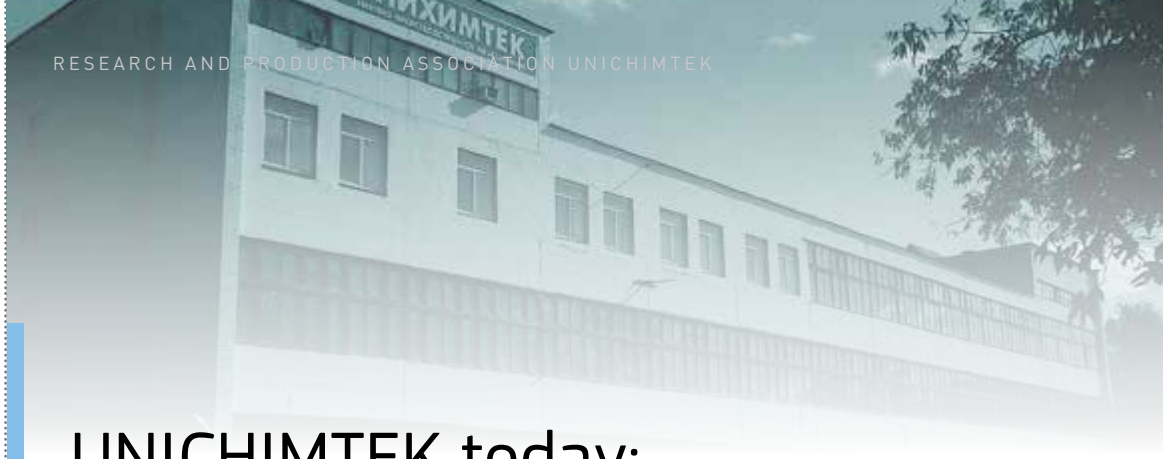
OGRAX®

TENSOGRAPH®

UNICHIMTEK

RESEARCH AND PRODUCTION ASSOCIATION



UNICHIMTEK today:

28000 m²
of in-house
floor space

115
patents,
including
international ones

5500
customers

35000
items
product range

600
employees
including 20 PhDs

From unique chemical technologies to reliability, safety and clean environment

History

In 1986 Applied R&D laboratory was established in the Moscow State University (MSU) with the support of USSR ministries and governmental agencies to develop new low-density carbon materials for defense and aerospace industry.

In 1990 In 1990 Research and Production Center (Company) "UNICHIMTEK" was set up on the basis of the applied laboratory. It was the first small state enterprise, established by the Moscow State University.

In 2000 In 2000 UNICHIMTEK became Russian market leader in the development, manufacture and supply of sealing and fire protection materials based on innovative technologies of graphite intercalation for industrial equipment and facilities. Governmental energy companies like Mosenergo, Chelyabenergo, Tyumenenergo, Kirovenergo, the Chekhov Power Engineering Plant became first UNICHIMTEK customers and partners.

In 2002-2003 In 2002-2003 National technical documents and standards were developed to apply new graphite sealing and fire protection materials at heat and atomic power generation companies.

In 2003 In 2003 the R&D unit — Institute of new carbon materials and technologies (JSC«INCMAT») — was established together with Moscow State University to intensify research and new products and technologies development.

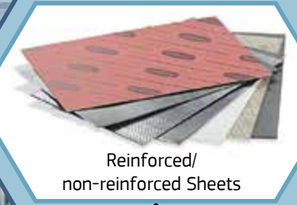
In 2012-2014 In 2012-2014 UNICHIMTEK is in the TOP 30 best innovative companies in Russia (According to TechUP rating).

UNICHIMTEK Technological Chart

70 patents
for products
and processes

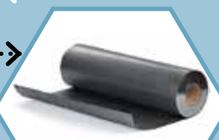
TENSOGRAPH®

Thermally expanded graphite



Reinforced/
non-reinforced Sheets

Flange gaskets



Graphite Foil

Spiral-wound gaskets,
kammprofile
gaskets

Braided packings
and molded
gland rings

Mechanical seals

Chemical treatment

Purified graphite
99,0 %; 99,8 %

Natural graphite
93%

Thermal treatment 2970 C°

Ultrapure graphite
99,99%

Thermal processing

Intercalated graphite

26 patents

28 patents
for products
and processes

OGRAX

Fire protection compositions

Fire protection roll materials

Fire protection couplings

Turnkey solutions
for Fire protection
of facilities

EURORUS

New developments, research, technologies, training

Carbon fiber fabrics
and tapes

Infusion binders, prepregs
and polymer composites

High-strength
carbon-carbon composites

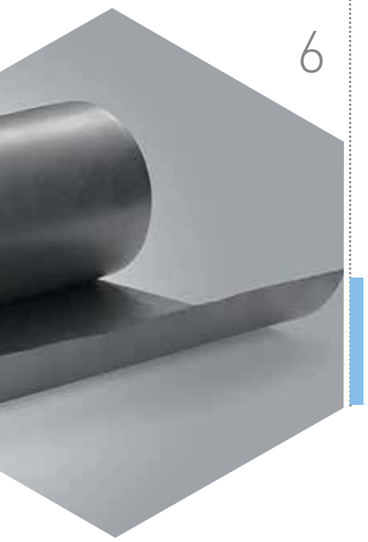
Heat distribution
low density materials

Foam vermiculite
and fire protection

Friction carbon materials
for aviation

Heat insulation plasters
and concretes

Heat insulation
and lining slabs



FLEXIBLE GRAPHITE FOIL TENSOGRAPH®

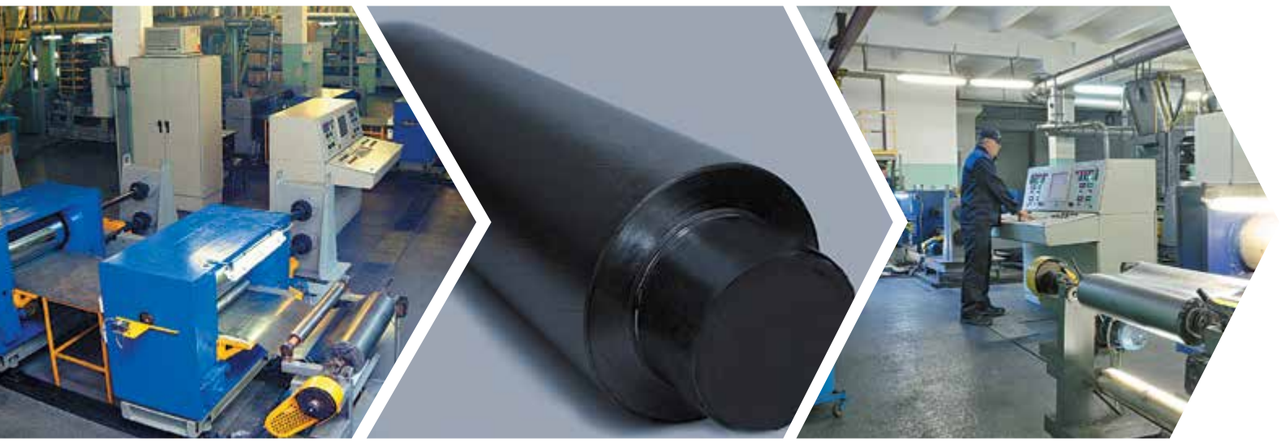
SEVERAL TYPES OF GRAPHITE FOIL TENSOGRAPH®, (STANDARD, HIGH PURITY HIGH-STRENGTH, AND REINFORCED WITH CARBON FIBERS ARE BEING PRODUCED).

UNICHIMTEK flexible graphite foil manufacturing site includes 8 production lines set up for standard foil and foil reinforced with various fibers. Maximal width of our graphite foil is 1500 mm. Physical and mechanical parameters are being controlled on all stages of production process.

Technologies and equipment for special treatment and intercalation of graphite allow to obtain sulphur free foil which doesn't transfer corrosion to metal parts contacting with foil.
At the customers' request we supply graphite foil with carbon content 96 % : 99.5 % and over. Extra pure graphite foil is applied in atomic industry and special objects.
Flexible graphite foil TENSOGRAPH® is used for manufacturing various high-quality flange and gland seals for thermal and atomic power plants, oil and gas transportation and processing, chemistry and other applications.

Typical properties of TENSOGRAPH® P high purity graphite foil

	Grade 1	Grade 2
Carbon content	>96 wt%	>99.5 wt%
Ash content	<3 %	<1 %
Density	1.0 g/cm^3	1.0 g/cm^3
Thickness	0.5 mm	0.3-0.8 mm
Tensile Strength (along rolling direction)	>4 MPa	>5,5 MPa
Sulfur content	<200 ppm	<200 ppm
Chlorine ion content	<30 ppm	<30 ppm
Width of rolls, sheets	Up to 1500 mm	Up to 1500 mm



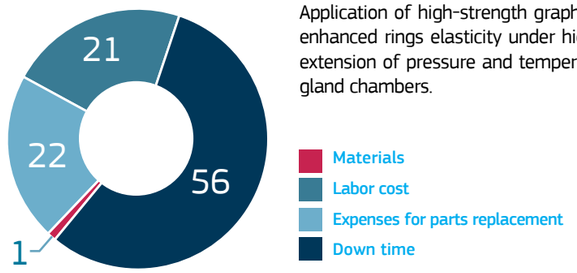
Tensile strength of high-strength graphite foil TENSOGRAPH®
exceeds that of standard grade graphite foils for more than 20 times.
It is used for manufacturing of multi-purpose sealing rings suitable for operating under high temperatures and pressures.

BRAIDED PACKINGS AND MOLDED GLAND RINGS TENSOGRAPH®

Gland sealing rings manufacturing by cold pressing of high purity graphite foil (99.9% grade and over) allows to produce high reliably non-corroding gland sealing rings TENSOGRAPH®. High purity of foil is particularly important for sealing the critical equipment in thermal and atomic power plants.

Braided gland packing manufacturing site is equipped with machines by the leading European companies, fibers by world industry leaders are used for packings production.
Friction coefficient of our braided packing is about 0.05. Application of graphite gland packings in pumps ensures sharp decrease of heat emission and power consumption. Extensive growth of linear speed (up to 25 m/s) of moving elements of the pump is also an important advantage. Valve stems are easier to move and the effect of "curing by graphite" of worn out stems and gland chambers was also observed.
Application of high-strength graphite foil TENSOGRAPH® reinforced with carbon fibers provides enhanced rings elasticity under high pressure and more uniform stress distribution, remarkable extension of pressure and temperature range. Rings do not brake, and can be used in worn out gland chambers.

Power plants valves repair costs structure (%)



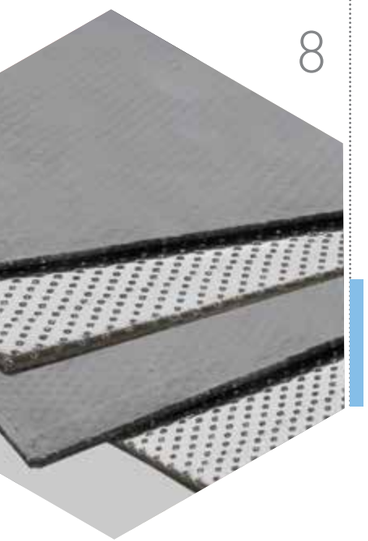
Braided packing TENSOGRAPH® is a good replacement to braided packing made of carbon fiber at lower cost.

According to power engineers estimates, application of TENSOGRAPH® gland seals allows consumer to:

increase repair interval
FIVE TIMES

decrease cost of equipment repair
IN TENS OF TIMES

significantly
reduce fuel and energy loss



TENSOGRAPH® SHEET MATERIALS

UNICHIMTEK developed, patented and implemented full cycle production technologies for TENSOGRAPH® sheet materials made of flexible graphite foil, as well as of graphite foil reinforced with 0.1 mm perforated stainless steel sheet.

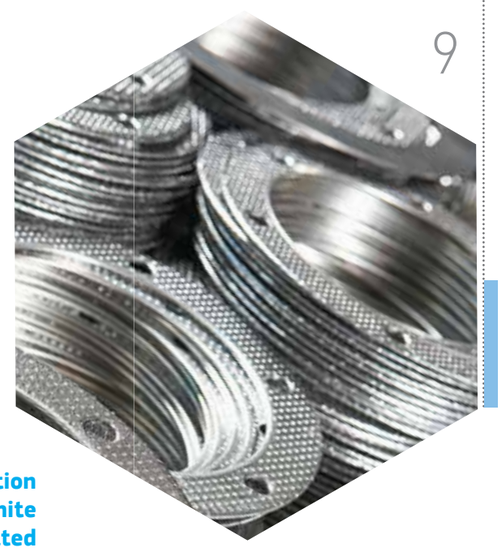
SHEET MATERIALS ARE UP TO 1500 MM WIDE, AND 0.3-5 MM THICK. TENSOGRAPH® SHEET MATERIALS ARE DESIGNED FOR MANUFACTURING FLANGE GASKETS.

UNICHIMTEK design-engineering department and testing laboratories possess successful experience in development of new technical solutions enhancing reliability and efficiency of equipment sealing in heat and atomic power engineering, in aviation and ground transport, in particular the following new technical solutions have been developed:

• solutions for compensator for TU-154M aircraft, allowing to save up to RUB 1 mln/year per one aircraft due to reduction of fuel consumption and maintenance expenses (in cooperation with Tupolev JSC and Rusairo components maintenance and repair department);

• solutions for sealing of major circulation pump junction with 1400mm dia gaskets at China, India and other countries NPP (coordinated with OJSC Central Mechanical Engineering Design Bureau);

• solutions on sealing of feeding pumps and high pressure heater of Mosenergo HPC with up to 3500 mm dia gaskets instead of metal ones (coordinated with the pumps' manufacturers), according to the customers' estimates they significantly (30 times) save maintenance labour consumption and equipment down time.



TENSOGRAPH® FLANGE GASKETS

UNICHIMTEK produces flange gaskets of a diameter from 10 to 1500 mm for sealing flange junctions of vessels and units, pipelines and valves. Our flange gaskets can be used in almost unlimited range of operation medias, pressure, temperatures. Gaskets are produced of TENSOGRAPH® sheet materials: both reinforced and non-reinforced graphite sheets and non-asbestos sealing sheets.

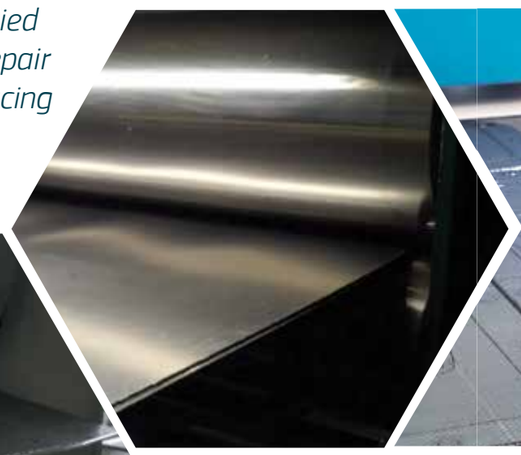
SIMPLICITY OF GASKETS PRODUCTION TECHNOLOGY (ADDITIVE- AND ADHESIVE-FREE PRESSING) ALLOWS TO MEET THE REQUIREMENTS OF RUSSIAN AND INTERNATIONAL STANDARDS FOR FLANGES.

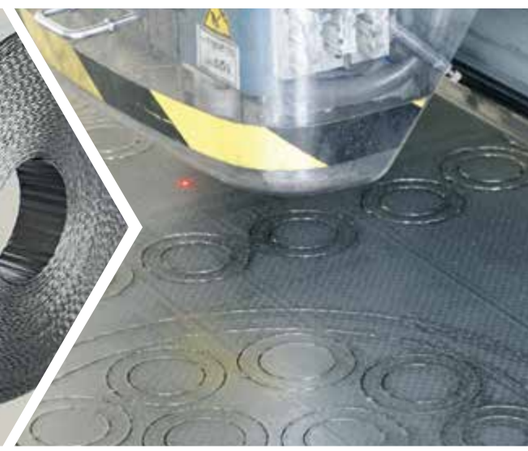
Product range of gaskets includes more than 30 000 items.
Production facilities are equipped with modern machines for pressing, punching and cutting gaskets of any form. State-of-the-art technologies for graphite sheet flange gaskets strengthening with protective devices (obturator rings, lid rings, jackets, etc.) are implemented.

COMPANY DESIGN-ENGINEERING AND R&D DEPARTMENTS PROVIDE SERVICES FOR SOLUTION OF:
• Non-standard tasks of equipment sealing to be performed in short terms;
• quality issues with sealing goods supplies.

Another important activity is development of standards for methods of testing asbestos-free sealing materials, their application for equipment sealing.
UNICHIMTEK also produces 8 to 70 mm wide smooth and corrugated tapes of TENSOGRAPH® graphite foil for large diameter flanges sealing and on-site express-repair.

1500 mm wide sheets can be supplied for usage during maintenance and repair works completed with tools for producing high precision gaskets in terms of size and edge quality.





UNICHIMTEK takes part in the development of industry-specific technical requirements on application of thermally expanded graphite seals in thermal and atomic power engineering.

TENSOGRAPH® METALLIC GASKETS

UNICHIMTEK produces different types of steel-based metal/graphite gaskets, double jacked gaskets and spiral wound gaskets (SWG) of any sizes and configurations, including custom design ones.

Production is based on application of modern equipment of leading European manufacturers. TENSOGRAPH® metal-graphite gaskets comply with Russian GOST, OST standards, equipment manufacturers' norms, as well as with international standards ASME, ANSI, API, DIN, EN. They have won confidence of Russian customers due to their high quality and reliability. SWG gaskets are manufactured using various asbestos-free fillers.

TENSOGRAPH® HIGH-STRENGTH FOIL IS PERFECT FILLER FOR SWG, ALLOWS MAXIMIZING THE PRODUCTIVITY AND EFFICIENCY OF AUTOMATIC EQUIPMENT FOR SWG PRODUCTION AND IS RECOMMENDED FOR MANUFACTURING OF LARGE DIAMETER SWG (OVER 2 METERS).

Typical properties of TENSOGRAPH® S ultra-strong graphite foil

Tensile strength (along rolling direction)	>100 N/mm²
Compressibility	>35 %
Recovery	>7 %
Density	0.8-1.4 %
Thickness	0.2-1.0 mm
Carbon content	98 %
Sulfur content	<200 ppm
Width of rolls	3-600 mm

TENSOGRAPH® MECHANICAL SEALS

Combination of world best practices in mechanical seals design and UNICHIMTEK's scientific and production resources permitted us to develop a new generation of mechanical seals adapted to structural features of Russian and imported equipment.

ALL PRODUCED ITEMS PASS QUALITY CONTROL WITH SPECIAL TESTING EQUIPMENT IN COMPLIANCE WITH EUROPEAN AND AMERICAN STANDARDS.

Mechanical seals are designed based on experience of the leading world manufacturers of industrial equipment sealing products with application of three-dimensional automatic design systems.

UNICHIMTEK produces whole range of mechanical seals, which are applied:
- in power engineering (feeding network, condensate pumps, compressor seals, oil supply system pumps)
- in oil production and refinery (pumps for Sewerage pump house, Transfer pumping station, Circulation pump station, oil transfer pumps, etc.);
- in chemical industry (chemical pumps , reactors, mixers);
- in heat and water supply systems (overhung pumps, imported equipment);
- in household and industrial waste water systems;
- in paper and pulp industry;
- in food industry (food pumps, mixing devices);
- in transportation machines;

Mechanical seals are produced in specialized workshops, equipped with modern mechanical processing machines and control and measuring equipment.

Owing to its own manufacturing site UNICHIMTEK is capable to produce SWG up to 4 meters diameter in short terms"

UNICHIMTEK Research and testing base allows performing static and dynamic testing of mechanical seals under pressure of 15MPa and with speed of shaft equal to 3000 rpm.

OGRAX® FIRE PROTECTION COMPOSITIONS

UNICHIMTEK is Russian leader in design, development and production of fire protection materials. National technical standards for their application in power engineering have been developed in cooperation with UNICHIMTEK (RD 153-34.1-20.262-2002 “The Rules for application of fire protection cable coatings at power industry enterprises”, SO 34.49.505-2003 “The rules for application of fire protection coatings of structural steelwork at power industry enterprises”).

UNPARALLELED IN RUSSIA TOTALLY MOISTURE RESISTANT FIRE PROTECTION COMPOSITION FOR CABLE LINES OGRAX-VV BASED ON WATER POLYMER DISPERSION, WITH FIRE PROTECTION LAYER 0.8 MM, HAS SEVERAL AWARDS OF RUSSIAN AND INTERNATIONAL EXHIBITIONS.

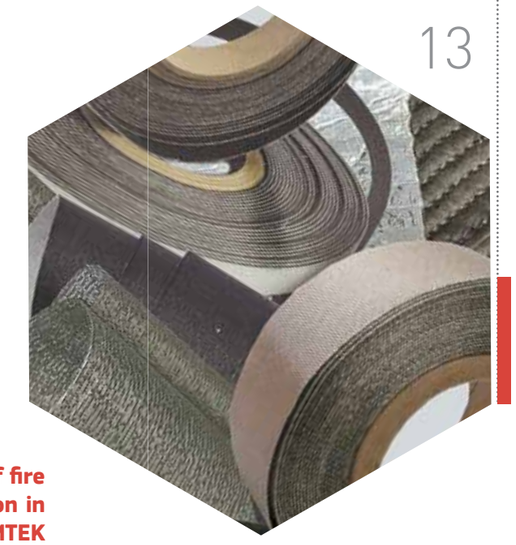
A NUMBER OF EFFICIENT FIRE PROTECTION COMPOSITIONS FOR STRUCTURAL STEEL FOR VARIOUS OPERATING CONDITIONS WERE DESIGNED, FOR EXAMPLE:

- High-technology and eco-friendly composition OGRAX-V-SK-1 - for protection of structural steel indoors.
- High-technology OGRAX-SK-1 composition with low consumption - for application under shelter.
- Weather-proof OGRAX-MSK composition for fire protection of structural steel, operated outdoors, may be applied at negative temperatures on unprimed surfaces.
- Resistant to aggressive media two- component composition OGRAX-SKE - for complex facilities of oil and gas industry provides fire protection up to 4 hours of structural steel with low mass factor.
- Low density plaster material OGRAX-NSH, provides fire protection up to 4 hours, is recommended for fire protection of high-rise buildings.

EFFICIENT FIRE PROTECTION OF CABLE LINES IS PROVIDED BY:

- indoors – using eco-friendly thin film composition OGRAX-V1 with 0.5 mm fire protection layer,
- under the conditions of increased humidity – using organic composition OGRAX-M.

Thermally expanding low-consumption composition OGRAX-VSK and long-life, low-consumption fire and bio proofing impregnation OGRAX-PD-2 provides first group of fire protection efficiency for indoors wooden structures.



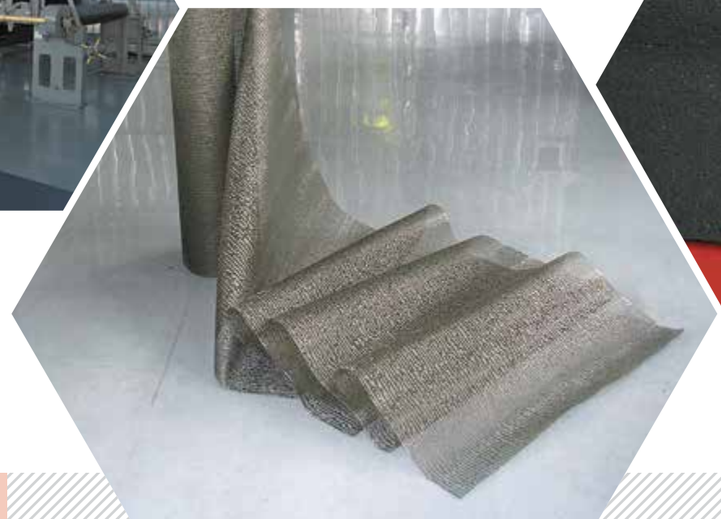
OGRAX® FIRE PROTECTION ROLL MATERIALS

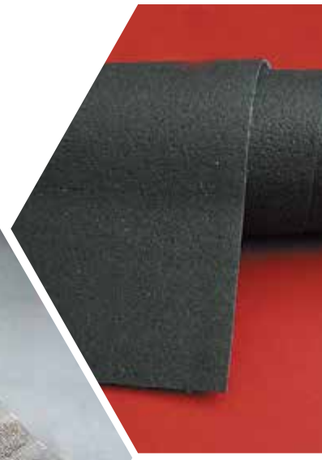
Elastic roll fire protection materials, as components for fire preventing measures, were developed, patented and manufactured by Unichimtek. Range of roll materials includes thermally expanding fabric-backed material OGRAX-L and profiles of various cross-sections OGRAX-P. These materials are used for manufacturing of fire protection doors, partitions, flame arrestors, smoke exhaust vents, fire-safety sleeves, etc.

UNICHIMTEK PRODUCES FIRE PROTECTION ROLL MATERIALS FOR VARIOUS PURPOSES.

Fire protection and thermally expanding composition OGRAX-L1 based on natural rubber and mineral fillers, applied to a fiber glass cloth back is an excellent solution for fire protection of heavy or dirty cables, when application of ordinary compositions is impossible.
UNICHIMTEK offers elastic roll material OGRAX-L2, thermally expanding nets OGRAX-S, fire protection composition OGRAX-MD for storage, transportation of combustible and explosive materials and items, creation of fire protective barriers, fabrication of covering fire protection items.
Fire proofing system OGRAX-VENT provides reliable protection of air ducts, plenum and exhaust systems of general antismoke emergency ventilation, as well as air conditioning systems.
OGRAX-VENT is a combination of roll basalt fiber foiled material OGRAX-BM and fire resistant adhesive composition OGRAX-K.

Service life of OGRAX-VENT fire protection system is equal to air duct service life.





OGRAX® FIRE PROTECTION PRODUCTS AND CONSTRUCTIONS

Fire-safety couplings OGRAX-PM are the first fire-safety couplings manufactured in Russia. UNICHIMTEK is one of the developers of the fire safety couplings application method.

OGRAX-PM couplings are recommended all over Russia when designing internal sewerage systems of residential buildings , social and recreation buildings to ensure fire safety.
Fire-resistant cable penetrations are used to prevent fire transfer along cable routes from one room into another.
Thermally expanding firestop pillow OGRAX-OTP making up the pads uniformly filled with thermally expanding material are used for provision of temporary cable penetrations (during construction, reconstruction and repair).

OGRAX-KP is a pre-fabricated structure for provision of permanent cable penetrations, it consists of mineral cotton slabs and thermally expanding material OGRAX-VV, ensuring high moisture resistance of the structure.

FIRE PROTECTION PRODUCTS OGRAX HAVE TAKEN THE LEADING POSITIONS AT THE MARKET OF FIRE PROTECTION MATERIALS.

TURNKEY FIRE PROTECTION

UNICHIMTEK Design and engineering department performs a full design cycle of fire protection of buildings and structures of any purpose and any level of complexity.
Experienced specialists shall conduct expertise and refine Section of fire protection measures in design documentation for construction of any facilities, including hazardous and technically complicated ones.

Should the fire safety norms and regulations be deviated from during construction, or should the normative requirements be missing at the design stage, UNICHIMTEK experts will develop special technical specifications to meet the requirements of fire safety regulatory documents.
UNICHIMTEK engineering service provides high quality fire protection works for any materials, structures and items.
Qualified personnel, availability of up-to-date technical basis and proven technologies of fireproof treatment allow UNICHIMTEK to execute fire protection in compliance with fire safety requirements at the facilities of any level of complexity.
UNICHIMTEK specialists had carried out successfully fireproof works at many large oil and gas, industry and civil facilities.

EURORUS

UNICHIMTEK engineering service has provided passive fire protection for more than a half of thermal power plants' units and nearly all nuclear power plants having been put into operation in Russia in recent 10 years.

NEW DEVELOPMENTS, RESEARCH, TECHNOLOGIES

MAIN GOAL OF THE INSTITUTE IS TO COMMERCIALIZE THE MOSCOW STATE UNIVERSITY RESEARCHES DEVELOPMENTS AND TO SET UP MANUFACTURING OF NEW MATERIALS FOR HIGH TECHNOLOGY INDUSTRIES.

Key competitive advantage of UNICHIMTEK is a powerful R&D Department – Institute of new carbon materials and technologies (JSC «INCMAT»), which was established in 2003 together with MOSCOW STATE UNIVERSITY.

The Institute employs over 60 highly skilled researches – over 30 % of them are PhD in chemistry and physics.

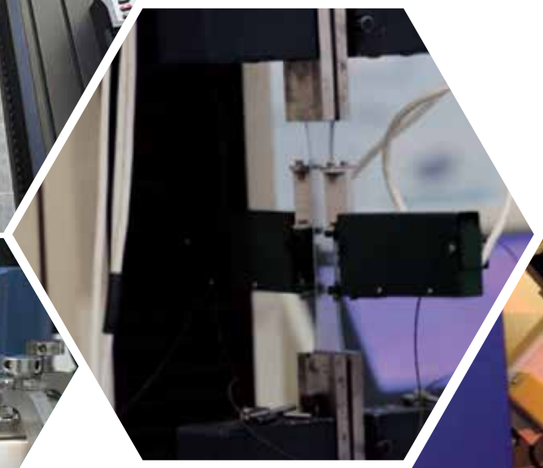
JSC «INCMAT» PERFORMS RESEARCH AND DEVELOPMENT IN THE FOLLOWING AREAS:

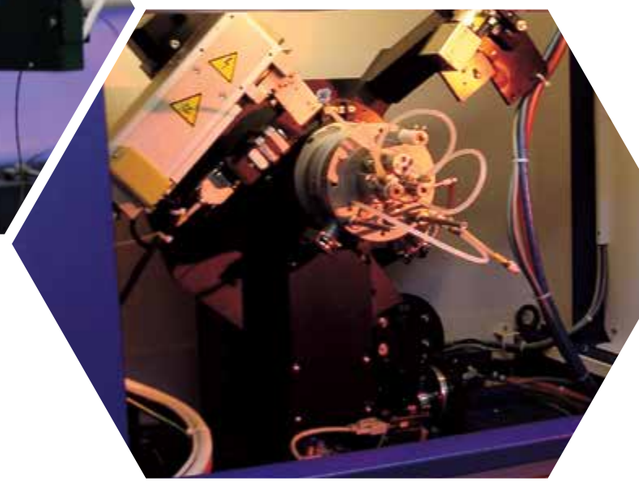
- Development of new low density graphite materials (sealing, heat distribution, etc.);
- Development of new fire protection compositions;
- Development and optimization of carbon-carbon composites production technology;
- Development of high temperature polymer matrices (Epoxy, BMI, cyanate ether), including materials for high temperature vacuum infusion and RTM
- Development of technologies of textile processing of carbon fiber;
- Development of the carbon fiber composites manufacturing technologies, prototyping

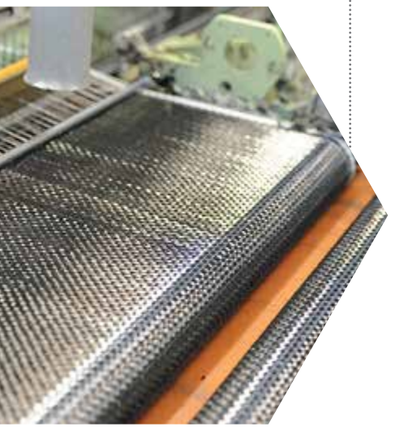
Equipment

Up-to-date research and testing equipment (including equipment for testing mechanical properties, thermal-physical characteristics and structure of materials) and highly skilled personnel allow the Institute to solve successfully the wide range of research and technological issues for UNICHIMTEK business development as well as for our customers and partners.

Tests are being executed in accordance with national or international standards or in accordance with exclusive methods, developed for special and non-standard tasks.







Composite materials

Composite materials have important advantages compared to metals. Nowadays most of metal structures can be replaced by composite ones which have much better functionality: they are less heavy and more rigid.
In process of developing constructions made of composite materials it is necessary to have huge database of information related to materials and technologies of forming.
JSC «INCMAT» performs materials and technology of forming optimization tasks, produces first samples of product using parameters obtained during laboratory testing.
Today JSC «INCMAT» produces at the UNICHIMTEK manufacturing site (Moscow region, Klimovsk) and markets high quality products.

CARBON FIBER FABRICS

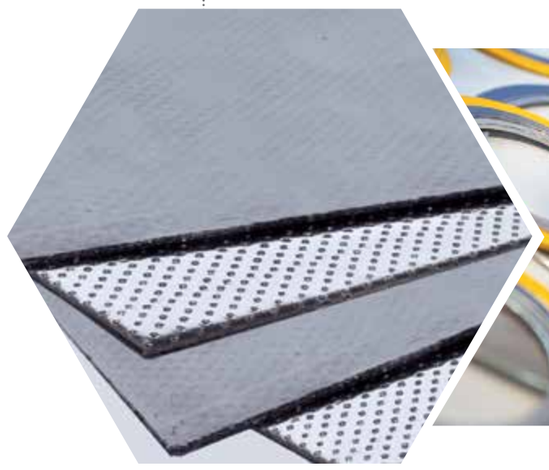
Wide range of carbon fiber fabrics and unidirectional tapes of national and imported carbon fiber, 300 to 1500 mm wide (manufacturing of fabrics as per Customer's technical requirements is possible).

INFUSION BINDERS

Are used for large-scale structures and critically important units of aircrafts, and for other applications. Specialists of JSC «INCMAT» developed a wide range of infusion binders with a vast scope of application.

PREPREGS

Application of prepregs and autoclave molding – the most reliable technologies for carbon-fiber reinforced composite structures manufacturing.
JSC «INCMAT» developed a number of binders, optimized for production of prepregs based on national and imported carbon fiber.
Taking into account the wide temperature range of carbon fiber reinforced plastics application, we created a product line based on the epoxy resins with glass transition temperature more than 200 °C, bismaleimide resins with glass transition temperature up to 280 °C and polyimide resins with more than 330 °C glass transition temperature.



Worldwide activity

Following patented products of UNICHIMTEK are most popular in the world scale.

Tensograph® foil

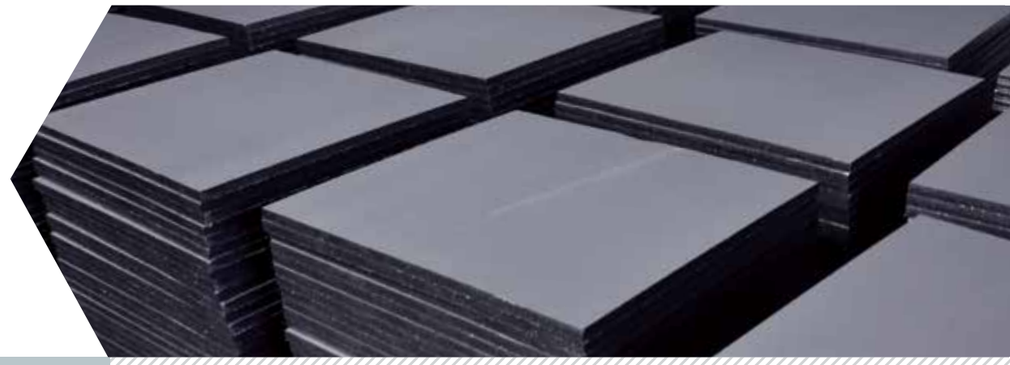
High-strength and ultrapure flexible graphite foils, gland sealing rings and packing, flange gaskets, SWG supplied under Tensograph® trademark;

Tensograph® sheet

Non-reinforced and reinforced graphite sheets TENSOGRAPH® with plane and perforated stainless steel 1500 mm wide, and 0.5-5 mm thick. TENSOGRAPH® sheet materials are designed for flange gaskets manufacturing.

TENSOGRAPH® low-density panels

Low-density panels based on thermally expanded graphite for energy saving air conditioning systems.



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