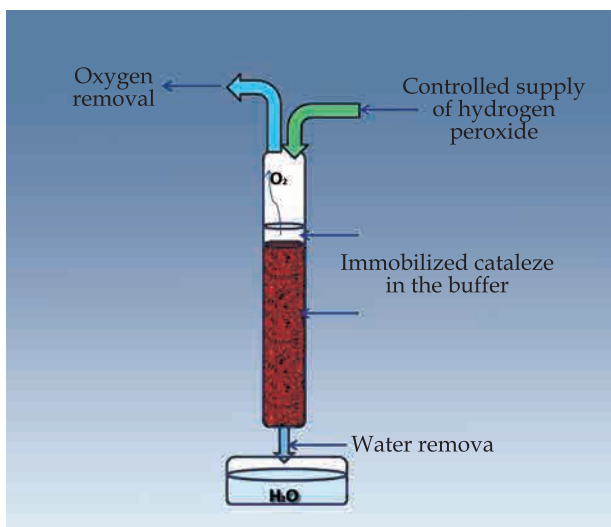
Contact Information

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METHOD FOR ENZYMATIC PRODUCTION OF OXYGEN



Portable non-volatile oxygen generator based on a U-shaped column



Flowchart of operation of portable energy-independent oxygen generator

Areas of Application

To obtain oxygen in small quantities when oxygen supply or oxygen concentrators are unavailable

Specification

An effective method for enzymatic production of oxygen is based on the enzymatic reaction of catalase preparation with a solution of hydrogen peroxide; ensures the required speed and amount of oxygen formation (from 0.1 – 0.3 l/min to 2.5 l/min). Oxygen is obtained in special chemical reactors of appropriate types: accumulative, flow, and periodic action (closed cycle system)

Advantages

There are no analogs in Ukraine and in the world. The method allows the use of catalase preparation of any origin, from any source (microbial, plant, animal, or synthetic); the use of the catalase preparation of any enzymatic activity as well as stabilized and/or immobilized on solid carriers by any methods; the use of hydrogen peroxide solution in a wide range of concentrations; controlled course of the enzymatic reaction of catalase with hydrogen peroxide for continuous oxygen generation; repeated use of catalase preparation and safe operation

Intellectual Property Protection
IPR3

Readiness Level.
Suggestions for Commercialization

IRL4, TRL4
Partners for commercialization wanted

Contact Information

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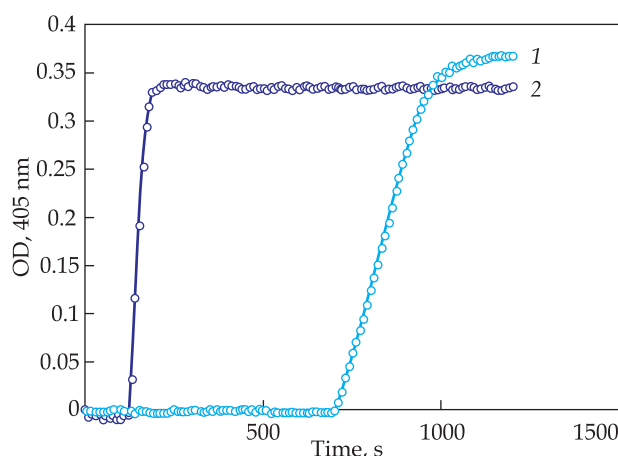
METHOD FOR INHIBITING FIBRIN POLYMERIZATION BY SYNTHETIC PEPTIDES THAT IMITATE FRAGMENTS OF FIBRIN(OGEN) SUPERCOIL DOMAIN

Areas of Application

To treat pathological intravascular thrombosis that leads to such deadly diseases as myocardial infarction, ischemic stroke, pulmonary embolism, etc. To inhibit the polymerization of fibrin and to create a substance for a drug that inhibits the process of thrombosis

Specification

In this method, the fibrin polymerization is inhibited by a mix of three synthetic peptides that are mimic fragments of the supercoil region of fibrin(ogen). The composition for inhibiting the fibrin polymerization contains synthetic structural analogs of the human fibrin(ogen) site in its supercoil region



Inhibition of fibrin polymerization by a mix of peptides mimicking the sequences of fragments of fibrinogen chains (1). 2 – fibrin polymerization in the reference sample

Advantages

Inhibition of thrombosis at the stage of polymerization of fibrin (that is thrombus framework); synergistic inhibitory effect of the composition components on the fibrin polymerization process; inhibition of fibrin self-assembly and prolongation of the lag polymerization period by 2–2.2 times

Readiness Level.
Suggestions for Commercialization

IRL3, TRL5
Partners for commercialization
of the method wanted

Intellectual Property Protection
IPR2, IPR4

Contact Information

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METHOD FOR OBTAINING AUTOLOGOUS REGENERATIVE FIBRIN GEL AND REAGENT KIT FOR THE GEL PREPARATION



Healing of the rabbit front limb during self-rehabilitation (left) and in the case of fibrin glue application (right)

Areas of Application

To be used in medicine and veterinary before operation (in orthopedics, traumatology, surgery)

Specification

One-step procedure to obtain fibrin gel by the interaction of patient's blood plasma with activator, with the use of 10–20 ml of patient's blood vs. 60–150 ml for the analogs. The kit contains sterile reagents for the procedure. The preclinical trials have been at the final stage

Advantages

There are no analogs in Ukraine. In contrast to the foreign counterparts, this method is a one-step procedure; it is easy to use; obtained right before the use from a small amount of the patient's blood plasma; provides a quick obtaining the autologous regenerative fibrin gel without allergic reactions, immunogenicity, antigenicity, and irritating effect; prevents the transmission of hematogenous infections, reduces the intensity of inflammatory process, the stimulation of tissue regeneration; adhesion to a wet surface, a high degree of modeling on affected tissues; a kit of sterile reagents for gel preparation is attached

Readiness Level. Suggestions for Commercialization

IRL6, TRL5
Partners for manufacturing wanted

Intellectual Property Protection IPR3

Contact Information

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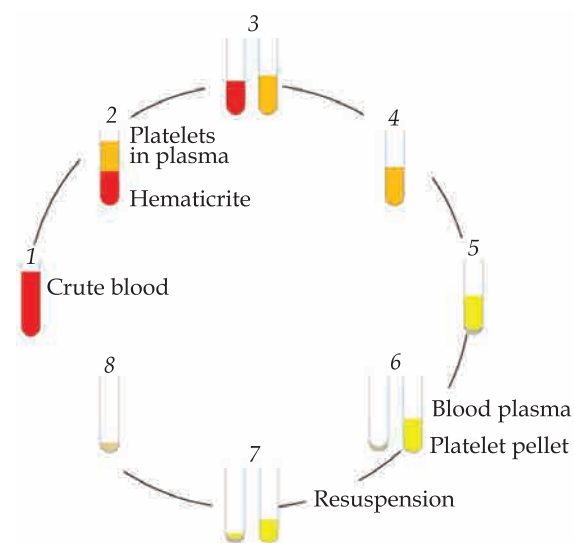
METHOD FOR PREPARATION OF AUTOLOGOUS PLATELET-RICH PLASMA WITH A PLATELET CONTENT OVER 1 million/ μ l

Areas of Application

To promote wound healing and to accelerate regenerative processes in surgery, orthopedics, traumatology, maxillofacial surgery, ophthalmology, gynecology, urology, and cosmetology; for cell therapy; in biotechnology; at any medical laboratory

Specification

Obtaining autologous human blood plasma with a content of native functionally active platelets over 1 million/ μ l, which retain the ability to release biologically active compounds after the stimulation or injection into tissues by cell therapy with a low anticoagulant content. Reducing the heparin concentration minimizes hemorrhage at the injection site, which promotes wound healing and accelerates regenerative processes. The clinical trials have been completed



Preparation of highly concentrated platelet-rich plasma

Advantages

In contrast to the foreign counterparts, this method provides the standardization of obtaining a platelet suspension; the reservation of functional activity of the obtained platelets; time saving; no additional steps of platelet washing; reducing the risk of hemorrhages

Readiness Level.

Suggestions for Commercialization

IRL7, TRL7

Partners for mass production wanted

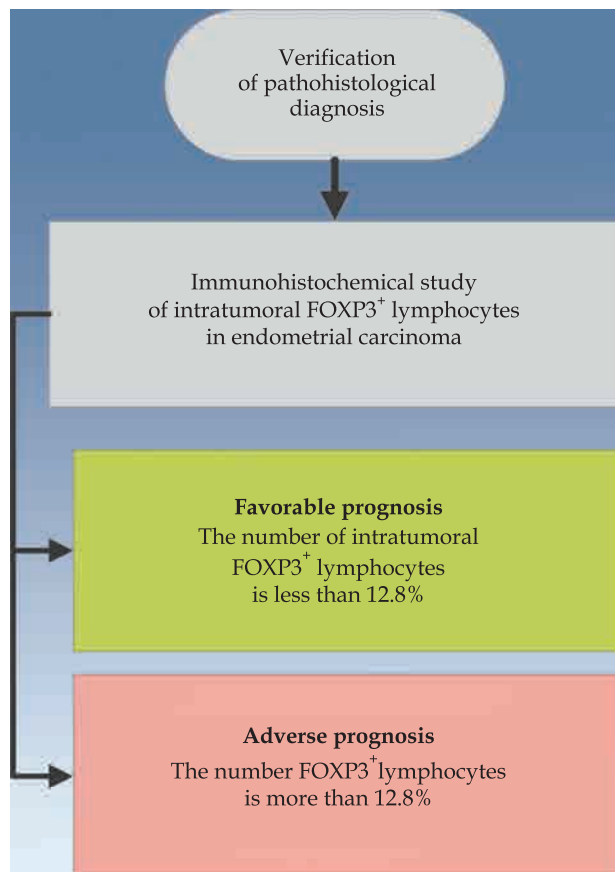
Intellectual Property Protection

IPR3

Contact Information

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METHOD FOR PROGNOSTICATING THE COURSE OF DISEASE IN PATIENTS WITH ENDOMETRIOID-TYPE ENDOMETRIAL CANCER (ECE) (THE 1ST AND THE 2ND STAGES)



Prognosis of the disease in patients with endometrial cancer of the endometrioid type, I and II stages

Readiness Level. Suggestions for Commercialization

IRL6, TRL7

May be implemented in medical institutions. Establishing prognosis of the clinical course in patients with ECE, stages I and II, based on the proposed method

Areas of Application

To prognose the clinical course in patients with endometrioid-type endometrial cancer, stages I and II, in oncology hospitals

Specification

The method is based on determining the number of intratumoral FOXP3⁺-lymphocytes in the samples of biopsy or surgical tumor material with the use of MAB (5H5L12 *Invitrogen*, USA) by the immunohistochemical method. Provides framework for predicting the clinical course of ECE at the early stages and for correcting the therapeutic tactics in the postoperative stage of treatment, increases life expectancy

Advantages

In contrast to the domestic and foreign analogs that are based solely on the qualitative assessment of the aggressiveness of the tumor process in the late stages of ECE, the proposed method provides a highly accurate quantitative prognosis of 5-year survival rate in patients with ECE, stages I and II. This allows choosing proper tactics for personalized treatment in a timely manner, which helps prolong the life expectancy of patients. It has good prospects for the application in clinical practice. Highly informative, does not require significant financial investment and special equipment

Intellectual Property Protection

IPR1, IPR3

Contact Information

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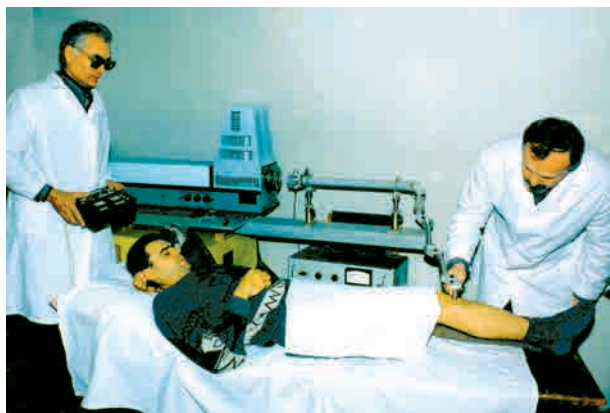
TERAHERTZ LASER SYSTEM FOR BIOMEDICAL RESEARCH

Areas of Application

Physiotherapy and biomedical research

Specification

The THz laser system is based on HCN laser (the operating wavelength is 0.337 mm). Monochromatic and continuous THz radiation; the power flux density ranges within $0.4\div 1.6 \text{ mW/cm}^2$; radiation may be brought to any point due to the use of a beam-guiding pantograph manipulator



General view of THz laser system

Advantages

Unlike other electromagnetic radiation, the coherent THz radiation used in this system is non-ionizing and has a low intensity. The THz radiation promotes the metabolic processes in a human organism, reduces the period of curing the joints and bones diseases. May be used to mobilize the immune system and regulatory functions of a human organism for preventing and curing the musculoskeletal system affections and for other physiotherapeutic purposes

Readiness Level.

Suggestions for Commercialization

IRL7, TRL8

Custom manufacture, supply, warranty service, and staff training

Intellectual Property Protection

IPR1, IPR3

Contact Information

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ENZYME-LINKED IMMUNOSORBENT ASSAY FOR QUANTIFYING THE FUNCTIONALLY ACTIVE DIPHTHERIA TOXIN



Specification

A reagent set for quantitative analysis of human blood plasma or serum for the presence of diphtheria antitoxin antibodies (specific to the receptor-binding site of diphtheria toxin *Corynebacterium diphtheria*) by enzyme-linked immunosorbent assay with the use of recombinant antigen substances of in-house production. The preclinical trials have been conducted

Areas of Application

To quantify antibodies to certain subunits of diphtheria toxin in human blood and serum; to be used in clinical laboratories and diagnostic centers

Advantages

In contrast to the foreign analogs, this method provides the use of recombinant antigen substances of in-house production; the minimum time for analysis is up to 10 minutes; easy-to-use; no qualified personnel are required

Readiness Level.

Suggestions for Commercialization

IRL5, TRL5

Partners for mass production wanted

Intellectual Property Protection

IPR3

Contact Information

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MEBIVID PHARMACEUTICAL COMPOSITION FOR THE TREATMENT OF BONE DISEASES

Areas of Application

For treating the bone structure
and function disorders and bone-thinning

Specification

The composition forms a bond
with the crystalline surface of hydroxyapatite
and prevents bone tissue resorption
by affecting the activity of osteoblasts
in combination with regulators of the structural
and functional state of the bone tissue.
The preclinical studies have been completed.
The production regulations and analytical
requirements have been prepared



Readiness Level. Suggestions for Commercialization

IRL5, TRL5
Partners for clinical trials and commercialization
wanted

Advantages

There are no analogs in Ukraine. In contrast
to the existing domestic and foreign analogs,
MEBIVID composition is effective
in the treatment of the structural
and functional disorders of the bone tissue;
increases the level of mineral components
in blood serum and bone tissue; increases
bone mass; eliminates osteoporosis; reduces
the risk of bone fracture; normalizes
the alkaline phosphatase activity

Intellectual Property Protection IPR3

Contact Information

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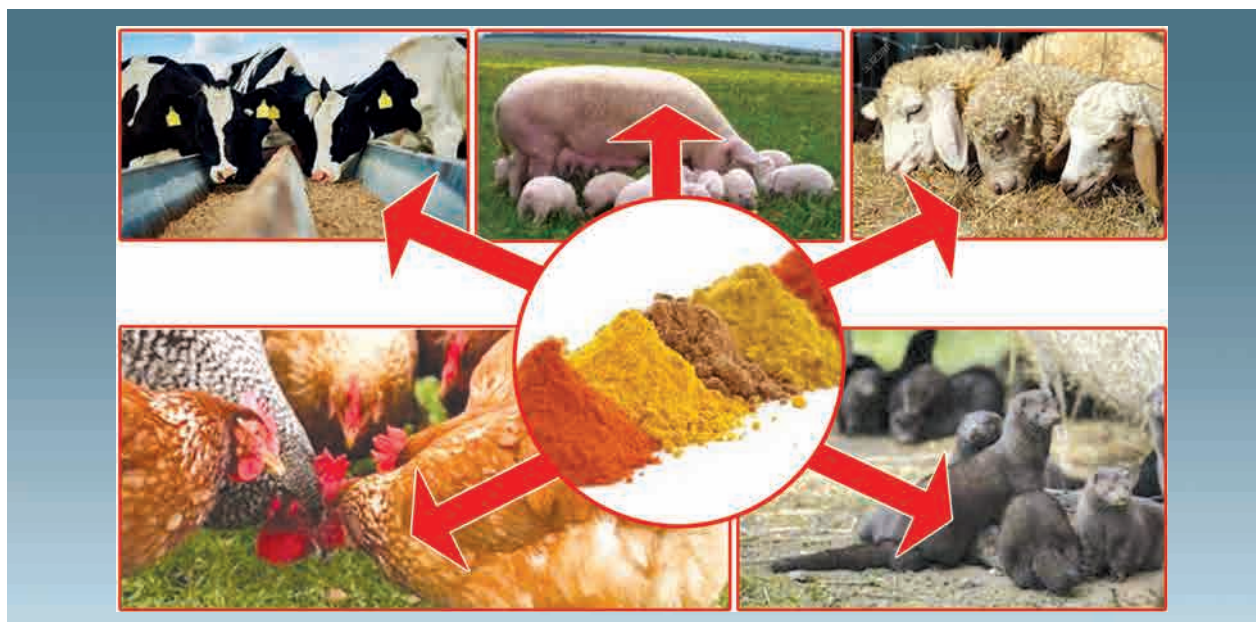
- ANIMOFER EFFECTIVE FEED ADDITIVES FOR FARM ANIMALS
- CARBON-MINERAL SORBENT FEED ADDITIVE



AGRO-INDUSTRIAL COMPLEX AND ORNAMENTAL HORTICULTURE



ANIMOFER EFFECTIVE FEED ADDITIVES FOR FARM ANIMALS



Areas of Application

For improving the quality and quantity of livestock and poultry products

Specification

Yellow-brown powder or hydrogen paste; odorless; water solubility is 170–180 g/l; non-toxic (LD50 = 5700–6500 mg/kg); the additives have no cumulative effect; do not cause any complications; environment friendly, easily digested by animals; give an increase in live weight by 6–10%; increase the milk yield in cows and the content of trace elements, fat, and protein in milk by 2–3%; decrease the content of radioactive isotopes ^{137}Cs and ^{90}Sr in animals

Advantages

In terms of effectiveness, environment friendliness, and low cost, the additives surpass the known imported counterparts, in particular *OSARSOL* and *ANTIANEMIN*, and are distinguished by the presence of a biologically active complex that converts the trace elements in the solution into an easily digestible form. In the course of metabolism, the additives break down with the formation of 7 essential amino acids necessary for better development of animals, eliminate anemia and dyspepsia. These additives are administered orally, which prevents the stress that accompanies injectable methods of administration of antianemic drugs

Readiness Level.

Suggestions for Commercialization

IRL5, TRL5

Custom manufacture of small batches.

Partners for industrial production wanted

Intellectual Property Protection

IPR1, IPR2

Contact Information

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CARBON-MINERAL SORBENT FEED ADDITIVE



Areas of Application

To be used in poultry and livestock breeding for preventing the accumulation and for accelerating the removal of harmful and toxic substances from the organism

Specification

Specific surface, m ² /g	300–350
Share of micro- and mesopores,	50–57
Average pore size, Å	12–14
Sorption activity on the organic test, mg/g	330–350
Sorption activity according to the cationic test, mmol/g	0.8–1

Intellectual Property Protection

IPR1, IPR3

Advantages

High sorption activity towards a wide range of toxic substances; safe for animals, no adverse effects on the gastrointestinal tract epithelium; stability of action at different pH values; low cost

Readiness Level.

Suggestions for Commercialization

IRL5, TRL5

Custom manufacture of small batches, partners for industrial production wanted

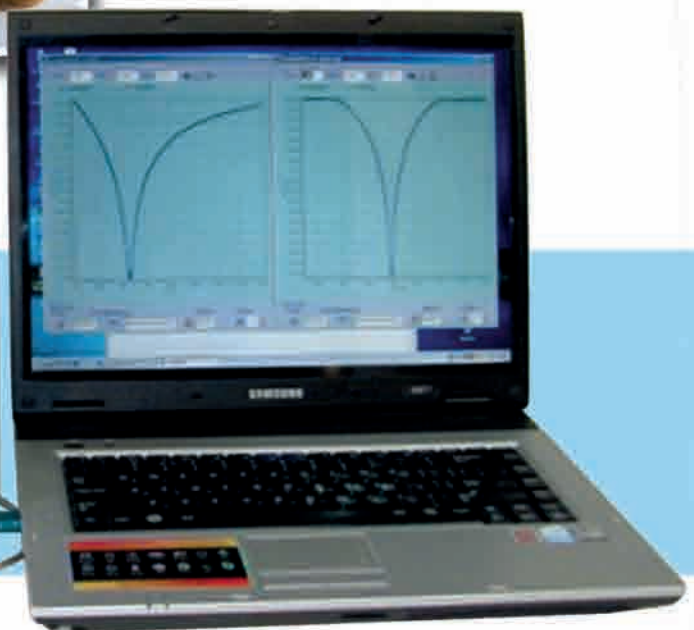
Contact Information

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- CU TEP-SM AUTOMATIC SUGAR COLOR ANALYZER
- MILLIMETER-RANGE DIELECTROMETER FOR DETERMINING THE PHYSICAL PARAMETERS OF AQUEOUS SOLUTIONS
- *CORECTIN* DIETARY SUPPLEMENT
- *HELICOBACT.NET* COMPLEX DIETARY SUPPLEMENT FOR PREVENTING AND TREATING *HELICOBACTERIOSIS*
- COMPLEX DIETARY SUPPLEMENT FOR REMEDYING THE HYPERCARBONYL STATE
- EQUIPMENT FOR THE PRODUCTION OF FUNCTIONAL PLANT POWDERS
- METHOD FOR THE QUANTITATIVE DETERMINATION OF BACTERIAL CA^{2+} -INDEPENDENT TRANSGLUTAMINASE ENZYMATIC ACTIVITY
- TECHNOLOGY FOR THE PRODUCTION OF HIGH-PROTEIN HYDROLYZED PRODUCT IN DRY POWDER FORM
- TECHNOLOGY FOR THE PRODUCTION OF DIETARY SUPPLEMENT FROM SHIITAKE MUSHROOM IN DRY FORM



FOOD INDUSTRY



CU TEP-SM AUTOMATIC SUGAR COLOR ANALYZER



Areas of Application

Rapid measurement of granulated sugar color in ICUMSA international units and in Stammer conventional units in accordance with the requirements of ICUMSA GS2 / 3-9, 1994 international standards; ICUMSA GS2 / 11-1994 DSTU 4866: 2007, GOST 12572-2015, and others

Advantages

In comparison with the well-known analogs, the automatic analyzer does not require long and laborious preparation of sugar solutions and dry substances. The device provides the necessary accuracy, is simple, reliable, easy to operate and does not require special staff training

Intellectual Property Protection
IPR2

Specification

Range of measurements of granulated sugar color:	
ICUMSA units	0 – 250
Stammer units	0 – 1.92
Continuous operation time, max, h	8
Signal measurement time, max, s	60
Power consumption at operating supply voltage, max, W	1.0
Power voltage form AC mains	220 V, 50 Hz
Dimensions, max, mm	250 × 250 × 150
Weight, max, kg	1.5
The measurement error is in accordance with international standards ICUMSA GS2/3-9,1994; ICUMSA GS2/11-1994, DSTU 4866:2007, GOST 12572-2015 etc.	

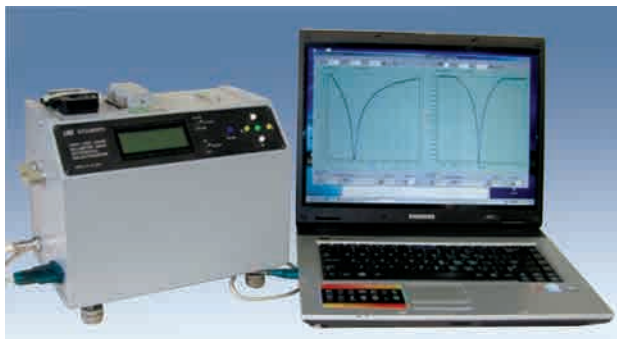
Readiness Level.
Suggestions for Commercialization

IRL7, TRL4
Custom manufacture, supply, warranty service, and staff training

Contact Information

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MILLIMETER-RANGE DIELECTROMETER FOR DETERMINING THE PHYSICAL PARAMETERS OF AQUEOUS SOLUTIONS



Appearance of waveguide differential dielectrometer



Measuring cells for reference and test fluids

Areas of Application

The determination of the quality (dielectric constant) of liquid food and active biological fluids and monitoring of the progress of enzymatic reactions in real time

Specification

The dielectrometer measures differences of approximately 0.5% in the physical parameter (the real and the imaginary parts of the complex permittivity) between two strongly absorbing liquids.

Dimensions, mm	250×200×200
Sample volume, ml	10
Time of analysis, min	3

Readiness Level.

Suggestions for Commercialization

IRL5, TRL6

Custom design and manufacture

Advantages

Autonomy and mobility, ease of operation and rapid measurements; possibility of dynamic control over processes in liquids (the course of biochemical reactions). Almost all similar meters exist in the form of stationary laboratory installations for research purpose

Intellectual Property Protection

IPR1

Contact Information

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CORECTIN DIETARY SUPPLEMENT



Areas of Application

An additional source of the amino acid glycine for normalizing the functional state of the nervous and immune systems, bone and connective tissues, reducing psycho-emotional stress, accelerating alcohol detoxification, and for strengthening the general condition of the body

Specification

The active ingredient is glycine that, at a standard dose, helps the body adapt to adverse environmental factors, reduces psycho-emotional stress and fatigue, improves sleep, has moderate neuroprotective, anti-stress, and hepatoprotective properties, mitigates the toxic effects of alcohol

Advantages

There are no counterparts in Ukraine.
As compared with the foreign analogs Corectin dietary supplement has a high physiological activity;
positively affects the bone organic and mineral components, anabolic processes, bone regeneration, platelet adhesion and aggregation properties;
prevents bleeding of vessel walls;
increases antibacterial protection due to blood granulocytes;
has a detoxifying effect;
does not cause allergic reactions;
is easily and quickly metabolized

Readiness Level.

Suggestions for Commercialization

IRL7, TRL8
Custom manufacture of small batches.
Partners for mass production wanted

Intellectual Property Protection

IPR3

Contact Information

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HELICOBACT.NET COMPLEX DIETARY SUPPLEMENT FOR PREVENTING AND TREATING HELICOBACTERIOSIS



Areas of Application

For preventing and treating *Helicobacter pylori* infection and for improving the gastrointestinal tract functioning in people of all ages

Specification

The supplement contains two ingredients: the first one is toxic to *Helicobacter pylori* that colonizes stomach, and the second one specifically facilitates the inhibitory effect of the first component. Does not contain antibiotics. Protects the mucous membrane from the irritating and inflammatory effects of various substances, improves the functioning and reduces the risk of cancer of gastrointestinal tract, supports the physical activity and health. The complex dietary supplement has been under registration

Advantages

There are no counterparts in Ukraine.

The product differs advantageously from the foreign analogs by high effectiveness in preventing and treating *Helicobacter pylori* infection;

does not contain antibiotics; consists of procurable and storage-stable components; a much smaller amount is required per single dose; reduces the cancer risk

Intellectual Property Protection
IPR3

Readiness Level.
Suggestions for Commercialization

IRL5, TRL5
Custom manufacture of small batches.
Partners for mass production wanted

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COMPLEX DIETARY SUPPLEMENT FOR REMEDYING THE HYPERCARBONYL STATE



Experimental sample of complex dietary supplement for remedying the hypercarbonyl state

Areas of Application

To reduce the negative effects of hypercarbonyl state of the body, in particular to decrease the amount of aldehydes, carbonyl groups of proteins, and postsynthetic protein modifications. Used in human medicine and veterinary

Specification

The complex dietary supplement consists of active ingredients and detoxifying agents that effectively protect endogenous biological objects from interaction with active carbonyl compounds, bind aldehydes and remove them from the body, prevent the formation of glycosylation end products, neutralize oxidizing substances, have antioxidant, angio- and hepatoprotective effects. The product has been under registration

Advantages

There are no analogs in Ukraine. The dietary supplement effectively improves the functioning of the body, reduces the risk of complications in patients with diabetes; consists of procurable storage-stable components

Readiness Level.

Suggestions for Commercialization

IRL4, TRL4
Custom manufacture of small parties.
Partners for mass production wanted

Intellectual Property Protection

IPR3

Contact Information

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EQUIPMENT FOR THE PRODUCTION OF FUNCTIONAL PLANT POWDERS



Areas of Application

Processing of agricultural raw materials (vegetables, fruits, greens) into functional powders. For the food industry, agricultural sector

Advantages

Easy installation, operation, and repair, the ability to provide automatic adjustment of the installation and software to control the drying process with data output to a personal computer or a mobile device. Payback period from the launch of a process line is 1 year

Intellectual Property Protection
IPR3

Specification

Thermal energy consumption for the drying process, kJ/kg evaporated moisture	3800
Productivity in terms of raw materials, t/h	0.75–0.8
Productivity in terms of a dry product, t/h	0.12–0.13
Power, kW	95–100
Steam or fuel consumption, t/h	2.5–3
Weight of process line, t	36–38
Production area, m ²	430

Readiness Level.
Suggestions for Commercialization

IRL8, TRL8
Custom manufacture, partners for mass production wanted

Contact Information

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METHOD FOR THE QUANTITATIVE DETERMINATION OF BACTERIAL Ca^{2+} -INDEPENDENT TRANSGLUTAMINASE ENZYMATIC ACTIVITY

Areas of Application

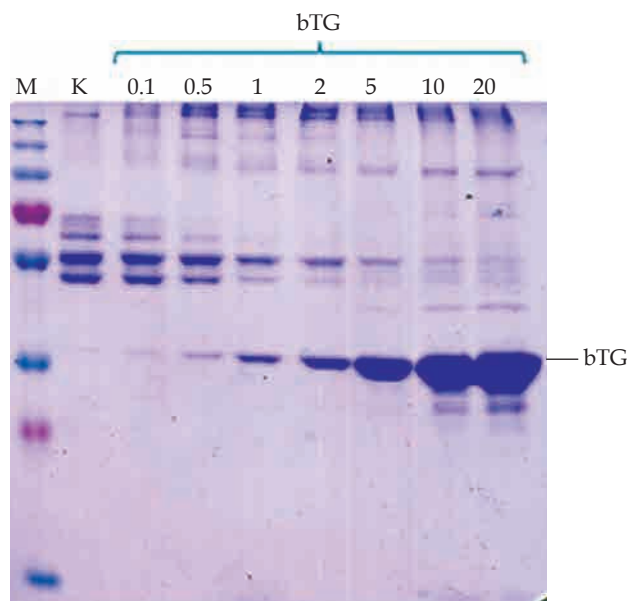
The quantitative monitoring of the quality of incoming Ca^{2+} -independent transglutaminase (bTG), the optimization of its consumption, the prevention of excessive intake and food contamination with excessive bTG.
To be used in quality control laboratories

Specification

This method allows the quantification of the enzymatic activity of bTG with the use of a natural protein substrate. The method is based on determining the degree of fibrin cross-linking by bacterial transglutaminase (bTG). The degree of cross-linking corresponds to the bTG activity. The method has been successfully tested in production conditions

Advantages

This method allows the quantification of the enzymatic activity of bTG with the use of a natural protein substrate. The method is based on determining the degree of fibrin cross-linking by bacterial transglutaminase (bTG). The degree of cross-linking corresponds to the bTG activity. The method has been successfully tested in production conditions
This method allows the quantification of the enzymatic activity of bTG with the use of a natural protein substrate. The method is based on determining the degree of fibrin cross-linking by bacterial transglutaminase (bTG). The degree of cross-linking corresponds to the bTG activity. The method has been successfully tested in production conditions



SDS-PAGE of samples of fibrin cross-linked by different amounts of transglutaminase (from 0.1 to 20 units). The amount of cross-linked fibrin chains indicates the functional activity of enzyme

Readiness Level.

Suggestions for Commercialization

IRL6, TRL5

Partners for industrial production wanted

Intellectual Property Protection

IPR3

Contact Information

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TECHNOLOGY FOR THE PRODUCTION OF HIGH-PROTEIN HYDROLYZED PRODUCT IN DRY POWDER FORM



A pilot batch of powdered *Liposomal* hydrolyzed whey-soy protein



Packs of powdered *Liposomal* hydrolyzed whey-soy protein

Areas of Application

Production of a dry hydrolyzed high-protein products for special dietary and sport nutrition

Specification

The technology allows the production of functional high-protein food products that contain at least 80% of proteins of plant and animal origin with a degree of hydrolysis up to 65–75%. The amino acid composition of the product is close to the “ideal protein”

Advantages

There are no analogs in Ukraine. In comparison with the products for similar purpose, this one has the improved organoleptic properties and is less allergenic; the finished product is better digestible

Readiness Level. Suggestions for Commercialization

IRL 7, TRL 6

The manufacture of equipment, author's support of technology, and staff training

Intellectual Property Protection IPR3

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TECHNOLOGY FOR THE PRODUCTION OF DIETARY SUPPLEMENT FROM SHIITAKE MUSHROOM IN DRY FORM

Areas of Application

The production of a complex dietary supplement from shiitake mushroom in dry instant form for the food industry

Specification

Contains substances with pronounced immunostimulatory, antitumor, and antiviral effects; proteins (15%), fats (0.7%), carbohydrates (80%), and minerals (4.2%).
A soluble product with a high content of activated polysaccharide complex



Shiitake mushroom



Dietary supplement made of shiitake mushroom

Advantages

There are no analogs in Ukraine.
The use of highly efficient methods for nanotechnological processing of shiitake mushrooms allows increasing the bioavailability of the polysaccharide complex from 3 to 18%, significantly reducing energy consumption, and, at the same time, preserving the content of other biologically active substances.
The right choice of heat conditions and structuring additives for spray drying results in increasing yield of finished product up to 92%

Intellectual Property Protection

IPR3

Readiness Level.

Suggestions for Commercialization

IRL4, TRL5

Author's support of technology, staff training

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TECHNOLOGY READINESS LEVEL (TRL) SCALE

Stage	TRL	Interpretation	Definition and Description
Invention	TRL1	Basic principles developed	Basic scholarly research is translated into potential new basic principles that can be used in new technologies
	TRL2	Technology concept formulated	Potential areas of application of basic (technological) principles, including the technological concept are identified. Basic manufacturing principles are elaborated and potential sales markets are identified. A small research team is established to assess the project feasibility
Concept validation	TRL3	First assessment of concept and technology effectiveness	Based on preliminary study, actual research is conducted to assess technical and market feasibility of the concept. This includes active R&D works at the lab and first negotiations with potential customers. The research team expands. Market feasibility is assessed
	TRL4	Ready-made prototype serviceability validated in the laboratory	Basic technological components are integrated to assess early feasibility by testing in laboratory environment. Manufacture options are studied with basic manufacturing principles identified. Key markets are researched to study demand. The organization is ready to scale up, possible services are analyzed. Comprehensive marketing analysis is made
Prototyping and incubation	TRL5	Prototype tested in user environment	The system is tested in user environment with broader technological infrastructure involved. The actual use is tested and validated. Production-support works and pre-production tests are done in lab environment. Trial batches of prototypes enter the key markets. The organization starts activities to further distribute the prototypes and to enter the sales markets
Pilot production and demonstration	TRL6	Pre-production, including tests in user environment	The product and manufacturing technologies are completely ready for the launch of a pilot line/pilot plant (low-scale manufacture). The product and manufacturing technologies are assessed and finalized. This may include additional R&D works. The early products and manufacturing technologies are tested in the key markets with simultaneous organization of manufacture (marketing research, logistics, production facilities, etc.)
	TRL7	Low-scale pilot production demonstrated	The product manufacture is fully operational at low rate. Actual commercial products are manufactured. The final products are verified in the key markets. The organizational component is completed (comprehensive marketing strategy, all components of manufacturing activities). The products are formally launched in test markets
Initial market introduction	TRL8	Manufacture fully tested, validated, and certified	The manufacturing flow charts, product final version, production organization, and marketing tools are completed. The fullscale manufacture has been launched. The final product is sold in majority of domestic and international markets
Market expansion	TRL9	Fully operational and competitive manufacture and products	The full-scale manufacture is sustainable, with the product gaining new markets. Minor modifications and improvements create new versions. The technology and product output are optimized through implementing innovative concepts on manufacturing process. The product is fully customized to the key markets

INNOVATION READINESS LEVEL (IRL) SCALE

IRL	Innovation Readiness Level	Definition
IRL1	Inventor or team with a dream	The lowest level of readiness where the intention transforms into an idea of space system application or the space technology transforms into a business venture
IRL2	Paper studies produced	Once the basic ideas have been formulated, they are put down on paper in studies and analyses of business opportunities
IRL3	Experimental evidence of business opportunity	Active research and development are initiated, including analytical / laboratory studies to validate predictions regarding the market, the competition, and the technology
IRL4	Capability to implement limited-scope programs with project teams	Basic technological and business components have been developed to establish that they will work together; an initial business plan is available
IRL5	Capability to support project engineering development and design (no product, no revenues)	The basic technological and business components have been integrated with reasonably realistic supporting elements. The business plan is credible, but still needs to be validated against the final product characteristics
IRL6	Capability to support development and design with a market-driven business team (product, no revenues)	The representative prototype system has been tested in a relevant environment. The business team is still incomplete and the venture is not yet ready for commercialization. A full business plan including the market, the operational, the technological, and the financial aspects is available
IRL7	Capability to support limited production; full business team in place (product and limited revenues)	The business can run on a limited scale. The full team is in place
IRL8	Capability to advance to full production and distribution (product and revenues)	The technology has been proven to work and the venture structure has proven to be able to support growing market shares
IRL9	Fully articulated business with appropriate infrastructure and staffing (growing market share)	The offering incorporating the new technology has been used in operational conditions and the business is running with a growing market share

INTELLECTUAL PROPERTY RIGHTS PROTECTION¹ LEVELS

IPR codes	Protection Level
IPR1	Technical solutions constitute a know how ²
IPR2	Applications for copyright protection of IPR objects are expected to be or have been submitted
IPR3	The copyright protection of IPR objects as established by the applicable law of Ukraine has been obtained and is kept in force
IPR4	International industrial patent application(s) (according to the PCT system, etc.) has (have) been submitted. Application(s) for industrial patents has (have) been submitted in foreign country(ies) under national procedure
IPR5	The industrial patent(s) in foreign country(ies) has (have) been obtained and is/are kept in force

¹ The IPR protection measures are implemented by R&D institutes in accordance with the applicable legislation of Ukraine and the requirements of paragraphs 5, 8, and 9 of the Regulations for the use of intellectual property objects at the NAS of Ukraine as approved by Resolution of the Presidium of the NAS of Ukraine No.15 of January 16, 2008, on the Structural Units Responsible for Technology Transfer, Innovation Activities, and Intellectual Property (as revised).

² Know-how is technical, organizational, or commercial data obtained with the use of experience and upon trials of technology and its components, which are: closely held (not a part of general knowledge or available for public) on the date of license agreement; essential, i.e. important and useful for manufacture of products, manufacturing process, and/or provision of services; and elaborated i.e. detailed and complicated enough to verify their compliance with the criteria of being never-before-known and essential (Clause 1 of the Law of Ukraine on the State Regulation of Technology Transfer Activities)

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