VIAM IS THE LEADING STATE SCIENTIFIC CENTER IN THE AREA OF MATERIALS SCIENCE

VIAM realizes a full innovative cycle from fundamental and applied research till creation of high-tech science-intensive productions for new generation materials, semi-finished products and unique technological equipment.

Develops and delivers a wide range of metallic and non-metallic materials, coatings, technological processes and equipment, methods and means of protection from corrosion and biodeterioration.

The developments of VIAM are in great demand in machinery, space industry, energy, construction, medicine and other fields.

32 SCIENTIFIC AND TECHNOLOGICAL COMPLEXES ARE CREATED IN VIAM FOR THE DEVELOPMENT OF NEW GENERATION MATERIALS

They have more than 3600 units of processing equipment and serially produce 210 products.

VIAM TESTING CENTER

Includes 19 complexes of a unique stand and test base.

Conducts more than 500 types of tests on 1100 units of the research and testing equipment.

Accredited as a technically competent center by Rosstandart, Aviation register of the IAC, JSC Rusnano, recognized by the Snecma of the SAFRAN group.

Included in the international climate testing stations network ATLAS Material Testing Technology LLC, European Federation of Corrosion (European Federation of Corrosion - EFC).

Cooperates with Q-LAB company.

Every year VIAM creates on average more than 40 brands of materials and about 150 developments and technologies of the institute are mastered in the industry. Almost 100 inventions of VIAM are used in its own production. Scientific developments of the institute are protected by copyright certificates (over 5 thousand) and patents (more than 900).
VIAM branch G.V. Akimov Gelendzhik center of climatic tests (GCTC of VIAM) – is the only scientific center in Russia allowing complex tests of materials, structural elements and products, as well as the development of systems for protection against corrosion, ageing and biodeterioration in the conditions of marine climate.
VIAM branch – Voskresensk experimental and technological center for special materials (VETC VIAM) has no analogues in Russia and the CIS and carries out research in the field of beryllium-containing alloys with closed metallurgical production and also develops and applies unique technologies for utilization and recycling of beryllium production waste. It produces polymer binders, prepregs and materials for anechoic chambers.
VIAM Branch – Ulyanovsk Scientific and Technological Center (UNTC VIAM) is one of the leading enterprises in the Ulyanovsk region to develop innovative technologies. Produces semi-finished products and products made of polymer composite materials.
The testing center of VIAM organizes and conducts research, testing of materials, including certification, arbitration and expertise. The definition and evaluation of the entire range of parameters for the working capacity of materials is carried out on a modern testing and research base that meets domestic and foreign standards.
THE TESTING CENTER OF VIAM

VIAM OFFERS:

- research of metal and non-metallic materials, complex in chemical and phase composition and structure;
- qualification tests of materials, semi-finished products and elements of structures;
- arbitration tests;
- forecasting the working capacity of materials and analysis of the reasons of structural elements destruction;
- development of standard samples and measurement procedures for determination of the chemical composition of materials.
**COMPREHENSIVE SYSTEM OF PROTECTION FROM CORROSION, AGEING AND BIODETERIORATION OF STRUCTURES FROM PCM**

**VIAM OFFERS:**
- development of integrated protection systems for structures made of metal, polymer composite materials and their compounds;
- development of protection and repair technologies;
- climatic and mycological tests.

**RESEARCH AND ANALYSIS OF REASONS FOR DESTRUCTIONS**

**Specimens**
- Full-scale testing of samples of materials, assemblies and structures in a free state at open air sites
- Accelerated testing of sample materials
- Mycological tests of samples

**Joints**
- Full-scale tests with simultaneous exposure to climatic factors and mechanical cyclic loading of large-sized structural elements from PCM with complex protection.

**Structures**
- The «carbon-plastic-aluminium alloy» compounds
  - Without protection
  - With an integrated protection

**BIODETERIORATION**
- Corrosion destruction of «carbon-plastic-aluminium alloy» joints during the operation of aviation equipment for 5 years
- Effects of biodestructors on structural element
- Aviation fuel struck by microflora
- Rescue ladder kit

**INTEGRATED PROTECTION SYSTEM**
- protective inorganic coatings;
- sealants;
- separation layers;
- primers and enamels.

**VIA OFFERS:**
- Corrosion destruction of «carbon-plastic-aluminium alloy» joints during the operation of aviation equipment for 5 years
- Full-scale testing of samples of materials, assemblies and structures in a free state at open air sites
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**ANNUAL LOSSES FROM CORROSION AMOUNT TO 2.2 TRILLION US DOLLARS (3.1% OF WORLD GDP) IN THE WORLD*. EVENTS FOR COMPLEX CORROSION PROTECTION REDUCE LOSSES BY 25% **.**

* "Now is the time" G.F. Hays, World Corrosion Organisation, «Corrosion cost and preventive in the United States**.


**VIAM CONDUCTS ACCELERATED AND FULL-SCALE TESTING OF MATERIALS AND STRUCTURES AT 9 CLIMATIC STATIONS (MOSCOW, GELENDZHIK, SOCHI, YAKUTSK, DAM BAY, HOA LAK, CON ZO, ARIZONA, FLORIDA) AND MYCOLOGICAL TESTS AT 6 STATIONS (MOSCOW, ZVENIGOROD, SOCHI, SARANSK, NHÀ TRANG, HANOI).**
The Test Center (TC) of VIAM has been testing for fire safety since the 1970s, has extensive experience and the necessary test base for conducting qualification tests to ensure compliance with the requirements of domestic and foreign aviation standards (AP, FAR, CS - Chapters 23, 25, 27 and 29, paragraphs. 853, 855, 856).

- Studies and standard tests carried out in the IC VIAM allow the assessment of fire safety and ensure the development of new competitive domestic materials.
- Only the TC of VIAM is accredited by AR IAC and can conduct a complex of qualification tests of materials for fire safety according to the characteristics of flammability, smoke generation, heat generation, inflammability of thermal and acoustic insulation materials and resistance to materials of life-saving inflatable structures.
- The only equipment in Russia for determining heat generation is available in VIAM. It allows testing materials and obtaining approval for certification in Russia for aircraft type.

To obtain approval for a certificate of the type of aircraft or helicopter it is necessary to qualify the materials used for fire safety to ensure compliance with the requirements of aviation standards pp. 853, 855, 856, and others.

The qualification of polymer materials and structural elements for fire safety is one of the main components of the process certification of an aircraft. Trust in foreign certificates and savings on testing in Russia have already led to fires in the objects of JSC Russian Railways made of polymer materials.

TC VIAM has been conducting fire safety tests for more than 40 years in accordance with the requirements of aviation standards and is ready to fill the necessary volume of qualification tests with the issuance of evidentiary documentation on tested materials and structural elements.
V-1341 and 1913 are for products of the national economy, capital construction and automotive industry. Alloys can be used in welded constructions due to the high characteristics of welded joints.

All materials are mastered in the conditions of OJSC KUMZ.

Alloys have strength at the level of alloy V95 with density reduced by 5–10%, rigidity increased by 10% and high corrosion resistance.

The half-pipe of alloy V-1341

Expansion vessel of alloy V-1341

NEW GENERATION OF SUPER-LIGHT AL-LI ALLOYS - B-1469 AND B-1461

HIGH-STRENGTH ALLOYS V96TS3P.CH. AND V-1963 OF THE AL-ZN-MG-CU SYSTEM FOR HIGHLY LOADED ELEMENTS

VIAM OFFERS:
- development of technologies for the production of the required range of semi-finished products with all documents for delivery;
- technological support during production;
- licenses for developed materials.
VIAM OFFERS:

- testing and mastering of alloys and technologies;
- supply of non-stick additive materials;
- technological support during production of parts;
- licenses for developed materials and technologies.

WROUGHT MAGNESIUM ALLOYS

High-strength alloys MA5, MA14, MA14gr

High-temperature alloys MA12, MA22. Alloy of the new generation VMD16, workable long under up to 200°C, for a short time under up to 300°C.

High-tech welded alloys MA20, MA20-SP

CASTING MAGNESIUM ALLOYS

High-strength alloys ML5, ML12, VML20

Corrosion-resistant alloys ML5P.CH., VML18

High-temperature alloys ML9, ML10, ML19

Application of casting magnesium alloys ensures weight reduction by 20-25%.

High-temperature alloys ML5, ML10, ML19

Carter motor of a car from the alloy ML5. Perspective is the alloy of the new generation VML18.

The wheel of ML12 alloy. Perspective is alloy of the new generation VML20

CASTING ALUMINUM ALLOYS

Technological hermetic aluminum-silicon alloys AL32, AL4MS. Alloy of the new generation AL4MS possesses optimal combination of mechanical properties, casting by any means.

High-strength heat-resistant alloys of the «solid solution» type VAL14, the alloy of the new generation VAL20 system Al-Cu-Mg high-strength technological. Fluidity is 300 mm. Molding castings of complex configuration in sand molds.

The use of new-generation alloys will provide a reduction in mass by 20–30%.

The industrial site for low-tonnage production of the non-stick additive VM-U, used for obtaining high-quality magnesium casting is organized at VIAM.

The wheel of ML12 alloy. Perspective is alloy of the new generation VML20

Gas-pumping unit GTU-12P. Fan housing and oil pump from ML5, ML10 alloys

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VIAM OFFERS:

- development of technologies for obtaining semi-finished products and thermal processing processes according to the Customer’s specification;
- carrying out physical and mechanical tests, analysis of the structure of parts and semi-finished products of titanium alloys;
- services for manufacturing forgings and stampings from titanium alloys with a mass of up to 35 kg and a diameter of up to 400 mm.

HIGH-STRENGTH ALLOYS

VT43 alloy for power structures:

\[
\sigma_u = 1150 \text{ MPa; } \sigma_{0.2} = 1100 \text{ MPa; } T_o = 400^\circ\text{C.}
\]

VT23 alloy (VT23M) for power structures up to a temperature of 600 °C aviation, rocket and space technology:

\[
\sigma_u = 1150 \text{ MPa; } \sigma_{0.2} = 1060 \text{ MPa; } T_o = 400^\circ\text{C.}
\]

Alloy VT22 (VT22M) for power parts of fuselage and chassis:

\[
\sigma_u = 1100 \text{ MPa; } \sigma_{0.2} = 1080 \text{ MPa; } T_o = 350^\circ\text{C.}
\]

VT38 alloy (sheet). Sheets of thickness 0.6 - 3.0 mm:

\[
\sigma_u = 960 \text{ MPa; } \sigma_{0.2} = 920 \text{ MPa; } T_o = 600^\circ\text{C.}
\]

The use of alloys provides a reduction in the mass of structures by 104% and an increase in crack resistance by 404%.

HEAT-RESISTANT ALLOYS FOR GTE AND GTU DETAILS

Pseudo-α-alloy VT41 for disks, blades:

\[
\sigma_u = 1100 \text{ MPa; } T_o = 600^\circ\text{C.}
\]

The alloy is designed for discs, aircraft engine blades of a new generation, operating up to a temperature of 600°C.

INTERMETALLIC ALLOYS FOR GTE DETAILS

The wrought ortho-alloy VTI-4:

\[
\sigma_{0.2} = 850–900 \text{ MPa; } \sigma_{0.2} = 310 \text{ MPa; } T_o = 650^\circ\text{C.}
\]

Casting γ-alloy VTI-3L:

\[
\sigma_{0.2} = 450–470 \text{ MPa; } \sigma_{0.2} = 210 \text{ MPa; } T_o = 800^\circ\text{C.}
\]
HEAT-RESISTANT WROUGHT ALLOYS FOR GTE TURBINE DISKS

VIAM OFFERS:

- development of materials and production technologies for semi-finished and finished products in accordance with the Customer’s specification;
- GTE disks stampings of small size;
- license agreements for alloys and technologies.

PROPERTIES OF ALLOYS

VZh175-ID ALLOY IS BETTER THAN THE BEST DOMESTIC AND FOREIGN ANALOGUES BY ITS PROPERTIES

The technologies of disks stampings production from alloy VZH175-ID are developed and introduced in production:
- large-sized (diameter up to 650 mm) at OAO MZ Elektrostal and OAO SMK;
- small-sized complex contour (diameter up to 320 mm) by isothermal deformation in air at VIAM.

ISOTHERMAL STAMPING ON AIR DIFFUSION DIFFICULT TO DEFORM HEAT-RESISTANT ALLOYS

Benefits:
- Increase metal utilization by 2–3 times.
- Reduce labor intensity and energy intensity by 3–5 times.
- Increase productivity by 10–15 times.

PRODUCTION OF PROTECTIVE TECHNOLOGICAL COATINGS

Release more than 32 brands of coatings.
Capacity - 40 tons per year.

Application:
- isothermal punching in air burnt high-temperature alloys;
- protection of parts and structures from high-strength steel and alloys during heat treatment.

The use of coatings allows increase the service life of the die tooling by 3–5 times.
Saving of metal is 8–10%.

Properties of Alloys

<table>
<thead>
<tr>
<th>Parameters</th>
<th>USA, Germany, France</th>
<th>Russia (VIAM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature $T_{\text{o}}$ °C</td>
<td>1000–1100</td>
<td>1000–1200</td>
</tr>
<tr>
<td>Medium</td>
<td>Vacuum</td>
<td>Air</td>
</tr>
<tr>
<td>Material of stampings</td>
<td>Molybdenum alloys</td>
<td>Intermetallic alloys</td>
</tr>
<tr>
<td>Technological cycle</td>
<td>1.5–2 hours</td>
<td>5–7 minutes</td>
</tr>
<tr>
<td>Protection from oxidation</td>
<td>No</td>
<td>Technological coating</td>
</tr>
</tbody>
</table>

VOLUME OF PRODUCTION: up to 2000 pcs. in year.
FUNCTIONAL MATERIALS

WEATHERPROOF
AK-1206, VE-46, VE-46K, VE-69, VE-69K, VE-76K enamels in various colors (matte and glossy) for decorative and deforming coloring, provide resistance to UV radiation, oils, fuels, non-flammable liquids. Funginertness: 1–2 points.

EROSION RESISTANT

CORROSION RESISTANT

FUEL RESISTANT

HEAT RESISTANT
KO-0070 putty, KO-052, KO-0170 primers, KO-811, KO-856, KO-818, KO-5189 enamels for items operating from -60 to + 400°C - for a long time.

ANTISTATIC

RADIO-TRANSPARENT

THERMALLY-REFLECTING
VE-72 enamel for fabrics and film materials.

SPECIAL COMPOUNDS
PSP-2M, KSP-2 welding compounds, ALKM-1 paste for protection of welded and fastening joints.

VIAM OFFERS:
• supply of paints and coatings;
• development of paint systems and painting technologies.
FUNCTIONAL MATERIALS

VIAM OFFERS:

- supply of materials;
- development of manufacturing technologies for structural elements.

SILICON-ORGANIC SEALANTS AND COMPOUNDS

VIXINT U-1-18, U-2-28, U-4-21, VGO-1 sealants, K-18, K-68, PK-68, PKF-68 compounds for sealing joints of structures, cabins, fuselages, heat-loaded assemblies, plug connectors and elements of instrument equipment operating in the air environment.

FIREPROOF MATERIALS

VOP-4, VZO-9, VZO-9X pastes to protect units and structures from temperatures up to 1150°C for 15–30 minutes.

TZR-5M is an elastomeric material for protection against heat flow with a temperature of 1100°C for at least 15 minutes.

FOAM SEALANT VPG-300M

Frost-resistant sealant for surface and electrical protection of instrumentation, radio electronic equipment, electrical connectors is operable in the temperature range from -120 to +300°C.

FUEL-RESISTANT THIOKOL SEALANT

Operable at temperatures from -60 to +130°C and up to +150°C for a short time.

Recommended for sealing:
- cabins, fuel tanks, elements of cellular structure of aircraft and helicopters - U-30MES-5, U-30, MES-5M, VER-1 (black), VITEF-1 (light beige);
- cabins, lanterns and other products made of organic glass (glazing) and PCM of aircraft and helicopters - VITEF-1B (green), VKT-1-29 (beige-pink);
- riveted, welded and bolted joints of structures including uncontrolled gaps of connecting parts, VGM-L (ribbon, light beige).

PNEHERMETIC OF VPG-300M

Designed for hermetic sealing, vibration and electrical protection of instrumentation and filling of free volume (designed to replace foamed sealer PG-2L).

VIKSINT KTM

It is designed for sealing heat-loaded energy-saturated products with a high density of installation and small gaps (up to 1–2 mm) operating in the temperature range from -70 to +250°C.
POLYMER COMPOSITE MATERIALS

Composite materials of the new generations are developed on the basis of thermoplastic and thermosetting-matrices (solution and melt including glue ones) and carbon, glass, aramid, hybrid reinforcing fillers.

More than 300 types of PCM have been developed, including 75 new generation materials:
- carbon plastics – 40 materials;
- fiberglass – 25 materials;
- organoplastics – 10 materials.

Materials of the new generation reduce the coefficient of properties variation from 15 to 4%.

INFORMCOMPOSITES

PCM with integrated sensors for monitoring deformation and temperature of critical and highly loaded structures.

Monitoring system is sensors, data collection and processing, software

Fiber-optic point and quasi-distributed sensors based on the fiber Bragg grating (FBG)

The device for data collection and processing for point and quasi-distributed optic fiber sensors FBG

Application of informcomposites
Traffic flow control: speed, mass, intensity

Materials are created by the principle of unity «MATERIAL-TECHNOLOGY-CONSTRUCTION»

VIAM OFFERS:
- development and delivery of polymer composite materials with the function of stress-strain-state monitoring for complex technical systems;
- supply of binders and prepregs.
THERMOPLASTIC ELASTOMERS, FOAM PLASTICS AND SPHEROPLASTS

CASTING AND VIBRATION ABSORPTION THERMOPLASTIC ELASTOMERS

VTEP-1L
Recommended instead of rubber for doors and hatches hermetic sealing.

VTEP-2L
Recommended instead of rubber for seals and shells of wires.

VTP-1B
Recommended as a vibration-absorbing material for reducing structural noise inside the passenger aircraft cabin.

VTEP-3L
Recommended instead of rubber for seals in the fuels and lubricants environment and at elevated temperatures.

POLYIMIDE AND PHENOLIC-RUBBER FOAM PLASTICS

VPP-1
Recommended as a light insulation instead of the thermal insulation of ATM-1, taken out of production.
Analogue of «Solimid» (USA) foam plastic.

VPP-3
It is fireproof. Designed to replace honeycombs in the manufacture of three- and multi-layer structural and radio-technical panels.
Analogue of «Ronassel» polystyrene by Evonik.

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Analogue of «Ronassel» polystyrene by Evonik.

FC-20
Constructional helicopters blades and screw-fans filler.
FK-20-A-20
Heat-insulating filler.
FK-40
Damping and heat-insulating filler for the manufacture of large-sized thermal protection screens.

VPZ-7M, VPZ-10, VPZ-18
Operating temperature is up to 80°C
VPZ-18 – with reduced curing: ≤12 hours at T = 21±3°C).

VPZ-14
The operating temperature is up to 160°C.

VPZ-16M
The operating temperature is up to 80°C. The material is intended for co-molding with honeycomb structures.

VPZ-17
Operating temperature up to 160°C. Rolled material for multilayer structures with claddings of glass and carbon plastic.
For the certification of the engine according to the AR IAC, EASA, FAA regulations, a statistically valid amount of information on the structural strength characteristics of metallic materials is required:

- 50–1200 samples per material at the stage certification of the engine (total ~ 18,000 samples);
- 900–2100 samples per material at the stage of developed operation (total ~ 45,000 samples).

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Values</th>
<th>Standards</th>
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</thead>
<tbody>
<tr>
<td><strong>Characteristics of elasticity and short-term tensile strength</strong></td>
<td>( T = 20, 150 \ldots 1200^\circ C )</td>
<td>( E, \sigma_u, \sigma_{0.2}, \delta, \psi ) diagram stretching for mean values</td>
</tr>
<tr>
<td><strong>Characteristics of long-term strength and creep at tension</strong></td>
<td>( T = 350 \ldots 1200^\circ C )</td>
<td>( \sigma_{100}, \sigma_{500}, \sigma_{1000}, \sigma_{0.2/100}, \sigma_{0.2/500}, \sigma_{0.2/1000}, \sigma_{0.5/100}, \sigma_{0.5/500}, \sigma_{0.5/1000}, \sigma_{1.0/100}, \sigma_{1.0/500}, \sigma_{1.0/1000} )</td>
</tr>
<tr>
<td><strong>Characteristics of low-cycle fatigue (LCF)</strong></td>
<td>( T = 20, 300 \ldots 1100^\circ C )</td>
<td>( \sigma_{R} ) based on ( N = 10^5 \ldots 10^8 ) cycles, ( R = -1, 0, 0.5 ) With probability non-destructive 50–99%</td>
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<td><strong>Characteristics of multi-cycle fatigue (MCF)</strong></td>
<td>( T = 20, 300 \ldots 1100^\circ C )</td>
<td>( \sigma_{R} ) based on ( N = 10^5 \ldots 10^8 ) cycles, ( R = -1, 0, 0.5 ) With probability non-destructive 50–99%</td>
</tr>
<tr>
<td><strong>Characteristics crack resistance (SRT) at the MSC</strong></td>
<td>( T = 20, 150 \ldots 1000^\circ C )</td>
<td>( d/dN ) at ( \Delta K ), MPa m(^{1/2} )</td>
</tr>
</tbody>
</table>
PRODUCTION ACTIVITIES

25 high-tech science-intensive low-tonnage production, producing 234 products

- Research and Production Complex for Research and Development protective and hardening coatings
- The research and production complex for obtaining fine-dispersed powders of solders and alloys based on Ni, Fe, Ti
- Scientific and production complex for the design and manufacture heat resistant foundry and deformable alloys and steels
- The research and production complex for the manufacture of stampings of disks from hard-deforming high-temperature alloys under isothermal conditions on air
VIAM OFFERS:

- binders for infusion for manufacturing parts from PCM;
- solvent binder for the production of prepregs;
- supply of PCM prepregs;
- development of manufacturing technologies for structural elements;
- manufacturing of forming tools and elements structures from PCM.
PRODUCTION OF HIGH-DEFORMABLE BINDERS AND ADHESIVES OF NEW GENERATION

In 2013 the first in Russia small-batch scientific and production complex (the first stage) for the production of binders and glues of melt type (financing is by Russian Ministry of Industry and Trade and own funds of institute).

- More than 15 brands of binders and adhesives are produced.
- The planned capacity of production is 60 tons / year.
- Automated control and support of technological processes parameters.

This complex supplies materials for the production of aviation technics including: PD-14, MS-21, IL-114, SSJ-75 and others.

The demand is up to 120 tons of products per year.

The project was developed to increase capacity to 100 tons / year with a two-shift work to ensure the materials production.
MANUFACTURE TECHNOLOGY OF LARGE-SIZE ARCH ELEMENTS FROM CARBON PLASTICS

The technology is used in the construction of prefabricated bridges with the use of arch-shaped structures as elevated elements and profiled flooring.

2. Sensors of the control of the strain condition on the basis of informcomposites.
3. Road detector with integrated fiber optic sensors based on FBG.
4. Concrete.
5. Profiled sheeting.
7. Road surface.

The standard concrete sample can withstand the compression load:
• 60 t - with carbon plastics reinforcement;
• 20 t without reinforcement.

Test results of the arch bridge element:
Loading 30 t: appearance of a crack in carbon fiber without destroying and deforming of construction (NIU MSSU).

Construction of a pilot facility – a two-lane pre-fabricated bridge with sidewalks using arch supports (span length - up to 15 m) as elevated parts and profiled flooring of composite materials, CFRP and fiberglass. (Implemented with the support of the Ministry of Industry and Trade of Russia within the framework of the «Composites» subprogram.)

Place of construction:
Russia, Ulyanovsk region, Karsunsky district, village Yazykovo
EFFICIENCY OF ADDITIVE PRODUCTION FROM METAL POWDERS

Unique capabilities of additive production

Creation of technologies for obtaining parts with any complexity of channels and cavities, determined by design decisions, the implementation of which is impossible with the use of foundry technologies.

Production of complex and unique parts without machining and expensive tooling.

Transition to bionic design of parts and structures.

Additive technologies
The technology of obtaining ultra-pure powders and additive synthesis technologies (3D-printing) of complex shape parts and structural elements in mathematics-models without machining.

Reducing the complexity of manufacturing parts in 10-30 times.
VIAM developed technologies and regulatory documentation for 26 brands of domestic powders (solders and powders for additive technologies).
ADDITIVE PRODUCTION OF PARTS FROM METALLIC POWDERS

DIRECTIONS OF WORK

Development of technologies of metal powders production
Experimental and serial production of high-quality powders for additive technologies

Development of synthesis technologies of parts
Samples computerized modelling
Modelling and forming layers quantity

Development of hot isostatic pressing technologies
Reducing porosity, increasing structural homogeneity

Materials qualification tests and certification of the production
Tests of mechanical properties, resource tests, general and special qualifications

Technologies transfer to production
Testing parts in complete products
ADVANCED TECHNOLOGICAL PROCESSES OF GTE BLADES MANUFACTURING

TECHNOLOGY OF CASTING OF FOUNDRY HEAT-RESISTANT ALLOYS

• use of extremely pure charge materials;
• active melt refining from impurities;
• microalloying of REM alloys (Ce, Y, La, etc.);
• express analysis in the process of smelting and fine-tuning the chemical composition to optimal;
• melt filtration during casting;
• casting in steel pipes with insulation inserts.

HIGH-GRADIENT DIRECTED CRYSTALLIZATION

HGDC technology provides:
• casting GTE blades with a single-crystal structure of rhenium-ruthenium-containing heat-resistant alloys of a new generation;
• an increase in the yield of a suitable structure up to 95% (at a blade cost of 10-50 thousand USD).

Directional crystallization
G = 40°C/cm (GE, PW)

High gradient directed crystallization
G = 200°C/cm (VIAM)

The yield is 60%
The yield is 95%

VIAM OFFERS:

• recycling of foundry wastes and supply of cast bar stock alloys;
• technology development and technical support;
• license agreements for alloys and technologies.

COMPETENCE CENTER FOR CREATION OF AUTOMATED COMPLEXES OF MONOCRYSTAL CASTING OF BLADES

Monocrystal blades and parts of the hot tract of aviation GTE

Obtaining castings with crystal-lattice orientation [001] without regard to azimuthal orientation

Obtaining castings with crystal-lattice orientation [001], [011], [111] with regard to azimuthal orientation

Directional crystallization

High gradient directed crystallization

Contract 95-3 Summary

• Thermal gradient >150K/sm has been observed
• The steady state gradient is about SOKfm
• This gradient (and the resulting cooling rate) is about 2.55 times of the laboratory units in the US
• It is about 30 times that of the advanced PG technology available in the US
WE LOOK FORWARD TO OUR COOPERATION

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