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WEAR RESISTANT CARBON DIAMOND-LIKE COATINGS ON MEASURING TOOLS

Wear resistant carbon diamond-like coatings deposited on a work surface of measuring tools, such as plain gauges-plugs, the thread gauges, Johansson blocks and et all repeatedly magnify their resistance to a wear, longevity and calibration interval periods.

Measuring tools with diamond-like carbon coatings have the following technical characteristics:

- increase of in term service — not less than 3 times;
- increase recalibration interval — 5-10 times
- friction coefficient with steel - — not more than 0.25

The developed protective wear resistant coating of working surface of measuring tools is given Patent #2026412 of Russian Federation.

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HARD WEAR RESISTANT AND HARDENING DIAMOND-LIKE CARBON COATINGS ON AUTOMOBILE MACHINERY COMPONENTS

Ball support for automobiles MAZ with deposited multilayer coating Ti-TiN-DLC
Plunger pair with carbon-like coating for internal combustion engine

A technology of diamod-like coating deposition is based on the method of pulsed cathodic-arc deposition from accelerated fluxes of carbon plasma in vacuum at low temperature of substrate.

Coatings deposited on steel articles have the following characteristics:

thickness	100...500 нм
hardness	60....70 ГПа
wearing factor	$(1...3)\cdot 10^3$ $\mu m^3/Н\cdot м$
termalstability	up to 350 ^oC

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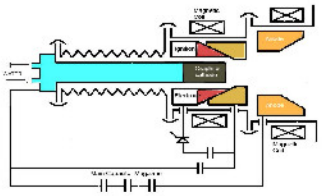
DIAMOND-LIKE COATINGS: MANUFACTURING AND APPLICATION

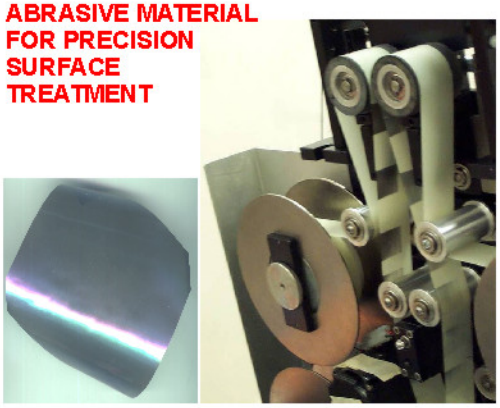
DLC COATING PROPERTIES:

- Thickness, nm ..... 10 to 1000
- Density, g/cm^3 ..... 2.8 to 3.1
- Young's Modulus, GPa .. 650 to 700
- Hardness, GPa ..... 60 to 70
- Friction coefficient ..... 0.1 to 0.15
- Wearing, μm^3/N•m ..... (1 to 3)•10^3
- Thermo-stability, °C ..... up to 400
- Thrombocyte test Index ..... > 4.5
- Endotelization period, days 30

CARBON PULSED ARC PLASMA SOURCE

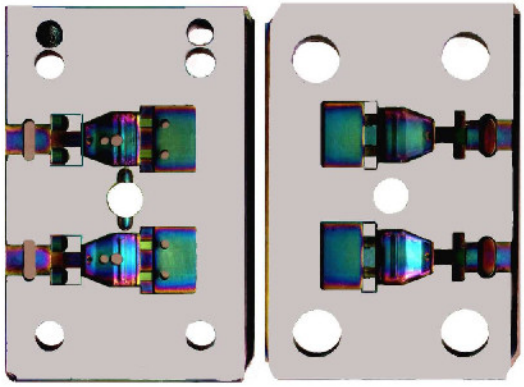


ABRASIVE MATERIAL FOR PRECISION SURFACE TREATMENT



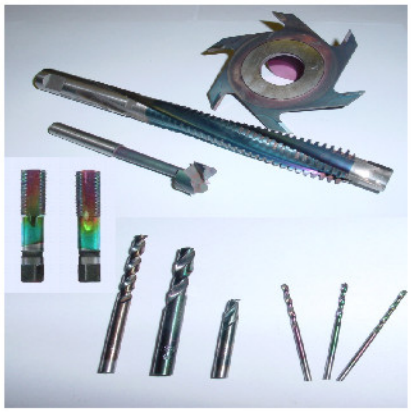
MACHINE PARTS (a ball connection, plungers

PLASTIC TRANSFER MOLD



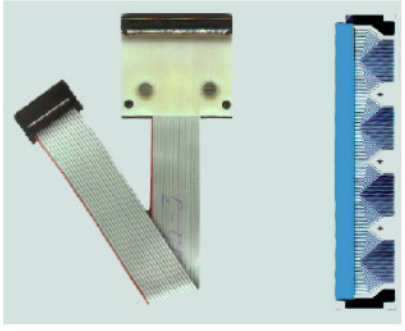
GAS ION SOURCE

CUTTING TOOLS

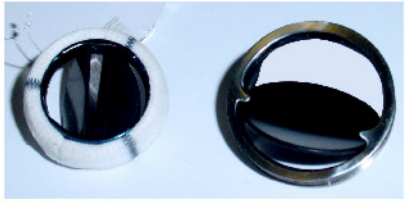


MEASURE TOOLS

THERMAL PRINT HEADS



ARTIFICIAL HEART VALVES



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MAGNETIC PULSE PRESSES OF MIP SERIES

MULTI-PURPOSE OPERATION, FLEXIBILITY, HIGH QUALITY, MINIMUM POWER REQUIREMENT AND MATERIAL AND WORKING COSTS.

MIP 40 Press

APPLICATION

Forming-assembling production
in machine-building, automotive and instrument industries, pressing-sintering of parts in powder metallurgy. Flow lines of packing, capping and hermetic sealing in chemical, food and pharmaceutical industries.

KINDS OF PROCESSED MATERIALS

Nonferrous metals and alloys, low-carbon steels and nonmetallic thin sheet materials.

ADVANTAGES

- Combination of stamping and assembling operations, decrease of die tooling costs by 5 to 20 times.
- Increase of metal deformation degree by 20 to 50 % and post-deformation strength by 20 %
- Possibility to carry out stamping without tool/workpiece contact while retaining initial quality of metallic, plastic and paint or varnish coatings with high degree of process sterility during assembling.
- High strength, tightness and thermal resistance of joints and 1.5-fold decrease of contact electric resistance of cable lugs and joint sleeves.
- Possibility of shaping of metallic powders and volume forming of sintered porous materials.
- Possibility of shaping of profiled long-sized items.

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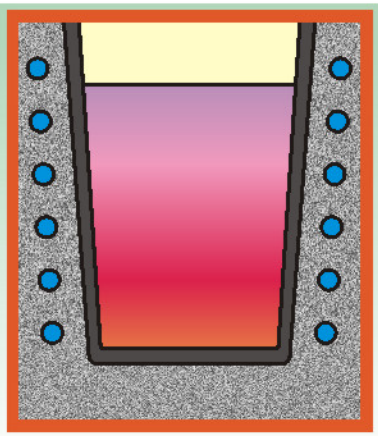
REFRACTORY CERAMIC MATERIALS FOR CASTING PRODUCTION OF NONFERROUS METALS AND ALLOYS



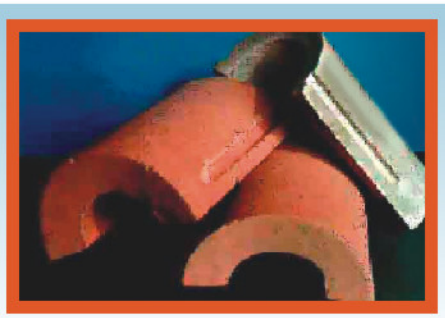
REFRACTORY CERAMIC MATERIALS ARE DESIGNED TO PRODUCE:

- Linings of melting furnaces.
- Component gating parts of molds.
- Refractory daubs and coatings.

OWING TO HIGH HEAT RESISTANCE AND LOW THERMAL CONDUCTIVITY THE MATERIALS:

- Are used in permanent split casting molds.
- Increase casting quality.
- Cut down material resource expenditures due to decrease of casting feeder.
- Decrease metal consumption during remelting.
- Ensure the possibility of periodical stopping and startup of induction furnaces and their shutdown during non-working days.

Refractory ceramic materials are produced from grounded fire-clay powders, aluminum slag, high strength clay with additions of phosphor-containing elements (including those obtained from production wastes) using the method of all-round compression of wetted mixture and subsequent heat treatment.



PHYSICAL AND MECHANICAL CHARACTERISTICS:

Ultimate compression strength after drying, MPa	26.0
Average density, kg/cm^3	1900
Linear shrinkage, %	0.2
Refractoriness, °C above	1610
Heat resistance under the conditions:	
Heating up to 950°C, air cooling cycles more	60
Temperature of 4-% deformation under the load of 0.2 MPa, °C	1350
Maximum allowable temperature of use, °C	1300

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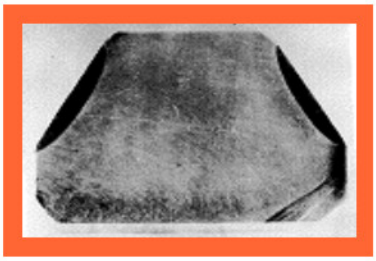
ELECTRON BEAM TECHNOLOGIES

TECHNOLOGIES	FIELDS OF APPLICATION
Surface hardening	Machine building, tool production
Surface melting, cladding	Refining of ingot surface, formation of wear resistant coatings
Welding	Machine building
Brazing	Tool production
Remelting	Metallurgy of pure metals and alloys. Use of wastes of expensive metals, production of targets for vacuum evaporation setups

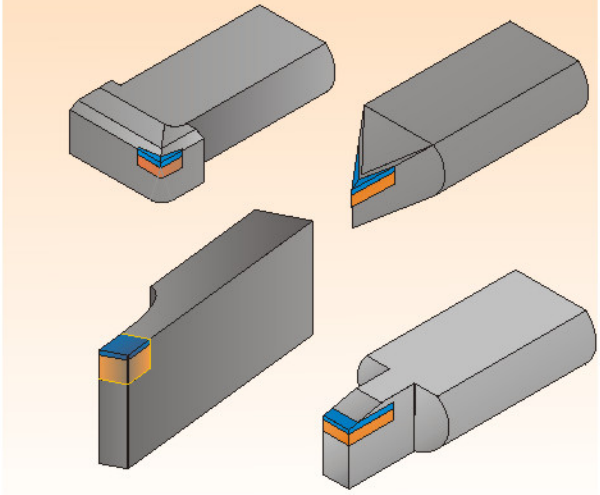
Electron beam with power of up to 1-15 kW ensures single-run **welding** of metals (such as steels, Al, Ti, Cu alloys, etc.) 1 to 150 mm thick with minimum deformations and maximum mechanical properties.



Surface hardening is carried out under the conditions of:

- Solid and liquid state quenching
- Cladding and surface alloying
- Treatment of predeposited coatings.

Hardening depth is from several microns up to 3 - 20 mm.



Brazing is used for production of tools with cubic boron nitride and polycrystal diamond tips. Such tools can be used for cutting steels and irons with the hardness of up to HRC 60-75, nonferrous metals and ceramics (Al_2O_3, SiC, siliconized graphite). Cutting speed is 3 to 40 times higher as compared with that used for hard material tools and amounts to 10-50 m/s. High accuracy and low surface roughness (0.05 - 0.63 μm) can be achieved.

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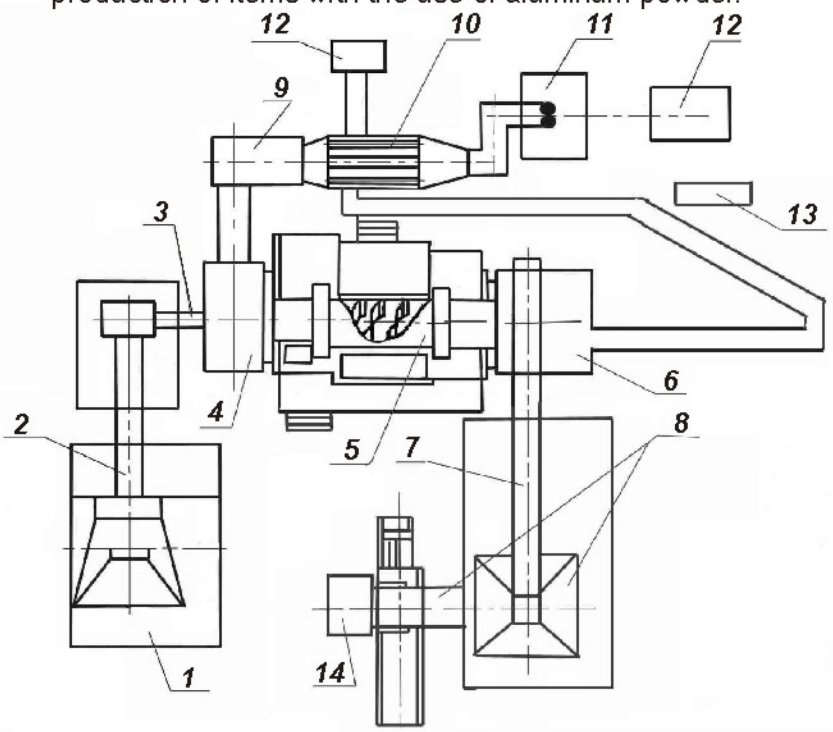
TECHNOLOGICAL COMPLEX FOR REPROCESSING OF ALUMINUM WASTES INCLUDING CHIPS AND SLAG

Combined efforts of Minsk Motor Plant specialists and researchers of Physical-Technical Institute of National Academy of Sciences of Belarus have led to a successful development of the complex that allows carrying out drying of chip wastes with annual output of 500 thousand tons and their separation from magnetic and weak-magnetic inclusions such as niresist of Fe-13 Ni-7 Cu composition.

The use of products resulting from burning of chip contaminants (lubricant coolant, etc.) as a protective atmosphere has enabled:

- Increase of metal output by up to 92 % to 95 %
- Eliminating the possibility of chip inflammation during remelting
- Intensification of mechanical dispersion of chip during production of items with the use of aluminum powder.



1 Receiving bin
2 Charging conveyor
3 Inertial chute feeder
4 Charging chamber
5 Drier drum
6 Furnace
7 Discharging conveyor
8 Chip separation and discharge system
9 After-burning chamber
10 Recuperator
11 Off-gas aspiration system
12 Fan
13 Control box
14 Container

Magnetic separation installation

The problems solved include not only effective reprocessing of chip for the purpose of its subsequent use during manufacturing of strength machine-building parts but also reprocessing of slag (its enrichment) for remelting in gas furnaces as well as for obtaining the refractory ceramic materials that are to be used for production of aluminum cast products. This ensured saving of power and material consumption as well as decrease of manufacturing costs and increase of material utilization coefficient. In 2006 year the total economic benefit resulting from industrial implementation of the technological complex was 270 thousand USD.

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CROSS-WEDGE ROLLING

Cross-wedge rolling (CWR) is designed for production of items of the type of solids of rotation with lengthened axle. The CWR technology increases labor productivity 10 times, decreases the norm of metal use by 30-60%. 30 % of world inventions in the field of CWR belong to the Physical-Technical Institute of the National Academy of Sciences of Belarus.

CWR MILL

ROLLED PARTS

Spheres of the technology application - the CWR is used in automobile, machine-building, instrument-making, agricultural machinery, tractor, and aircraft industries and in the atomic industry to machine structural and a range of instrumentall steels, refractory steels as well as copper-, titanium-, and zirconium-base non-ferrous alloys.

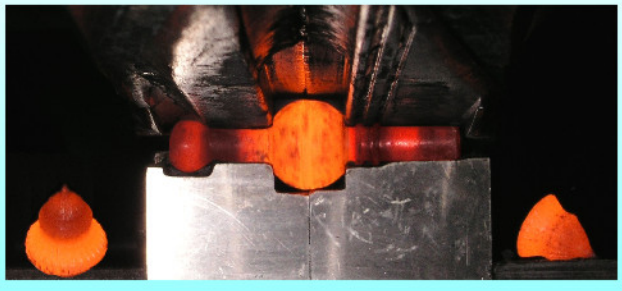
Sizes of rolled parts: diameter from 5 to 160 mm, length from 30 to 1000 mm.

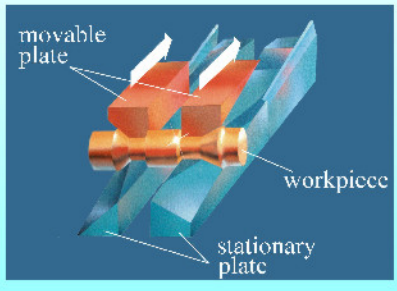
Equipment repayment term is less than a year.

The CWR technology and equipment are in operation in Belarus, Russia, the Ukraine, Poland, the Czech Republic, Italy, Spain, Turkey, the USA, Mexico, India and Korea.

COMBINED PROCESS: ROLLING-STAMPING

CWR PROCESS





Our service: ● Delivery of the CWR equipment; ● Delivery of rolled parts; ● Delivery of the drawings of the equipment; ● Training of specialists.

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