ADVANCED R&D AND TECHNOLOGIES

THE NAS OF UKRAINE

POWER ENGINEERING AND ENERGY EFFICIENCY

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

ALTEC-8018 THERMOELECTRIC GENERATOR WITH LIGHTING GAS LANTERN

Areas of Application

The generator is designed for supplying DC power to radio receivers or other low-power electronic equipment, as well as for lighting living premises and utility rooms (buildings, country houses, warehouses, garages, trade kiosks, and pavilions)

Specification

Rated electric capacity, W	2.5
Output voltage, V	3
Type of fuel	Lighting kerosene
Fuel flow rate, g/h	14.5
Fuel tank, l	0.5
Operation time per one full charge, h	23
Generator weight without fuel, kg	2.2

Advantages

The generator provides electric power to autonomous consumers having no centralized power supply, as well as can be used as a light source. Ease of operation and minimum maintenance make it indispensable under field conditions, in expeditions

Stage of Development. Suggestions for Commercialization

IRL6, TRL6
Manufactured and supplied, upon request

IPR Protection

IPR3

Contact Information

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ALTEC-8019 THERMOELECTRIC GENERATOR WITH LIGHTING KEROSENE LAMP

Areas of Application

The generator is designed for supplying DC to household radiolectronic equipment (radio receivers, tape recorders, etc.), small radio stations, as well as for charging various-purpose accumulators

Specification

Voltage output, V	3; 6; 12
Generator electric power, at least, W, at a voltage of, V	3 — 2.5 6 — 2.3 12 — 2.2
Fuel consumption under normal climatic conditions, g/h	16
Type of fuel	Lighting kerosene
Volume of fuel tank, l	0.4
Weight of a generator with fuelled lamp, kg	≤2.7
Operation time per one full charge, h	≥16

Advantages

The generator can be conveniently used in remote areas with no uninterrupted power supply. In addition to power generation, it can be simultaneously used as a light source

Stage of Development. Suggestions for Commercialization

IRL6, TRL6
Manufactured and supplied, upon request

IPR Protection

IPR3

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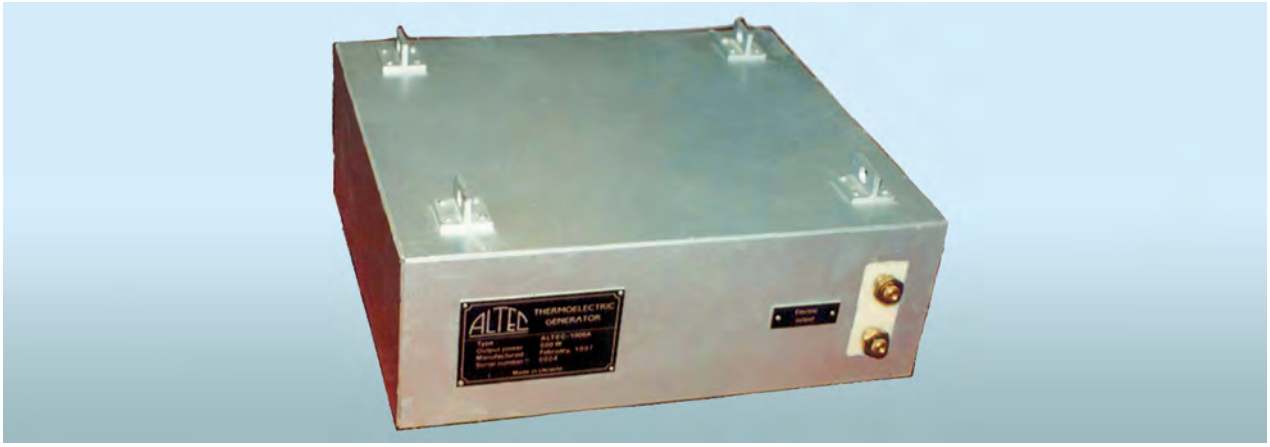
ALTEC-8020 THERMOELECTRIC GENERATOR



Areas of Application

The thermoelectric generator is designed for converting waste heat from industrial facilities and heat engines (internal combustion engines, gas turbines, etc.) into electric energy. It is an additional source of energy that can be used both for internal needs and for generation into external electric power systems

Specification

Hot liquid temperature at the inlet, °C	250
Hot liquid consumption rate, ml/s	225
Hot liquid pressure at the inlet, MPa	0.34
Cold liquid temperature at the inlet, °C	50
Cold liquid consumption rate, ml/s	100
Cold liquid pressure at the inlet, MPa	0.12
Electric voltage, V	50
Electric power, W	500
Efficiency, %	3.7
Weight, kg	14

Advantages

The use of generator enables to reduce fuel consumption by 5–7%. The device is an environment friendly source of electric energy

Stage of Development. Suggestions for Commercialization

IRL6, TRL6
Manufactured and supplied, upon request

IPR Protection

IPR3

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ALTEC-8036 THERMOELECTRIC GENERATOR

Areas of Application

The thermoelectric generator is designed for supplying electric energy to natural gas metering complexes, telemetering equipment, and automatic safety controls of gas distributing stations

Specification

Nominal electric power, W	10
Output voltage, V	12/24
Weight, kg	35

Advantages

As compared with known world analogs used for power supply to the systems for cathode protection of gas pipelines from corrosion, this thermoelectric generator does not emit any toxic gases during operation; it has a higher efficiency and is 1.5 times cheaper

Stage of Development. Suggestions for Commercialization

IRL6, TRL6
Manufactured, supplied, and serviced within warranty period, upon request

IPR Protection

IPR3

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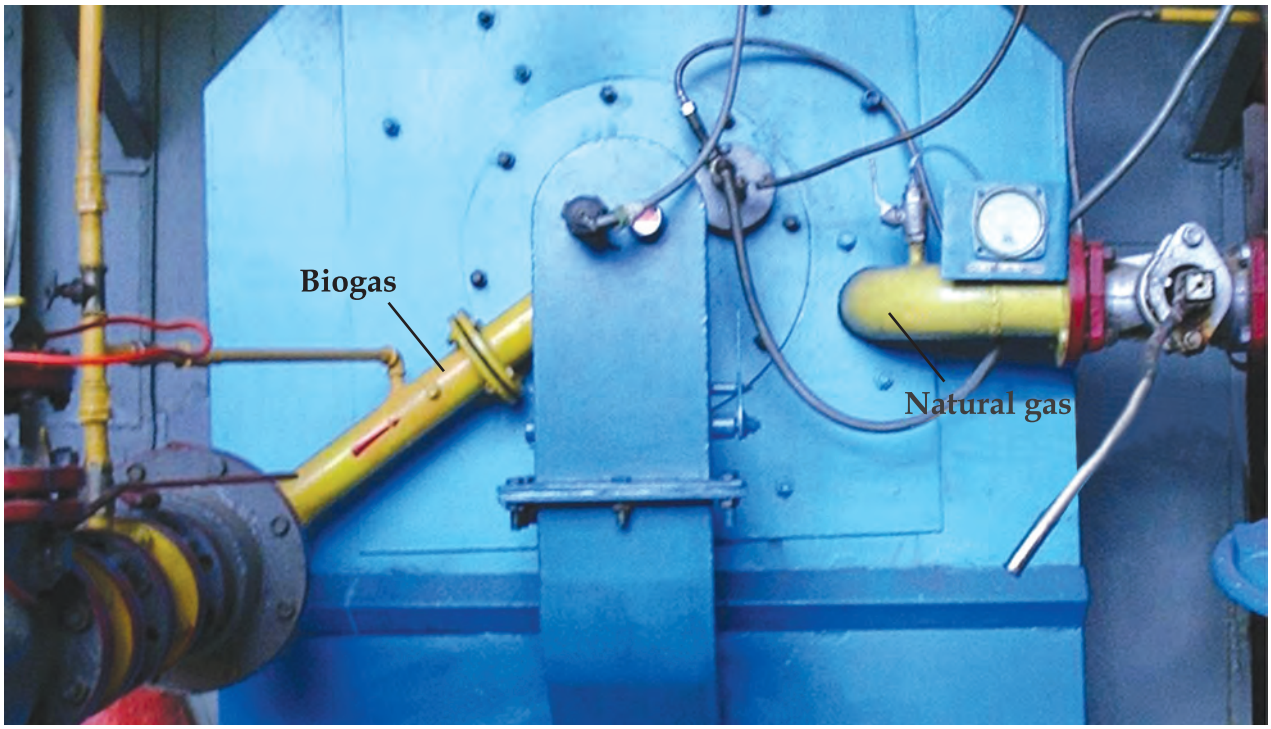
BURNERS FOR CO-COMBUSTION OF BIOGAS AND NATURAL GAS



Upgraded GM-10-B burner for co-combustion biogas and natural gas for DE-16/14 boiler

Areas of Application

The burners are designed for boilers used in food industry, wastewater treatment plants and other facilities where biogas production is possible

Specification

Burner capacity: 0.1–20 MW; α = 1.03–1.2; control factor: 10; $NO_x \leq 100$ mg/nm^3; $CO \leq 100$ mg/nm^3

Advantages

Unlike in the existing analogs, in these burners simultaneous combustion of biogas and natural gas occurs in a single burner and a boiler, instead of a few ones. This enables saving natural gas and electricity. The burners provide the required steam output regardless of amount of produced biogas. It is possible to upgrade the existing burners for simultaneous combustion of biogas and natural gas with minimum capital expenses and thereby to extend the boiler service life by 7–10 years. The payback period is 1 year

Stage of Development. Suggestions for Commercialization

IRL7, TRL8
Manufacture, supply, installation, commissioning, maintenance within warranty period, and staff training, upon request

IPR Protection

IPR3

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CATHODE MATERIAL FOR LITHIUM-ION BATTERIES

Film of nanostructured composite material (left) electrodeposited on the inner surface of lithium-ion battery body and battery components (right)

Areas of Application

The material is to be used in cathode of Li-ion batteries

Specification

Nanostructured oxide composite materials based on chromium and cobalt compounds.

Power density, W/kg	<150
Capacity, mA · h/g	165

Advantages

Composite materials have a stable composition and are formed with bespoke nanostructure and properties; they are manufactured using a simplified process with a reduced number of operations; the product has a low cost

Stage of Development. Suggestions for Commercialization

IRL3, TRL3
Materials and technology of their application are ready for starting production on a pilot line

IPR Protection

IPR3

Contact Information

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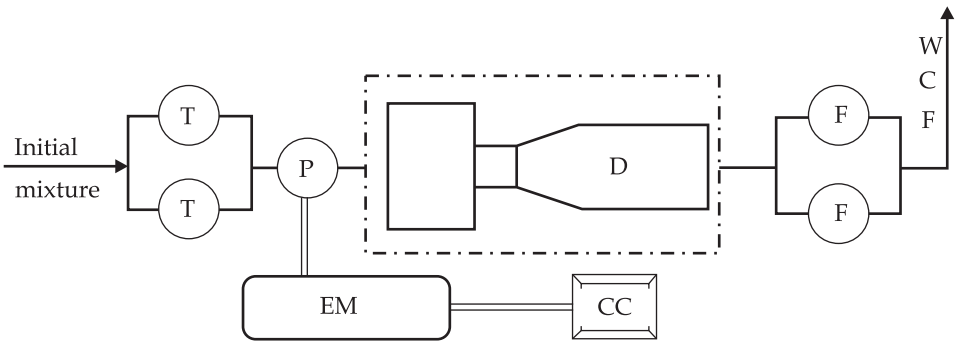
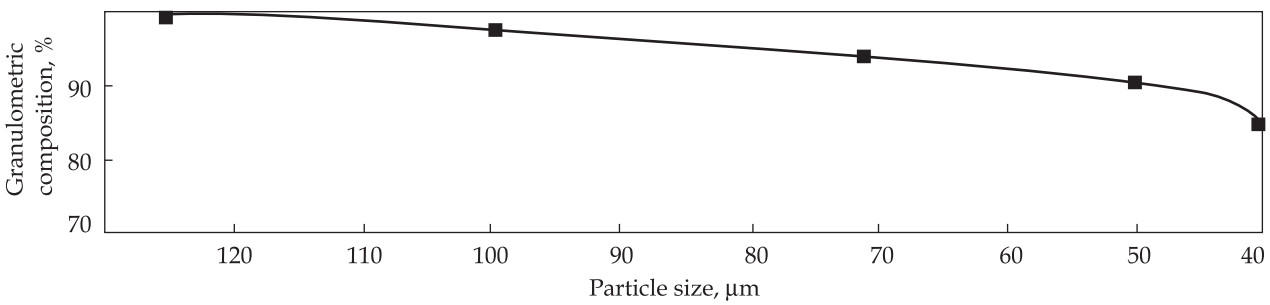
CAVITATION-PULSE PLANT FOR PREPARATION OF COAL-WATER FUEL (CWF)



Device for the cavitation-pulse technology:
T — filter-trap; P — pump;
EM — electric motor;
D — cavitation-pulse powder dispenser;
CC — control cabinet;
F — filter



Fineness of slime concentrate ground with the use of cavitation-pulse technology

Areas of Application

Preparation of coal-water fuel to burn in power-generating boilers

Specification

The technology enables preparation of coal-water fuel from coal, anthracite, and slime concentrate with a fineness of solid particles less than 50.0 μm (90%)

Advantages

One cavitation-pulse plant replaces 7 bead or 6 ball mills. Unlike its counterparts, the cavitation-pulse plant has no moving parts and automatic elements in cavitation-pulse generator of fluctuations. Energy consumption per unit of product decreases significantly. The plant has a simple design, a high performance and a wide range of adjustment of cavitation-cumulative impact

Stage of Development. Suggestions for Commercialization

IRL8, TRL7
Seeking partners for commercializing the CWF plant

IPR Protection

IPR1

Contact Information

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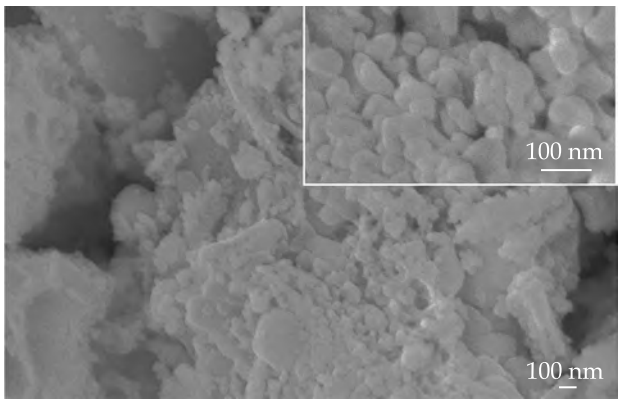
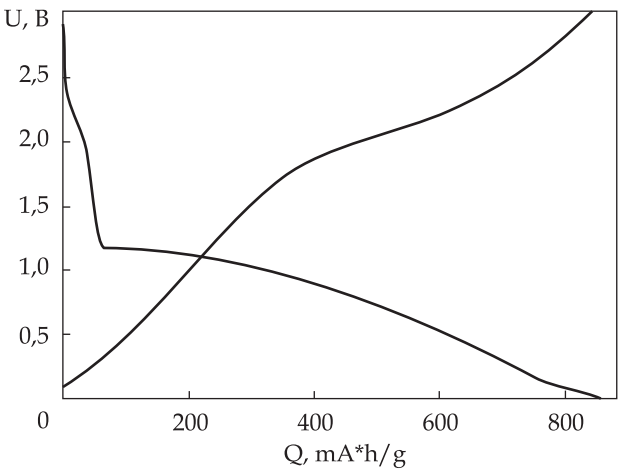
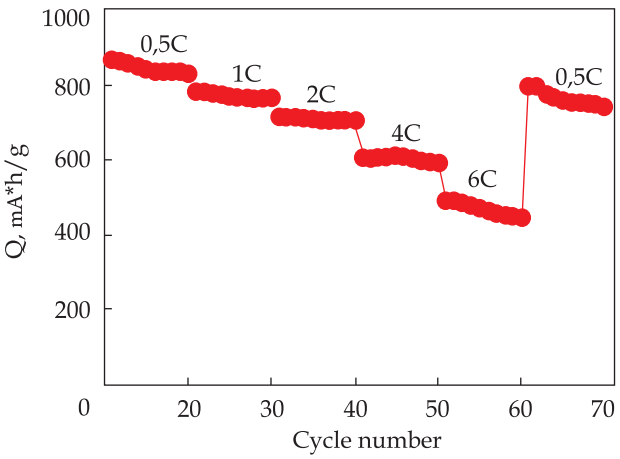
COBALT OXIDE Co_3O_4 FOR HIGH-RATE BATTERY APPLICATIONS



SEM micrograph of Co_3O_4



Charge/discharge curves for Co_3O_4 at a current of 358 mA/g (0.5 C)



Dependence of capacity on discharge current density for Co_3O_4

Areas of Application

Anode material for lithium-ion batteries used in renewable energy

Specification

Operating voltage range, V	0.01—3.0
Nominal capacity at 1.5 C discharge current, mA · h/g	445
Maximal current load, mA/g	5340
Particle size, nm:	1—3
Crystallite size, nm	23—32

Advantages

The material can be used as analog of graphite anode materials. It has a higher specific capacity than graphite and can sustain a current load of up to 5340 (6 C)

Stage of Development. Suggestions for Commercialization

IRL5, TRL4
The electrode material is proposed

IPR Protection

IPR2, IPR3

Contact Information

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COMBINED PHOTOVOLTAIC AND THERMAL MODULE

Areas of Application

The combined photovoltaic and thermal (PVT) module is designed to obtain heat and electric energy simultaneously from solar energy. The module can be used in power systems of various objects (industrial and public utility companies, private houses, etc.). The modules can form a series-parallel battery for obtaining required parameters and amount of hot water and electric energy

Specification

Rated capacity of photovoltaic section, W	70
DC voltage U_{xx}, V	20.4
Current intensity $I_{кз}$, A	4.2
Rated capacity of thermal section, daily	<up to 60 liters of hot water (50 °C)
Overall dimensions	
width, mm	560
height, mm	1240

Advantages

There are no counterparts manufactured in Ukraine. The PVT module costs 20–30% less as compared with its foreign analogs having identical technical parameters

Stage of Development. Suggestions for Commercialization

IRL4, TRL4
Seeking partners for serial production of modules; the product can be customized upon request

IPR Protection

IPR3

Contact Information

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DARRIEUS-TYPE WIND ROTOR WITH STRAIGHT CONTROLLABLE BLADES FOR INDIVIDUAL WIND AND HYDRO POWER PLANTS

Darrieus-type wind rotor with straight controllable blades in the NAU Wind Tunnel. 1 — rotor spindle; 2 — support; 3 — carbon fiber blade (NACA0015 profile); 4 — blade control mechanism

Areas of Application

The plant is to be used for households, small industrial facilities and farms to convert the kinetic energy of wind and river flows into the mechanical energy of rotation

Specification

The plant is a wind (hydro) rotor with three straight blades and rotation axis. It has 3 blades with dimensions of 12.5 × 120 cm, rotor diameter of 1.5 m, and nominal capacity of 1 kW. The dimensions enlarge as the capacity increases up to 10 kW

Stage of Development. Suggestions for Commercialization

IRL4, TRL5
Seeking partners for the power plant production; recommendations on plant siting are provided

Advantages

The automatic control of blades position during rotation provides 1.5 times increase in the rotor`s capacity in comparison with the existing models

IPR Protection

IPR2, IPR3

Contact Information

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EXHAUST GAS HEAT REGENERATORS FOR GAS-FIRED BOILERS

Heat recovery plant with TPK-1.1-230 regenerator installed behind DE-16-14GM boiler at the boiler house of *Farmak* corporation, Kyiv

Heat recovery plant with convection bank PK-1-102 sh installed behind TVG-4r boiler at the boiler house at 2a Osipovska St., Kyiv

Areas of Application

The devices are to be used in municipal power engineering system for raising efficiency of boilers due to recovery of exhaust gas heat for warming water for heat-supply systems

Advantages

As compared with domestic counterparts, these regenerators increase boiler efficiency by 3—10%; recover vaporization heat; are compact and have a low hydraulic resistance; easily serviceable

Stage of Development. Suggestions for Commercialization

IRL8, TRL5
Design of heat recovery plants and organization of commercial production

IPR Protection

IPR1, IPR3

Specification

Description	Surface condensation heat regenerators TPK (7 types)	Convection banks, PK		
		PK-1-102sh	PK-2-102sh	PK-1-48k
Nominal heat capacity, MW	8–130	240	460	240
Consumption of exhaust gases, kg/s	0.09–1.42	2.47	4.94	1.54
Water consumption, kg/s	1.2–4.2	14.7	29.4	11.1
Aerodynamic resistance, Pa	120–250	215	240	65
Hydraulic resistance, kPa	20–30	5.2	3.2	1.5
Weight, kg	160–650	880	1265	675
Dimensions, mm:				
height	1200—1900	1040	1040	700
length	800—2000	1450	2340	2360
width	300—1600	1240	1240	560
Payback period, years	1—2	1—1,5		

Contact Information

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GRID BIDIRECTIONAL INVERTERS

500 kW inverter

Areas of Application

The inverters are to be used for transmitting energy from solar photoelectric systems and electric energy storage systems to external power grids. They provide integrating with power-generating equipment of renewable power engineering facilities and interacting with end users; maintaining the power load curve and power supply in the case of interruptions; improving the reliability of electric power and energy system operation; accumulating electric power in the period of its low cost and supplying in the period of its high cost

Advantages

As compared with European analogs, these inverters have considerably low dimensions and cost and produce much lower acoustic noises during operation. They provide almost sinusoidal output voltage. The modular configuration of inverters enables to easily control power in the power supply system

Specification

Nominal output power, kW	500
AC output voltage	283/400 V + 10—15% 50 Hz + 3—5%
Operating frequency, kHz	20
Total harmonic distortions (THD), %	≤3
Load — transmission grid (through step-up transformer), kV	0.4/10
Range of input voltage, V	400—1000
Cooling	Autonomous, water

Stage of Development. Suggestions for Commercialization

IRL7, TRL6
Manufacture, delivery, maintenance within warranty period, and staff training, upon request

IPR Protection

IPR1, IPR2

Contact Information

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HIGH-PERFORMANCE PROFILED SPRINKLER FOR FILM-TYPE COOLING TOWERS

Areas of Application

The sprinkler can be used for efficient cooling of process circulating liquid in film-type cooling towers in various industries and power engineering

Cooling towers

Specification

The sprinkler heat-transfer surface, along which the cooled liquid flows down, has special dimples with certain dimensions. The cubic density of sprinkling for film flow ranges from 0.44 to 2.83 $m^3/(m \cdot h)$.
The sprinklers in cooling towers are angled to the horizontal plane

Fan cooling tower

Advantages

The use of sprinklers with the proposed surface relief in cooling towers leads to a significant intensification of heat transfer from flowing liquid to air as compared with the flow on smooth surfaces in the typical sprinklers.
Under optimal conditions, the intensity of heat transfer increases almost thrice

IPR Protection

IPR2

Stage of Development. Suggestions for Commercialization

IRL5, TRL3
Upon request, the degree of liquid cooling in film-type cooling tower with a profiled sprinkler is calculated, a new cooling tower is developed or an existing facility is upgraded, and profiled surfaces are manufactured (in cooperation with the customer)

Contact Information

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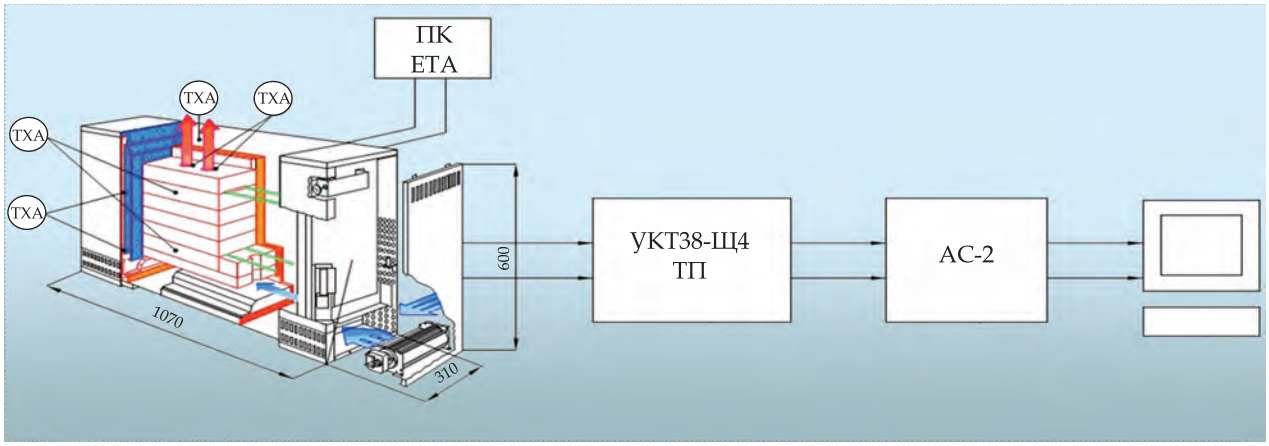
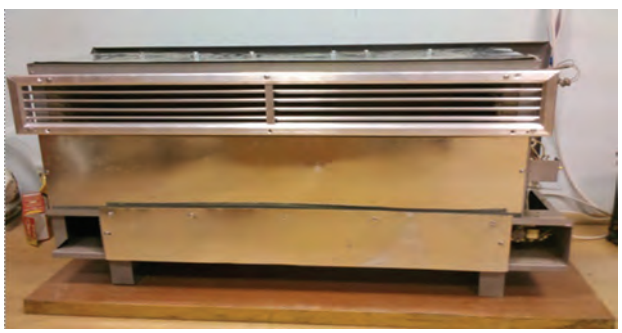
HIGH-PERFORMANCE THERMAL ENERGY STORAGE PLANT



Connection and control scheme



Electric thermal heater (ETH)

Advantages

In comparison with foreign analogs, the proposed configuration of heat storage device provides a 15% increase in heat output with the use of cheaper heat storage materials and enables reducing the device cost, at least, by 15%

Areas of Application

The plant is to be used as electric heat storage system for heating public and residential buildings. It can operate using time-based differentiated rates for electricity

Stage of Development. Suggestions for Commercialization

IRL3, TRL2
Seeking partners for serial production; customized design, upon request

Specification

Weight, kg	115
Dimensions, cm	107 × 51 × 32
Electrical power, kW	2.4
Maximum total heat output, kW	1.17

IPR Protection

IPR2

Contact Information

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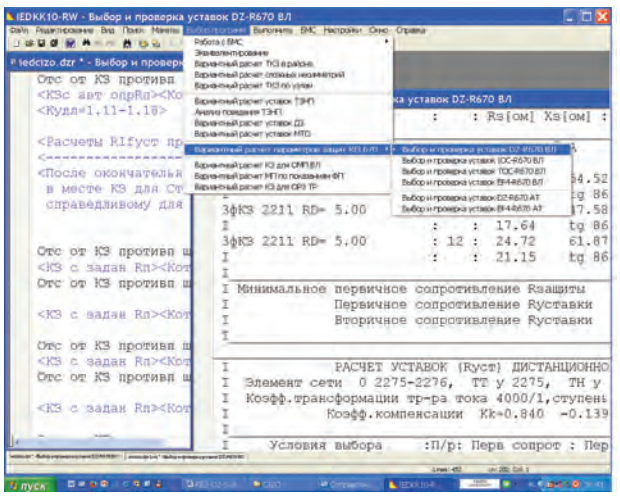
IEDKK10-SW, IEDKK10-RW SOFTWARE SYSTEMS

Areas of Application

The software systems are designed for automatic calculations of emergency conditions of overhead power transmission lines as well as for calculations of set points of standard relay protection schemes and Siemens 7SA** (7SA6**) and ABB REL6** microprocessor devices

Specification

The computer network consists of up to 10,000 nodes, which makes it possible to completely map a network element equivalent circuit in the basic mathematical model and to take into account the discontinuity and branching of 110 kV network and all specific features of 330—750 kV high voltage networks. The factors taken into account are as follows: capacity susceptance and mutual induction of high-voltage lines; EMF difference in terms of magnitude and angle; transformation ratios of transformers and autotransformers; connections of zero-resistance elements; elements impedances, fault resistances; and load and electromechanical process parameters

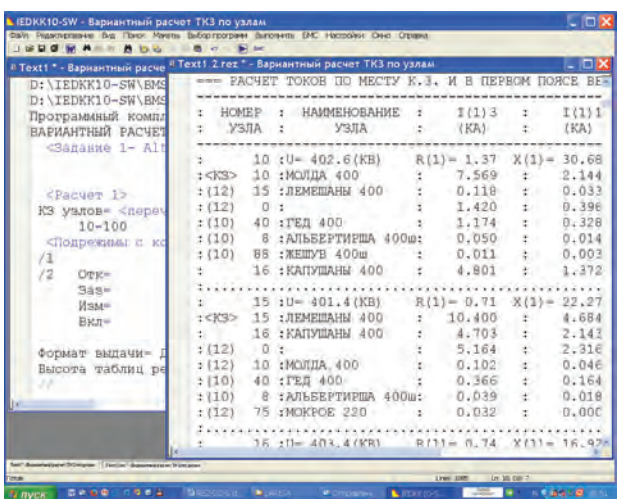


Advantages

These software systems have no counterparts in Ukraine or abroad. Their use provides a high reliability, stability, and efficiency of operation of power supply systems and networks

Stage of Development. Suggestions for Commercialization

IRL7, TRL9
Development and installation of software systems, staff training, upon request



Example of calculations made using IEDKK10-SW, IEDKK10-RW software

IPR Protection

IPR3

Contact Information

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KTC-4 HEAT-FLUX BOMB CALORIMETER FOR MEASURING COMBUSTION HEAT

Areas of Application

The calorimeter can be used in laboratories and quality control centers of fuel plants using fossil fuels, thermal power plants, power plants, and industrial boilers. It is designed for measuring combustion heat of various types of fossil fuels. The calorimeter meets the requirements of DSTU and ISO 1928

Specification

Heat measurement range, kJ	10—35
Limits of a supposed basic relative error, %	±0.2
Time of preparation for measurements, hours	≤2.0
Time of measurements, hours	0.75
Indication of measurement results	Digital

Advantages

As compared with counterparts, the device provides high-level metrological measurements of combustion heat at a cheaper price

Stage of Development. Suggestions for Commercialization

IRL7, TRL6
Manufactured and adjusted, upon request

IPR Protection

IPR1, IPR3

Contact Information

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KVMU-1.25 GN MODULAR GAS-FIRED WATER BOILER WITH UTILIZER OF EXHAUST GASES HEAT

Areas of Application

The boiler is to be used for heat and hot water supply to residential, industrial, and administrative facilities in closed heating systems

Specification

Nominal heat output, MW	1.25
Fuel (natural gas) consumption, m^3/h	116
Heat transfer agent operating pressure, MPa	0.6
Range of heat output regulation, %	10—110
Heat transfer agent consumption, m^3/h	5—16.5
Hydrodynamic resistance, kPa	50
Estimated service life, years	25

Advantages

The boiler has a relatively low cost of production, a payback period of 12 months, and the highest possible efficiency (98%) within the whole range of load; the modular configuration enables to use each module separately; in addition to heat energy, the boiler can generate electric energy. This boiler enables up to 40% gas saving as compared with the obsolete boilers; 40% reduction in NO_x emission; no CO emission

IPR Protection

IPR3

Stage of Development. Suggestions for Commercialization

IRL8, TRL8
Manufactured and serviced within warranty period, upon request

Contact Information

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KVVD-0.63 GN COMBINED WATER HEATER

Areas of Application

The KVVD-0.63 GN boiler with forced circulation of heat carrier is operated on natural gas or light liquid fuel and is designed to warm water up to 95 °C with a pressure up to 0.6 MPa for heating and hot water supply systems and for process needs

Specification

Nominal heating capacity, MW	0.63
Adjustment range, %	40—100
Efficiency, %	≥92
Nominal fuel consumption (natural gas with NCV = = 35 600 kJ/m^3), m^3/hour	70 ± 5%
Content of nitrogen oxides (in NO_2 equivalent) in dry combustion products (adjusted to α = 1), mg/m^3	≤200
Overall dimensions	
length with burner, mm	3260
length without burner, mm	2400
width, mm	900
height, mm	1600
Boiler mass, kg	≤1700

Advantages

This boiler can replace obsolete boilers *Minsk-1*, *NIISTU-5*, *Universal*, *Energy*, etc.

IPR Protection

IPR3

Stage of Development. Suggestions for Commercialization

IRL7, TRL8
Manufactured, supplied, and serviced, upon request

Contact Information

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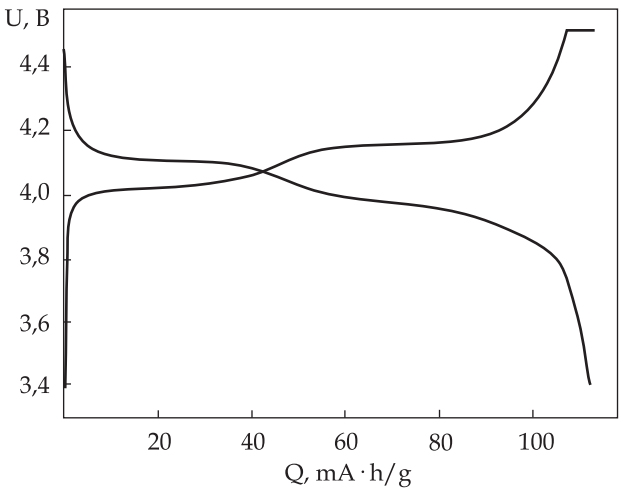
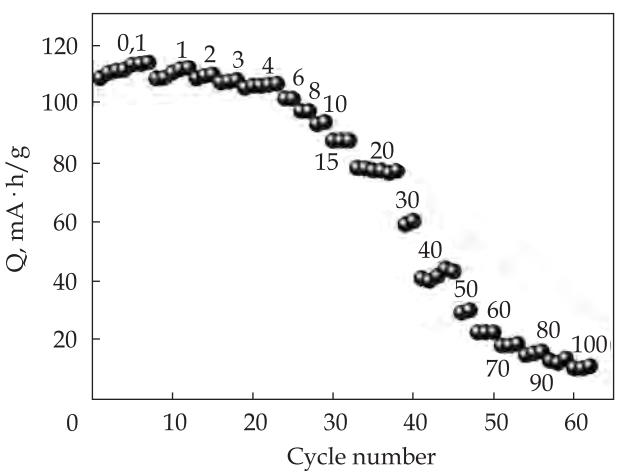
LITHIUM MANGANESE SPINEL $LiMn_2O_4$ FOR HIGH-RATE BATTERY APPLICATIONS

Advantages

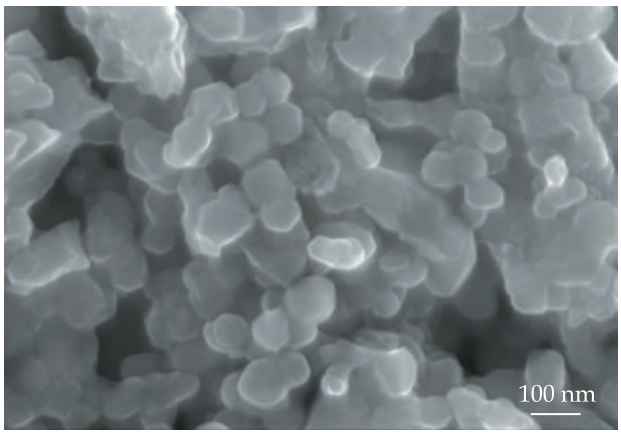
High-voltage cathode material; as compared with the commercial analog, it can sustain current loads of up to 14 800 mA/g (100 C)



Stationary charge/discharge curve for $LiMn_2O_4$ at a current load of 148 mA/g (1 C)



Discharge capacity dependence on the cycle number for $LiMn_2O_4$



SEM micrograph of $LiMn_2O_4$

Areas of Application

Cathode material for lithium-ion batteries used in renewable energy

Specification

Operating voltage range, V	3.4—4.5
Nominal capacity at 1.5 C discharge current, mA · h/g	115
Maximal current load, mA/g	14 800
Particle size, nm	50—70
Crystallite size, nm	65

Stage of Development. Suggestions for Commercialization

IRL5, TRL4
The electrode material is proposed

IPR Protection

IPR2, IPR3

Contact Information

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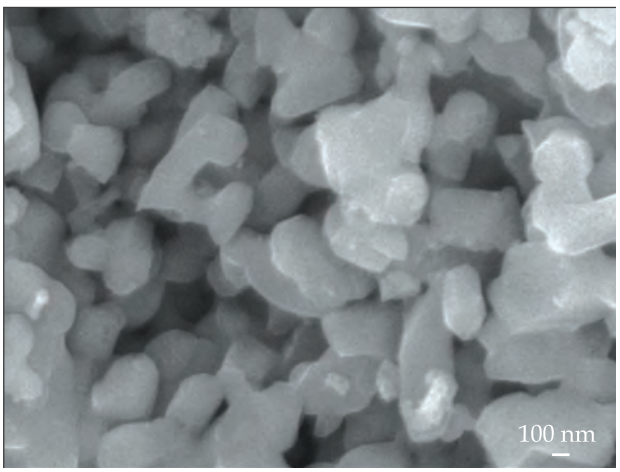
LITHIUM TITANATE $Li_4Ti_5O_{12}$ FOR HIGH-RATE BATTERY APPLICATIONS



SEM micrograph of $Li_4Ti_5O_{12}$

Advantages

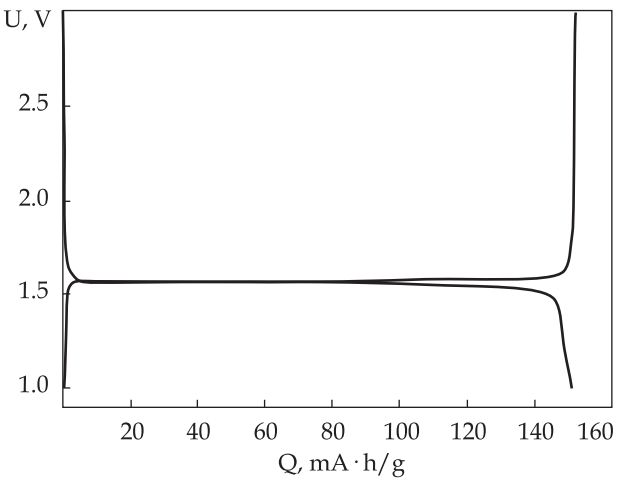
The material provides a long cycling life of battery without degradation. It can sustain twice as much current load as compared with the commercial sample (10 500 mA/g (60 C) vs 5250 mA/g (30 C), respectively)

Areas of Application

Anode material for lithium-ion batteries used in renewable energy

Specification

Operating voltage range, V	1.5—3.0
Nominal capacity at 1.5 C discharge current, mA · h/g	150
Maximal current load, mA/g	10 500
Particle size, nm	300—600
Crystallite size, nm	70



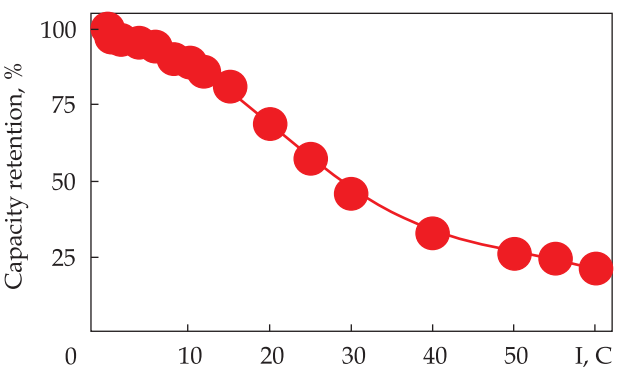
Stationary charge/discharge curves for $Li_4Ti_5O_{12}$

Stage of Development. Suggestions for Commercialization

IRL5, TRL4
The electrode material is proposed

IPR Protection

IPR2, IPR3



Dependence of capacity retention on discharge current for $Li_4Ti_5O_{12}$

Contact Information

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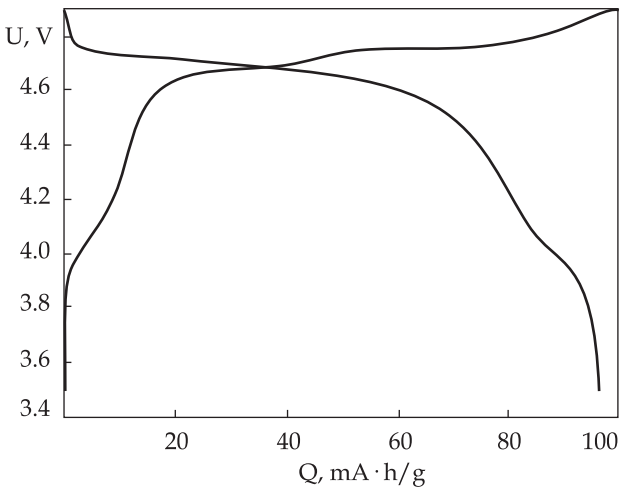
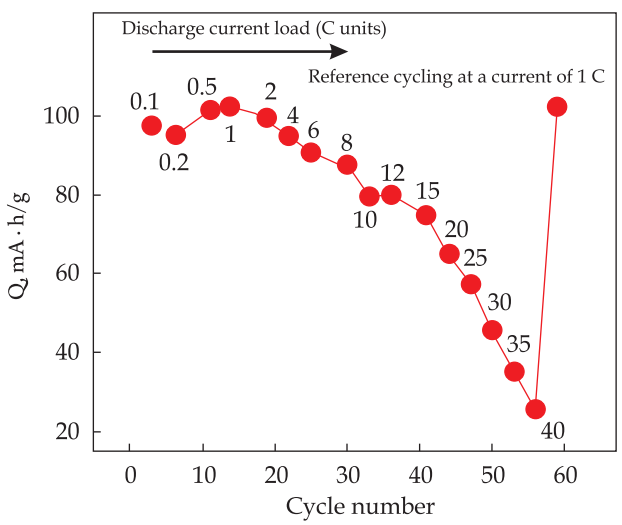
LITHIUM-NICKEL-MANGANESE SPINEL $LiNi_{0.5}Mn_{1.5}O_4$ FOR HIGH-RATE BATTERY APPLICATIONS

Advantages

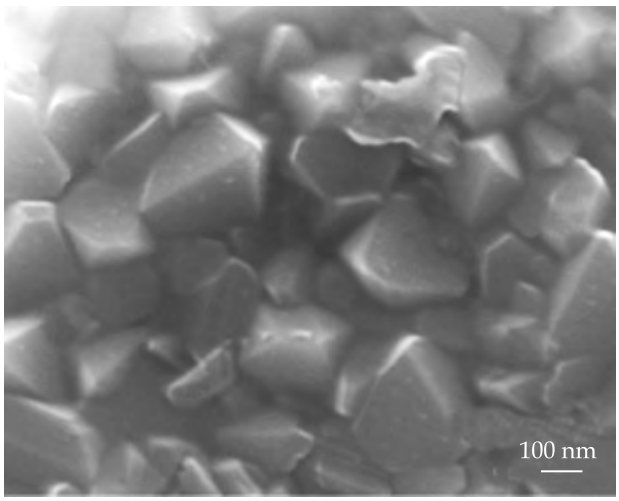
Lithium-nickel-manganese spinel $LiNi_{0.5}Mn_{1.5}O_4$ is one of the cathode materials having the highest energy density (500 mW · h/g). It can sustain higher current loads up to 5870 mA/g (40 C) as compared with commercial analog



Stationary charge/discharge curves for $LiNi_{0.5}Mn_{1.5}O_4$ at a current load of 14.7 mA/g (0.1 C)



Dependence of discharge capacity on the cycle number for $LiNi_{0.5}Mn_{1.5}O_4$



SEM micrograph of $LiNi_{0.5}Mn_{1.5}O_4$

Areas of Application

Cathode material for lithium-ion batteries used in renewable energy

Specification

Operating voltage range, V	3.4—4.85
Nominal capacity at 1.5 C discharge current, mA · h/g	105
Maximal current load, mA/g	5870
Particle size, nm	<200
Crystallite size, nm	15—22

Stage of Development. Suggestions for Commercialization

IRL5, TRL4
The electrode material is proposed

IPR Protection

IPR2, IPR3

Contact Information

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MATERIALS FOR REPAIRING DAMAGED INSULATION ON PIPES WITH BITUMINOUS MASTIC AND POLYETHYLENE COATING

Areas of Application

The set of materials is to be used for repairing penetration and surface damages of pipe insulation

Specification

The set includes a primer, an adhesive filler, and a double-layered polyethylene tape. The technical characteristics of the repaired coatings meet the requirements of DSTU 4219-2003. The repair materials are referred to the 4th hazard class

Advantages

No preheating of the pipe body at the repair site is required, which eliminates any risk of damaging the base coat integrity and significantly reduces energy consumption

Stage of Development. Suggestions for Commercialization

IRL6, TRL6
Technology for production and use of repair materials is proposed

IPR Protection

IPR1, IPR3

Contact Information

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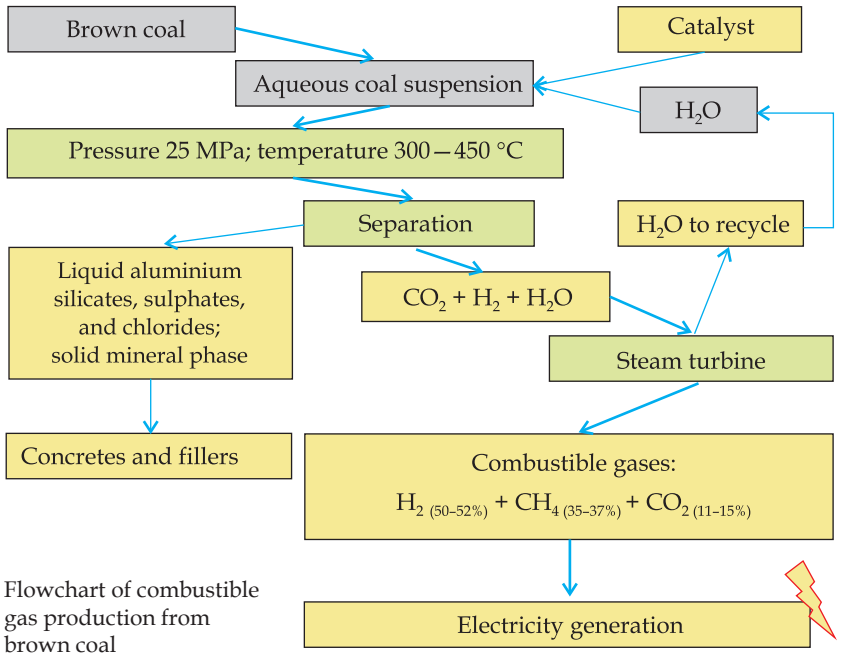
METHOD FOR COMBUSTIBLE GAS GENERATION BY HYDROTHERMAL CONVERSION OF BROWN COAL



Flowchart of combustible gas production from brown coal

Areas of Application

The method applies to production of combustible gas from brown coal for its use at TPPs as fuel

Specification

Gasification of 30% brown coal aqueous suspension under the supercritical conditions of water, in the presence of mineral additives of alkali nature leads to the formation of gases containing H_2 (50÷52%, vol.), CH_4 (35÷37%), and CO_2 (15÷11%), which can be used as fuel for TPPs

Advantages

Selective formation of hydrogen and methane mixture at supercritical temperature; if necessary, after CO_2 separation the combustible gas can be used as raw material for synthesis of other products. Water used as source of oxygen reduces the cost of oxidising agent as compared with molecular oxygen and the nitrogen content in gaseous products as compared with air. Operating temperature decreases from 800—1200 °C (conventional processes) down to 330—600 °C. The process is accompanied with desulfurization and recycling of waste into gypsum chips

Stage of Development. Suggestions for Commercialization

IRL3, TRL4
Specification requirements for designing a plant for combustible gas production; ready for the elaboration of business plan

IPR Protection

IPR3

Contact Information

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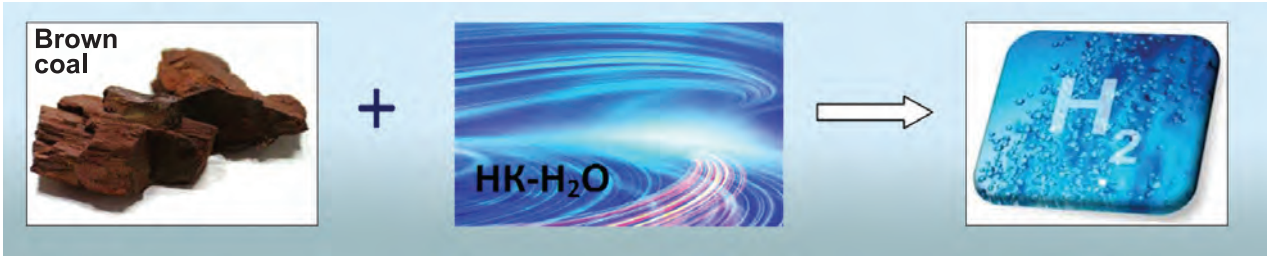
METHOD FOR HYDROGEN PRODUCTION BY HYDROTHERMAL CONVERSION OF BROWN COAL



Hydrogen production by hydrothermal conversion of brown coal aqueous suspension

Areas of Application

The method applies to obtaining of hydrogen containing gas from brown coal for hydrogen production

Specification

Gasification of 30% brown coal aqueous suspension under the supercritical conditions of water with ionic activation of catalysts leads to the formation of gases containing H_2 (60÷82%, vol.), CH_4 (12÷8%), and CO_2 (10÷30%), which can be used for hydrogen extraction

Advantages

The hydrogen production from brown coal is 1.5 cheaper as compared with the electrolysis method. Selective formation of hydrogen at supercritical temperature with ionic activation of catalysts; if necessary, after CO_2 separation the combustible gas can be used as raw material for synthesis of other products. Water used as source of oxygen reduces the cost of oxidising agent as compared with molecular oxygen and the nitrogen content in gaseous products as compared with air.
Operating temperature decreases from 800—1200 °C (conventional processes) down to 330—500 °C. The process is accompanied with desulfurization and recycling of waste into gypsum chips

Stage of Development. Suggestions for Commercialization

IRL3, TRL4
Specification requirements for designing a plant for combustible gas production; ready for the elaboration of business plan

IPR Protection

IPR3

Contact Information

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MOBILE PHOTOELECTRIC STATION FOR POWERING AND CHARGING THE LOW-POWER EQUIPMENT IN FIELD CONDITIONS

Mobile photoelectric station: operating (left) and folded (right)

Areas of Application

The station is a reliable, efficient, autonomous mobile device for powering and charging low-power devices (mobile phones, radio stations, thermal imagers, tablets etc.) in the field conditions

Specification

Output voltage, V	12
Output power of station, W	(AM 1.5) 2 × 10
Battery capacity, A·h	2 × 6
Dimensions in operating condition, mm	530 × 460 × 35
Folded station dimensions, mm	530 × 230 × 70
Weight, kg	7

Advantages

There are no analogs in Ukraine and the world.
The station uses highly efficient silicon solar cells that enable operating at low solar radiation.
All elements are arranged in a hermetic metal case, solar cells are protected with tempered glass.
The device consists of two independent parts, which significantly increases its reliability

Stage of Development. Suggestions for Commercialization

IRL6, TRL5
Manufactured upon request

IPR Protection

IPR3

Contact Information

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MODULAR PANEL HEAT REGENERATORS FOR GLASS FURNACES

Heat recovery plant with TVM regenerator installed behind the furnace No. 3 of Hostomel Glassworks in Kyiv Oblast

Areas of Application

The devices are designed to raise efficiency of glass furnace fuel due to recovery of exhaust gas heat for warming water for heat-supply systems

Specification

Heat capacity, MW	0.15—3.5
Water temperature at inlet, °C	70
Temperature of exhaust gases at outlet, °C	150—250
Consumption of exhaust gases, kg/sec	1.0—3.5
Aerodynamic resistance, Pa	300—600
Hydraulic resistance, kPa	5—30
Dimensions, mm:	
height	1500—4500
length	1700—3500
width	1300—2500
Payback period, months	3—6

Advantages

Increase in fuel factor by 10—30%;
decrease in intensity of dust generation;
effective cleaning of working surfaces

Stage of Development. Suggestions for Commercialization

IRL8, TRL5
Design of heat recovery plants and organization of commercial production

IPR Protection

IPR1, IPR2

Contact Information

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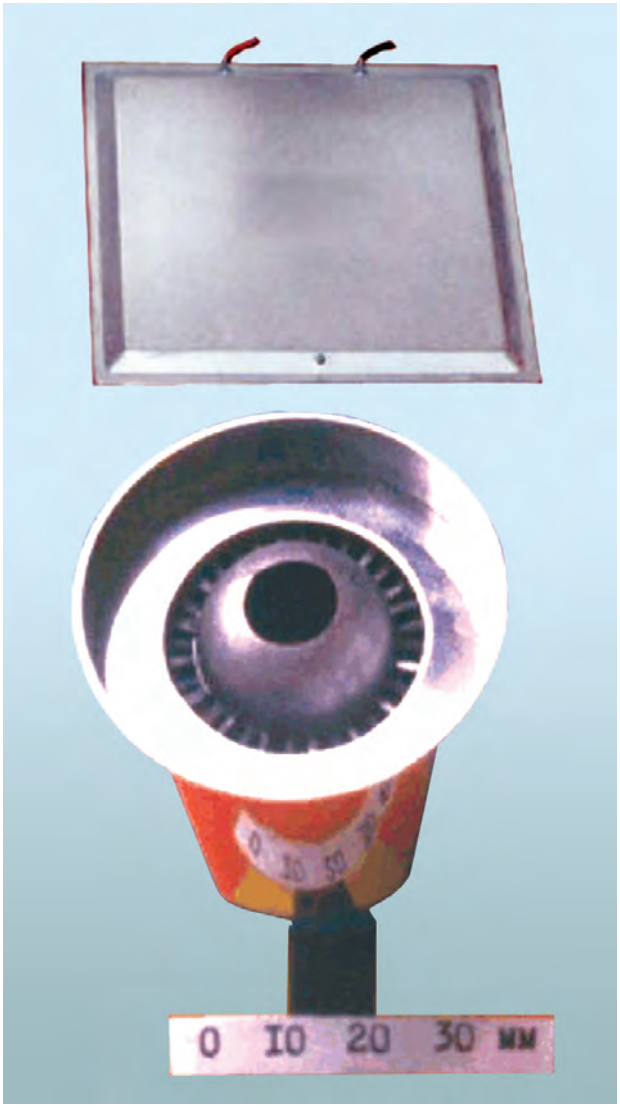
MODULES FOR THERMOELECTRIC GENERATORS

Areas of Application

The modules are designed for creating thermoelectric generators used as low-temperature stage of heat engines, combustion engines, diesel engines, gas turbines, etc. using the exhaust heat, as well as for creating heat and electricity generators with catalytic flameless combustion of gaseous or liquid fuel



Specification

Operating temperature of the hot side during long-term operation, °C	250 and lower
Permissible overheat of the hot side, °C	300—400
Operating temperature of the cold side, °C	30—80
Permissible overheat of the cold side, °C	120
Number of heating-cooling cycles	≤20 000

Stage of Development. Suggestions for Commercialization

IRL6, TRL6
Manufactured and supplied, upon request

IPR Protection

IPR3

Advantages

The modules have a higher reliability as compared with known analogs. They are made of special thermoelectric materials (including functionally gradient materials) that assure their maximum efficiency in a wide temperature range

Contact Information

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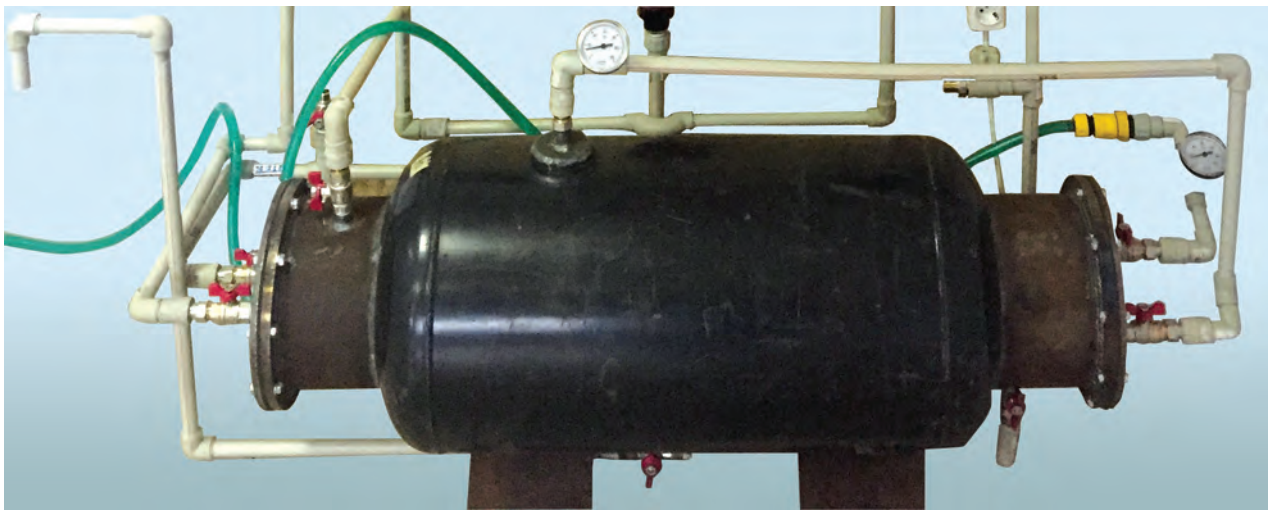
MULTI-LOOP HEAT EXCHANGER FOR INDEPENDENT HEATING AND HOT WATER SUPPLY SYSTEMS



Coil-type heat exchanger with collector

Areas of Application

The heat exchanger is to be used in independent schemes of local heating and hot water supply systems for residential, public, and industrial buildings

Specification

Heating up to, °C	80—100
Heating system temperature, °C	70
Supplied water temperature, °C	55
Length, m	2—3

Advantages

The device configuration makes it possible to overcome the peak load on hot water supply system and to reduce metal consumption of the heat exchanger. The detachability of exchanger enables easy cleaning of heat transfer surfaces. Countercurrent flow of all coolants creates turbulence that facilitates self-cleaning of surfaces

Stage of Development. Suggestions for Commercialization

IRL4, TRL4
Heat exchanger for private houses is available for sale; seeking partners for commercial manufacture to be used in individual heating systems of high-rise buildings

IPR Protection

IPR2, IPR3

Contact Information

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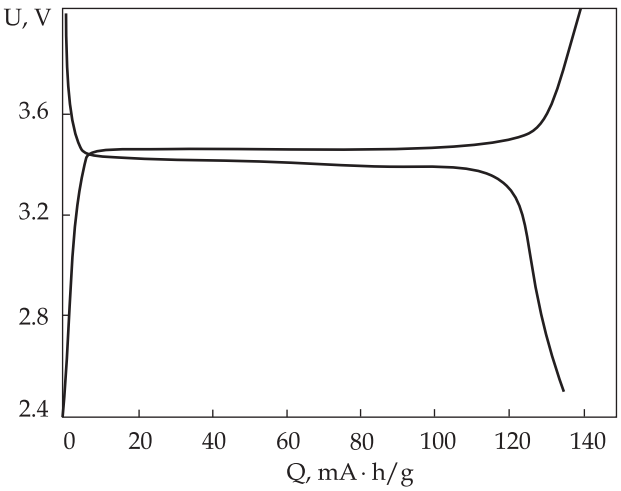
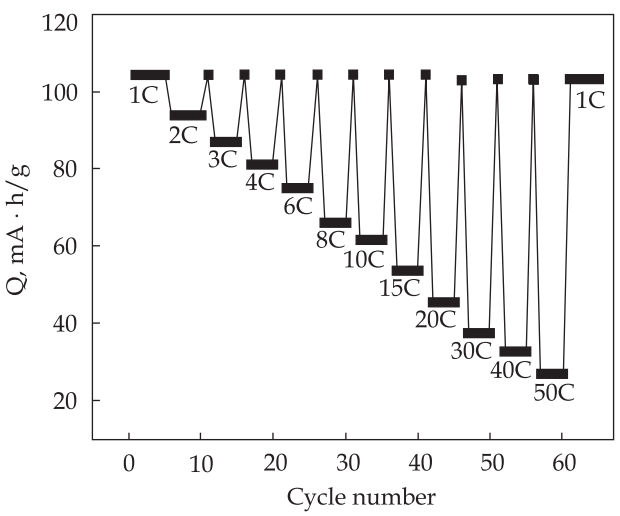
NANOCOMPOSITE $LiFePO_4$/C FOR HIGH-RATE BATTERY APPLICATIONS

Advantages

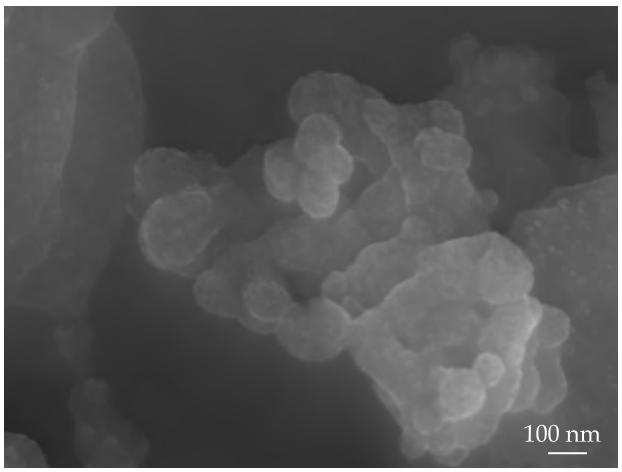
$LiFePO_4$ is one of the cheapest cathode materials for lithium-ion batteries.
It can sustain almost twice as much current load (8500 mA/g or 60 C) as compared with the commercial counterpart (7000 mA/g or 40 C)



Charge/discharge curves for $LiFePO_4$/C at a current load of 17 mA/g (0.1 C)



Dependence of discharge capacity at current loads from 1 to 50 C on the cycle number $LiFePO_4$/C



SEM micrograph of $LiFePO_4$/C

Areas of Application

Cathode material for lithium-ion batteries used in renewable energy

Specification

Operating voltage range, V	2.5—4.0
Nominal capacity at 1.5 C discharge current, mA · h/g	135
Maximal current load, mA/g	8500
Particle size, nm	100—200
Crystallite size, nm	20

Stage of Development. Suggestions for Commercialization

IRL5, TRL4
The electrode material is proposed

IPR Protection

IPR2, IPR3

Contact Information

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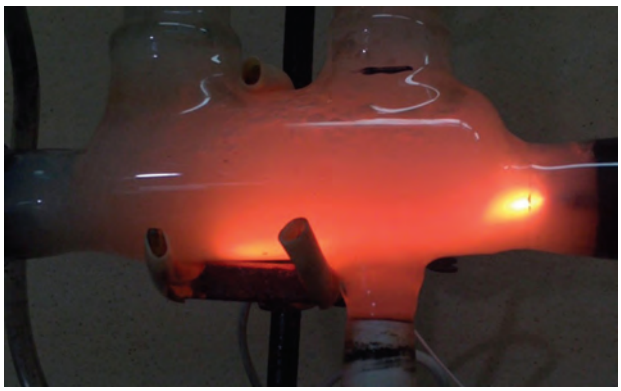
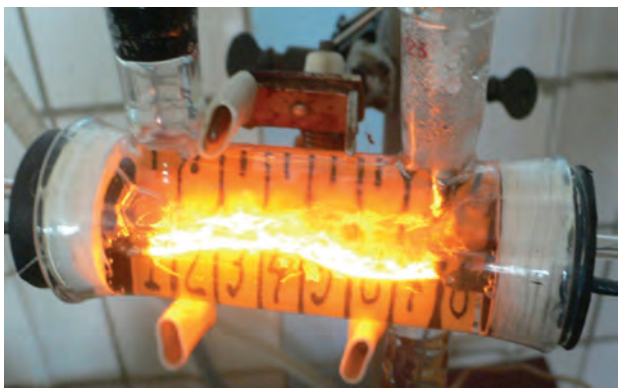
NANOFLUIDS FOR EFFICIENT HEAT EXCHANGE SYSTEMS OF POWER ENGINEERING, TRANSPORT, AND INDUSTRY

Nanofluids based on aluminum silicates (left) and carbon nanotubes (right)





Trial vessel. Boiling nanofluid

Areas of Application

The nanofluids are colloidal dispersions of nanoparticles having different nature and chemical composition in conventional heat-transfer agents. Today, the nanofluids are promising heat carriers to be used in nuclear industry, power engineering, electronics, metallurgy, laser transmitters, power transformers etc.

Specification

Average particle size, nm	70—3000
Concentration of particles, wt %	0.5—1.0
Sedimentation stability, months	1.5—2.0
Critical heat flux, $q \cdot 10^{-6}$, W/m^2	3.5—3.8
Heat exchange coefficient, α, W/m^{2}K	35 000—52 000

Advantages

The nanofluids can increase the critical heat flux 3—4 times as comparison with distilled water; enable to avoid the sudden boiling crisis unlike the single-phase heat transfer agents; have a high colloidal constancy and stability to multiple boiling-cooling cycles.
The nanofluids are obtainable, cheap, and environment friendly

Stage of Development. Suggestions for Commercialization

IRL5, TRL4
Nanofluid samples; technology and regulations for nanofluids production on industrial scale

IPR Protection

IPR3

Contact Information

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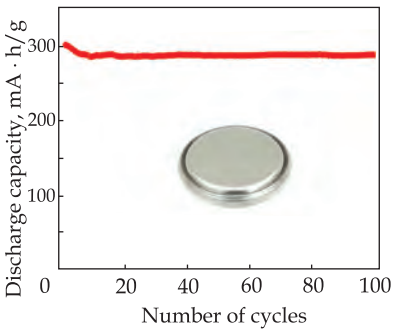
NEW HYBRID NANOCOMPOSITE CATHODE MATERIALS FOR LITHIUM ELECTROCHEMICAL CELLS

Options for application of lithium electrochemical cells based on developed cathode materials



Charge-discharge cyclability of nanocomposite cathode based on polypyrrole and V_2O_5

Areas of Application

The materials are to be used in lithium and lithium-ion batteries for different purposes, particularly, for portable electronic equipment

Specification

Hybrid organic-inorganic nanocomposites are based on conducting polymers (polyaniline, polypyrrole, and polythiophene), grapheme, and electroactive compounds of transition metals (V_2O_5, $LiFePO_4$, etc.). The materials have a discharge capacity of 250—300 mA·h/g under long-term cycling as active component of cathodes of lithium batteries, including those with high current density

Advantages

As compared with counterparts, these materials have a higher specific capacity (by 25—70%), stability to degradation (the ability to withstand high current loads), and improved rate response; they are easily obtainable and cheaper

IPR Protection

IPR1, IPR3, IPR5

Stage of Development. Suggestions for Commercialization

IRL3, TRL4
Samples of nanocomposite cathode materials are produced and supplied, upon request

Contact Information

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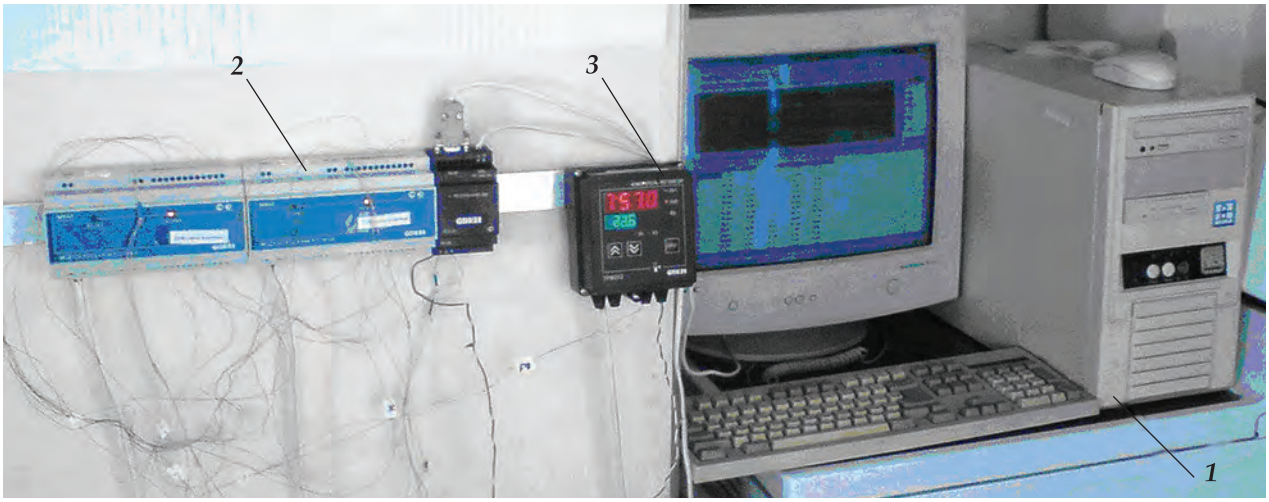
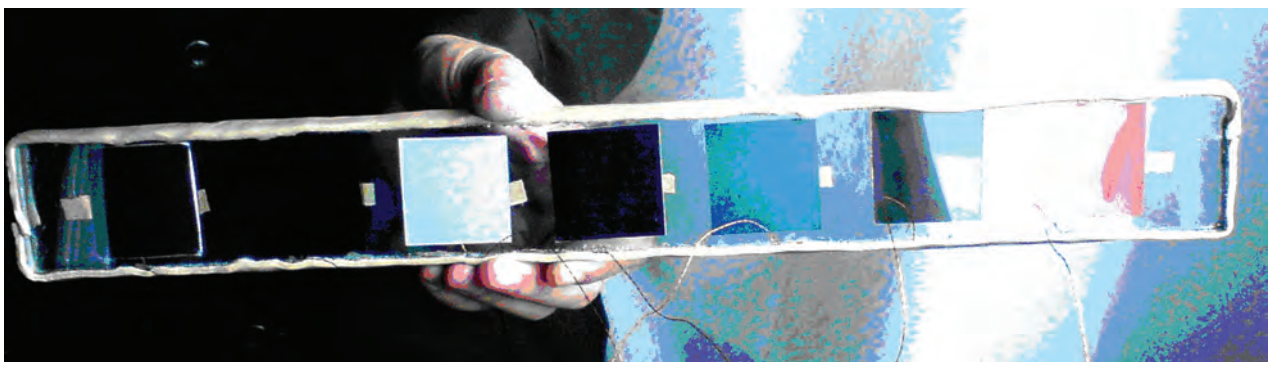
PHOTOACTIVE COATINGS





Device (above) and magazine of samples (below) for measuring sunlight absorptance: (1) recording unit, (2) magazine, and (3) measuring unit

Areas of Application

The coatings are to be used as absorbing layer of solar collectors

Specification

Composition: nanostructured oxide composite materials based on chromium and molybdenum; sunlight absorptance is 98%

Advantages

The method enables to obtain stable metal compounds and their composites, to simplify requirements for process equipment, and to reduce the number of manufacturing operations (down to 2—3) for the formation of absorbent layer on the solar collector surface

Stage of Development. Suggestions for Commercialization

IRL3, TRL3
The method for synthesis and application of coatings has been successfully tested at solar collector prototype for one year and are ready for manufacturing materials

IPR Protection

IPR3

Contact Information

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PLANT FOR PRODUCTION OF TORREFIED FUEL FROM PLANT WASTE

Samples of torrefied biomass

Samples of torrefied fuel

Areas of Application

The plant is designed to produce torrefied fuel from plant waste as alternative to coal (anthracite group) and can be burnt together with coal at CHPPs or individually, in domestic boilers

Specification

Output of torrefied fuel, %	50—65
Carbon content in fuel, %	~70
Combustion heat, MJ/kg	20—23
Torrefaction temperature, °C	160—340

Advantages

The plant has no counterparts. It is mobile, operates in autothermal mode, does not require any additional energy, and has a simple configuration that enables to use it at private farms and houses

Plant for production of torrefied fuel from plant waste

Stage of Development. Suggestions for Commercialization

IRL4, TRL4
Seeking partners for serial production; customized design, upon request

IPR Protection

IPR3

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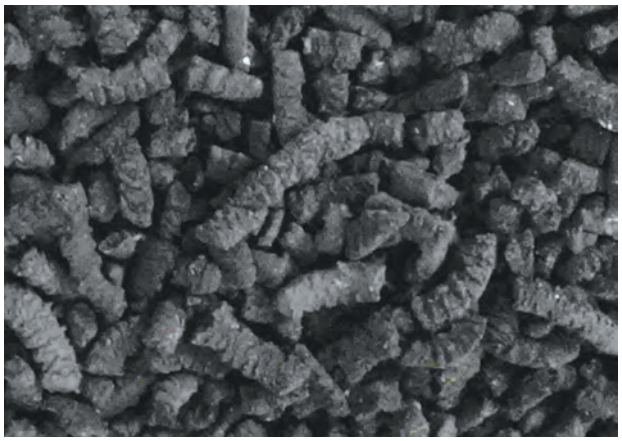
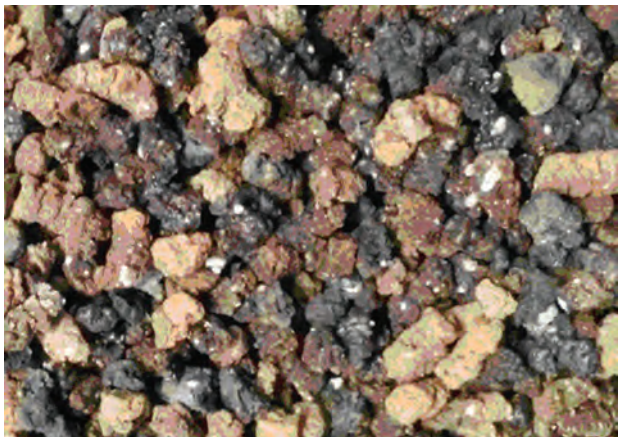
PLANT FOR THERMAL CONVERSION OF SEWAGE SLUDGE



Sludge



Ash

Areas of Application

This plant is for treating WWTP sludge that has been kept at filtration fields for a long time in order to use it for gas production. The ash remaining from combustion can be used for producing construction materials

Specification

The sludge conversion results in:

Ash output per dry weight of fuel, %	35—42
Combustible gas with a combustion heat, MJ/m^3	5.4—6.9
Gas output, m^3/kg	0.8—1.2

Advantages

The plant has no counterparts. Its main advantages are mobility, waste-free production, and easy assembly

Plant prototype

Stage of Development. Suggestions for Commercialization

IRL4, TRL4
Seeking partners for serial production; customized design, upon request

IPR Protection

IPR3

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PLASMA-CHEMICAL REACTOR FOR PRODUCING PHOTOVOLTAIC CELL INSULATION

Areas of Application

The reactor is to be used in alternative power engineering for producing photovoltaic cells

Specification

The treatment cycle, min	30
Simultaneously treats 60 plates:	
plate size, mm^2	125×125, 150×150
plate thickness, μm	210
Magnetic field, E	100
Generator capacity, kW	1.5
at a frequency, MHz	13.56

IPR Protection

IPR1

Advantages

This reactor has a capacity 2.4 times exceeding that of the best foreign analogs and provides a higher quality of treatment

Stage of Development. Suggestions for Commercialization

IRL6, TRL6
Manufactured, delivered, and serviced within warranty period, upon request

Contact Information

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POLYMERIC ANTICORROSIVE COATING TO PROTECT THE FACILITIES FOR CHEMICAL TREATMENT OF TPP AND CHP WATER



Protection from corrosion: internal and external areas of filter pipes (left); H-cationite filter reservoir (central); and demineralized water tank (right)

Areas of Application

The polymer corrosion-resistant coating is designed to protect the working surfaces of all components of chemical water treatment facilities, which are in contact with liquid and gaseous aggressive media and enables extending service life; protecting metal surfaces from acids, alkali, and other aggressive environment; decorating/finishing the surface; and protecting from unfavorable atmospheric factors, water and aqueous salt solutions

Specification

Operating temperature range, °C	–50...+150
Adhesion to metal membrane, points	≥1
Hardness by ME-3 pendulum, c. u.	0.3—0.5
Membrane strength:	
Impact strength, J	≥5
Bend strength, mm	1—3
Moisture permeability, %	0.6—1.0

Advantages

Increased chemical resistance, high moisture resistance, elasticity and mechanical durability, maintainability; the durability of this coating is 10 years longer than that of epoxy and reaches 12-15 years

Stage of Development. Suggestions for Commercialization

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

IPR Protection

IPR1

Contact Information

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RECORD HEATER AND COOKING FURNACE

Areas of Application

The device is to be used for heating residential premises and utility space having an area from 20 to 40 m² and for cooking

Specification

Fuel type: wood chips, wood and combined pellets, wood, lignite, peat, hay, straw.
The device can operate in the two modes: accelerated and long-term combustion (at least, 6 hours per one charge).

Nominal heat output, kW	2—4
Temperature of exhaust gas, °C	<200
Efficiency, %	75—80
Emissions:	
CO, mg/m^3	1300
NO_x, mg/m^3	50
Weight, kg	50

Advantages

The device keeps a desired temperature in the premise (about 20 °C with minimal fuel consumption); has the highest possible efficiency; the original design of combustion chamber and air regulation system provides nearly 95% complete fuel combustion without coke residue; environment effect: as compared with other known configurations of heaters, exhaust gas temperature is 3 times lower, NO_x and CO emissions are 4 times and 6 times less, respectively. The furnace is equipped with thermoelectric generator of original configuration, which enables to produce 12V DC electricity with an output of up to 100 W

IPR Protection

IPR3

Stage of Development. Suggestions for Commercialization

IRL6, TRL5
Manufactured and serviced, upon request

Contact Information

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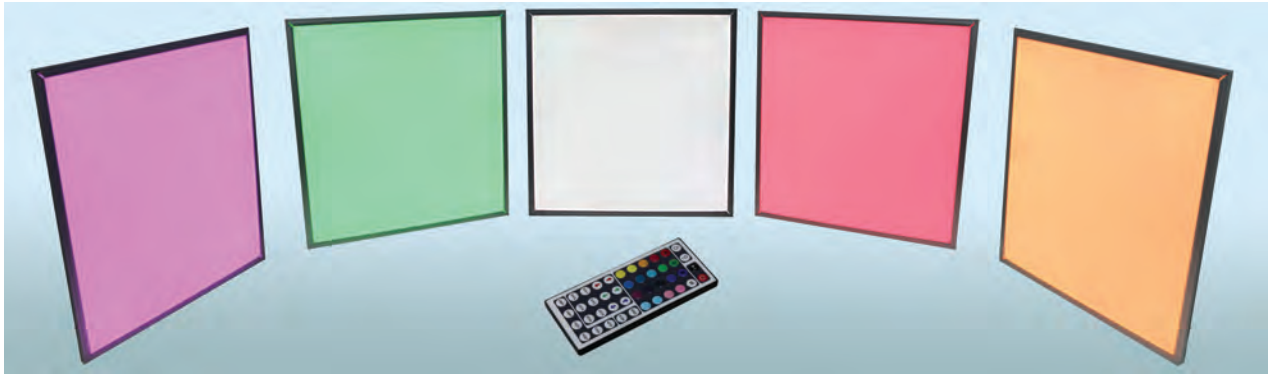
SMART LIGHTING SYSTEM



Several light shades that can be irradiated by SLS

Areas of Application

This LED lighting system has a controllable spectral composition and light intensity and optical parameters of artificial light adaptable to the natural light

Advantages

The Smart Lighting System is unique in Ukraine and differs from foreign counterparts by option of getting white light with chromaticity coordinates corresponding to the Planck curve, with a color temperature range from 2700 K to 10000 K, and with color rendering index higher than 85

IPR Protection

IPR2

Specification

Dimensions, mm	600 × 600 × 150
Power supply, V	180—260
Power consumption, W	5—40
Luminous flux, lm	500—4000
Luminous efficiency, lm/W	>100
Power factor	>0,9
Full harmonic distortion factor (ITHD), %	<15
Intensity curve	Wide
Fall in light flux since switch-on until the stable mode is reached (30 min), %	<1
Stability of luminous flux at a temperature from 0 to 40 °C, %	<1

Stage of Development. Suggestions for Commercialization

IRL7, TRL6
The manufacture, delivery, warranty service, and staff training, upon request

Contact Information

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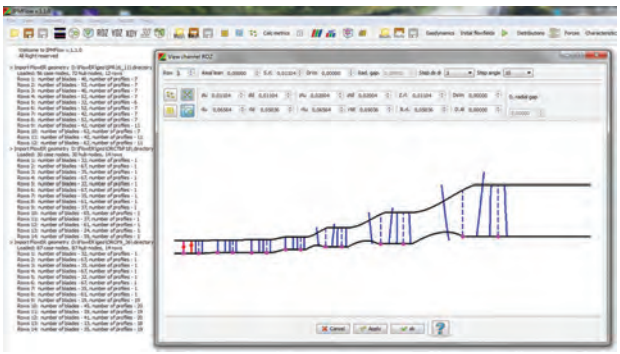
SOFTWARE PACKAGE FOR CALCULATION AND DESIGN OF FLOW PARTS OF POWER PLANTS

Areas of Application

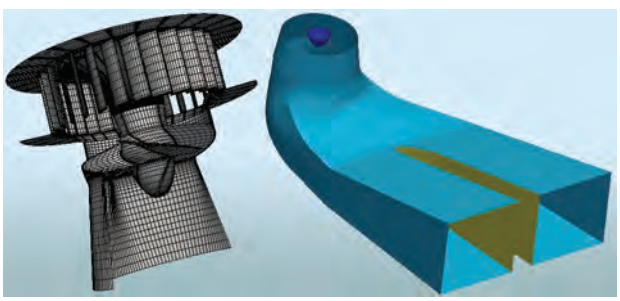
IPMFlow software package is to be used for designing flow parts of steam, gas, and hydraulic power plants. It can be interesting for enterprises of power engineering, aviation gas turbine building, integrated gas refineries and transportation systems and so on



Interface of *IPMFlow* software package

Specification

3D viscous flow modeling is based on numerical integration of Reynolds' equations using Godunov's high-accuracy implicit quasimonotonic schemes.
The turbulent effects are taken into account using Menter's two-parameter turbulence model.
The software package enables to design efficient blade profiles using computational experiment without involving physical tests



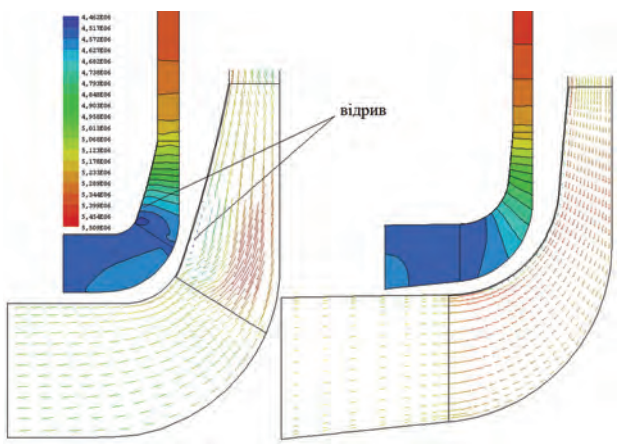
Guide vanes, impeller, and suction tube of Kaplan turbine

Advantages

The software package enables developing highly efficient flow parts and reducing design time. It surpasses the existing analogs in Ukraine in terms of all basic characteristics

Stage of Development. Suggestions for Commercialization

IRL8, TRL4
Design and computations of flow parts are provided, upon request



Visualization of static pressure and speed vectors in flow parts of compressor: prototype model and new compressor

IPR Protection

IPR1, IPR2

Contact Information

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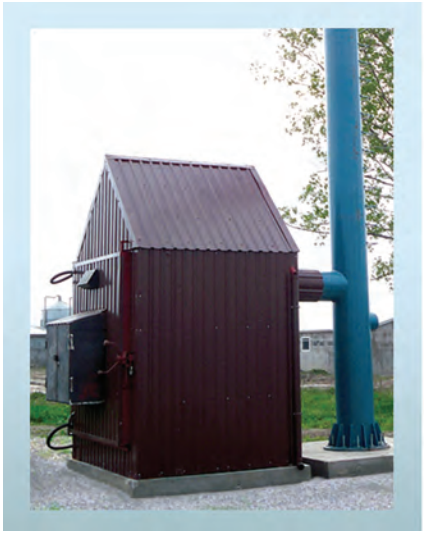
STRAW-FIRED WATER HEATING GENERATORS WITH A CAPACITY OF 0.5 MW



TSE-250 heat generator

KSs-100 heat generator

Areas of Application

The generators are to be used for reducing natural gas consumption for heating purposes in rural regions due to the use of agricultural product waste as fuel

Advantages

These devices are cheaper than the foreign counterparts with similar characteristics

Specification

Straw-fired heat generators	TS-350	TSE-250	KSs-100
Heat capacity, kW:	350	250	100
Efficiency, %	83	83	78
Fuel	Large straw bales (1.5 m width, 1.8 m diameter)	Large straw bales (1.5 m width, 1.8 m diameter)	Small rectangular bales (1.0 × 0.4 × 0.5 m)
Straw consumption, t/season	380	270	115
Natural gas saving, thousand m^3/season	171	122	49
Payback period, years	2—3	2.5—3.5	3

Stage of Development. Suggestions for Commercialization

IRL6, TRL6
Design, manufacture, and warranty service, upon request

IPR Protection

IPR2

Contact Information

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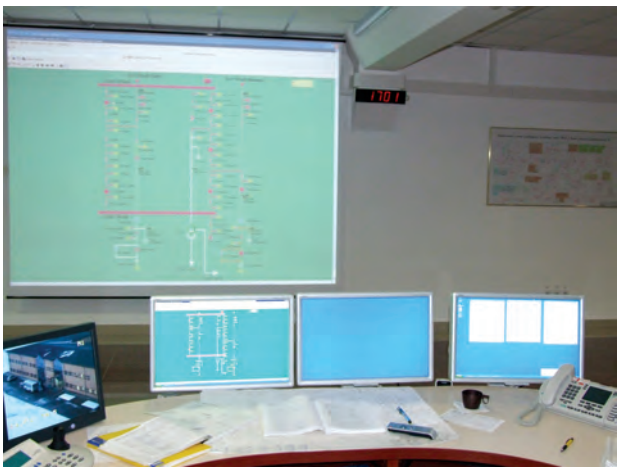
SUBSTATION AUTOMATED CONTROL SYSTEM

Areas of Application

The system is designed for automated monitoring and control of electrical substations



Control room at the *Kyiv* 750kV substation

Specification

The main ACS subsystems are as follows:
Automated dispatch control system;
Automated system acquisition of data received from microprocessor relay protection devices and electrics;
Emergency events registration system;
Transient mode monitoring system;
System of data transmission to the upper hierarchical levels;
Automated control system of high-voltage bush insulation;
Substation's needs monitoring system;
Automated system of dispatcher reporting and online documentation formation; and
System of process and security CCTV

Stage of Development. Suggestions for Commercialization

IRL7, TRL8
Development of project, manufacture and delivery of equipment, assembly and commissioning works, staff training, as well as warranty and post-warranty service of the ACS are provided, upon request

Advantages

The developed ACS is a brand new full-featured automated complex that provides a dramatic reduction in labor costs and an increase in the substation reliability. The system is unique in Ukraine and meets the highest international standards

IPR Protection

IPR1, IPR2

Contact Information

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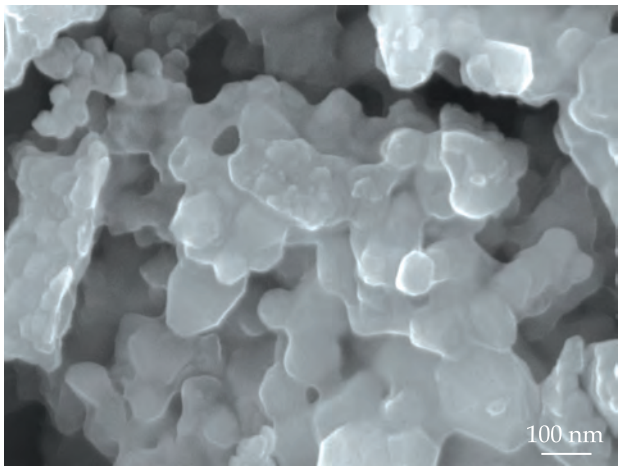
SURFACE-MODIFIED LITHIUM MANGANESE SPINEL $LiMn_2O_4/LiNi_{0.5}Mn_{1.5}O_4$ FOR HIGH-RATE BATTERY APPLICATIONS



SEM micrograph of $LiMn_2O_4/LiNi_{0.5}Mn_{1.5}O_4$

Areas of Application

Cathode material for lithium-ion batteries used in renewable energy

Specification

Operating voltage range, V	3.4—4.5
Nominal capacity at 1.5 C discharge current, mA · h/g	115
Maximal current load, mA/g	9620
Particle size, nm	200
Crystallite size, nm	25

Stage of Development. Suggestions for Commercialization

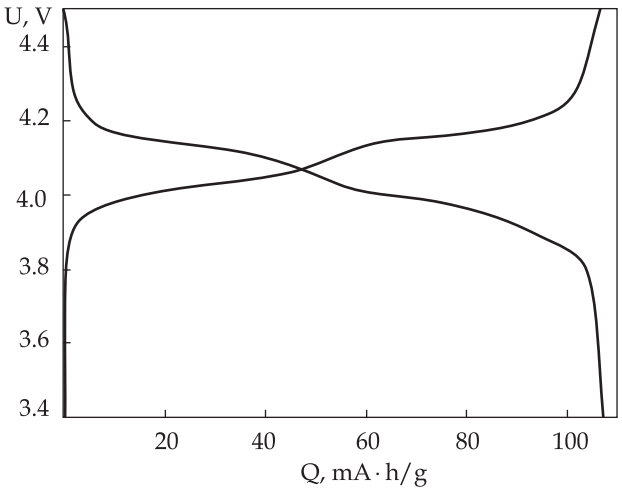
IRL5, TRL4
The electrode material is proposed

IPR Protection

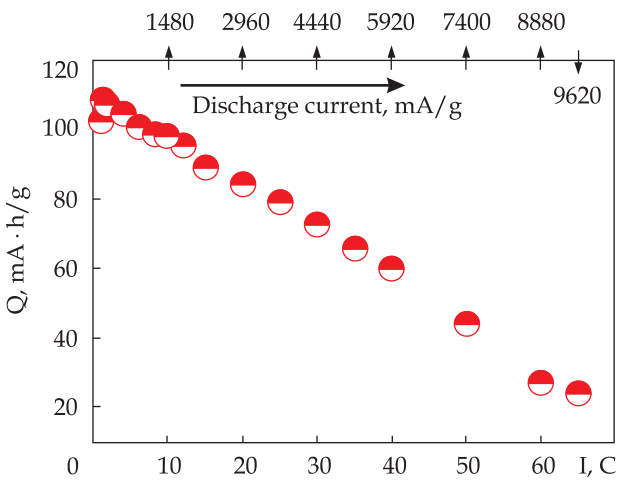
IPR2, IPR3

Advantages

This high-voltage cathode material can sustain wice as much current load at 9620 mA/g (65 C) as compared with commercial analogs



Stationary charge/discharge curve $LiMn_2O_4/LiNi_{0.5}Mn_{1.5}O_4$ at a current load of 14.7 mA/g (0.1 C)



Discharge capacity dependence on current load for $LiMn_2O_4/LiNi_{0.5}Mn_{1.5}O_4$

Contact Information

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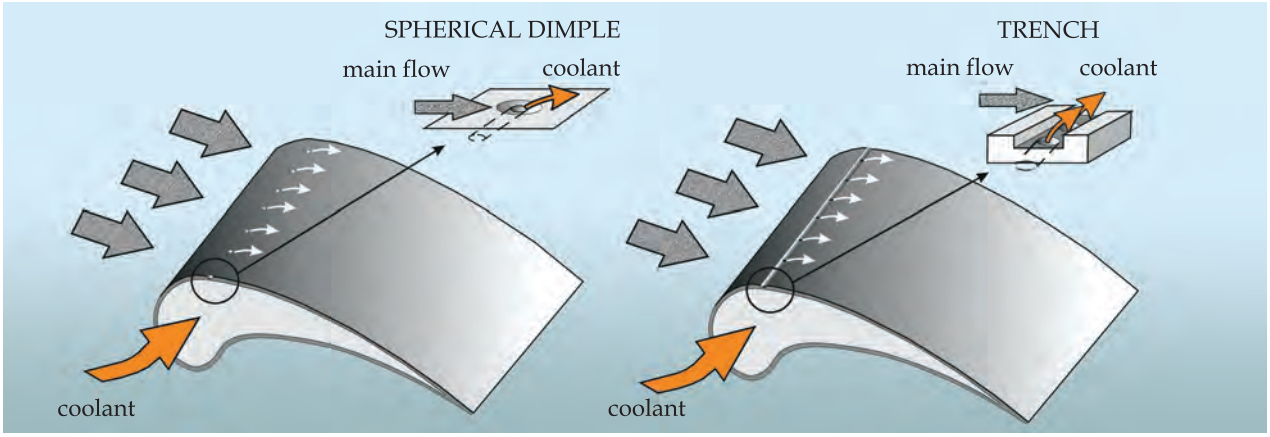
TECHNOLOGY FOR COOLING GAS TURBINE BLADES WITH COOLANT SUPPLY INTO VARIOUSLY SHAPED INDENTATIONS



The scheme of turbine blade film cooling with air supply into spherical dimples and trench

Areas of Application

Applies in power engineering.
Reduction in the coolant mass rate at the film cooling of gas turbine blades

Specification

The technologies are based on the coolant supply into surface indentations of different shape (spherical, cylindrical, triangle, trenched) with low depth to diameter ratio (0.5…1.0). This provides increase in the film cooling efficiency by 1.5…2.5 times in comparison with traditional cooling scheme, or reduction by 10…15% in the coolant flow rate

Advantages

The technology provides the uniformity of protective cooling film, decreases the flow from cooled surface separation and minimizes the negative effect of secondary vortex structures. It is characterized by more simple production technology compared with innovative foreign analogs

Stage of Development. Suggestions for Commercialization

IRL3, TRL3
In case of interest the calculations and optimizations of gas turbine blade cooling system can be developed

IPR Protection

IPR3

Contact Information

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TECHNOLOGY FOR OBTAINING HIGHLY CONCENTRATED SLURRY FUEL FROM COAL

Highly concentrated suspension fuel based on coal

◀ Production of highly concentrated suspension based on coal

Areas of Application

Highly concentrated slurry fuel (HCSF) based on coal and wastewater of coke, chemical, pharmaceutical, and polymer refineries and factories can be used in boilers at TPPs, CHPs, light industry factories, refineries, cement plants, housing and public utilities enterprises

Specification

This technology enables obtaining HCSF with a maximum concentration of solid particles of 60—75% (wt.), a particle size of 1—250 μm, an effective viscosity of 1.0—1.5 Pa · s at a warp rate of 9 s^{-1}, and an aggregate and sedimentation stability of 12—30 days

Advantages

As compared with known methods, this technology can increase the sedimentation stability of dispersed fuels 2—3 times while keeping their properties that meet the process requirements for direct combustion in power plants. The use of organic effluents as dispersive medium provides a comprehensive solution to the problem of organic effluent disposal and enables to increase the fuel value

Stage of Development. Suggestions for Commercialization

IRL3, TRL3
Upon request, the technology is customized to the specific requirements and staff training is provided

IPR Protection

IPR2, IPR3

Contact Information

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TECHNOLOGY FOR PROTECTING THE HEATED ELEMENTS OF THERMAL POWER PLANTS FROM ABRASIVE WEAR AND GAS CORROSION

Areas of Application

The technology is to be used for applying the alloyed arc-sprayed coatings made of Fe-Cr-B-Al-Mg powder wires on the surfaces of furnace-wall tubes and economizer pipes of thermal power plants to effectively protect them from abrasive wear and gas corrosion at an operating temperature of up to 600 °C

Specification

Maximum spraying capacity	
Aluminum, kg/h	10.0
Zinc, kg/h	30.0
Powder wire, kg/h	12.0
Operating air pressure, Pa	0.5—0.6
Air consumption, m^3/min	1.5
Power consumption, kW	16.0

Advantages

The technology for using special powder wires enables to obtain protective coatings that match the plasma-sprayed ones in terms of quality and to double the service life of protected pipes

Stage of Development. Suggestions for Commercialization

IRL7, TRL8
Application of electric-arc coatings under works contract or transfer of license for the use of technology; manufacture of equipment and materials for works

IPR Protection

IPR2, IPR3

Contact Information

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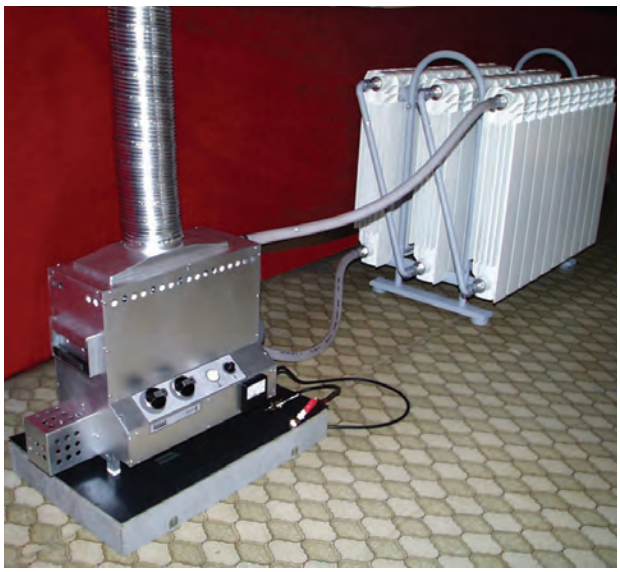
THERMOELECTRIC GENERATOR FOR AUTONOMOUS GAS HEATING SYSTEMS



Areas of Application

The thermoelectric generator is designed for power supply to electric devices of autonomous gas-fired heating sources (tanks, boilers)

Specification

Electric power, W	65
Output voltage, V	12
Thermal power, kW	1.8
Operational life, years	≥10
Overall dimensions, mm	260 × 220 × 100
Weight, kg	8

Advantages

The autonomous thermal generator provides an efficient system for forced convection of liquid heat carrier and forced removal of flue gases from the combustion chamber of water heater. This leads to an increase in efficiency of heating sources and an essential reduction in the content of toxic NO_x and CO gases in fuel combustion products. This thermoelectric generator has a long service life, is reliable, noiseless, and has no movable parts.
Its use enables operating heating systems independently of centralized power grid

Stage of Development. Suggestions for Commercialization

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

IPR Protection

IPR3

Contact Information

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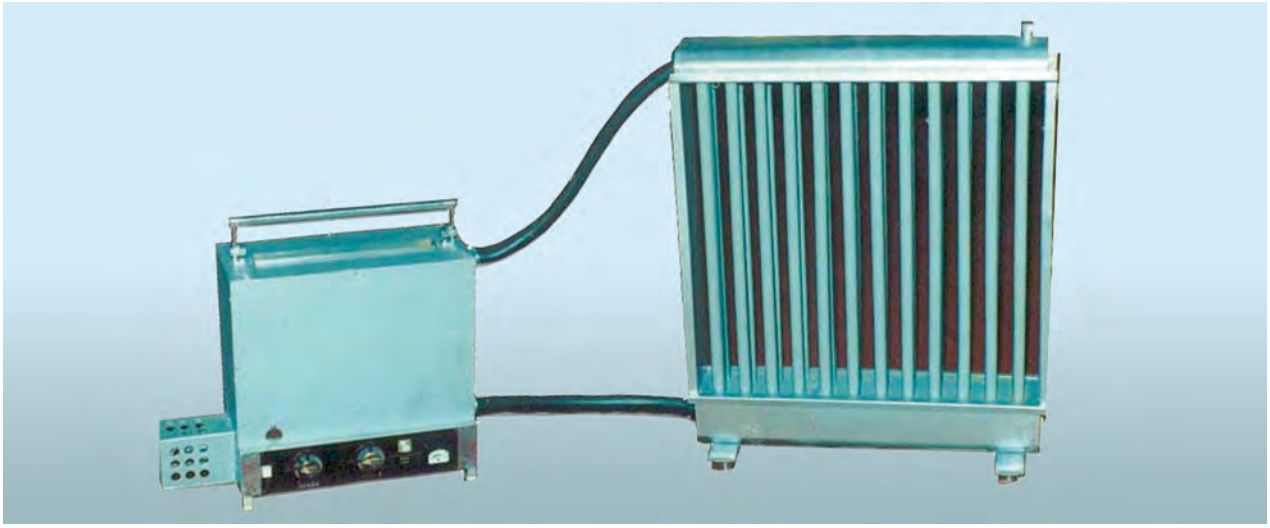
THERMOELECTRIC GENERATOR



Areas of Application

The generator is designed for supplying thermal and electric energy to habitable premises and amenity spaces, country houses, cottages, hangars, garages, trade kiosks, green houses, etc., as well as for charging accumulators, and for providing autonomous power supply to domestic equipment (radio receivers, TV sets, tape recorders) and mobile communication systems

Specification

Thermal capacity of heat source, kW	≤4.3
Electric power of generator, W	100
Output voltage, V	12
Type of fuel	Propane-butane, methane
Fuel consumption	
Propane-butane, g/h	≤310
Methane, m^3/h	≤0.3
Overall dimensions, mm	550 × 450 × 270
Generator weight (heating block), kg	≤20

Advantages

Due to a combination of parameters the generator outperforms the known world counterparts

Stage of Development. Suggestions for Commercialization

IRL6, TRL6
The product is manufactured and supplied, upon request

IPR Protection

IPR3

Contact Information

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THERMOSETTING PRIMER

Areas of Application

The primer is designed to increase the effectiveness of pipe corrosion protection; it can be used as a surface modifier for pipes that have remains of old coating in the case of re-insulation of active pipeline with polymeric bitumen coatings

Specification

Viscosity (flow time as measured by VZ 246 viscometer), at 20 °C, s	60—80
Drying time at 20 °C, min	1.5—2.0
Consumption, g/m²	80—100

The primer is a low-toxic compound referring to the 4th hazard class

Advantages

The chemical reaction between the coating's adhesive layer and the primer results in enhanced corrosion resistance of protective insulation. In the case of re-insulation of active pipelines with polymeric bitumen coatings, the primer modifies the pipe surface with remains of old coating, which enables to abandon costly sandblasting cleaning and significantly reduces energy consumption

Stage of Development. Suggestions for Commercialization

IRL6, TRL6
Primer and production technology

IPR Protection

IPR1, IPR3

Contact Information

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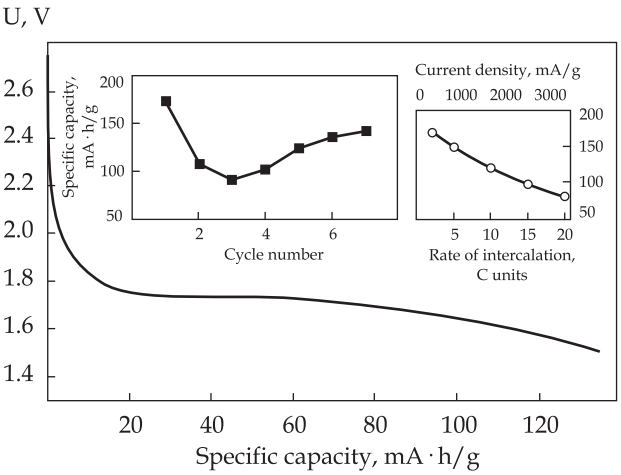
TITANIUM DIOXIDE TiO_2 FOR HIGH-RATE BATTERY APPLICATIONS

Areas of Application

Anode material for lithium-ion batteries used in renewable energy

Specification

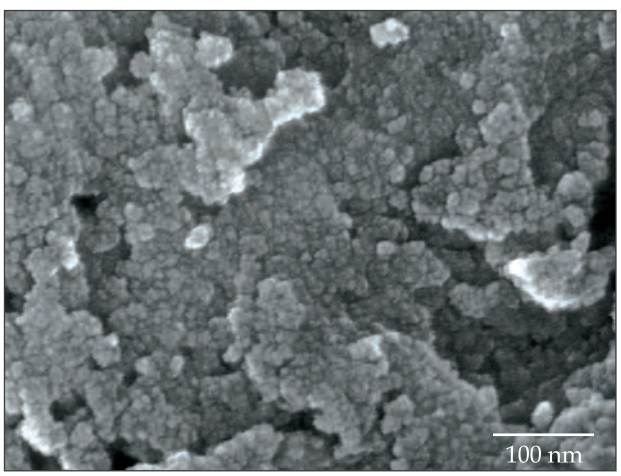
Working voltage range, V	1.3—2.8
Nominal capacity at 1.5 C discharge current, mA · h/g	165
Maximal current load, mA/g	3350
Particle size, nm	250
Crystallite size, nm	14—20



Galvanostatic discharge curves for TiO_2 and dependence of specific capacity on discharge current

Advantages

The material is cheaper than the commercial analogue, $Li_4Ti_5O_{12}$, and the method of its obtaining is simpler, whereas the specific and power density characteristics of both materials are comparable



SEM micrograph of TiO_2

Stage of Development. Suggestions for Commercialization

IRL5, TRL4
The electrode material is proposed

IPR Protection

IPR2, IPR3

Contact Information

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TP-TYPE THERMOELECTRIC CONVERTERS

Areas of Application

The devices are to be used for converting arbitrary shaped AC signals in wide frequency range (from fractions of hertz to several hundred megahertz) to DC thermopower functionally related to effective value of converted signal

Specification

Heater resistance, ohm	0.5—9.5
Nominal current, mA	10—150
Nominal EMF, mV	≥4.5—10
Overload capacity, % of nominal current	120
Insulation resistance, Mohm	≥50
Thermocouple resistance, ohm	≤15
Time constant, s	≤1,5
Coupling capacitance, pF	≥1,2
Weight, g	0.5

Advantages

These devices have the smallest dimensions among the known thermal converters (height 5.5 mm, diameter, without mounting wires 5 mm), which significantly improves the accuracy and reliability of research. They have a higher sensitivity, a better overload capacity, a higher output thermopower, and a wider operating frequency range. There are no analogs

Stage of Development. Suggestions for Commercialization

IRL7, TRL6
Manufactured and supplied, upon request

IPR Protection

IPR3

Contact Information

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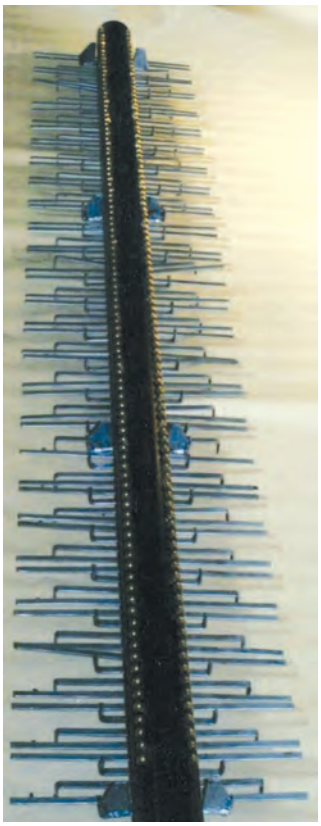
UPGRADE OF TVG-8 AND TVG-8M BOILERS

Installation of convective surface made of ∅32×3 mm pipe instead of original ∅28×3 mm one in TVG-8M boiler

MPIG-3 bottom burner of new generation



Areas of Application

The technology is to be used in public utilities engineering for upgrading the facilities in order to increase their efficiency and to reduce natural gas consumption

Specification

The upgrade provides for installing new burners having a capacity of 3 MW, a control factor of 5, NO_x concentration of ≤180 mg/Nm^3; CO concentration of ≤100mg/Nm^3 at 3% O_2; convective section made of Ø32×3 mm pipe, and flue gas temperature at the outlet of ≤120 °C

Stage of Development. Suggestions for Commercialization

IRL8, TRL8
Manufacture, supply, installation, commissioning, warranty service, and staff training, upon request

IPR Protection

IPR3

Advantages

The upgrade technology has the lowest payback period of 1 year among alternative options for raising efficiency of 4—10 MW gas-fired boilers as compared with new domestic or imported boilers. The boilers can be upgraded during repair works. The upgrade results in efficiency increasing from 89—90% to 94—96% and enables saving 172 thousand m^3/year natural gas using TVG-8 boiler

Contact Information

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+38 044 456 03 56, +38 050 444 28 40, e-mail: bor.ilienko@gmail.com

WIND TURBINE WITH A CAPACITY OF 4 kW

Areas of Application

The wind turbine is to be used for converting the wind kinetic energy into electricity in the areas with average annual wind speed of 3 m/s and more

Specification

Rated capacity, kW	4
Rotor diameter, m	6.8
Number of blades, pcs	3
Rotor speed, rpm	140
Height of support, m	17

Stage of Development. Suggestions for Commercialization

IRL3, TRL2
Seeking partners for serial production; customized product can be developed upon request; recommendations on plant siting can be provided

Advantages

In comparison with the world analogues this wind turbine has the following advantages: it is adapted to the wind conditions of Ukraine in terms of average annual wind speed; it has a centrifugal rotor speed regulator that protects the plant at storm winds; it uses a generator with constant magnets based on serial asynchronous electric motor; it utilizes an expanded range of wind speed due to an impulse charging block

IPR Protection

IPR1, IPR3

Contact Information

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ZERO-ENERGY PASSIVE HOUSE

Areas of Application

The technology is to be used in communal heating systems. The proposed passive house consumes minimum heat and has an autonomous power supply (electricity, heating/cooling, and hot water) based on renewable energy sources

Specification

The prototype house has energy-efficient double-pane windows, type 4M1i-10-4M1i-10-4M1; exterior walls from domestic construction materials: fan coils and combination of warm floor or warm walls as heating devices; heat pump based on geothermal heat; annual heat consumption (for climate conditions of Kyiv) of about 14.8 kW · h per 1 m^2 (passive house standard). The air heat curtain system of facades and roof is based on ground heat exchangers. The rated capacity of power supply system is 15 kW (5 kW produced by the wind turbine and 10 kW by the electric solar panels).

Total heated area, m^2	306
Thickness of facade heat insulation, cm	≤35
Heating system capacity, kW	2.6
Hot water supply system capacity, kW	3.4

Advantages

Autonomy from centralized power supply networks; complete autonomy of operation; high environment safety

Stage of Development. Suggestions for Commercialization

IRL7, TRL7
Manufacture, supply, installation, commissioning, warranty service, and staff training, upon request

IPR Protection

IPR1, IPR3

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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

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