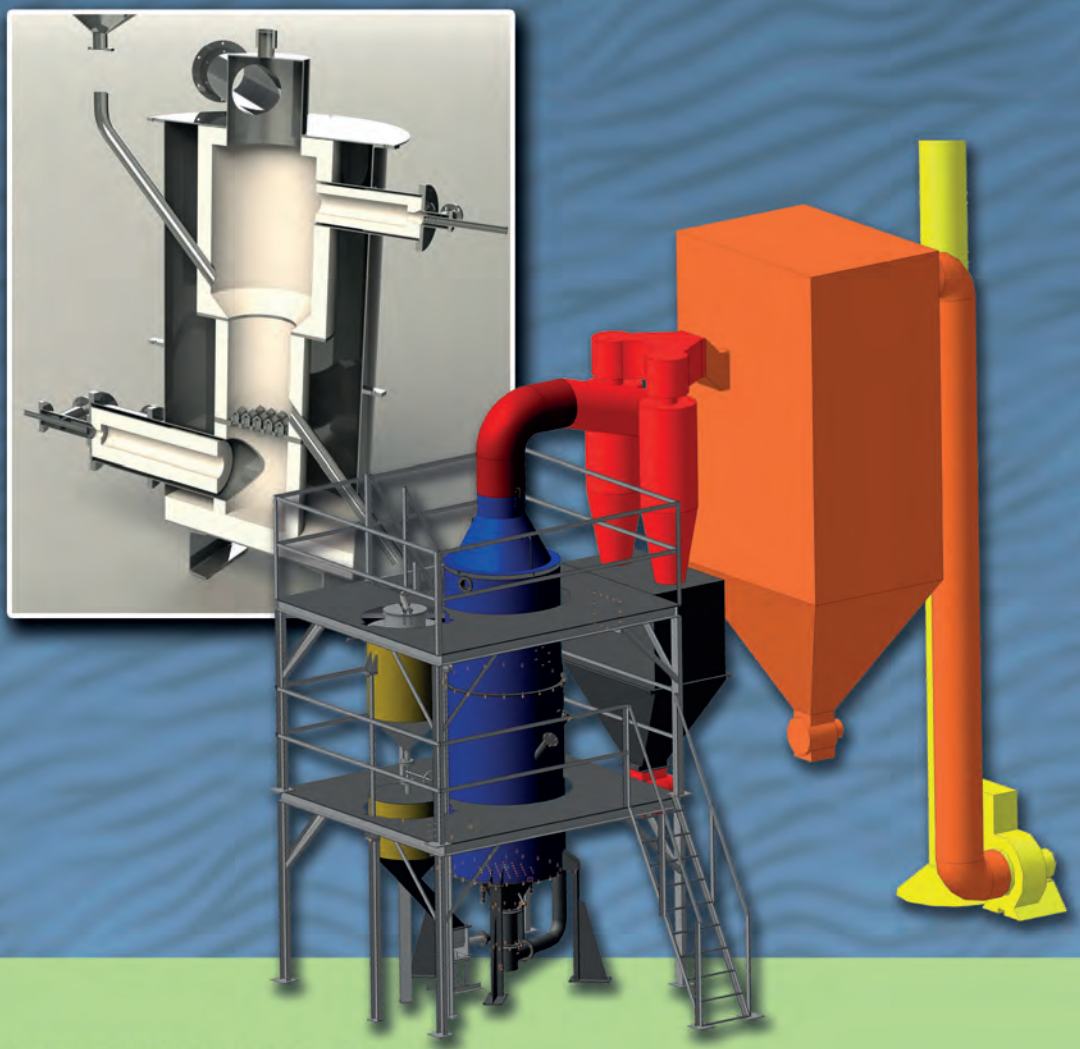
ADVANCED R&D AND TECHNOLOGIES

THE NAS OF UKRAINE



TECHNOLOGIES FOR CONSTRUCTION AND FUNCTIONAL MATERIALS

ADVANCED R&D AND TECHNOLOGIES

THE NAS OF UKRAINE

SPECIAL ISSUES

ENVIRONMENT AND NATURE PROTECTION

FOOD INDUSTRY

FUEL, LUBRICANTS,
AND TECHNOLOGIES

INDUSTRIAL AGRICULTURE
AND LANDSCAPE GARDENING

INFORMATION AND SENSOR SYSTEMS
AND DEVICES

INFORMATION TECHNOLOGY

MACHINE-BUILDING
AND INSTRUMENT ENGINEERING

MEDICAL PRODUCTS
AND MEDICAL DEVICE ENGINEERING

POWER ENGINEERING
AND ENERGY EFFICIENCY

TECHNOLOGIES AND EQUIPMENT
FOR EXPLORING, ESTIMATING,
AND EXTRACTING MINERAL RESOURCES

TECHNOLOGIES FOR CONSTRUCTION AND FUNCTIONAL MATERIALS

ALLOYS WITH PREASSIGNED ELECTRIC CONDUCTIVITY

Coins of Ukraine

Areas of Application

For manufacture of circulating coins and coins of higher denominations

Specification

Electric conductivity ranges 17÷19% IACS with an error up to ±0.4% IACS; hardness of annealed alloys (HRC <90) enables reproducing fine details of design without loss of wear resistance of coining instruments; hardness of tempered alloys (HRC 130—150) enables cutting burr-free blanks from metal strip and imparts a proper wear resistance to minted coins; manufacturable at domestic plants

Trial tokens made of LAOMn82-1-1-1 alloy

Advantages

The cost is 20% lower as compared with the EU coins; a high wear resistance matching that of the best European coins ensures a 20-year circulation life; a high corrosion resistance in different media; no growth of bacteria and fungi; nontoxicity; does not change the color while stored and circulating; preassigned electric conductivity

Stage of Development. Suggestions for Commercialization

IRL3, TRL2
Token pilot batch and coinage technique

IPR Protection

IPR2

Contact Information

Anatoly V. Narivskyi, Physico-Technological Institute of Metals and Alloys of the NAS of Ukraine;
+38 044 424 35 15, e-mail: metal@ptima.kiev.ua

ALUMINUM CAST ALLOYS WITH ENHANCED MECHANICAL PROPERTIES

Fluidity of industrial cast 356.0 (USA) and (α-Al + Mg_2Si) alloys

Overall view of ingots

Areas of Application

The alloys can be used to produce critical parts of cylinder-piston group by the casting method

Specification

Tensile strength at 330 °C, MPa	170—228
Yield stress at 330 °C, MPa	150—204
Plasticity at 330 °C, %	2.1—2.6

Advantages

These alloys surpass the existing aluminum piston cast alloys in the combination of high mechanical, injection, and tribotechnical properties. Within the temperature range from 20 to 400 °C their tensile strength exceeds by 7—55% that of the best piston group cast alloys

Stage of Development. Suggestions for Commercialization

IRL3, TRL3
Vending of patent based on license agreement

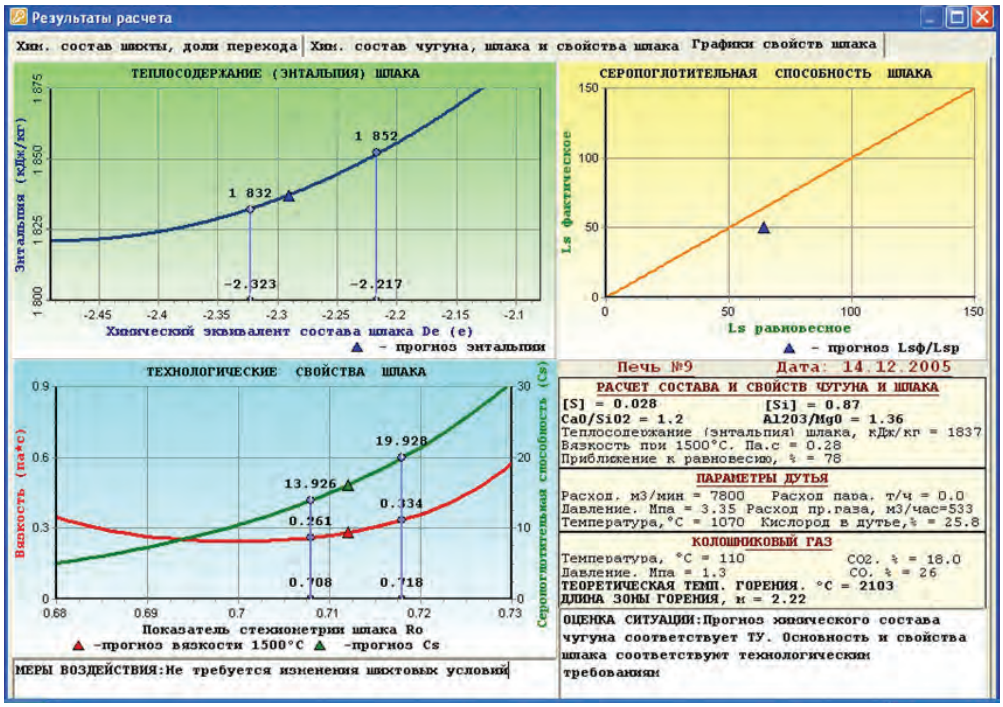
IPR Protection

IPR3

Contact Information

Vitalii P. Bevz, G.V. Kurdyumov Institute for Metal Physics of the NAS of Ukraine;
+38 044 424 12 05, e-mail: bevzv@ukr.net

AUTOMATIC SYSTEM FOR CONTROL AND STABILIZATION OF BLAST SMELTING SLAG MODE



Picture of *Slag* system

Areas of Application

Used in metallurgy, for producing iron in blast furnaces

Advantages

The system is unparalleled.
It provides smelting conditioned iron (with reduced fluctuations of silicon and sulfur content in pig iron) and reducing coke consumption by 3—6 kg/t pig iron due to optimized proportion of charge materials

Specification

The system includes: evaluation of sulfur absorption, viscosity, temperature at the beginning and at the end of crystallization, specific heat at fluidity temperature, surface tension both retrospective and for specific cast; evaluation of the crystallization ability and calculation of the slag standard mineralogical composition; control of the furnace thermal state based on the blowing mode parameters (theoretical combustion temperature, slag enthalpy, content of silicon and carbon in pig iron); selection of charging materials proceeding from predicted composition and properties of pig iron and slag based on charge properties and blowing mode parameters. Implementation period: 3—6 months

Stage of Development. Suggestions for Commercialization

IRL8, TRL8
Installation, warranty service, and staff training

IPR Protection

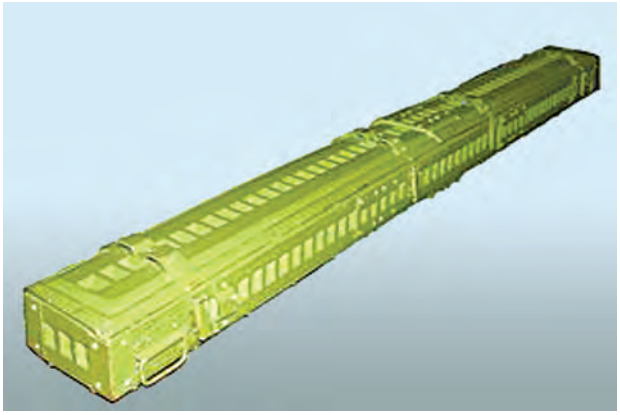
IPR3

Contact Information

Oleksii Ye. Merkulov, Iron and Steel Institute of Z.I. Nekrasov of the NAS of Ukraine;
+38 056 790 0515, e-mail: office.isi@nas.gov.ua

BARELY FLAMMABLE BASALT FIBER CONTAINERS FOR TRANSPORTATION AND LONG-TERM STORAGE

Container for 120 mm caliber mines



Container for gunning from 122 mm caliber rocket weapon

Container for 152 mm caliber munition

Areas of Application

These containers can be used for storing cables, devices and control systems for fire-hazardous and explosive manufactures; munitions, explosive substances, and accoutrements

Specification

Service life, years	≥50
Combustibility (GOST 28157), category	ГВ-1
Biostability	Stable
Dust- and water protection	Stable
Cargo-handling loads	Stable
Air landing	Stable
Dropping from height 1.5 and 3.0 m:	Stable
Stockpiling	Stable
Corrosion-resistant coating of fittings	available

Advantages

The proposed containers surpass the world analogs in physical, mechanical, and operational properties; have a relocatable load-carrying structure made of basalt fiber composite materials with thermal insulating layer. There are unlimited sources of raw material for the reinforcing components

IPR Protection

IPR2

Stage of Development. Suggestions for Commercialization

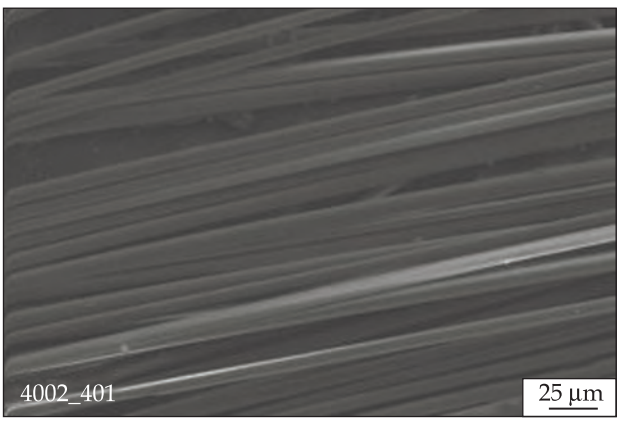
IRL3, TRL4
Manufacture of small batches.
Seeking partners for industrial production

Contact Information

Serhii M. Fomenko, Institute for Problems of Material Science of the NAS of Ukraine;
+38 044 424 04 27, +38 095 244 36 38, e-mail: fsergej688@gmail.com

BASALT CONTINUOUS FIBERS, TEXTILES, AND COMPOSITES

Samples of continuous basalt fibers and textile on their base



Roving structure of basalt complex fiber

Specification

Fiber diameter, µm	9 ± 1
Density, kg/m³	2750
Tensile strength, MPa	2000—3500
Modulus of elasticity, GPa	80—110
Operating temperature, °C	700—900

Areas of Application

Basalt continuous fibers and textiles can be used as technical textiles for filters and water proofing membranes; as reinforcing material for composites (in boats, automobiles, aircrafts, cisterns, etc.); as reinforcing material for construction composites (reinforcement, roof materials, tubes, geogrids for roads, electrical insulations, etc.); and as reinforcement for fibrous concrete

Basalt-plastic reinforcement

Advantages

Basalt fibers surpass the mineral, glass, carbon, and synthetic analogs in thermal and mechanical properties

Stage of Development. Suggestions for Commercialization

IRL3, TRL4
Manufacture of small batches.
Seeking partners for industrial production

IPR Protection

IPR2

Contact Information

Serhii M. Fomenko, Frantsevich Institute for Problems of Materials Science of the NAS of Ukraine;
+38 044 424 04 27, +38 095 244 36 38, e-mail: fsergej688@gmail.com

CARBON-CARBON COMPOSITE MATERIALS (CCCM) FOR INDUSTRY

Areas of Application

Mechanical engineering, chemical industry, metallurgy, automobile and aircraft industries

Specification

Density, g/cm^3	1.4—1.8
Ultimate strength at 20 °C, MPa:	
compression strength	150—400
bending strength	100—160
tensile strength	50—120
Heat conductivity, W/m · deg^{-1}:	
at 20 °C	5—7
at 500 °C	7—11
at 1000 °C	10—15
CLTE α — 10^{-6} · deg^{-1}:	
20—1000 °C	3—4
20—1500 °C	3.5—4.5

IPR Protection

IPR1

Advantages

The technology and equipment for production of carbon-carbon compound materials are unique for Ukraine; high mechanical strength; resistance to mechanical and thermal shocks; chemical and radiation resistance; long service life; low weight of product

Stage of Development. Suggestions for Commercialization

IRL8, TRL8
Customized manufacture, manufacture of unit orders

Contact Information

Igor V. Gurin, National Science Center "Kharkov Institute of Physics and Technology";
+38 067 712 16 74, +38 057 349 10 61, e-mail: Igor@kipt.kharkov.ua

CERAMIC BIOMATERIALS

Areas of Application

The developed ceramic biomaterials can be used in orthopedics, traumatic surgery, oncology, ophthalmology, and dentistry to repair bone tissue in various clinical situations; the bioactive ceramic powders are suitable for micro-plasma deposition of coatings with antibacterial properties on metallic implants

Specification

The bioactive ceramics are analogous to the mineral component of bone tissue and have an exceptional biocompatibility; approved for the clinical use in medical institutions.

Granule size, μm	80—800
Size of powder particles for deposition, μm	20—80
Specific surface, m^2/g	2—200
Compressive strength, MPa	20—200

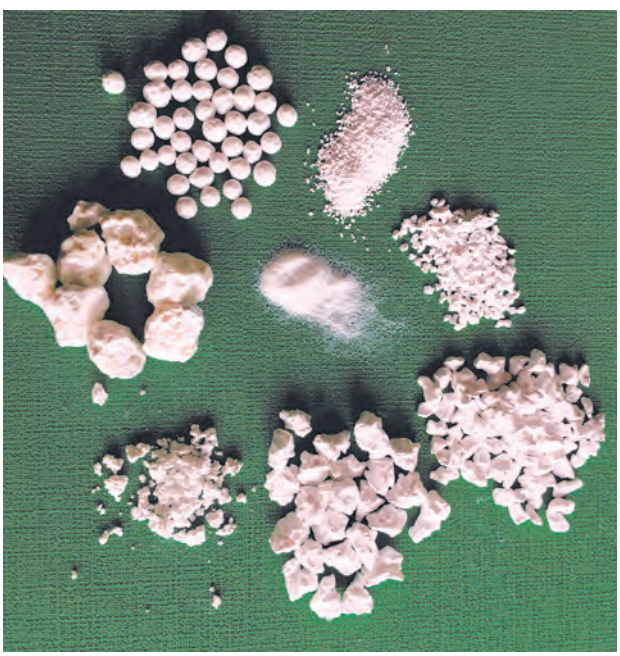
Advantages

Easy-to-use and highly biocompatible with bone tissue

Stage of Development. Suggestions for Commercialization

IRL3, TRL5
Manufacture of small batches.
Seeking partners for industrial production

Articles made of bioactive ceramics with different properties



Powders and granules of bioactive ceramics with different properties

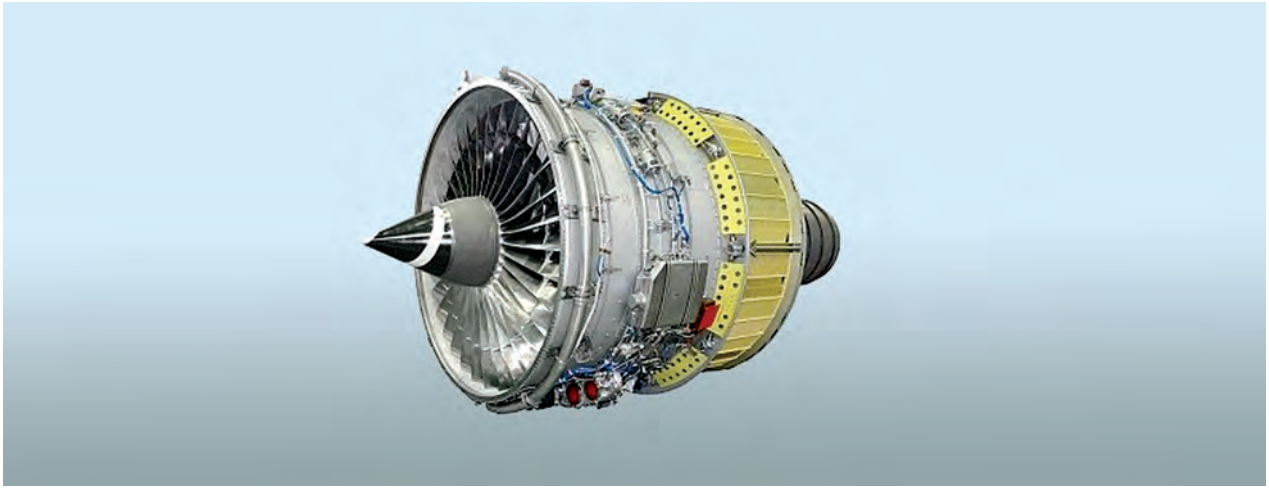
IPR Protection

IPR2

Contact Information

Serhii M. Fomenko, Frantsevich Institute for Problems of Materials Science of the NAS of Ukraine;
+38 044 424 04 27, +38 095 244 36 38, e-mail: fsergej688@gmail.com

COBALT-BASED POWDER ALLOY WITH HIGH WEAR RESISTANCE



Dual-flow turbojet engine D-18T

Areas of Application

The alloy can be used to reinforce shroud platforms of aircraft turbine engines by coating their edges with wear-resistant powder material

Specification

Production technology:
powder metallurgy methods.

Melting temperature, °C	≥1300
High heat resistance, °C	<1100
High uniform wear resistance within the temperature range, °C	20—1100

Advantages

Wear resistance of cobalt powder alloy within the temperature range from 20 to 1050 °C exceeds 10 times that of serial cast alloys XTH-61 and XTH-62

IPR Protection

IPR3

Stage of Development. Suggestions for Commercialization

IRL3, TRL4
Vending of patent based on license agreement

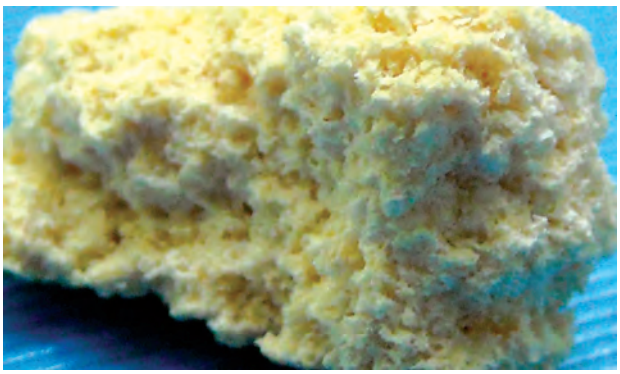
Contact Information

Vitalii P. Bevz, G.V.Kurdyumov Institute for Metal Physics of the NAS of Ukraine;
+38 044 424 12 05, e-mail: BevzV@ukr.net

COMPOSITE NANOSTRUCTURED MATERIALS

Areas of Application

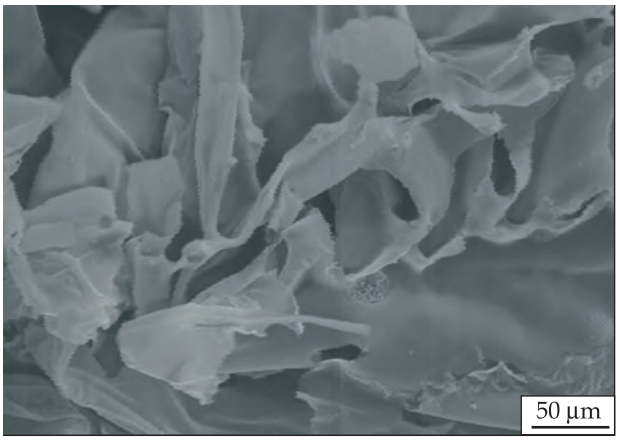
The hydroxyapatite and biopolymer composite materials are to substitute for the hard tissues (bones, joints).
The films and gels are used for treatment of burns and external injuries as hemostatic materials.
The chitosan-based granules, beads, and gels are used to transport biologically active substances, proteins, DNA, drugs, and to normalize internal microflora



Porous composite material based on chitosan and calcium phosphate for osteoplasty

Specification

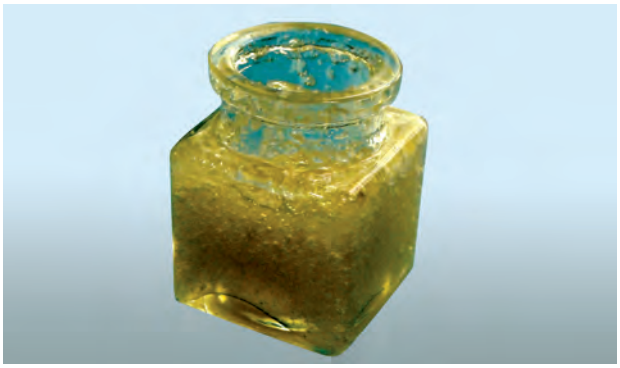
The materials are manufactured in dense and porous forms. The biomaterials have a good biocompatibility and bioinertness; the porous forms have good osteoconductive properties (the ability to stimulate the growth of bone tissue).
Composite materials as substitute for hard tissues: polymer matrix: chitosan; mineral component: hydroxyapatite; mineral component to biopolymer matrix, wt. %: 50:50; size of mineral component crystallite: ~20 nm; porosity: 0—50%



Photomicrograph of chitosan hemostatic sponge

Advantages

There are no complete analogs in the domestic market. The foreign analogs, in particular, the chitosan-based hemostatic materials, are much more expensive than those manufactured in Ukraine



Chitosan based gel with silver nanoparticles

Stage of Development. Suggestions for Commercialization

IRL2, TRL4
License for materials manufacture; support in production organization and maintenance

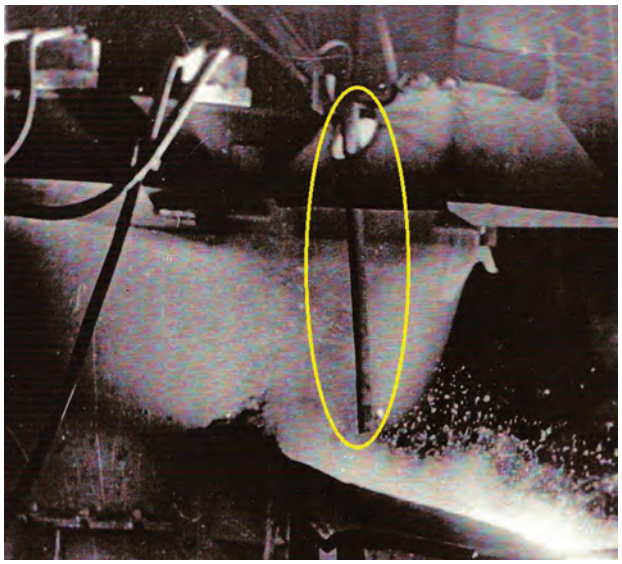
IPR Protection

IPR1

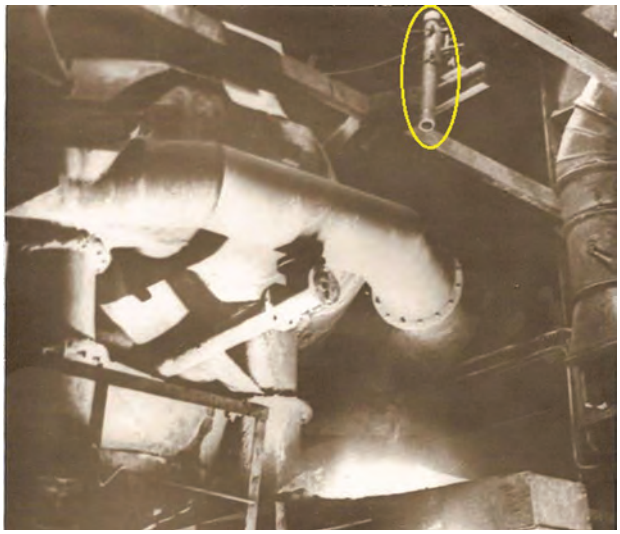
Contact Information

Oleksii I. Voroshilo, Institute of Applied Physics of the NAS of Ukraine;
+38 0542 22 46 08, +38 0542 22 27 94, e-mail: voroshilo@ipfcentr.sumy.ua

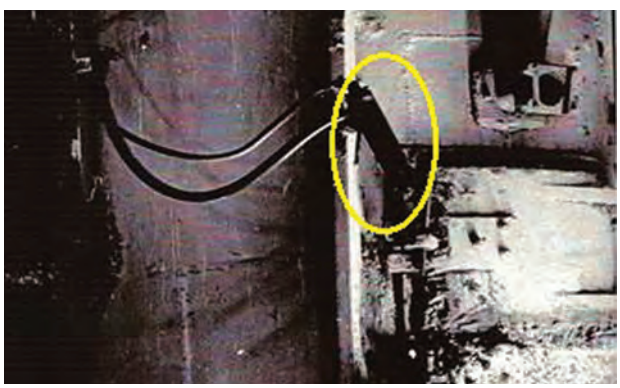
CONTACTLESS THERMOMETRY SYSTEM



Contactless temperature control of cast iron and steel while tapping from arc furnace



Contactless temperature control of cast iron while tapping from cupola furnace with a closed syphon spout and a rotary mixer



Contactless temperature control of cast iron while tapping from cupola furnace with a stationary mixer

Areas of Application

Continuous contactless control of melt metal temperature in stream while tapping or pouring from metallurgical furnaces. Can be used for continuous temperature control of slab under mold, metal sheets, strips, and wires, as well as in chemical, refractory, glass, and other industries

Specification

Range of measurable temperatures, °C	200 – 2500
Primary measurement error, %	≤1.0

Stage of Development. Suggestions for Commercialization

IRL8, TRL8
Manufacture, delivery, warranty service, and staff training, upon request

IPR Protection

IPR3

Advantages

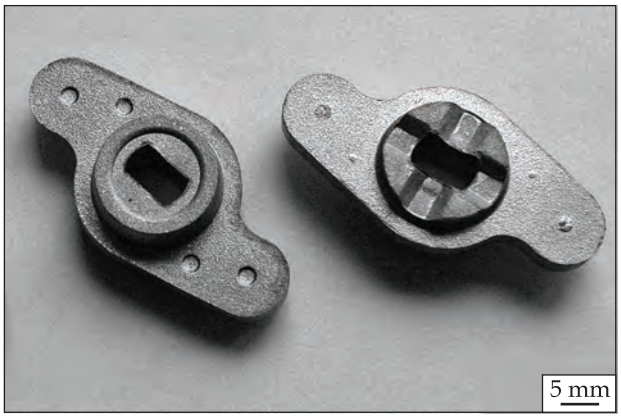
The applied multicolor algorithms of primary pyrometric information processing and the new measurement methods provide much higher metrological characteristics and widen the application scope of continuous temperature control under difficult conditions at metallurgical and other plants

Contact Information

Anatoliy V. Narivskiy, Physico-Technological Institute of Metals and Alloys of the NAS of Ukraine;
+38 044 424 35 15, e-mail: metal@ptima.kiev.ua

COST-EFFECTIVE POWDER TECHNOLOGY FOR MANUFACTURING TITANIUM ALLOYS AND PRODUCTS WITH DESIRED PROPERTIES

Automotive connecting rod (Ti–6Al–4V alloy)



Lock body of aircraft hatch (Ti–6Al–4V alloy)

Areas of Application

The technology can be used for manufacturing titanium alloy parts operating under noncritical loads for automotive, chemical, defense, medical, and aerospace industries

Specification

The technology uses the multicomponent powder mix method in its simplest version that is pressing and unpressurized sintering. Its distinctive feature is the use of cheap hydrogenated titanium powder instead of conventional one. Hydrogen purifies the material from impurities, decreases porosity, and provides the desirable microstructure of products obtained

Watch bodies (CP-Ti)

Advantages

The technology advantage is a significant reduction in the production prime cost (2–5 times depending on the product type) and the obtainment of required characteristics of alloys and products that meet the standards for corresponding alloys produced by casting and forging technologies

Stage of Development. Suggestions for Commercialization

IRL4, TRL4
License agreement
for commercial use of technology

IPR Protection

IPR1, IPR3, IPR5

Contact Information

Vitalii P. Bevz, G.V. Kurdyumov Institute for Metal Physics of the NAS of Ukraine;
+38 044 424 12 05, e-mail: BevzV@ukr.net

CRYOGENIC SYSTEM FOR CYCLIC THERMAL TREATMENT OF STEELWORK

Cryogenic system

Steel articles

Areas of Application

The cryogenic system is designed to implement the comprehensive technology for steelwork treatment. The technology combines deep cold cyclic treatment and tempering and improves operating properties of special steels

Specification

Temperature control range, °C	–173…+150
Cooling rate within the range from +20°C up to –173 °C, °C /min	1—5
Keeping at deep cold, temperature (–173) °C, h	24—48
Keeping at hot temperature (+150 °C), h	5—6
Cryogenic agent: liquid nitrogen; flask volume	≥15

IPR Protection

IPR3

Advantages

The cryogenic system with deep cold treatment of high-precision figurine-shaped steelwork (gearings, cutters, drills, bearings and others) enables relieving internal stresses, improving the rmicrostructure and hardness uniformity, increasing the service life of steelwork 1.5—2 times, and reducing the maintenance costs; the system is software-controlled

Stage of Development. Suggestions for Commercialization

IRL3, TRL3
Customized cryogenic system manufacture and warranty service; open to investors and business partners for serial production

Contact Information

Petro P. Pogoretskyi, Institute of Physics of the NAS of Ukraine
+38 044 525 98 41, e-mail: p.pogorets@gmail.com

DEVICE FOR DEEP PURIFICATION OF Cd, Zn, AND Te ISOTOPES

Cd-106 isotope

Areas of Application

The unit is designed for the deep purification of enriched isotopes ^{106}Cd, ^{116}Cd, ^{64}Zn, ^{128}Te, ^{130}Te, and others and for the creation of low-background scintillation crystals based on them to study the properties of neutrinos and the weak interaction and to search for effects beyond the standard model of elementary particles

Specification

Weight of original charge, kg	0.25
Product yield, % of original charge	96
Yield capacity, g/hour	50—80
Operating temperature, °C	350—650
Fineness, %	99.9—99.99... >99.999—99.9999

Advantages

The equipment is unique in Ukraine. High efficiency of the refining process; high product yield; high purification efficiency (>hundred-fold); minimum non-recoverable losses (<1%)

Stage of Development. Suggestions for Commercialization

IRL6, TRL6
Pure metals manufactured, upon request

IPR Protection

IPR3

Contact Information

Sergii G. Pugach, National Science Center "Kharkov Institute of Physics and Technology";
+38 057 335 68 43, +38 057 349 10 49, e-mail: pugach@kipt.kharkov.ua

DEVICE FOR DEEP PURIFICATION OF Cd, Zn, AND Te

Areas of Application

The device is designed for obtaining semiconductor and scintillation crystals for ionizing radiation detectors

Specification

Weight of original charge, kg	2.5
Product yield, % of original charge	90
Yield capacity, g/hour	300—400
Power capacity, kW	≤3
Operating temperature, °C	350—650
Fineness, %	99.9—99.99... >99.999—99.9999

Advantages

The equipment is unique in Ukraine.
Deep purification from a wide range of impurities;
high efficiency of the refining process;
high product yield

IPR Protection

IPR3

Stage of Development. Suggestions for Commercialization

IRL6, TRL6
Pure metals manufactured, upon request

Contact Information

Sergii G. Pugach, National Science Center "Kharkov Institute of Physics and Technology";
+38 057 335 68 43, +38 057 349 10 49, e-mail: pugach@kipt.kharkov.ua

DEVICE FOR DEEP PURIFICATION OF Ga, In, AND Pb

Areas of Application

The device is used to synthesize microelectronic and optoelectronic materials

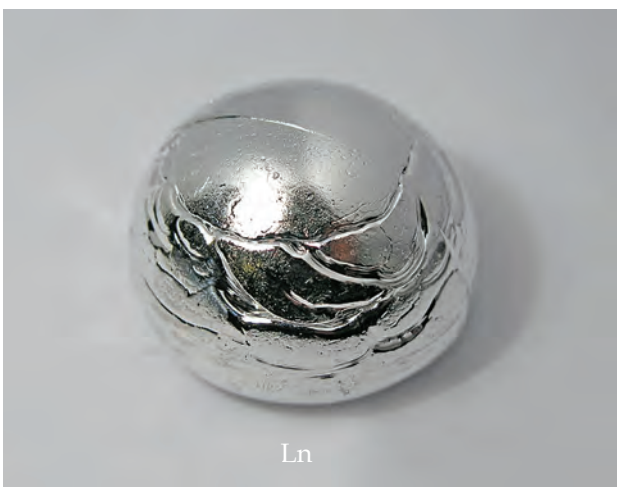
Specification

Weight of original charge, kg	2.3
Product yield, % of original charge	90
Yield capacity, g/hour	300—400
Operating temperature, °C	950—1300
Fineness, %	99.9—99.99… >99.999—99.9999


Ga

Advantages

The equipment is unique in Ukraine.
Deep purification from a wide range of impurities;
high efficiency of refining process;
high product yield


Ln

Stage of Development. Suggestions for Commercialization

IRL6, TRL6
Pure metals manufactured, upon request


Pb

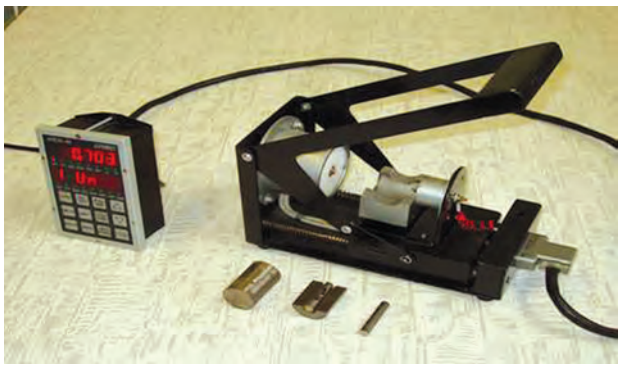
IPR Protection

IPR3

Contact Information

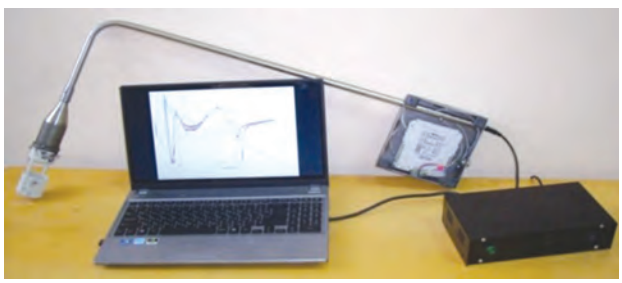
Sergii G. Pugach, National Science Center "Kharkov Institute of Physics and Technology";
+38 057 335 68 43, +38 057 349 10 49, e-mail: pugach@kipt.kharkov.ua

DEVICES FOR RAPID ANALYSIS OF ALLOY COMPOSITION AND STRUCTURE



STEA-CI device for rapid thermoelectric analysis of cast iron

STGEA-CI device for rapid thermographic analysis of cast iron



STECS-CI device for rapid thermodynamic control of graphite form in cast iron

Areas of Application

Rapid thermoelectric, thermographic and thermodynamic analysis of C, Si, Mn content and carbon equivalent in cast irons and steels;
C and Si content in cast irons and steels;
Si, Fe, Mg, Ni, Cu, Mn, Zn, Ti content in aluminum alloys; graphite form in cast irons

Advantages

The devices have higher metrological characteristic due to the use of hot bimetallic electrodes, statistical processing of primary measurement data, and sampling technique;
the use of painted metallic cups;
the use of dependence of thermal conductivity (instead of ultrasound speed) on cast iron structure

Specification

Fundamental absolute error of content measurement, %	≤0.1
Statistical confidence of graphite form measurement	≥0.95
Time of analysis, min	≤2

Stage of Development. Suggestions for Commercialization

IRL8, TRL8
Manufacture, delivery, warranty service, and staff training, upon request

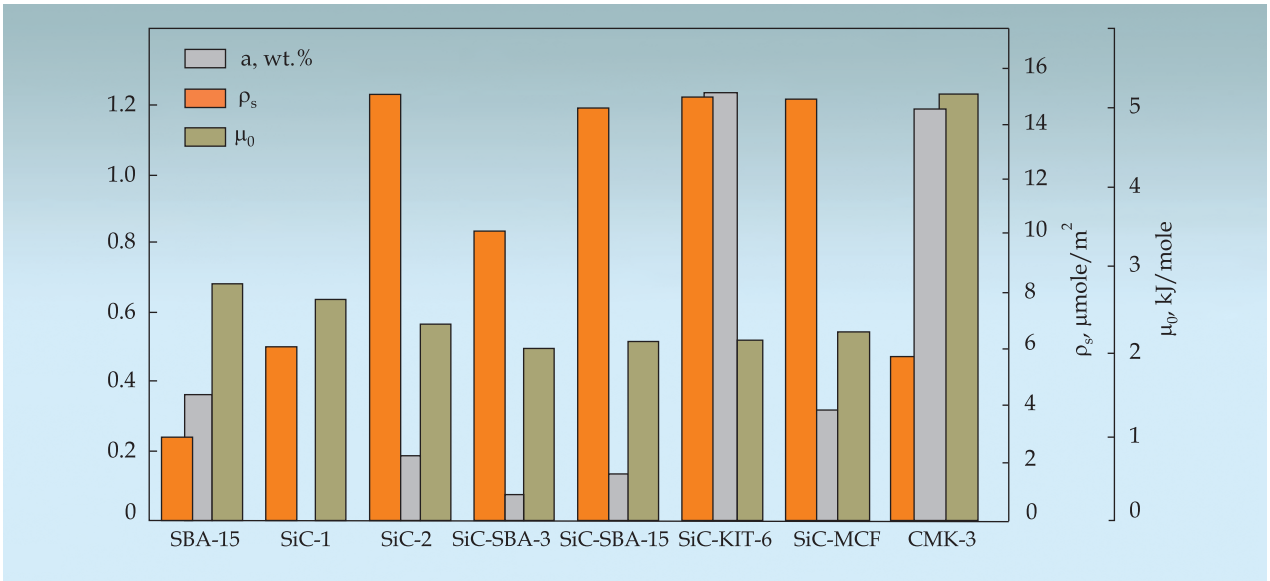
IPR Protection

IPR3

Contact Information

Anatoly V. Narivskyi, Physico-Technological Institute of Metals and Alloys of the NAS of Ukraine;
+38 044 424 35 15, e-mail: metal@ptima.kiev.ua

DISPERSE AND POROUS SILICON CARBIDE BASED MATERIALS FOR VARIOUS FUNCTIONAL PURPOSES



Phisical snd chemical properties of developed materials

Areas of Application

The materials are to be used for creating sorbents and catalysts for high-temperature and high-exothermic reactions, hydrogen adsorbents, materials for defense industry and electronics

Specification

Crystallite size, nm	~13—70
S_{BET}, m^2/g	<410
V_{pore}, cm^3/gr	<1.0
Hydrogen adsorption at 77 K and 1 atm, wt.%	<1.24

Advantages

As compared with analogs, the offering has higher structural and sorption characteristics, possesses a higher adsorption capacity towards hydrogen and the highest specific adsorption of H_2 (ρ up to 15 μmole/m^2) among the studied porous materials based on silica and carbon

Stage of Development. Suggestions for Commercialization

IRL3, TRL3
Batch manufacture, upon request

IPR Protection

IPR3

Contact Information

Serhii O. Soloviov, L.V. Pisarzhevskii Institute of Physical Chemistrty of the NAS of Ukraine;
+38 044 525 66 70, +38 044 525 62 16, e-mail: soloviev@inphyschem-nas.kiev.ua

ELECTROCHEMICAL METHOD FOR APPLICATION OF Co-Mo AND Co-W SUPERALLOY COATINGS

Areas of Application

The cobalt superalloys with molybdenum and tungsten have many valuable properties for the advanced techniques and electronics, namely, high corrosion resistance, hardness, magnetic and catalytic properties, and wear resistance for the use in MEMS

Specification

The dense, fine-grained, X-ray amorphous coatings containing 13÷25 at.% Mo and 20÷24 at.% W are obtained from electrolytes by electrodeposition. The coatings obtained in standard corrosion environment have a high corrosion resistance (up to 8.5 kOhm for Co-Mo and 19 kOhm for Co-W). The alloys have a higher electrocatalytic activity for hydrogen evolution reaction in alkaline media in comparison with pure cobalt. In the case of Co-Mo alloys, a decrease in hydrogen evolution overvoltage comes to ~400 mV, while in the case of Co-W, it amounts to ~360 mV. The coatings show soft-magnetic properties: they have a low coercive force and reach a magnetization saturation in low-intensity fields

Advantages

The application of plating technology based on environment friendly citrate-pyrophosphate electrolyte enables to obtain high-quality functional coatings of Co-Mo and Co-W alloys and to control efficiently the plating process to produce the desired alloy composition and properties. These alloys can replace electrolytic chromium coatings having a lower corrosion resistance

Stage of Development. Suggestions for Commercialization

IRL3, TRL3
The method is ready for developing customer requirement specification

IPR Protection

IPR2

Contact Information

Valeriy S. Kublanovsky, Vernadsky Institute of General and Inorganic Chemistry of the NAS of Ukraine; +38 044 424 33 11, e-mail: kublanovsky@ionc.kiev.ua

EPOXY RESINS MODIFIERS

Areas of Application

The epoxy-urethane modifiers of epoxy resins provide durable adhesive-bond joints for products of mechanical engineering, aviation, and shipbuilding industry

Specification

Viscous transparent colorless liquids; miscible with commercial epoxy resins; the long-term stability of modified composition (20 °C) exceeds 6 months; the shear strength (modified ED-20 resin, 20 °C, stainless steel) is 13.2 MPa; harden at low temperature

Epoxy resin modifiers

Advantages

In comparison with the known analogs, the offered modifiers provide, at a moderate cost, the required viscosity of final adhesive composition and durable adhesive-bond joints of different materials; enable adjusting the final composition viscosity

Stage of Development. Suggestions for Commercialization

IRL5, TRL5
Batches manufactured and supplied, upon request

Scope of application of modified epoxy resins

IPR Protection

IPR1

Contact Information

Vitaliy F. Matyushov, Institute of Macromolecular Chemistry of the NAS of Ukraine;
+38 044 559 31 18, e-mail: tolstov@nas.gov.ua

EPOXY-PHENOLIC LACQUERS AND ENAMELS

Principal applications of developed coatings

Areas of Application

The epoxy-phenolic lacquers and enamels with bactericidal activity are to be used as protective coatings in machine-building, medical, and food industries

Specification

Viscous transparent or nontransparent liquids; the hardened films are highly stable in chemical and biological environment (DSTU 5981-88).

Hardening temperature, °C	210—215
Hardening time, min	10—15
Hardening time, min, N·m	>5

Advantages

In comparison with commercial composites, these materials provide antimicrobial and anticorrosion protection of the surfaces }and have improved decorative properties

IPR Protection

IPR3

Stage of Development. Suggestions for Commercialization

IRL4, TRL4
Manufactured and supplied, upon request

Contact Information

Vitaliy F. Matyushov, Institute of Macromolecular Chemistry of the NAS of Ukraine;
+38 044 559 31 18, e-mail: tolstov@nas.gov.ua

EROSION-RESISTANT CARBON-CARBON COMPOSITE MATERIALS (CCCM)

Areas of Application

The erosion resistant CCCM are used in rocket, space, aeronautical, and mechanical engineering for manufacturing the critical elements of solid-fueled, liquid-propellant, and electrothermal rocket engines (critical sections, chambers, heat exchangers, heaters, etc.)

Specification

Density, g/cm^3	1.3—1.85
Mechanical strength, MPa	100—400
Low open porosity, %	3—4…8—12

Carbon-carbon parts

Advantages

The proprietary techniques and manufacturing technologies enable kicking the dependence on imported dual-use materials.
The materials are weldable to metallic (titanium) elements, operable at a high temperature (up to and above 3000 °C) and at considerable thermal and mechanical shocks

Production of carbon-carbon materials

Stage of Development. Suggestions for Commercialization

IRL7, TRL8
Manufactured and suppled, upon request

IPR Protection

IPR1

Contact Information

Igor V. Gurin, National Science Center "Kharkov Institute of Physics and Technology";
+38 067 712 16 74, +38 057 349 10 61, e-mail: Igor@kipt.kharkov.ua

ETU-250 INDUCTION HEATING MACHINE

ETU-250 prototype

Heating of a cast-iron stop shoe
of subway car reduction gear

Specification

Supply voltage	400 V/50 Hz
Maximum output power, kW	250
Oscillation frequency, kHz	0.5—25
Efficiency, %	<95
Heating rate, °C/kg · s	30—50
Heating temperature (max.), °C	<900

Areas of Application

The induction heating machine is designed for electro-thermal treatment of components of various equipment. The scope of application covers thermal treatment of component parts and blanks, including heating while repairing industrial, power, and transport equipment

Stage of Development. Suggestions for Commercialization

IRL7, TRL8
Manufacture, delivery, warranty service, and staff training, upon request

IPR Protection

IPR1, IPR2

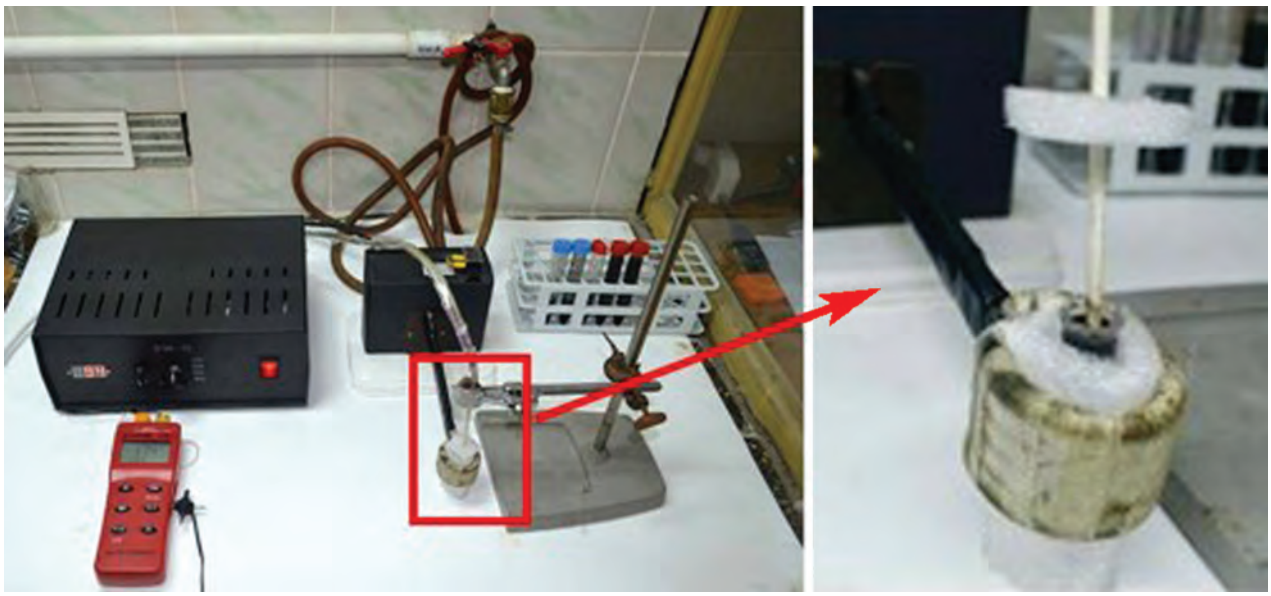
Advantages

The machine is unique in Ukraine.
As compared with the conventional electrothermal technologies, the use of ETU-250 enables to reduce electricity consumption by 20—30%; to increase the labor productivity 1.5—2 times; to significantly reduce the cost of materials for inductor production and repair; to replace the inductors of different sizes and configurations automatically keeping the electro-thermal process parameters at a given level; and to improve the production ecology

Contact Information

Volodymyr V. Bryl, Institute of Electrodynamics of the NAS of Ukraine;
+38 044 366 25 70, e-mail: brylvv@ied.org.ua

FERROMAGNETIC NANOPARTICLES FOR HYPERTHERMIA TREATMENT



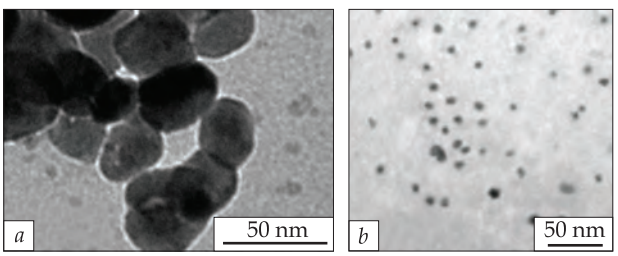
Stand for in vivo magnetic nano-hyperthermia

Areas of Application

The ferromagnetic nanoparticles can be used as magnetic inductors of nano-hyperthermia for controlled local heating of tumors

Specification

The ferromagnetic nanoparticles and magnetic fluids based on them show a high specific power loss (40 W/h) under the action of external AC magnetic fields in the frequency range of 100÷400 kHz



Manganite (*a*) and magnetite (*b*) nanoparticles

Stage of Development. Suggestions for Commercialization

IRL5, TRL5
The offering needs financial support for preclinical tests and further manufacture

IPR Protection

IPR1, IPR3

Advantages

The introduction of magnetic liquid (dispersion of ferromagnetic nanoparticles) into tumor and the further action of external alternating magnetic field on it leads to local heating up to a temperature of 42—45 °C that stops the growth of deep-seated tumors. The advantage of this offering is the particle composition and size, which provide the removal of waste products from the body in the natural way. Detailed information on analogs manufactured by pharmaceutical companies is not disclosed

Contact Information

Anatolii G. Belous, Vernadsky Institute of General and Inorganic Chemistry of the NAS of Ukraine;
+38 044 424 22 11, e-mail: belous@ionc.kiev.ua

FILM-FORMING MATERIALS BASED ON GERMANIUM-METAL OXIDE (SULFIDE, SELENIDE) SYSTEMS

Specimens of coatings obtained from *Ge – ZnS* (brown color); *Ge – ZnO* (orange color); refined *ZnS/Cr* (green-blue color) on quartz substrates

Specification

The materials are composites made by sintering the powders of their components. They have evaporation temperature lower than that of initial components (germanium and metal oxide, sulfide or selenide). The materials form coatings with a high refractive index (3.0—3.8), are transparent in the IR range (0.7—20 μm), have high mechanical durability (group 0), climate resilience, and thermal resistance

Areas of Application

The materials are designed for applying thin-film coatings on germanium optical elements of devices operating in the IR range (imaging IR-equipment, night vision devices, etc.) by the thermal evaporation method in vacuum

Advantages

The film materials have no analogs all over the world, expand the range of materials with required refractive index and corresponding range of transparency. The coatings based on them surpass the conventional products with similar properties in mechanical durability and optical transparency

Stage of Development. Suggestions for Commercialization

IRL3, TRL2
Trial samples manufactured, upon request

IPR Protection

IPR3

Contact Information

Tetiana V. Mikhaylova, A.V. Bogatsky Physico-Chemical Institute of the NAS of Ukraine;
+38 048 700 99 06, e-mail: office.physchem@nas.gov.ua

FOAMED ALUMINUM ALLOYS OF WIDE USE

Areas of Application

The alloys can be used in construction as wall panels, hung ceilings, slabs for elevators, escalators, and tunnels for the purpose of electromagnetic shielding and sound absorption; in automotive industry as shock-absorbers in bumpers and supporting blocks; in machine-tool building as vibration damping shell

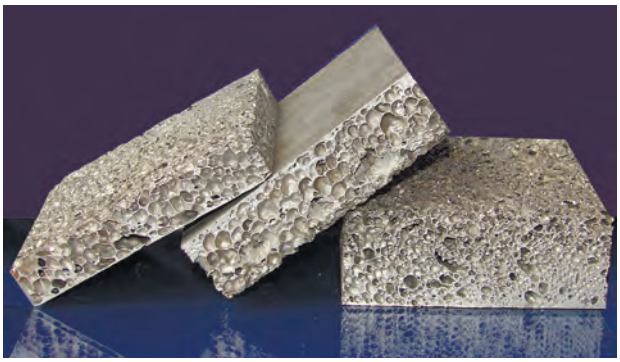
Specification

The foamed aluminum alloys are manufactured as sheets, panels, rods, and granules. They can withstand high deformations (up to 60—80%) at almost constant load.

Density, kg/m^3	0.4—0.8
Compression limit, MPa	2.3—10.6
Heat conductivity, W/(m · K)	3.5—8.0
Sound conductivity, dB/cm	1.1
Electromagnetic shielding (f = 1—1000 MHz), dB	78—130

Advantages

The foamed aluminum alloys have a unique combination of physical and mechanical properties including the ability to absorb impact energy and sound, to damp vibration, and to shield electromagnetic radiation. They are inflammable, nontoxic, and resistant to biological impacts, fuels, lubricants, cleaning detergents, solvents, ultraviolet and atomic radiation



Sandwich panels

Foamed pellets

Sound absorbing panels with foamed pellets

Stage of Development. Suggestions for Commercialization

IRL4, TRL4
Manufacture of small batches.
Seeking partners for industrial production

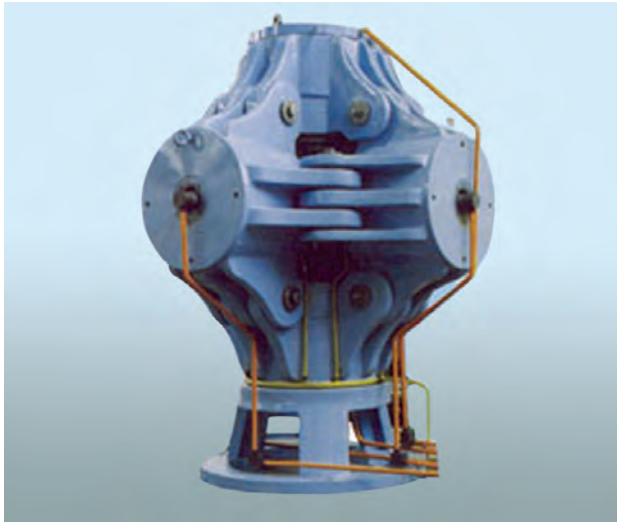
IPR Protection

IPR3

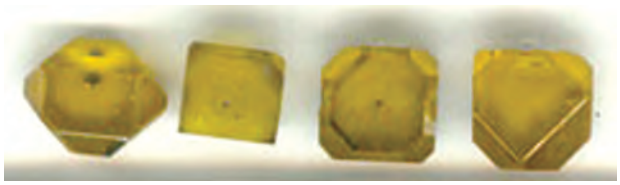
Contact Information

Serhii M. Fomenko, Frantsevich Institute for Problems of Materials Science of the NAS of Ukraine;
+38 044 424 04 27, +38 095 244 36 38, e-mail: fsergej688@gmail.com

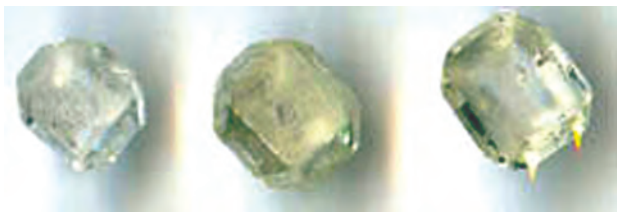
GROWTH OF STRUCTURALLY PERFECT DIAMOND SINGLE CRYSTALS



Equipment for growing structurally perfect single crystal diamonds: 6-cylinder hydraulic press CSXII; load 6×48.5 MN, piston diameter 750 mm, weight 70 tons; dimensions 4×4×4,5 m



a



b

c

Structurally perfect single crystal diamond obtained at a high pressure and temperature:
a) type Ib, weight up to 20 ct., *b*) type IIa, weight up to 15 ct., *c*) type IIb (semiconductor), weight up to 10 ct.

Areas of Application

The offering is designed to grow structurally perfect diamond single crystals to be used in electronics, optics, précising processing, and in other industries

Specification

Diamond type: Ib, IIa, IIb; growing technique: seed-grown in the diamond thermodynamic stability region by the temperature gradient method; the process parameters: pressure P = 5.8—6.5 GPa, temperature: T = 1400—1700 °C; 6-cylinder synthetic diamond machine CS-VII–CS-XIII; crystal weight: 0 1—20 ct

Advantages

As compared with the existing methods, the offering has a growing capacity up to 0.5 dm^3 and enables obtaining diamonds up to 40 carats in one cycle; reducing significantly the production costs, and raising profitability

Stage of Development. Suggestions for Commercialization

IRL8, TRL8
The offering is ready for large-scale implementation. Design, delivery, warranty service, and staff training, upon request

IPR Protection

IPR1, IPR2, IPR3

Contact Information

Volodymyr Z. Turkevich, V. Bakul Institute for Superhard Materials of the NAS of Ukraine;
+38 044 468 86 32, e-mail: almaz@ism.kiev.ua

HIGH-STRENGTH CAST ALUMINUM ALLOYS

Areas of Application

The alloys can be used
for producing cast and 3D-printed parts
in automotive and aviation industries

Specification

Mechanical properties of cast alloys
after thermal treatment:

tensile strength, MPa	500—575
yield stress, MPa	360—520
plasticity, %	3.3—1.0

Mechanical properties of rods produced
by the ingot extrusion method
after thermal treatment:

tensile strength, MPa	556
yield stress, MPa	460
plasticity, %	8.5

Ingot and rod obtained by the extrusion method

Advantages

Due to a unique combination
of mechanical, cast, and tribotechnical
properties the alloys can be used both as cast
and after deformation. The wear resistance
under dynamic load exceeds 2 times
that of some existing wrought industrial alloys;
the fluidity exceeds 1.3 times that of the best
commercial aluminum-silicon alloys

Stage of Development. Suggestions for Commercialization

IRL3, TRL3
Vending of patent based on license agreement

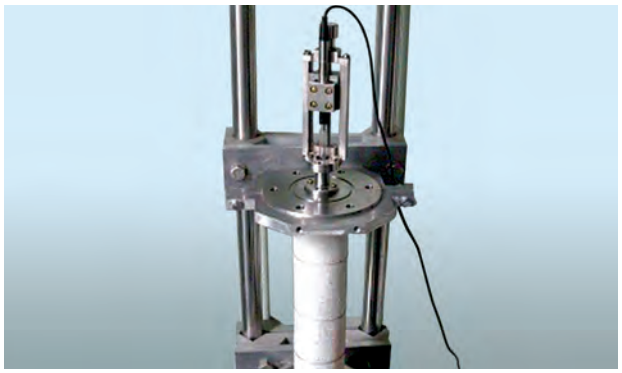
IPR Protection

IPR3

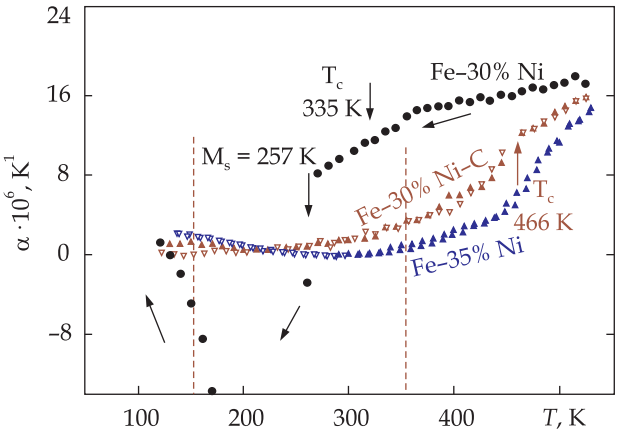
Contact Information

Vitalii P. Bevz, G.V. Kurdyumov Institute for Metal Physics of the NAS of Ukraine;
+38 044 424 12 05, e-mail: bevzv@ukr.net

HIGH-STRENGTH INVAR ALLOY



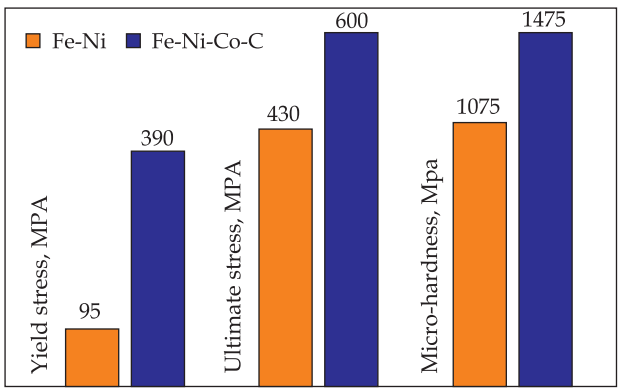
Quartz dilatometer in the structure of which the developed high-strength invar alloy is used



Temperature dependence of thermal expansion coefficient of the alloys with different content of nickel and carbon

Areas of Application

The alloy can be used in metrology, geodesy, instrument engineering, and in laser optics (for telescopic systems and their structural components to ensure stability of their geometrical dimensions at varying temperature; electro-engineering products and measuring instruments, etc.)



Dependence of yield stress, ultimate stress, and micro-hardness of invar Fe–Ni-based alloys: orange columns correspond to the conventional alloy; purple columns correspond to proposed invar alloy

Advantages

High mechanical properties: the yield stress is four times higher as compared with the conventional invar, the ultimate stress and hardness exceed the standard values by 40%; the alloy is stable under cyclic loads; at minor changes in the chemical composition, the alloy shows the anti-invar effect, i. e. abnormally high TEC within the range from 250 to 500 K, which is impossible to realize in the conventional alloys; its chemical composition enables adjusting TEC by thermomechanical treatment in the same product; the alloy shows the invar or anti-invar properties with a reduced content of expensive Ni, which is lower than the standard one (36%)

Specification

Thermal expansion coefficient (TEC) within the temperature range 100—400 K: $\alpha = (0{,}9\text{–}5) \cdot 10^{-6}\ K^{-1}$.

Yield stress, MPa	~390
Ultimate stress, MPa	600
Micro-hardness, MPa	1475

IPR Protection

IPR3

Stage of Development. Suggestions for Commercialization

IRL3, TRL4
Vending of patent based on license agreement

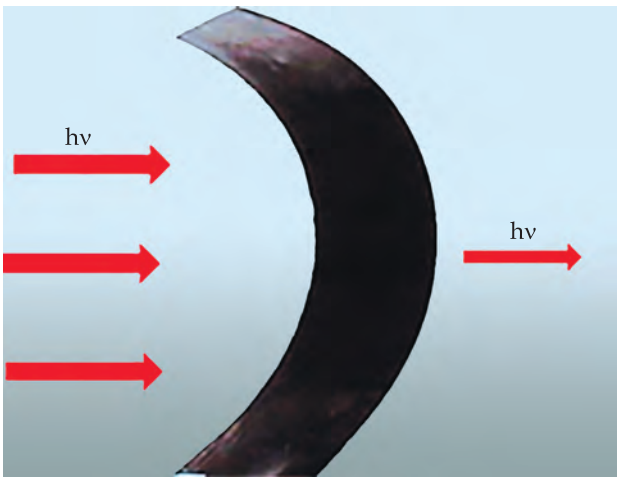
Contact Information

Vitalii P. Bevz, G.V. Kurdyumov Institute for Metal Physics of the NAS of Ukraine;
+38 044 424 12 05, e-mail: BevzV@ukr.net

HYBRID FLEXIBLE FILM COMPOSITE MATERIALS FOR ELECTROSTATIC AND ELECTROMAGNETIC PROTECTION

Areas of Application

The materials are designed for protection of environment, electronic equipment, personnel, and information storage devices from electromagnetic fields and static electricity



Scheme of electromagnetic shielding by composite material film (photo of real film sample)

Specification

The materials contain conductive polymer, carbon nanotubes, and magnetic nanoparticles, which are distributed in commercial polymer matrix; 1 mm-thick films of these composite materials show a high conductivity (~ 1.3 S/cm), an electromagnetic shielding efficiency up to -45 dB within the range of 10 MHz–20 GHz, and a quite low specific gravity

Advantages

These film materials do not have analogs in Ukraine. As compared with foreign counterparts, in particular, the fabrics containing metallic threads, these materials are notable for a small content of conductive and magnetic components, a low specific gravity, percolating electrical properties, and a significant absorption of electromagnetic radiation

Stage of Development. Suggestions for Commercialization

IRL3, TRL4
Manufacture of trial samples, tests in customer operating conditions, support in design and organization of manufacture, upon request

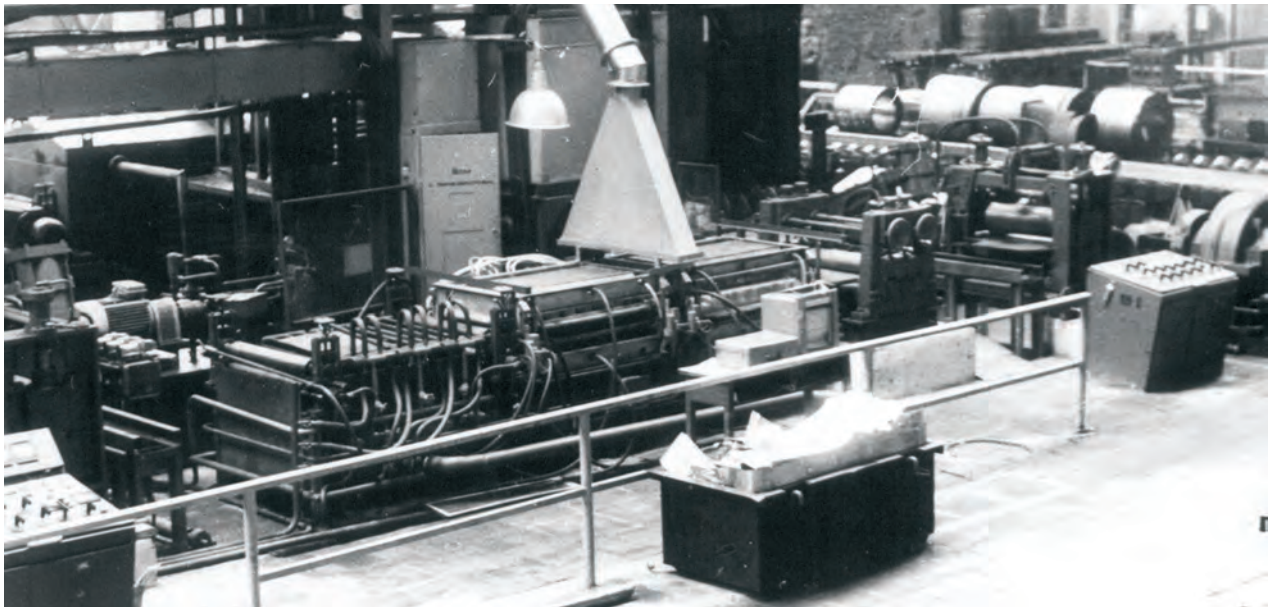
IPR Protection

IPR1, IPR3

Contact Information

Oleksandr A. Pud, Institute of Bioorganic Chemistry and Petrochemistry of the NAS of Ukraine;
+38 044 559 70 03, +38 067 501 42 41, e-mail: pud@bpci.kiev.ua

INDUCTORS FOR HEAT TREATMENT OF FLAT-ROLLED METAL PRODUCTS



Plant for induction annealing at the rolling mill of metallurgical works

Areas of Application

The offering is designed for hardening, annealing, and etching flat-rolled metal products in specialized annealing lines; can be used in ferrous and nonferrous metallurgy

Specification

Total power, kVA	100—1000
Power supply	380 V/50 Hz
Yield capacity, t/h	2—10
Power factor	0.5—0.7
Heating temperature, °C	700
Specific energy consumption, kW·h/t	50—80
Efficiency, %	≥85
Strip width, mm	620 ± 20
Strip thickness, mm	0.4—4
Overall dimensions, m	1× 1 × 0.6

IPR Protection

IPR3

Advantages

The specific electricity consumption is 2–4 times lower as compared with the conventional heating in resistance furnaces; no need in the use of mineral fuels; reduced metal fumes and equipment dimensions. Heat treatment of ferrous metals is carried out at a frequency of 500 Hz

Stage of Development. Suggestions for Commercialization

IRL7, TRL8
Manufacture, delivery, warranty maintenance, and staff training, upon request

Contact Information

Volodymyr V. Bryl, Institute of Electrodynamics of the NAS of Ukraine;
+38 044 366 25 70, e-mail: brylvv@ied.org.ua

LIGHT-GUIDE THERMOMETRY SYSTEM

Areas of Application

Continuous light-guide temperature control of metal melts in furnaces and melting facilities, in metallurgy; salt and ceramic melts, gaseous environments, and brickworks in other industries

Specification

Range of measurable temperature, °C	600—1800
Fundamental measurement error, %	0.5—1.0

Advantages

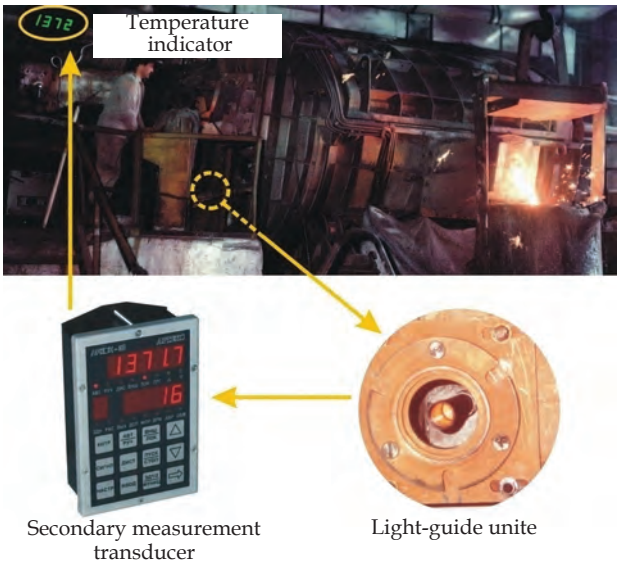
Provides optimal online control and regulation of temperature regimes of manufacturing processes; reduces power consumption by 20—80%, temperature defects by 40—100%, waste of charge materials by 20—40%; extends brickwork service life by 50—100%; increases yield capacity of furnaces by 40—80%; prevents failures caused by metal overheating or overcooling

Stage of Development. Suggestions for Commercialization

IRL8, TRL8
Customized manufacture, delivery, warranty service, and staff training, upon request

IPR Protection

IPR3, IPR5



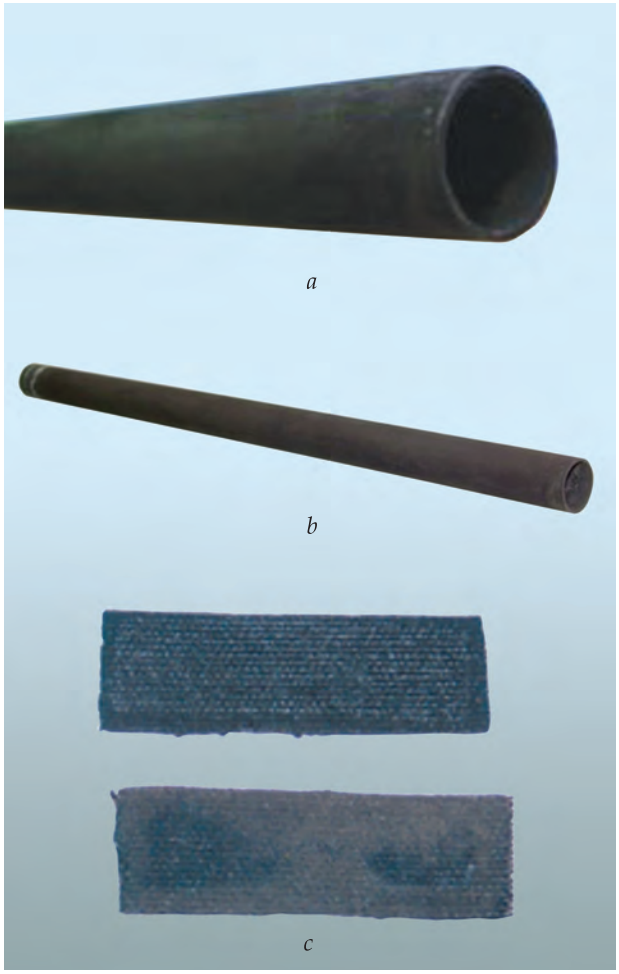
Continuous light-guide temperature control of liquid cast iron in the induction channel mixing furnace

Continuous light-guide temperature control of liquid cast iron in the induction channel pouring furnace

Contact Information

Anatoly V. Narivskyi, Physico-Technological Institute of Metals and Alloys of the NAS of Ukraine;
+38 044 424 35 15, e-mail: metal@ptima.kiev.ua

METHOD FOR MANUFACTURING HIGH-TEMPERATURE PROTON CONDUCTIVE MATERIALS



Proton conductive material deposited on ceramic hollow tube (*a*, *b*) and flexible pad (*c*)

Areas of Application

The proton conductive materials for high-temperature fuel cells and membrane catalytic contacts used in the synthetic fuel processes: synthesis gas conversion, olefins hydration, alcohols dehydration, and alkyl aromatics hydrocracking

Specification

The materials are products of acetylene dehydropolycondensation, carbamide homopolycondensation, and polyvinylchloride dehydrochlorination. They have the properties as shown in Table below

Parameter	Product		
	acetylene dehydro-polyconden-sation	carbamide homopoly-conden-sation	polyvinyl-chloride dehydro chlorination
Proton conductivity, S/cm, at 450—460 °C	10^{-4}	$4 \cdot 10^{-5}$	$5 \cdot 10^{-5}$
Thermo-stability, °C	600	550	500

Stage of Development. Suggestions for Commercialization

IRL3, TRL4
Trial batch of proton conductive materials for testing at customer workspace; ready for the elaboration of business plan

Advantages

The injected proton conductivity of developed materials ranges within 10^{-5}—10^{-4} S/cm at a temperature of 200—460 °C

IPR Protection

IPR3

Contact Information

Valerii A. Bortyshevskyi, Institute of Bioorganic Chemistry and Petrochemistry of the NAS of Ukraine; +38 044 559 04 95, e-mail: bort2001@gmail.com

METHOD FOR RHEOCASTING OF ALUMINUM ALLOYS BY DIE CASTING MACHINES


a


b

Areas of Application

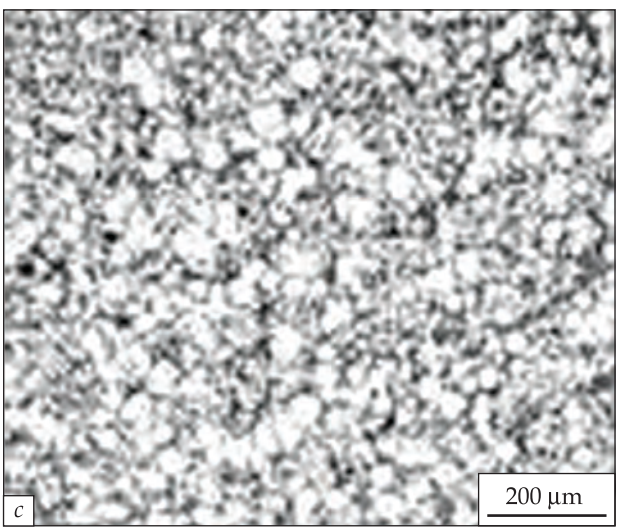
For manufacturing cast articles operable at a high pressure, at foundries and machine-building plants

Specification

Time for preparation of dose of aluminum alloy suspension, s: 3—5

Advantages

Both rheo- and tixocasting are possible; guaranteed obtainment of sealed castings; increase in ductility



c

Rheocasting method testing: *a*) a blank for tixocasting; *b*) small body of gas oven burner; *c*) microstructure of a cast piece

Stage of Development. Suggestions for Commercialization

IRL4, TRL5
Manufacturing application of the method for casting semisolid melt

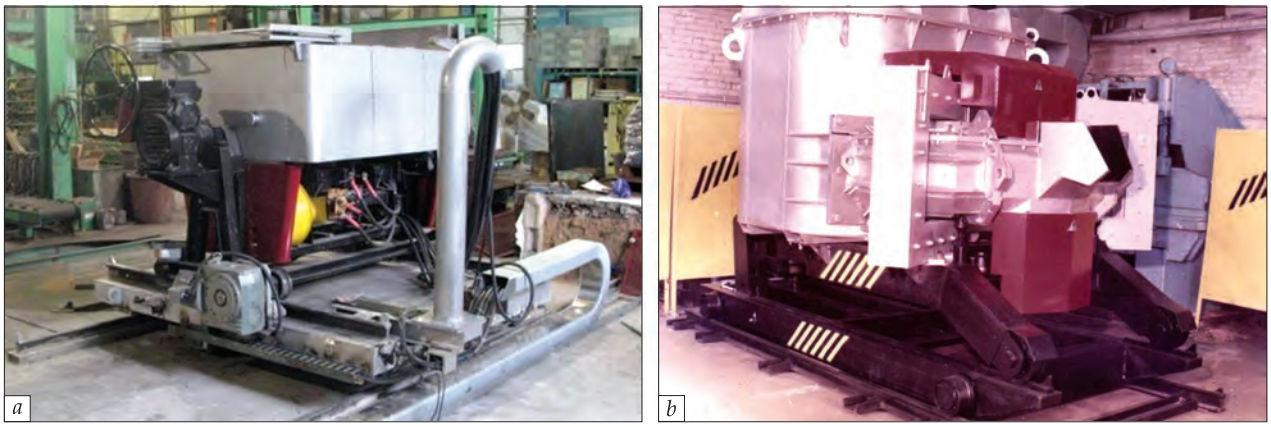
IPR Protection

IPR4

Contact Information

Anatoly V. Narivskyi, Physico-Technological Institute of Metals and Alloys of the NAS of Ukraine; +38 044 424 35 15, e-mail: metal@ptima.kiev.ua

MHD-EQUIPMENT AND TECHNOLOGIES FOR PRODUCTION OF HIGH-QUALITY FERROUS AND NONFERROUS ALLOYS AND CASTS



Magnetodynamic mixing-and-batching devices for aluminum alloys (*a*) and for cast iron and steel (*b*)

Areas of Application

The equipment and technologies are designed to prepare and to pour ferrous and nonferrous alloys into molds, die casting machines, and continuous casting molds, to cast under electromagnetic pressure, to obtain metal suspensions for aluminum alloy rheocasting technologies, and to prepare "copper-chromium cast iron" alloys with the "frozen emulsion" structure

Advantages

The offered MHD-equipment has no direct analogs in the world. It enables intensifying the alloys preparation, reducing the energy consumption and waste of materials, removing impurities, refining the structure, improving the physical, mechanical, and operational properties of alloys, and automating the process

IPR Protection

IPR1, IPR2, IPR3

Specification

The magnetodynamic mixing-and-batching devices (for aluminum alloys with a melt capacity up to 630 kg and a power capacity up to 70 kW; for cast iron and steel with a melt capacity up to 10 tons and a power capacity up to 600 kW) provide out-of-furnace treatment and controlled electromagnetic casting of liquid alloys. The based on the action of pulsed magnetic field electromagnetic stirrer with a power capacity up to 40 kW stirs the melts in furnaces, mixers, ladles, and molds. The specialized MHD-devices provide obtainment of functional alloys

Stage of Development. Suggestions for Commercialization

IRL7, TRL6
Customized manufacture, supply, after-sales service of equipment, technology mastering, and staff training, upon request. For the interested companies, organization of joint customized equipment manufacture and supply. Manufacture of small cast batches

Contact Information

Anatoly V. Narivskyi, Physico-Technological Institute of Metals and Alloys of the NAS of Ukraine; +38 044 424 35 15, e-mail: metal@ptima.kiev.ua

MULTIFUNCTIONAL HARDWARE AND SOFTWARE COMPLEX FOR DIAGNOSING THE METAL SAMPLE HEATING AND COOLING PROCESSES

Areas of Application

The complex can be used in engineering and metallurgical industries, at labs and shops, specialized research institutes and universities for testing the cooling properties of different steel-tempering liquids; for development of more effective liquids in accordance with international standards; for contactless acoustic identification of cooling rate and mode in production environment

Specification

PC: OS: Windows XP, 512MB RAM, processor type Intel Pentium 4 CPU 2.66 GHz.

Dimensions:	
record and control unit, mm	215 × 235 × 235
furnace, mm	348 × 162 × 35243
Voltage, V	220 ± 22
Furnace capacity, kW	2

Advantages

Identification of process conditions for obtaining fine-grained structure and optimum depth of metal surface hardening, which increases 1.5—3 times the life of products; elimination of production defects: cracks, deformation, "soft spots" on the surface; the possibility of replacing high-alloy steels by cheaper ones; reduces price of new quenching medium by 50% as compared with imported analogs; improves the environment conditions and simplifies the utilization of waste materials; the possibility of acoustic diagnostics for hardening

Stage of Development. Suggestions for Commercialization

IRL6, TRL6
Manufactured and delivered, upon request

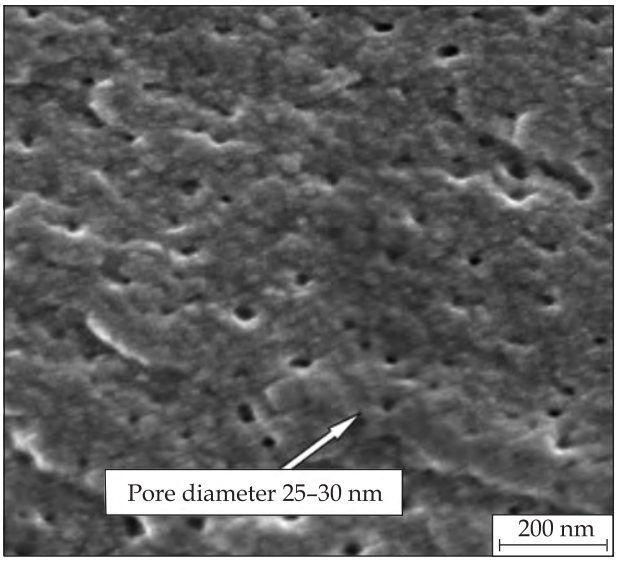
IPR Protection

IPR2

Contact Information

Alexander I. Chaika, Institute of Engineering Thermophysics of the NAS of Ukraine;
+38 044 456 93 81, e-mail: chaika@ittf.kiev.ua

NANOPOROUS FILTER MATERIALS



High-strength nanoporous track-etched membranes made of polycyanurate obtained on ion-electron device

Specification

The technology is based on bombarding polymer materials by heavy charged particles with further irradiating with picowave radiation. It differs from similar technologies by the use of ion cyclotron U-120 and 4 MeV electron accelerator. The production capacity is 800 sq. m. material monthly. The ion energy is 24 MeV or higher. The pore diameter ranges from 25 to 30 nm

Areas of Application

The nanoporous filter materials based on nuclear track membranes are to be used for the ultra-filtration in advanced industrial processes in medicine (for hemodialysis), electrical engineering (for production of chemical power sources), metrology (for gas purification), food industry (as semitransparent packing materials), etc.

Stage of Development. Suggestions for Commercialization

IRL3, TRL3
Nanoporous filtering materials

Advantages

There are no analogs in Ukraine.
The materials are cheaper than the foreign counterparts

IPR Protection

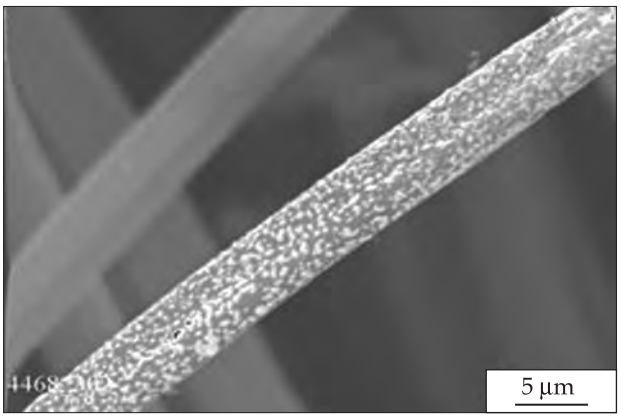
IPR3

Contact Information

Tatiana V. Kovalinska, Institute for Nuclear Research of the NAS of Ukraine;
+38 044 525 45 75, e-mail: tkovalinska@kinr.kiev.ua

NANOSTRUCTURED CARBON FIBER ACTIVATED SORPTION MATERIALS FOR MEDICAL APPLICATION

Carbon fiber nanostructured material of medical application



Immobilization of copper nanoparticles on carbon fiber surface

Areas of Application

The material can be used in clinics as sorbent for treatment of toxic poisoning; as filter for cleaning of blood and lymph; as antibacterial agent for treatment of wounds, eczemas, and burns; as antiradionuclide agent; as target drug carrier

Advantages

As compared with the world analogs, the offering has 2—3 times higher sorption kinetics and sorption capacity with respect to low-, middle-, and high-molecular physiological active substances, which broadens the area of its application and enables selective sorption and targeted functional treatment of more than 40 diseases

Specification

Whole porous volume (benzol), cm^3/g	0.8—1.3
Specific surface area, m^2/g	1500—2800
Adsorption of methylene blue, mg/g	450—800
Residual concentration at 60 min sorption, mg/ml	
creatinine (initial concentration — 4.5 mg/ml)	0.02
medinal (initial concentration — 6 mg/ml)	0.02
urea (initial concentration —15 mg/ml)	0.013

IPR Protection

IPR2

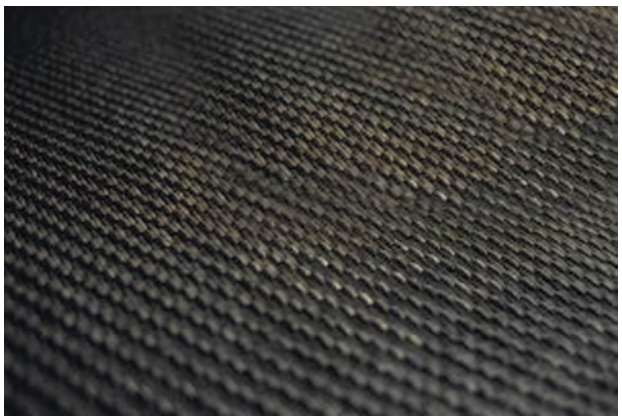
Stage of Development. Suggestions for Commercialization

IRL3, TRL4
Manufacture of small batches.
Seeking partners for industrial production

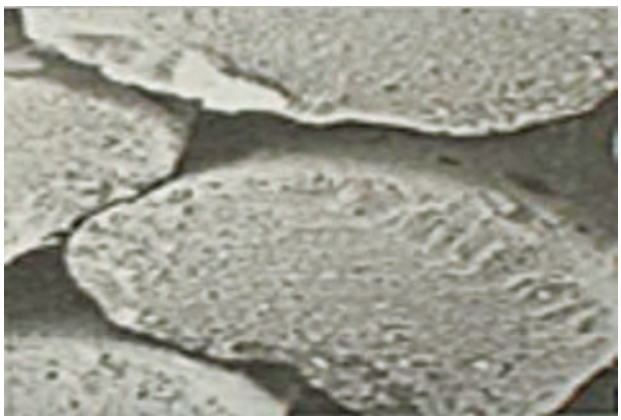
Contact Information

Serhii M. Fomenko, Frantsevich Institute for Problems of Materials Science of the NAS of Ukraine;
+38 044 424 04 27, +38 095 244 36 38, fsergej688@gmail.com

NANOSTRUCTURED CARBON FIBER ACTIVATED SORPTION MATERIALS FOR TECHNICAL APPLICATION



Carbon fiber nanostructured materials for engineering application



Filter for water purification

Areas of Application

The material can be used as electrode for super capacitors; as filter for water and air purification from hard metals, phenol, chlorine, and isotopes; as screen for protection from ultrahard radiation of control systems in robotics, rocket and nuclear power engineering

Specification

Specific surface area, m^2/g	1500—2800
Sorption, %	98.8 Al; 99.0 Cu; 97.0 Sr; 94.0 Co; 84.0 Cs
Oxidation stability on an air, °C	700—773

Advantages

The offering has 2—3 times higher sorption kinetics and sorption capacity as compared with the world analogs. The use of various types of structure and shapes (fibers, tubes, threads) broadens the possibilities of sorption purification of water and air from pollutants. Using this offering as protection from hard gamma radiation in aerospace engineering, robotics, and surveillance systems of atomic power plants enables to employ 10 times lighter shields as compared with the steel ones and 9 times lighter than the concrete ones, which have the same protection properties

Stage of Development. Suggestions for Commercialization

IRL3, TRL4
Manufacture of small batches.
Seeking partners for industrial production

IPR Protection

IPR2

Contact Information

Serhii M. Fomenko, Frantsevich Institute for Problems of Materials Science of the NAS of Ukraine;
+38 044 424 04 27, +38 095 244 36 38, fsergej688@gmail.com

NANOSTRUCTURED CERAMIC MATERIALS

Areas of Application

Nozzles and cutting-tool cartridges for mechanical engineering, chemical and petrochemical industries; medical implant blanks

Specification

Materials for cutting-tool cartridges, nozzles	Al_2O_3(95%), B_4C
Materials for implant blanks	Y-TZP
Bending strength, MPa	
Al_2O_3(95%)	≤550
B_4C	≤450
Y-TZP	≤1300

Advantages

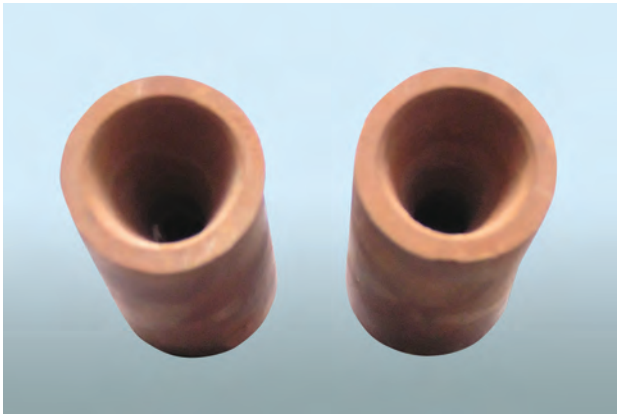
Nozzles and cutting-tool cartridges: high wear resistance, chemical stability, heat resistance. Medical implant blanks: bioinertness, high hardness and wear resistance, corrosion resistance

Stage of Development. Suggestions for Commercialization

IRL6, TRL6
Manufactured, upon request

IPR Protection

IPR1



Nozzles of Al_2O_3

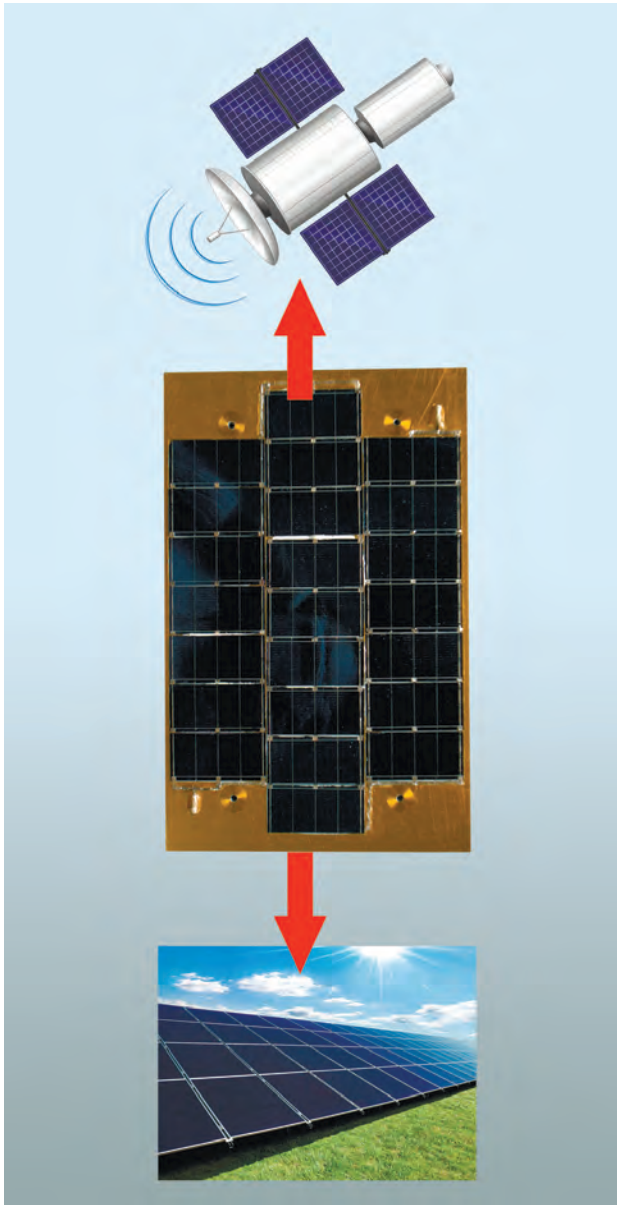
Nozzle of B_4C

Medical implant blanks

Contact Information

Sergii G. Pugach, National Science Center "Kharkov Institute of Physics and Technology";
+38 057 335 68 43, +38 057 349 10 49, e-mail: pugach@kipt.kharkov.ua

OPTICALLY-TRANSPARENT PROTECTIVE COATINGS



Photoelectric converters for solar panels

Areas of Application

For photovoltaic and optoelectronic devices

Specification

The coating:	
optical transparency, %	≥92—95
adhesion to inorganic and organic surfaces, MPa	≥45
operating temperature range, °C:	–190…+200
ultimate breaking shear stress, MPa	27.5
thermal-cycling stability (from –100 to +80 °C), cycles	1000
The photoelectric transducer with the coating:	
short-circuit current, A	1.09
open-circuit voltage, V	12.0
efficiency, %	16.4

Advantages

In comparison with domestic and foreign analogs, the proposed optically-transparent coatings have a higher adhesion to surfaces with various surface energy, a wider operating temperature range, a higher resistance to ultraviolet and radioactive radiation, with the optical properties kept, and a higher mechanical strength. The application of such coatings enables rising the efficiency of solar energy photoelectric converter, reducing its prime cost, and extending its service life more than 2 times

Stage of Development. Suggestions for Commercialization

IRL3, TRL3
Manufactured and supplied, upon request

IPR Protection

IPR3

Contact Information

Oleksandr O. Brovko, Institute of Macromolecular Chemistry of the NAS of Ukraine;
+38 044 559 42 95, e-mail: brovko@ihvs.nas.gov.ua

PHOTOPOLYMER ADHESIVES

Areas of Application

The photopolymer adhesives are designed for bonding organic and silicate glass to metals, ceramics, cement, wood, and plastics for civil aviation, machine-building industry, and for military purposes

Specification

Viscous transparent liquids (colorless or slightly yellowish), high water resistance.

Shear strength (glass/steel; 25 °C), MPa	15—40
Operating temperature, °C	–40…+100
Hardening	UV or visible light
Setting time, min	1—5
Storage life at a temperature ≤30 °C, months	≥6

Advantages

In comparison with the known analogs, the adhesives have a lower cost, improved adhesion and ability to bond different ypes of materials, and are characterized by “absolute” adhesion

Selected areas of adhesives application

Stage of Development. Suggestions for Commercialization

IRL7, TRL7
Manufactured and supplied, upon request

IPR Protection

IPR1

Contact Information

Vitaliy F. Matyushov, Institute of Macromolecular Chemistry of the NAS of Ukraine;
+38 044 559 31 18, e-mail: tolstov@nas.gov.ua

PHOTOPOLYMERIZABLE ADHESIVE MATERIAL FOR FINISHING PRINTED PRODUCTS

Products manufactured by the cold foil stamping method

Areas of Application

High-performance photoadhesive material for bonding foil to printed material using the method of cold foil stamping; can be used for manufacturing electronic and cable products

Specification

One-component photopolymerizable adhesive material, polymer film setting time under UV action is 2—3 s, shelf life is, at least, one year, can be applicable to a wide range of printing materials (paper, cardboard, plastics, and metallized films), including heat-sensitive ones

Advantages

In comparison with the analogs, this material is cheaper, enables reducing the product labor input and manufacturing cost, has a wider scope of application, enables a significant improvement in product quality without any dot gain of image elements. The materials are applied on the printed products by the flexographic printing method followed by bonding to foil and treating with UV radiation through the foil in a single production cycle

Stage of Development. Suggestions for Commercialization

IRL6, TRL5
Batch manufacture, upon request

IPR Protection

IPR3

Contact Information

Serhii O. Solovyov, L.V. Pisarzhevskii Institute of Physical Chemistry of the NAS of Ukraine;
+38 044 525 66 70, e-mail: admini@inphyschem-nas.kiev.ua

PLANT FOR PRODUCING BASALT SUPERFINE FIBERS (BSFF)

Areas of Application

To produce BSFF (∅1÷3 μm) for the duplex technology. The product is obtained from 5÷20 mm gravel fractions in the form of canvas with a given density and size. This canvas is used for manufacturing environment friendly highly resilient heat- and sound-insulating materials with a high resistance to thermal transmission, aggressive substances, extreme temperature, and vibration to be employed in power engineering, metallurgy, machine-, aircraft- and shipbuilding industries, and construction

General view of the plant

Specification

Continuous running plant.

Yield capacity, kg/day	≤600
Consumption:	
natural gas, m^3/kg	2.3
power, kW · h/kg	2.6

BSFF canvas

Advantages

As compared with the best world counterparts, this plant enables 1.5 times reduction in power consumption; improving the product quality as the share of BSFF-sp type (with the content of non-fiber particles less than 4.8%) increases by 10%

Stage of Development. Suggestions for Commercialization

IRL7, TRL7
Manufacture, staff training, and warranty service, upon request

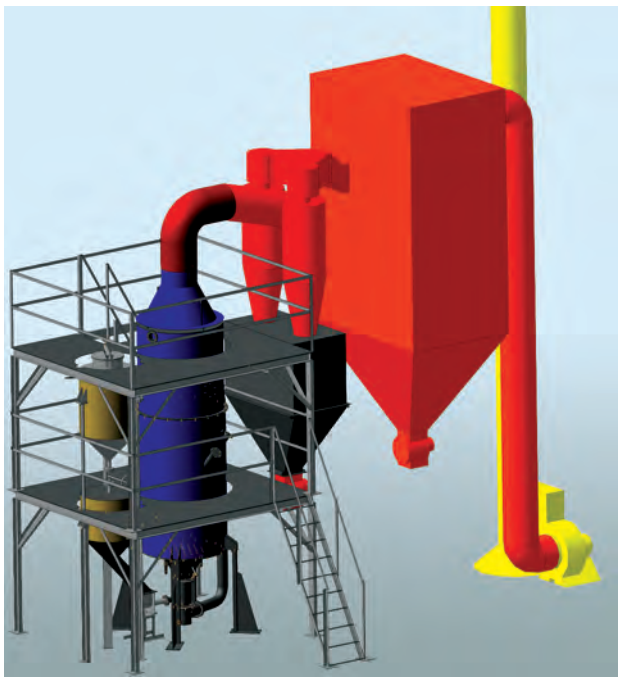
IPR Protection

IPR1

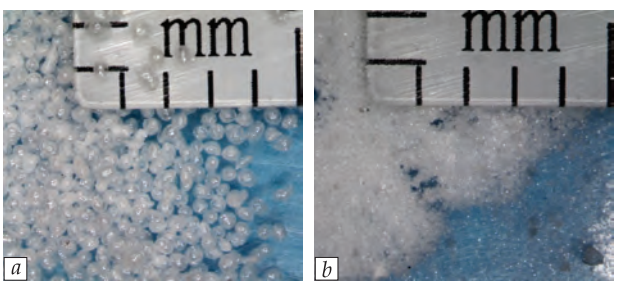
Contact Information

Alexander I. Chaika, Institute of Engineering Thermophysics of the NAS of Ukraine;
+38 044 456 93 81, e-mail: chaika@ittf.kiev.ua

PLANT FOR PRODUCTION OF FINE LIGHTWEIGHT FILLER OR FILTER POWDER



Plant for production of fine lightweight filler or filter powder



Perlite filler (a) and perlite filter powder (*b*)

Areas of Application

The plant is designed for obtaining fine filler or filter powder from volcanic ash (perlite) of various deposits

Specification

Plant capacity, kg/h	500.0
Bulk product density, kg/m^3	100.0—150.0
Particle size, mm	0.5—0.1
Natural gas consumption, nm^3/h	40
Overall dimensions, mm	7950 × 2900 × 7300

Advantages

The plant enables obtaining high-quality lightweight filler or filter powder from fine-powdered raw materials with a particle size up to 100 μm, which no competitors work with; a low natural gas consumption that makes up 70 nm^3/ton raw materials; small size, easy installation, simple operation

Stage of Development. Suggestions for Commercialization

IRL6, TRL6
Manufacture, supply, maintenance, and staff training, upon request

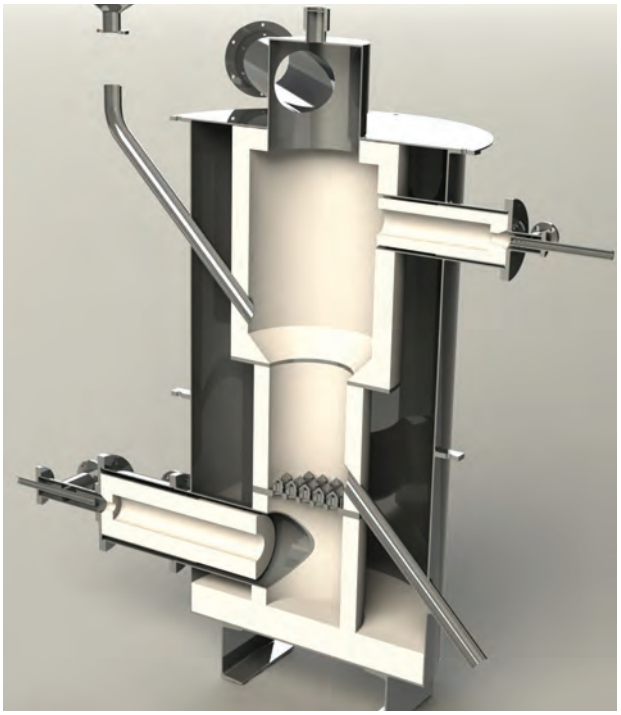
IPR Protection

IPR3

Contact Information

Boris K. Ilienko, Gas Institute of the NAS of Ukraine;
+38 044 456 03 56, e-mail: bor.ilienko@gmail.com; ig-secr@i.com.ua

PLANT FOR PRODUCTION OF HIGH-QUALITY ACTIVATED COA



Cross section of the coal activation reactor

Original material for activation

Activation in a fluidized bed of hot product

Areas of Application

The plant is designed to produce activated coal with a high specific surface and a density of 0.5 g/cm^3. This material can be used in medicine as sorbent or hemosorbent; in metallurgy, construction, machine building, and power engineering for manufacturing lithium-ion batteries; in military industry for the means of protection (gas masks and bomb shelters) etc.

Specification

Cycle, h	1–2
Natural gas consumption, m^3/h	1
Operating temperature, °C	900
Yield capacity, kg/h	1–3

IPR Protection

IPR2

Advantages

The high-quality activated carbon is notable for a high specific surface of 2000 m^2/g and a high mechanical strength achieved by special activation method. The know-how is the method of pulsed injection of air and ammonia into reactor to induce a non-stationary residual burning of conversion products and formation of radicals

Stage of Development. Suggestions for Commercialization

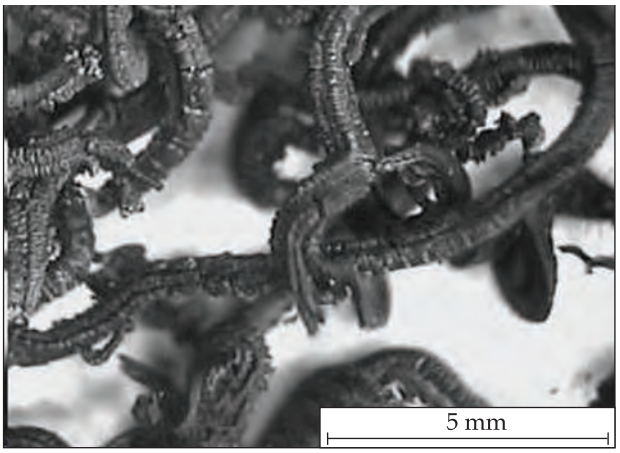
IRL7, TRL8
Manufacture, delivery, warranty service, and staff training, upon request

Contact Information

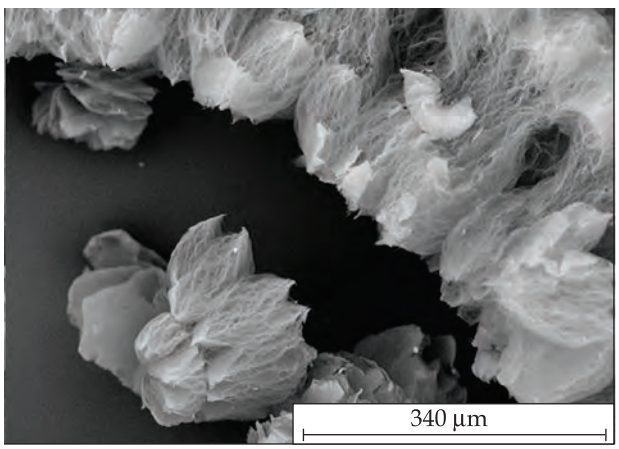
Yevhen V. Strativnov, Gas Institute of the NAS of Ukraine;
+38 044 456 44 71, +38 095 182 73 43, +38 097 306 18 46, +38 044 456 88 30, e-mail: estrativnov@gmail.com

PLANT FOR SYNTHESIS OF THERMALLY EXPANDED GRAPHITE (TEG)

Visualization of the reactor for synthesis of thermally expanded graphite



Macrostructure of thermally expanded graphite



Microstructure of thermally expanded graphite

Areas of Application

The plant is designed for producing TEG that can be used in petrochemical industry as effective sorbent for liquidation of emergency spills of oil and oil products; in metallurgy, construction, and mechanical engineering for the manufacture of heat-resistant, sealing and leak-proofing materials; power engineering for the production of lithium-ion batteries, etc.

Specification

Continuously running reactor.

Natural gas consumption, m^3/h	2
Operating temperature, °C	1000
Yield capacity, kg/h	35

Advantages

The plant is based on a new technology for obtaining high-quality TEG with a low density (up to 3 g/dm^3) and minimum residues of sulfuric acid (water extract acidity of 6.5—7 pH). This technology enables reducing specific energy consumption, plant weight and dimensions

Stage of Development. Suggestions for Commercialization

IRL7, TRL8
Manufacture, delivery, warranty service, and staff training, upon request

IPR Protection

IPR1, IPR3

Contact Information

Yevhen V. Strativnov, Gas Institute of the NAS of Ukraine;
+38 044 456 44 71, +38 095 182 73 43, +38 097 306 18 46, +38 044 456 88 30, e-mail: estrativnov@gmail.com

POLYFUNCTIONAL POLYURETHANE MATERIALS FOR BONDING AND COATING OF DIFFERENT TYPES OF SURFACES

Areas of Application

The polyfunctional polyurethane materials (PPM) based on single synthetic model with the use of renewable raw materials are used to ensure durable bonding of different materials and to protect different types of surfaces (metal, concrete, brick, wood) from destruction under the action of (a)biotic and anthropogenic factors

Specification

The polyfunctional polyurethane materials are water-, oil-, benzo-, and lightproof, bio-, wear-, and chemical-resistant.

Adhesive bond strength, MPa	22—35
Cohesive strength, MPa	41.5—46.0

Advantages

There are no domestic counterparts. The advantages of the offered materials, as compared with the foreign analogs, are as follows: long-term comprehensive protection of materials, structures, and infrastructure facilities from destruction; guaranteed continuous service of facilities for 10—15 years after repair

Stage of Development. Suggestions for Commercialization

IRL6, TRL5
Manufacture of a wide range of polymer materials for various purposes according to customer requirements; seeking investors for industrial production

Steel to steel adhesive bonding

Uncoated sample

Coated sample in 1 year

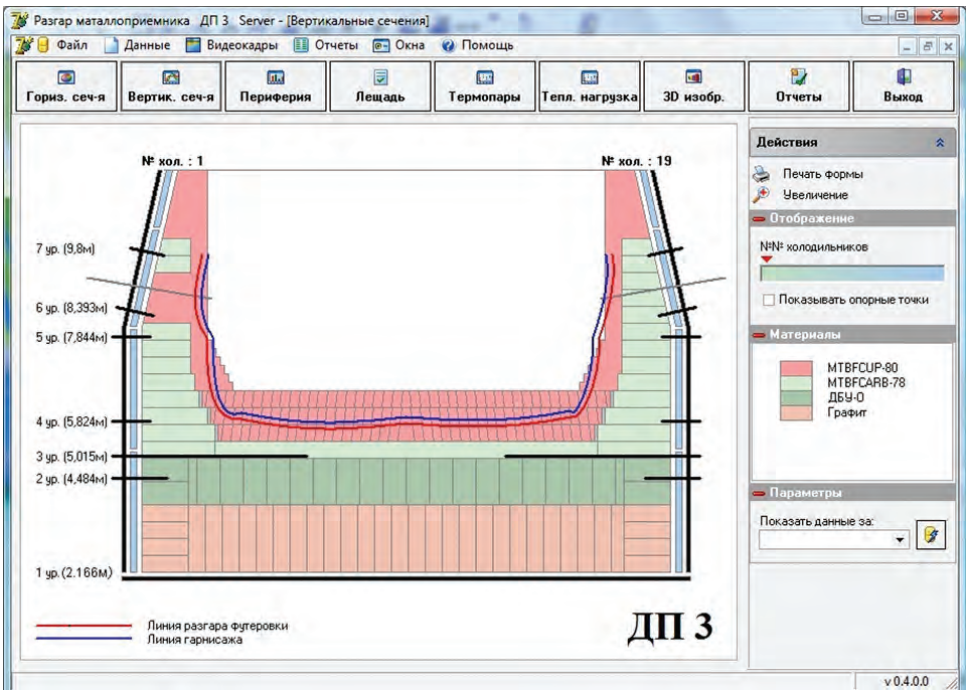
IPR Protection

IPR1, IPR3

Contact Information

Yuri V. Savelyev, Institute of Macromolecular Chemistry of the NAS of Ukraine;
+38 044 559 73 95, e-mail: yuri2savelyev@gmail.com

RAZGAR SYSTEM FOR CONTROL OF CRUCIBLE AND HEARTH INWALL RESIDUAL THICKNESS



Snapshot of *Razgar* system

Areas of Application

The automatic control system is designed to monitor the remaining thickness of crucible and hearth inwall and the skull formation. This enables a safe and long-term operation of blast furnaces

Specification

The system visualization includes 3D image of vertical and horizontal erosion of hearth inwall. The adaptation to specific blast furnace takes up to 1 year

Advantages

The Razgar system functions enable:
displaying changes in inwall temperature and average temperature at the horizontal levels of thermocouples;
taking into consideration the thermal load on the hearth;
taking into consideration the depth of hearth erosion;
taking into account the skull thickness;
calculating crucible and hearth wear rate;
displaying the horizontal profiles of inwall erosion along the crucible perimeter by the levels of thermocouples

Stage of Development. Suggestions for Commercialization

IRL8, TRL8
System installation, warranty service, and staff training

IPR Protection

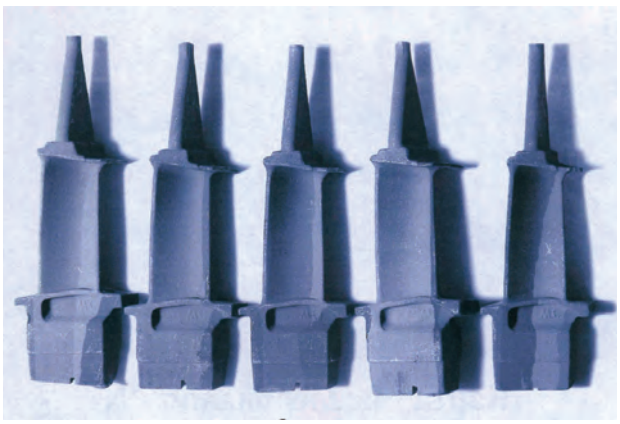
IPR3

Contact Information

Oleksii Ye. Merkulov, Iron and Steel Institute of Z.I. Nekrasov of the NAS of Ukraine;
+38 056 790 05 15, e-mail: office.isi@nas.gov.ua

SEEDS FOR SINGLE-CRYSTAL BLADES OF GAS TURBINE ENGINES

Single crystal seeds



Single crystal blades

Areas of Application

The seeds are to be used for manufacturing blades of gas turbine engines (GTE) operating at a high temperature, under mechanical loads and corrosion impact, for needs of aerospace engineering, shipbuilding, and power engineering

Specification

Crystallographic orientation [100]; deviation from crystallographic orientation [100] is 5 degrees, maximally; a high perfection of microstructure

Advantages

The use of seeds with a perfect microstructure eliminates defects of casting the single crystal GTE blades, increases the blade service life and long-term heat resistance 1.5—2 times

Stage of Development. Suggestions for Commercialization

IRL7, TRL8
Manufactured, upon request.
Production output is up to 3000 pcs monthly

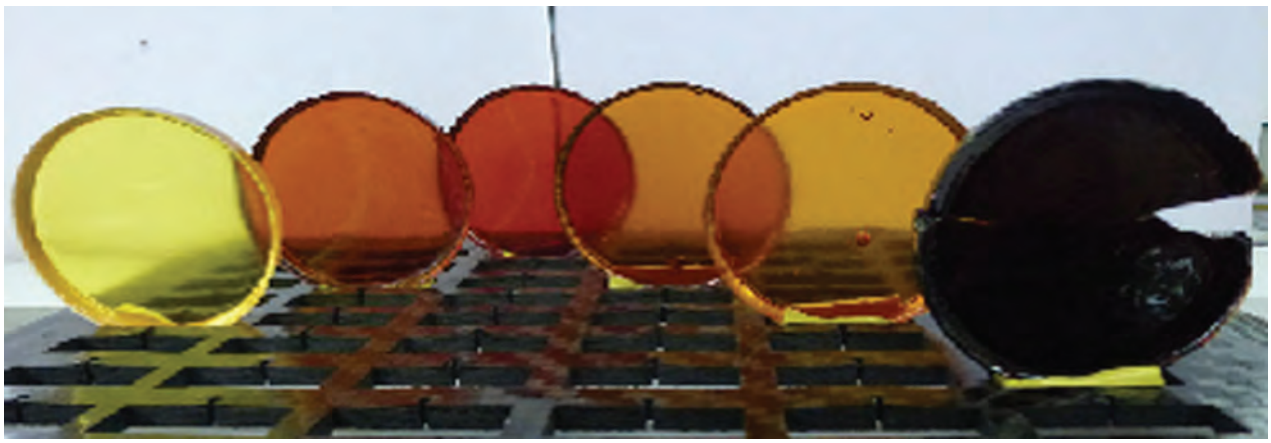
IPR Protection

IPR3

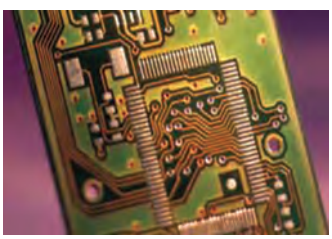
Contact Information

Sergii G. Pugach, National Science Center "Kharkov Institute of Physics and Technology";
+38 057 335 68 43, +38 057 349 10 49, e-mail: pugach@kipt.kharkov.ua

HIGH-PERFORMANCE SOLVENT-FREE BINDER FOR CARBON AND GLASS PLASTICS



Polymer matrices obtained from binders at different temperatures



Applications of new polymer matrices

Areas of Application

Aerospace industry, microelectronics, railway transport, car- and shipbuilding

Advantages

There are no analogs in Ukraine.
In comparison with the binders currently used in Ukraine, the materials developed have a significantly lower dielectric loss and operability at a high temperature and humidity. These carbon plastics demonstrate physical and mechanical properties similar to those of the best counterparts from EU and USA

IPR Protection

IPR3

Specification

Binder Properties

Organic solvent content, wt.%	0
Viscosity (VZ-4) at T = 60 °C, s	20—50
Viability at T = 60 °C, h	>8
Glass transition temperature, °C	235
Onset temperature, °C	390
Water uptake, wt.%	1—2

Properties of carbon plastics

Binder content in plastics, wt.%	28—32
Tensile modulus, MPa	1660
Compression strength, MPa	1090
Flexural strength at T = 20 °C, MPa	1650
Flexural strength at T = 150 °C, MPa	950
Flexural strength at T = 200 °C, MPa	440
Operating temperature, °C	150—350
Porosity, %	0

Stage of Development. Suggestions for Commercialization

IRL3, TRL4
Seeking partners for production

Contact Information

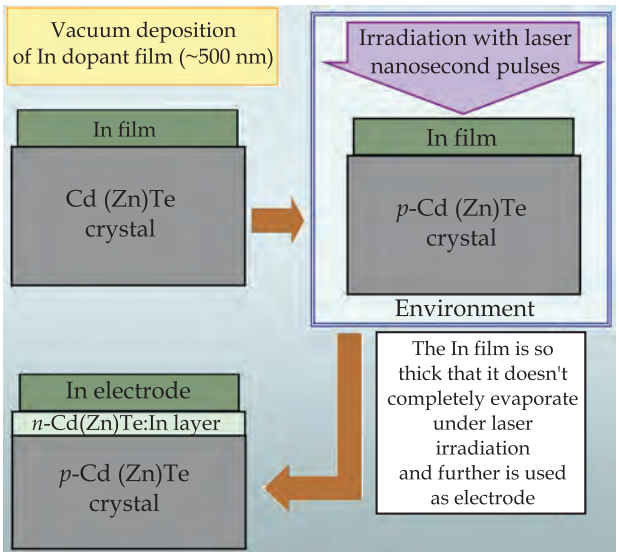
Oleksandr M. Fainleib, Institute of Macromolecular Chemistry of the NAS of Ukraine;
+38 044 559 53 72, e-mail: fainleib@i.ua

TECHNIQUE FOR LASER-INDUCED SOLID-PHASE DOPING OF NANOLAYERS IN CD(ZN)TE CRYSTALS AND FORMATION OF *p-n* JUNCTION

Specification

As a result of laser irradiation of *p*-Cd(Zn)Te crystal pre-coated with a dopant film, the nanolayer is doped heavily and an abrupt *p-n* junction is formed.

p-Cd(Zn)Te crystals, resistivity, Ohm · cm	10^9 — 10^{10}
Dopant film thickness, nm	~500
Environment at irradiation	Vacuum ~1 Pa, argon ~0.3 MPa, liquid
Laser:	
wavelength, nm	248, 532, 694
pulse duration, ns	7 — 8, 20
energy density, mJ/cm^2	80 — 150
Doped layer:	
thickness, nm	30 — 60
electron concentration, cm^{-3}	~10^{19}
resistivity, Ohm · cm	10^{-2} — 10^{-3}



Flowchart of processes of laser-induced solid-phase doping of *p*-Cd(Zn)Te crystal nanolayer with In dopant and formation of *p-n* junction

Areas of Application

The technique is to be used for the heavy doping of a thin surface semiconductor region, the formation of an inverse layer and abrupt *p-n* junction, and the creation of In/Cd(Zn)Te/Au diode structures for X/γ-ray radiation detection

Advantages

There are no analogs in Ukraine. As compared with the foreign counterparts, the advantages are as follows: a high charge carrier concentration in the doped semiconductor nanolayer due to the introduction of electrically active dopant and suppression of its self-compensation effect, as well as the rate, accuracy, and manufacturability of abrupt *p-n* junction formation

Stage of Development. Suggestions for Commercialization

IRL4, TRL5
Manufacturing application of the technology

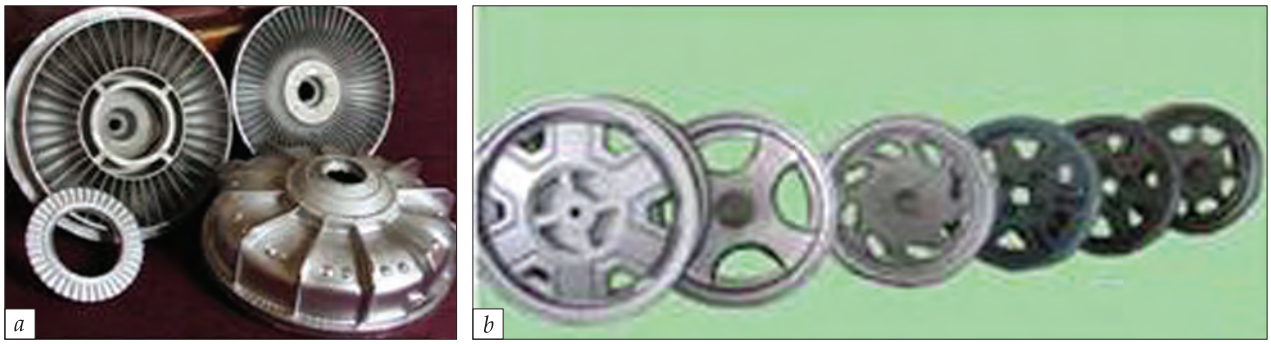
IPR Protection

IPR2, IPR3

Contact Information

Anna S. Stanetska, V.Ye. Lashkaryov Institute of Semiconductor Physics of the NAS of Ukraine;
+38 044 525 60 43, +38 099 292 66 60, e-mail: stanetska_anna@ukr.net

TECHNOLOGY FOR LOW-PRESSURE DIE CASTING



Set of hydraulic clutch components (*a*) and car wheels (*b*) obtained by the low-pressure casting method using ALUT-3 machine

ALUT-3 machine for casting under controlled low pressure

Areas of Application

Production of cast articles from aluminum alloys for aerospace industry, machine- and shipbuilding, instrument engineering, etc

Specification

Automated full-cycle manufacturing process, from pouring into molds to obtaining ready cast articles

IPR Protection

IPR3

Advantages

Enhancement of mechanic properties ($\sigma_в$, δ, HB) and operating parameters (vacuum density, cyclic strength) by 15—30%; decrease in power consumption down to 100—300 kW/h per 1 ton castings; decrease in metal consumption by the feeding system 3—19 times

Stage of Development. Suggestions for Commercialization

IRL6, TRL8
Technology transfer to enterprises with individual, serial and mass production; supply of ready cast articles

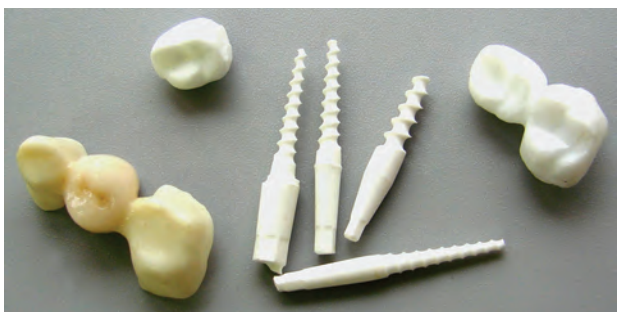
Contact Information

Anatoly V. Narivskyi, Physico-Technological Institute of Metals and Alloys of the NAS of Ukraine;
+38 044 424 35 15, e-mail: metal@ptima.kiev.ua

TECHNOLOGY FOR MANUFACTURING WEAR-RESISTANT CERAMIC AND COMPOSITE ARTICLES BASED ON ZIRCONIUM NANOPOWDERS

Ceramic plungers for oil station SNT-32

Inserts made of $ZrO_2 - Al_2O_3$ composite



Dental prostheses and implants from ZrO_2

Areas of Application

The technology is used for production of figurine-shaped articles for mine and oil industry, machine-building industry, chemical industry, metallurgical industry, power engineering, orthopedics (hip joints), and dentistry (implants and prosthesis)

Specification

Density, %	95—99.5
Bending strength, MPa	800
Fracture strength, MPa · $m^{1/2}$	7—10
Wear resistance, m^3/km	$6 \cdot 10^{-9}$

Advantages

The ceramic articles manufactured using the proposed technology have stable properties that are higher than those of the analogs; they have 20—50 times longer service life than the conventional metallic parts. In medicine, the zirconium-based ceramic materials have a high biocompatibility, speed up the formation of bone-implant contact, do not cause galvanic effects, allergic reactions or inflammation

Stage of Development. Suggestions for Commercialization

IRL6, TRL6
Joint venture

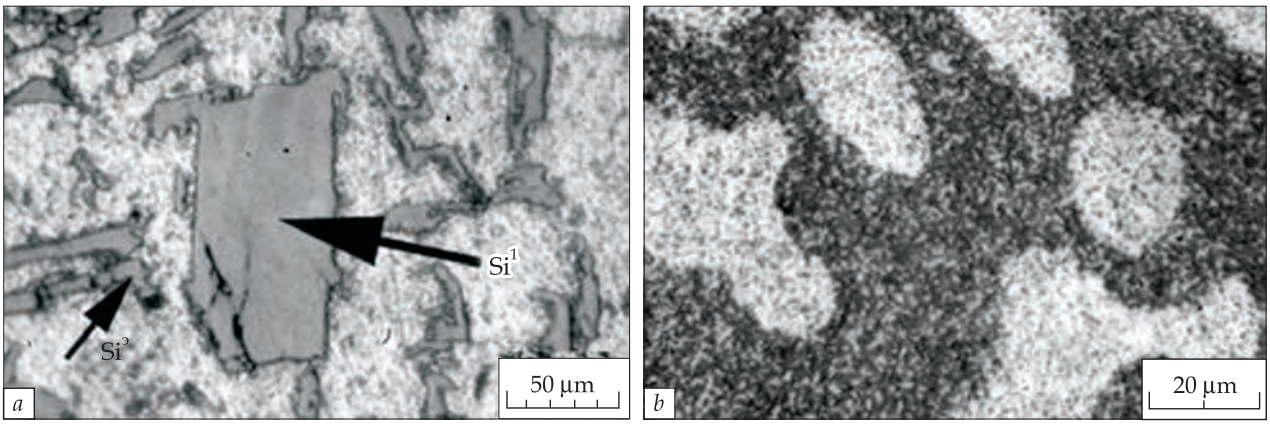
IPR Protection

IPR1, IPR2

Contact Information

Dmytro V. Raspornia, Donetsk Institute for Physics and Engineering named after O.O. Galkin of the NAS of Ukraine; +38 050 206 92 21, e-mail: diaprintster@gmail.com

TECHNOLOGY FOR MODIFYING ALUMINUM ALLOYS



Change of the structure of alloy Al-18,5 % Si before (*a*) and after treatment of the melt by electric current (*b*) with special regimes

Areas of Application

Production of cast articles with enhanced properties for aerospace industry, machine, and shipbuilding, etc.

Specification

Modification of melts using electric current during 5—20 s

Advantages

Production of finely structured aluminum alloys with nanoelements; enhancement of mechanic properties of industrial aluminum alloys smelted from waste and scrap: $\sigma_в$ by 10—40%, δ 1.5—3.5 times, HB by 10—16%; neutralization of iron harmful effect

Stage of Development. Suggestions for Commercialization

IRL3, TRL4
Trial batch manufacture, upon request

IPR Protection

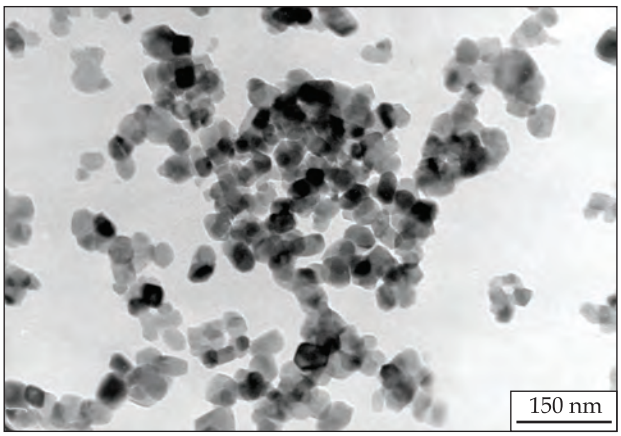
IPR3

Contact Information

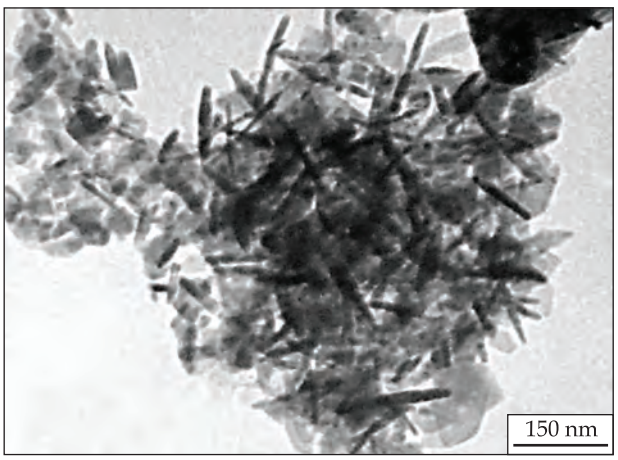
Anatoly V. Narivskyi, Physico-Technological Institute of Metals and Alloys of the NAS of Ukraine; +38 044 424 35 15, e-mail: metal@ptima.kiev.ua

TECHNOLOGY FOR OBTAINING CERAMIC AND COMPOSITE NANOMATERIALS

Pilot line for nanopowder production



Nanopowder ZrO_2-3 mol % Y_2O_3



Nanopowder ZrO_2-3 mol % Y_2O_3 modified by F ions

Areas of Application

The technology is used to create ceramic and composite nanomaterials for biomedical implants, corrosion-resistant ceramics for mechanical engineering, chemical and food industries; as well as to manufacture medical markers and catalysts, polymer nanocomposites, fluorescent and X-ray contrast materials

Specification

Pre-determined chemical and phase composition.

Particle size, nm	$d = 10-30$
Specific surface area, m^2/g	120–20

Advantages

The technology is simple in terms of hardware solutions unlike the widespread analogs. The proposed technology enables to widen the range of powder chemical compositions without significant modifications of production

Stage of Development. Suggestions for Commercialization

IRL6, TRL7
Vending of license for the technology

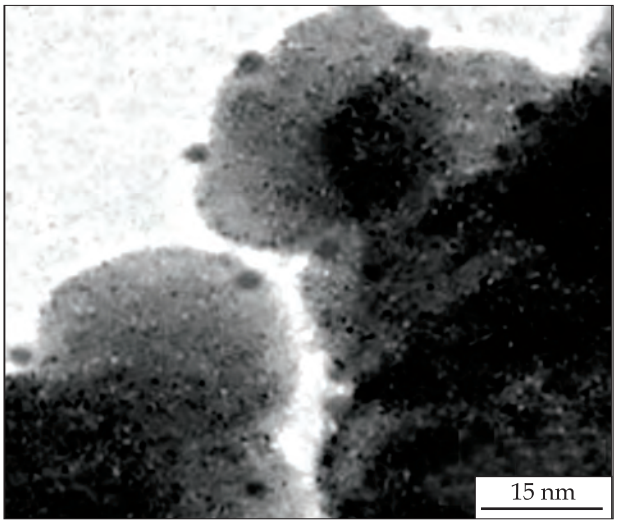
IPR Protection

IPR1, IPR3

Contact Information

Dmytro V. Raspornia, Donetsk Institute for Physics and Engineering named after O.O. Galkin of the NAS of Ukraine; +38 050 206 92 21, e-mail: diaprintster@gmail.com

TECHNOLOGY FOR OBTAINING PHOTOSENSITIVE AND PHOTOCATALYTIC OXIDE NANOPOWDERS



Photosensitive nanopowder
$Ag(Ag_2O) - ZrO_2 - 3$ mol % Y_2O_3

Areas of Application

This technology is used to produce composite oxide powders for photocatalytic purification of air and water

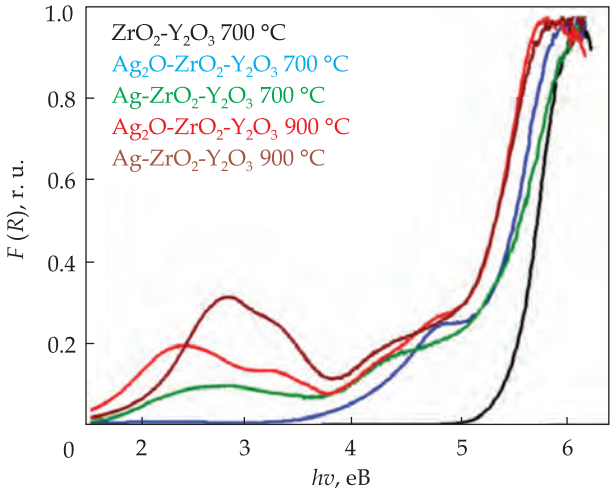
Specification

Phase composition: as required.
Chemical composition: as required.

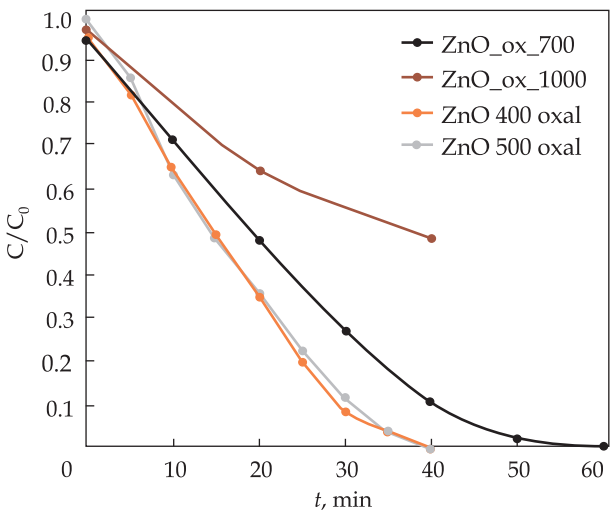
Particle size, nm	$d = 10-300$
Specific surface area, m^2/g	120—10

Advantages

This technology is simpler in terms of hardware solutions as compared with the analogs. The physical actions essentially reduce drying time and decrease the aggregation of nanoparticles, so that no grinding is required.
The proposed technology enables to widen the range of powder chemical compositions without significant modifications of production and to control the nanopowder dispersion



Optical properties of nanopowde
$Ag(Ag_2O) - ZrO_2 - 3$ mol % Y_2O_3



Photocatalytic properties of ZnO nanopowder

Stage of Development. Suggestions for Commercialization

IRL3, TRL6
Joint venture

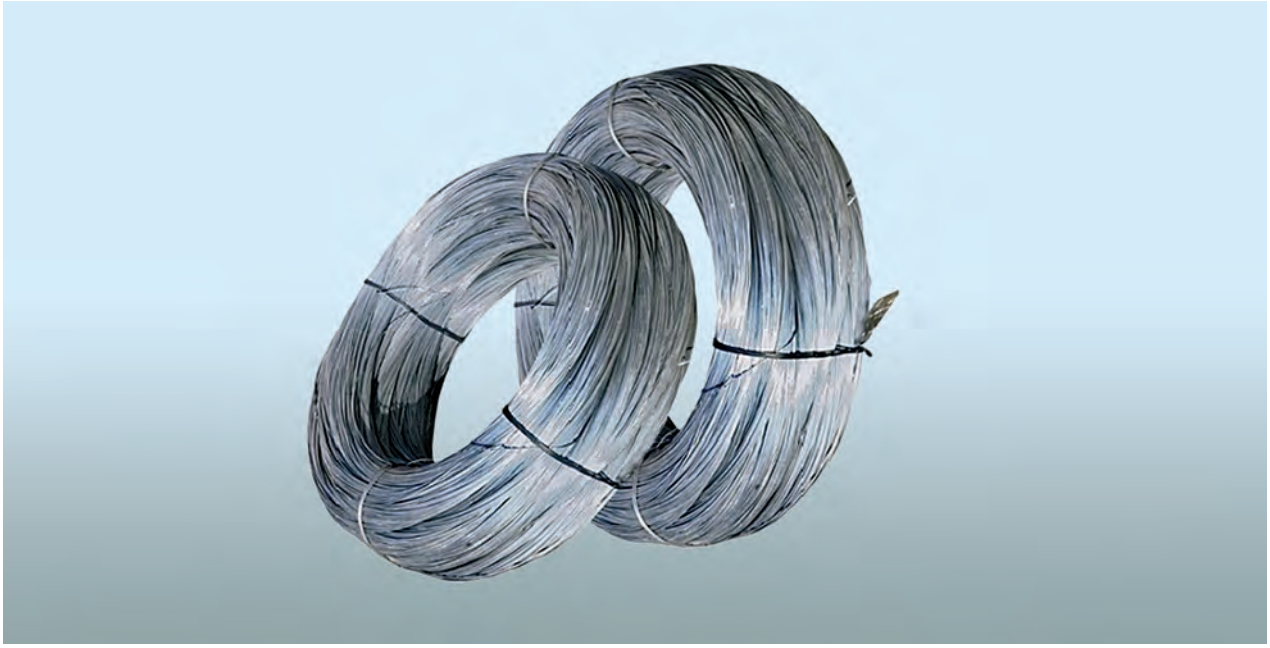
IPR Protection

IPR1

Contact Information

Dmytro V. Raspornia, Donetsk Institute for Physics and Engineering named after O.O. Galkin of the NAS of Ukraine; +38 050 206 92 21, e-mail: diaprintster@gmail.com

TECHNOLOGY FOR PRODUCTION OF WIDE-APPLICATION WIRE ROD



Round-section rolled wire

Areas of Application

Wire rod for manufacture welding materials and metal products

Advantages

The proposed technology enables producing wire from the rod by direct drawing without prior annealing operations

Specification

The high-carbon type is used to produce steel ropes for critical structures; the low-carbon SAE1005-1010 type with guaranteed mechanical properties enables drawing wires with a diameter from 0.8 to 1.0 mm at optimal rate without additional softening heat treatment; the welding type with guaranteed mechanical properties enables drawing wires with a diameter from 0.8 to 1.0 mm at optimal rate without additional softening heat treatment; the construction type is designed for cold upset

Stage of Development. Suggestions for Commercialization

IRL8, TRL8
BTechnical specifications for steel wire rod heat treatment modes and for steel composition

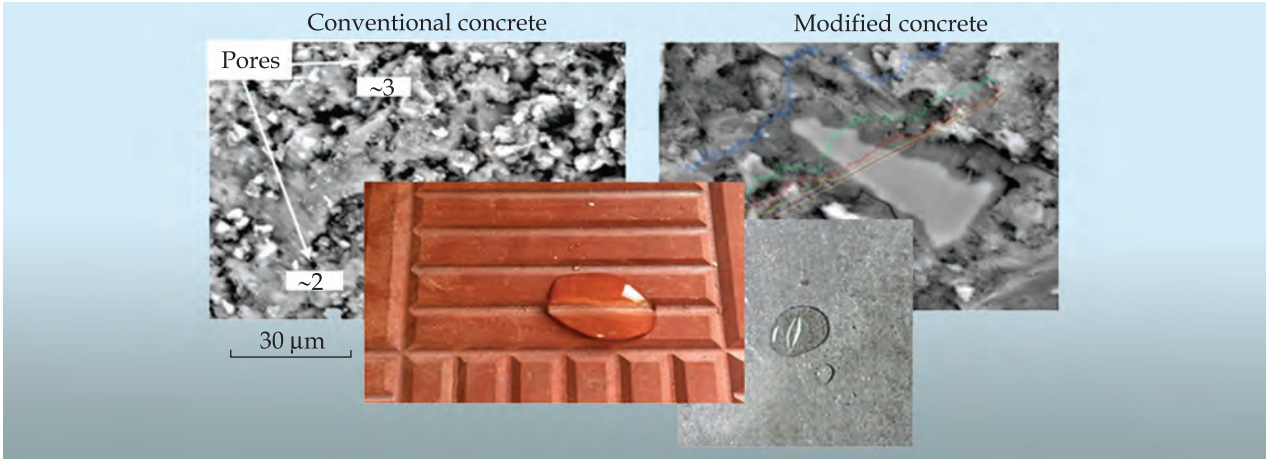
IPR Protection

IPR3

Contact Information

Oleksii Ye. Merkulov, Iron and Steel Institute of Z.I. Nekrasov of the NAS of Ukraine;
+38 056 790 05 15, e-mail: office.isi@nas.gov.ua

TECHNOLOGY FOR RADIATION MODIFICATION OF COMPOSITE ORGANIC AND MINERAL CEMENT SYSTEMS



Effects of radiation modification of concrete and concrete products:
the hydrophobicity test of modified products (corrugated fiber cement sheets, paving slabs)

Areas of Application

This technology is designed to enhance water repellency, corrosion resistance, and durability of concrete structures and products made of asbestos concrete and other organic and mineral concrete systems used in extreme operating conditions

Advantages

There are no analogs in Ukraine.
The technology is notable for simplicity of processes and remote control of structuring in the very material mass;
no hazardous substances are used;
can apply both to the unfinished concrete products at any stage of manufacture and to the ready articles

IPR Protection

IPR1

Specification

As a result of radiation treatment, the porous construction materials are modified into dense hydrophobic composites with higher strength and corrosion resistance. The technology consists of introducing the modifying structures into the porous material mass and treating the material with electron beams in order to make it monolithic. The technology is based on the use of electron accelerators with average electron energy of 4—10 MeV; at a beam power of, at least, 5 kW, about 1.5 tons of concrete structures can be modified annually

Stage of Development. Suggestions for Commercialization

IRL6, TRL6
Technology, mass production line design

Contact Information

Tatiana V. Kovalinska, Institute for Nuclear Research of the NAS of Ukraine;
+38 044 525 45 75, e-mail: tkovalinska@kinr.kiev.ua

TECHNOLOGY FOR RAPID HEAT TREATMENT OF COMMERCIAL TITANIUM ALLOYS

Areas of Application

The technology can apply to bulk or local/surface treatment of parts and products in aerospace, automotive, chemical, and defense industries as well as in the manufacture of medical devices, including implants

Specification

The technology is based on rapid heating at a rate up to hundreds degrees per second, using sources of high energy, under very nonequilibrium conditions. Depending on the size and desired results, the articles can be heated by current passage, heat inductor, electron beam, laser, etc.

High-strength titanium fasteners for aerospace application

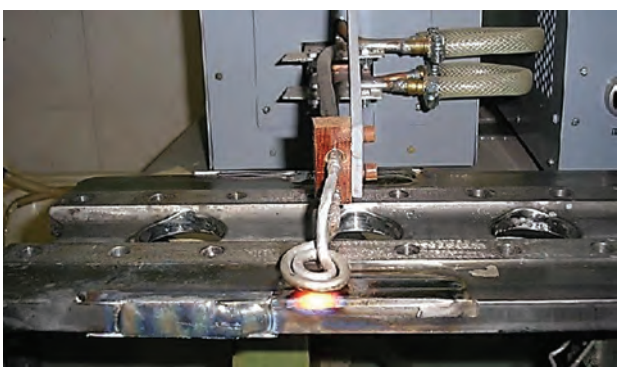
Advantages

The technology enables the formation of unique microstructural states in different types of commercial titanium alloys, which ensure the physical and mechanical properties unreachable with any other kinds of treatment, namely, a combination of the highest static and dynamic strength and other high important properties

High-strength titanium springs for aerospace application

Stage of Development. Suggestions for Commercialization

IRL7, TRL4
Vending of patent based on license agreement



Plant for rapid induction heat treatment of titanium products

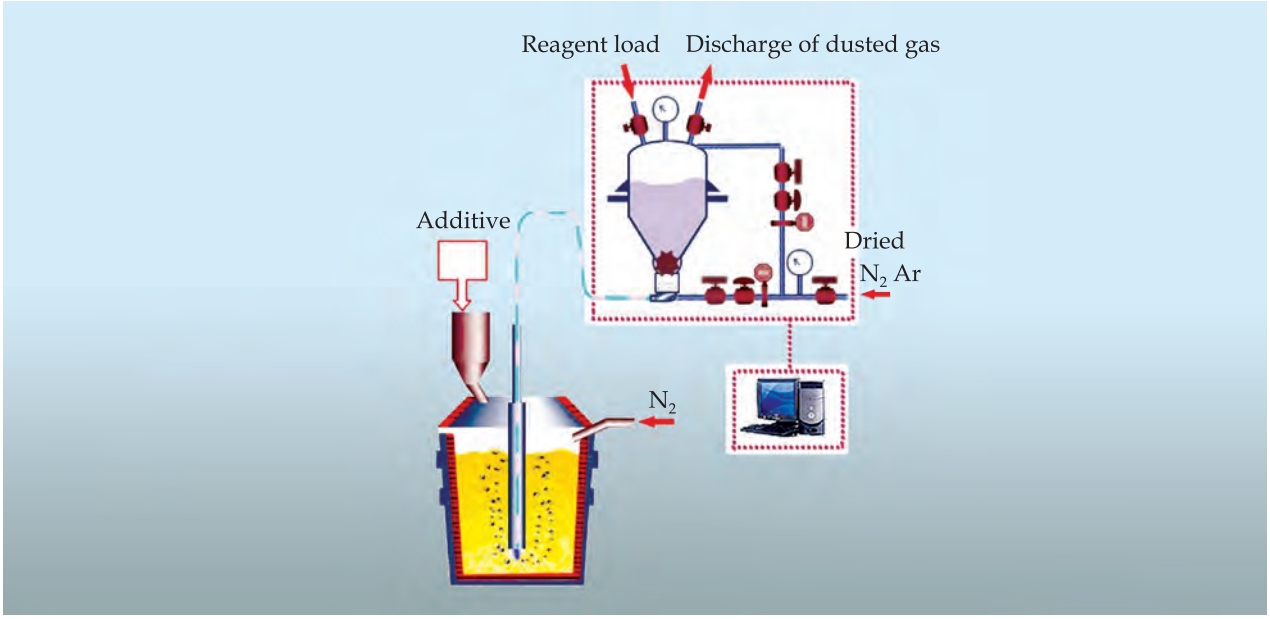
IPR Protection

IPR1, IPR3, IPR5

Contact Information

Vitalii P. Bevz, G.V. Kurdyumov Institute for Metal Physics of the NAS of Ukraine;
+38 044 424 12 05, e-mail: BevzV@ukr.net

TECHNOLOGY FOR REFINEMENT AND DESULFURIZATION OF CAST IRON BY GRANULAR MAGNESIUM IN LADLES



Desulfurization process scheme

Specification

Refined reagent recovery, %	≥95
Reagent consumption, kg/ton of cast iron	0.2—0.7
Cast iron desulfurization, %	99
Sulphur content in cast iron after treatment, %	≤0.001
Cast iron temperature loss, °/min	0.5—0.8

Areas of Application

The technology is designed to obtain low-sulfur and refined cast iron before its melting or cast iron products (ingots, pigs, castings)

Stage of Development. Suggestions for Commercialization

IRL8, TRL8
Technology, specifications and working drawings, control systems, main components of complexes for cast iron off-furnace treatment in ladles of various dimension type (4–350 tons)

Advantages

The key difference of the proposed technology from the world analogs is the most favorable conditions for saturating the cast iron with magnesium and the further mass exchange between magnesium lysed in cast iron and melt sulfur. The technology parameters provide a high concentration of magnesium in carrier gas (over 20 kg/m^3), required injection rate, and distribution of refining environment in the melt.
The costs are less by USD 3—5 /ton cast iron than that of world analogs

IPR Protection

IPR3

Contact Information

Oleksii Ye. Merkulov, Iron and Steel Institute of Z.I. Nekrasov of the NAS of Ukraine;
+38 056 790 05 15, e-mail: office.isi@nas.gov.ua

TECHNOLOGY FOR TITANIUM ALLOY SURFACE HARDENING

Areas of Application

The technology is designed to improve tribotechnical properties and corrosion resistance of titanium alloy friction couples operating under bearing pressure up to 10 MPa, particularly, in aggressive environments. It can be used in machine building, aviation engineering, aerospace industry, and medicine for treating surgical instruments, brackets, and shafts for curing bone fractures, as well as other products operating under bearing pressure and in corrosive environments

Specification

The technology is based on diffusion saturation of surface layers with nitrogen

Advantages

The technology provides a high wear and corrosion resistance due to the formed complex solid-solution areas with a depth up to 100—200 μm; ensures mechanical strength properties and enhances plasticity; ensures a high quality of surface (used as final process operation); enables treating the articles of arbitrary shape, including those with bores of arbitrary diameter and length, with the use of serial vacuum electric furnaces and commercially pure nitrogen

Stage of Development. Suggestions for Commercialization

IRL7, TRL8
Diffusion saturation works using our equipment under services contract or technology transfer based on license agreement; consultancy support

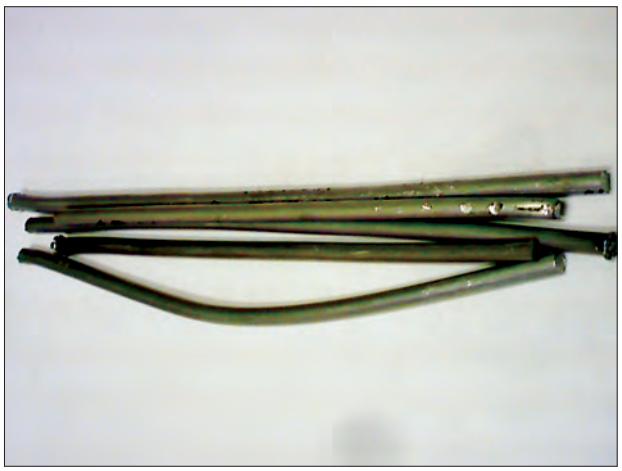
IPR Protection

IPR2, IPR3

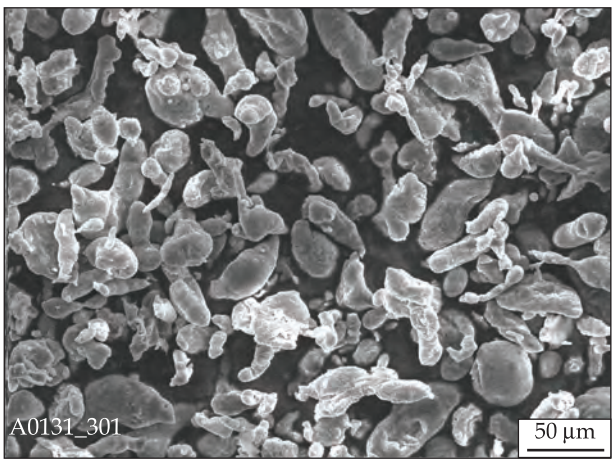
Contact Information

Zynovii T. Nazarchuk, Karpenko Physico-Mechanical Institute of the NAS of Ukraine;
+38 032 263 30 88, e-mail: pminasu@ipm.lviv.ua

TECHNOLOGY FOR TREATMENT OF ALUMINUM ALLOYS WITH SUB-MICROCRYSTALLINE ALLOYING COMPOSITIONS



Sub-microcrystalline alloying composition



Microstructure of the alloying composition

Areas of Application

Production of aluminum alloy ingots at foundry shops of machine-building plants

Specification

The alloying compositions are proposed in the form of extruded rods

Stage of Development. Suggestions for Commercialization

IRL3, TRL4
Technology for alloy modification and trial batch of the alloying compositions, upon request

Advantages

No dangerous substances are formed during interaction with the melt; guaranteed and complete assimilation of active substance; no special equipment is required; no pyroelectric effect or smoke emission; environment safety; enhancement of mechanical properties of obtained alloy by 10—15%; longer duration of melt modification effect

IPR Protection

IPR2

Contact Information

Anatoly V. Narivskyi, Physico-Technological Institute of Metals and Alloys of the NAS of Ukraine;
+38 044 424 35 15, e-mail: metal@ptima.kiev.ua

THERMOPLASTIC ELASTOMERS FROM TIRE RUBBER AND POLYOLEFIN WASTE

Areas of Application

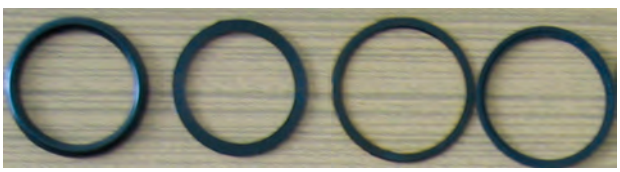
Hydraulic and floor covering, roofing, various bonding and sealing materials for automobile and construction industries, agriculture

Specification

Tensile strength (σ), MPa	13.0—14.0
Relative elongation (ε), %	625—720
Shore Hardness (A)	78—95
Brittleness temperature (T), °C	-43
Operating temperature, (T), °C	-40...+80

Advantages

As compared with the competing industrial products, the developed TPEs have equivalent fundamental properties, but are much cheaper



Articles made of thermoplastic elastomers

Stage of Development. Suggestions for Commercialization

IRL3, TRL4
Seeking partners for commercial production

IPR Protection

IPR3

Contact Information

Oleksandr A. Fainleib, Institute of Macromolecular Chemistry of the NAS of Ukraine;
+38 044 559 53 72, e-mail: fainleib@i.ua

THIN BERYLLIUM VACUUM-TIGHT FOILS

Beryllium foils

Areas of Application

Instrument-making industry: detectors of ionizing radiation, X-ray tubes

Specification

Foil shape: rectangle, disk. Low coefficient of X-ray absorption within the range of soft radiation (energy under 2keV).

Beryllium purity, %	99.95 – 99.999
Foil thickness, mm	0.008 – 0.15

Advantages

The manufacture of beryllium vacuum-tight foils has no analogs in Ukraine and CIS countries. As compared with the analogs, the foils contain purer beryllium, have higher mechanical properties and corrosion resistance

IPR Protection

IPR1

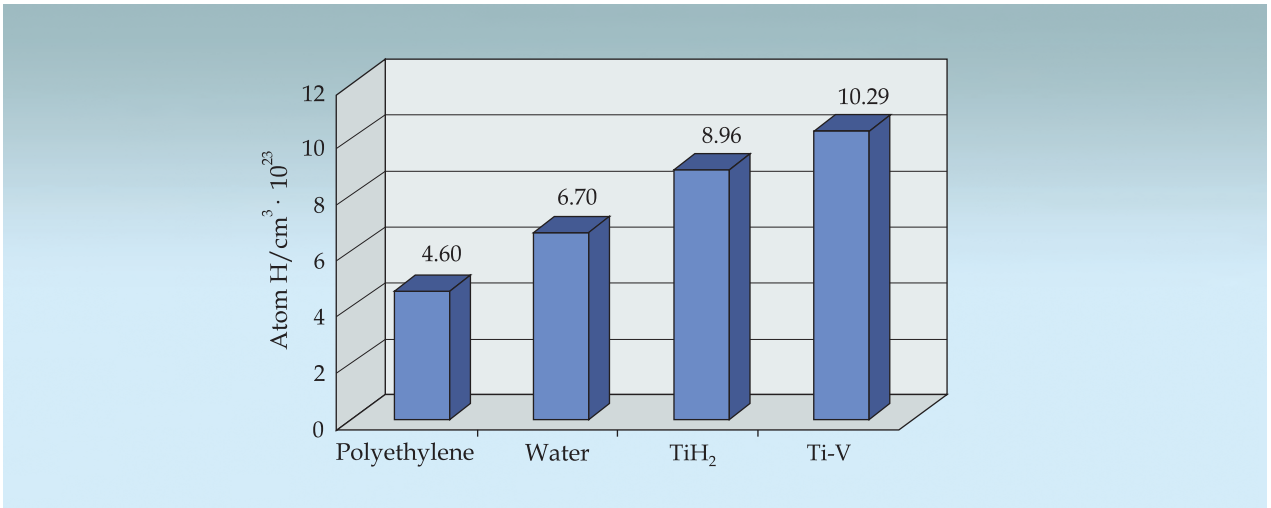
Stage of Development. Suggestions for Commercialization

IRL8, TRL9
Customized manufacture and sale of products

Contact Information

Konstantin V. Kovtun, National Science Center "Kharkov Institute of Physics and Technology";
+38 057 335 65 01, e-mail: kkovtun@kipt.kharkov.ua

TI-V-H ALLOYS FOR NEUTRON SHIELDING



Density of hydrogen atoms in effective fast neutron moderators

Areas of Application

The alloys can be used in nuclear power engineering, in particular, as materials with a high hydrogen content, which hold much promise for neutron radiation protection as effective moderator of fast neutrons

Specification

High sorption capacity	H/Me = = 2.11—2.26
Initial temperature of intensive absorption, °C	~300 (for Ti—~400)
High average hydrogenation rate, g/s	~8,4 · 10^{-6}
Stability during exploitation:	
time, years	≤15
thermal, °C	≤500
Hydrogen atoms per cm^{-3}	~1.03 · 10^{23}

Advantages

The proposed alloys with enhanced protective properties have advantages over the known analogs as they enable an increase in the mass coefficient of neutron removal and efficiency of protection, a decrease in the thickness of protective layer and a reduction in the production costs

Stage of Development. Suggestions for Commercialization

IRL3, TRL2
Vending of patent based on license agreement

IPR Protection

IPR3

Contact Information

Vitalii P. Bevz, G.V. Kurdyumov Institute for Metal Physics of the NAS of Ukraine;
+38 044 424 12 05, e-mail: BevzV@ukr.net

TPD-C PORTABLE CONTACT THERMOMETERS

TPD-C portable contact thermometer

TCT-P thermoelectric changeable transducer

Industrial application of TPD-C portable contact thermometers

Areas of Application

The thermometers are designed for contact measurements of temperature of solid bodies, liquids, and gaseous environments with the help of thermoelectric transducers; used in metallurgy, chemical, refractory, and other industries. For temperature control of metal melts the thermometers are complemented with thermoelectric changeable transducers TCT-P

Specification

Range of measurable temperature, °C	300—2500 (600—1700 with TCT-P)
Types of nominal static characteristics	A-1, A-2, A-3, L, K, S, B
Fundamental measurement error, %	≤0.2 (≤0.6 with TCT-P)
Number of immersions for TCT-P	≤20
Measurement time with TCT-P, s	5—10
Weight, kg	≤2

Advantages

The special algorithm of primary measurement data processing reduces the measurement time 3—4 times. This enables to increase the number of measurements by one TCT-P up to 20 (while the analogs are designed for 1—3 measurements) and to decrease the cost of temperature control

Stage of Development. Suggestions for Commercialization

IRL8, TRL8
Customized manufacture of thermometers and transducers, delivery, warranty service, and staff training, upon request

IPR Protection

IPR3

Contact Information

Anatoly V. Narivskyi, Physico-Technological Institute of Metals and Alloys of the NAS of Ukraine;
+38 044 424 35 15, e-mail: metal@ptima.kiev.ua

TPD-N PORTABLE NONCONTACT THERMOMETERS

Bicolor noncontact portable thermometer TPD-N

Monocolor noncontact portable thermometer TPD-N

Areas of Application

Periodical contactless measurements of temperature of solid bodies, liquids, and gaseous environments in metallurgy, chemical, refractory, and other industries

Specification

Range of measurable temperature, °C	200—2500
Fundamental measurement error, %	≤1.0
Weight, kg	≤2

Advantages

Due to the bicolor measurement method, the thermometers have higher metrological characteristics and, consequently, a wider scope of application. They are more convenient in practical use

Stage of Development. Suggestions for Commercialization

IRL8, TRL8
Customized manufacture, delivery, warranty service, and staff training, upon request

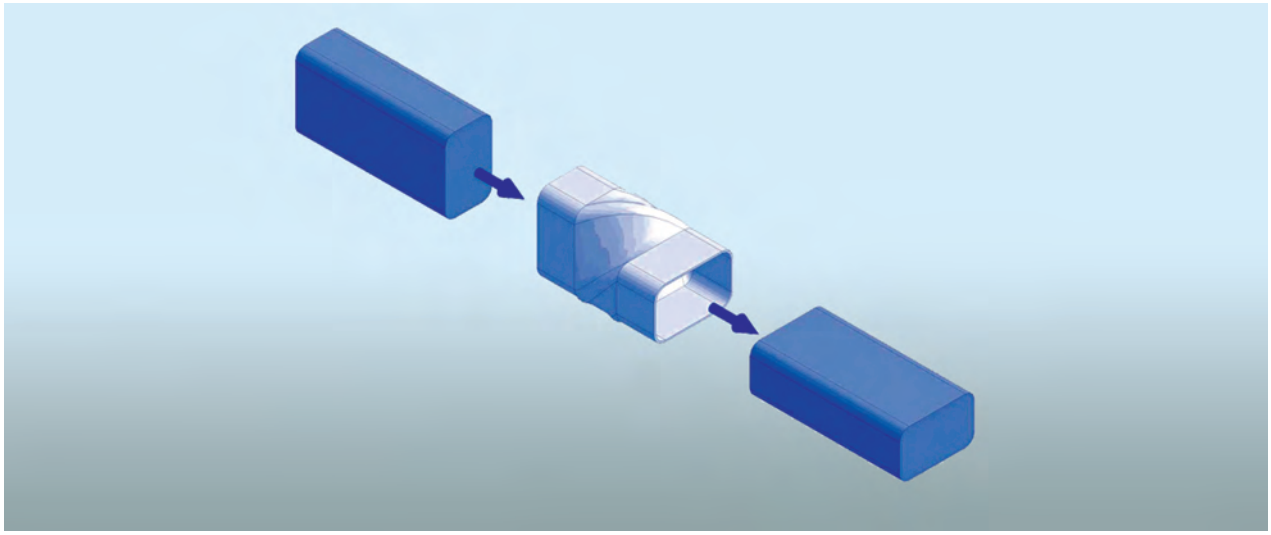
IPR Protection

IPR3

Contact Information

Anatoly V. Narivskyi, Physico-Technological Institute of Metals and Alloys of the NAS of Ukraine;
+38 044 424 35 15, e-mail: metal@ptima.kiev.ua

TWIST EXTRUSION TECHNOLOGY



Principal scheme of twist extrusion

Areas of Application

The technology is used for obtaining nonferrous materials with enhanced mechanical properties and operating characteristics for application in medicine (bone and dental implants) and aircraft industry (turbine engine blades)

Specification

The technology is based on severe plastic deformation with the help of special matrix. The use of this matrix enables to create an intensive vortex flow within the treated material, which leads to grain size reduction and significant changes in the microstructure

Advantages

The technology has a lesser material consumption as compared with the analogs (by 30—50%); enables working with profiled materials and is highly integrable into the existing processes. The materials treated by the twist extrusion method have 1.5—2.5 times higher mechanical properties and operating characteristics

Stage of Development. Suggestions for Commercialization

IRL3, TRL2
Vending of license for the technology

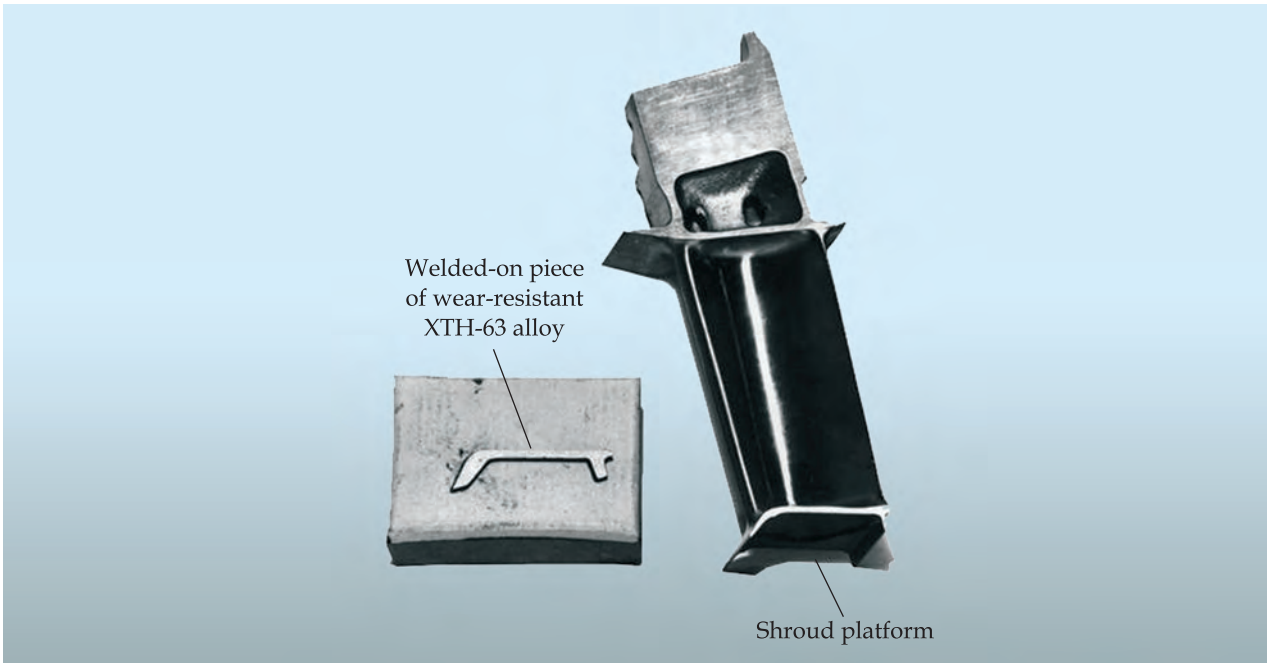
IPR Protection

IPR1, IPR3

Contact Information

Dmytro V. Raspornia, Donetsk Institute for Physics and Engineering named after O.O. Galkin of the NAS of Ukraine; +38 050 206 92 21, e-mail: diaprintster@gmail.com

XTH-63 WEAR- AND HEAT-RESISTANT CAST ALLOY



Areas of Application

The alloy can be used in machine-building, especially, to protect from wear the shroud platforms of turbine blades

Specification

Melting temperature, °C	1320 ± 10
Volume wear at a temperature of 1100 °C, mm^3/cycle	$16.0 \cdot 10^{-6}$

Stage of Development. Suggestions for Commercialization

IRL6, TRL4
Vending of patent based on license agreement

Advantages

The heat resistance of this alloy at a temperature of 1100 °C is 2 times higher than that of the serial XTH-62 alloy used for the same purpose

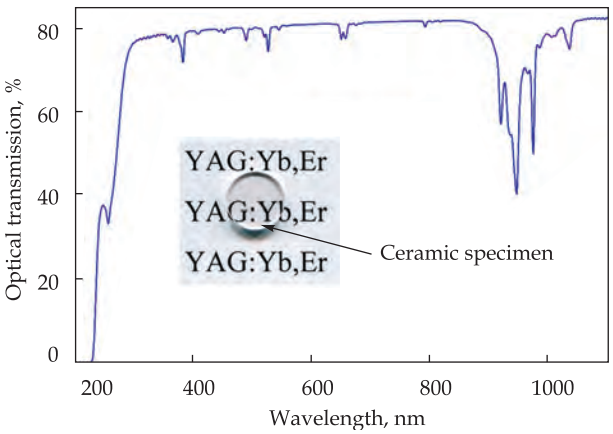
IPR Protection

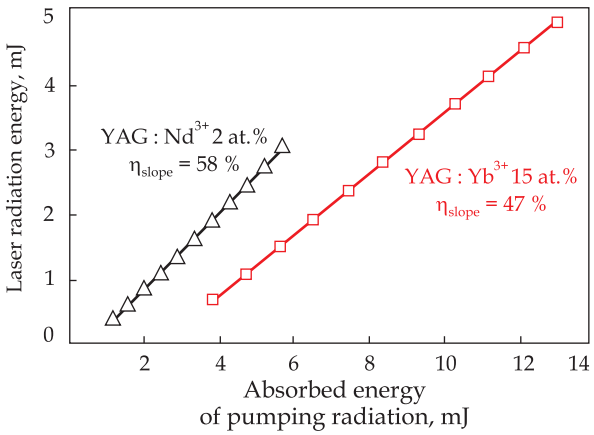
IPR3

Contact Information

Vitalii P. Bevz, G.V. Kurdyumov Institute for Metal Physics of the NAS of Ukraine;
+38 044 424 12 05, e-mail: BevzV@ukr.net

YAG:RE STRUCTURED TRANSPARENT CERAMICS AS ACTIVE MEDIUM FOR SOLID-STATE LASERS IN THE NEAR-IR RANGE



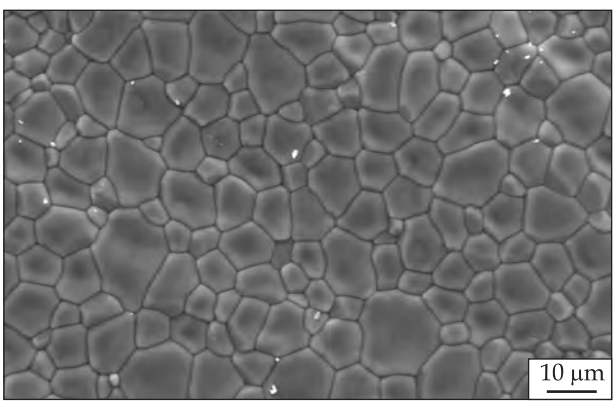


Areas of Application

The ceramic materials based on YAG doped or co-doped by Nd^{3+}, Yb^{3+}, Er^{3+} ions can be used as active media for new types of compact diode-pumped solid-state lasers. The ceramic-based microchip lasers can be employed in the devices for high-accuracy distance measurement, laser location and navigation, in communication and data record systems, and so on

Specification

The garnet phase comprises 100% of ceramic mass. The average size of crystal grains is 10—20 μm. The optical loss for the scattering within the 800—1600 nm spectral range is $\alpha < 0.1$ cm^{-1}. The active ion absorption on the pumping wavelengths (808 nm for Nd and 940 nm for Yb) is >10 cm^{-1}



SEM image of Nd^{3+}:YAG ceramic polycrystalline structure

Advantages

A high homogeneity of dopant distribution in the volume; the cost of active ceramic laser medium is much less than that of the single-crystal one. A high active ion concentration provides a high power density in the active medium with ~2 mm length

Stage of Development. Suggestions for Commercialization

IRL3, TRL4
Laser elements for various applications manufactured upon request

IPR Protection

IPR1, IPR2

Contact Information

Roman P. Yavetskiy, Institute for Single Crystals of the NAS of Ukraine;
+38 057 341 02 77, e-mail: yavetskiy@isc.kharkov.ua

TECHNOLOGY READINESS LEVEL (TRL) SCALE

Stage	TRL	Interpretation	Definition and Description
Invention	TRL1	Basic principles observed	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	Prototype validation at lab	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 testing 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 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 full-scale manufacture has been launched. The final product is sold in majority of domestic and international markets
Market expansion	TRL9	Manufacture and products fully operational and competitive	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 Protection[1] Levels

IPR codes	Protection Level
IPR1	Technical solutions are 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 institutions 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 elaborate 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)

Reference book

THE NATIONAL ACADEMY OF SCIENCES OF UKRAINE

R&D AND TECHNOLOGIES

THE NAS OF UKRAINE

IN 11 SPESIAL ISSUES

Issue
TECHNOLOGIES
FOR CONSTRUCTION
AND FUNCTIONAL MATERIALS

Compiled by
I.A. Malchevskyi and S.A. Bespalov

Translated, edited, and proofread
by O.A. Zagorodnia

Art work by
Ye.O. Ilnytskyi

Technical editor
T.M. Shenderovych

Desktop publishing by
V.M. Kanishcheva, N.M. Kovalenko,
and S.V. Kubariev

Illustrative materials prepared by
N.M. Kovalenko

Signed to print 18.05.2018.
Format 60 × 84/8. Font: Book Antiqua.
Conventional printed sheets 8.37. Published sheets: 6.62.
Circulation 100 copies. Order № 5262.