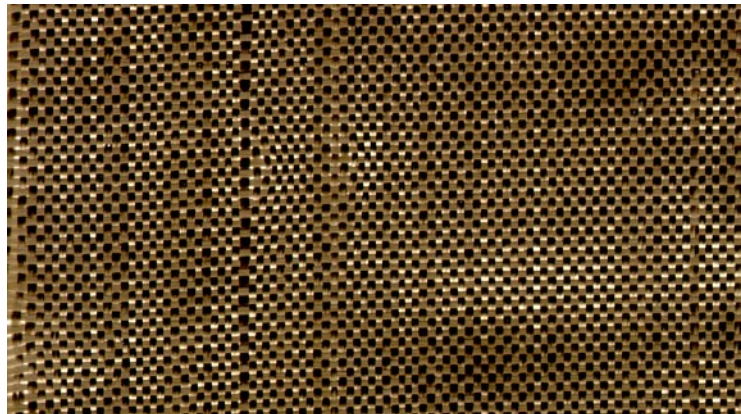


**AKETOMA**

***P**ROFESSIONAL  
**P**RODUCTS *with*  
**P**ERFORMANCE*



**Basalt fabrics, tubes,  
prepegs, rods etc.**

# THE MATERIAL FOR THE 21st CENTURY

Basalt is well known as a rock found in virtually every country round the world. Its main use is a crushed rock in construction, industrial and high way engineering. However, it is not commonly known that basalt can be used in manufacturing and made into fine, superfine and ultra fine fibres. Comprised of single-ingredient raw materials melt basalt fibres are superior to other fibres in terms of thermal stability, heat and sound insulation properties, vibration resistance and durability.

Basalt continuous fibres offer prospect of a completely new range of composite materials and products.

Basalt has no toxic reaction with air or water, is non-combustible and explosion proof. When in contact with other chemicals they produce no chemical reactions that may damage health or the environment. Basalt can replace almost all applications of asbestos and has three times its heat insulating properties. Basalt base composites can replace steel and known reinforced plastics (1 kg of basalt reinforcement equals 9,6 kg of steel). The life of basalt pipes, designed for variety of applications is at least 50 years without maintenance or electric or technical protection.

Basalt fibres together with carbon or ceramic fibres as well as various metals is the most advanced and exciting area of application, as they can develop new hybrid composite materials and technologies.

Basalt special properties reduce the cost of products whilst improving their performance. More than hundreds specific unique manufacturing techniques using basalt fiber materials and products have been developed and patented in Russia.

## BASALT-FIBER COMPOSITE, HYBRID MATERIALS AND ARTICLES

- Thermal and sound insulation,
- Pipes for various, purposes.
- Bars, fittings.
- Fabrics nets, prepregs.
- Structural plastics.
- Insulating plastics.
- Frictional materials.

# BASALT FABRICS

Basalt fabrics are produced for structural, electro technical general a specialized proposes. For structural uses, basalt fabrics are useful for producing structural basalt-plastics based on various thermosetting binders expose and phenolic polyesters (for instance by laying out method). From these materials components automobiles, aircraft, ships and households appliances can be produced. In the case of preliminary metalization of the fabrics, the resulting basalt-plastic acquires shield properties against electromagnetic radiation. Also basalt fabrics can be used as basics when producing soft and rigid roofing. Basalt fabrics for electro technical purposes are used as a base for the production of insulation materials. Their properties are shown I table one. These materials are employed in the production of substances for printed circuit boards for electronics and electrical engineering. These have superior properties to similar conventional components made of fibreglass. General-purpose fabrics are useful, for example in fire feltings for suppression of extremely complex fires resulting from ignition of highly flammable liquids, in particular gasoline. The employments of incombustible basalt fabric inserts in industrial ventilators increase their fire safety as well as the fire resistance of ventilating systems. The cost of basalt fabrics is considerable lower than that of similar materials. The non-combustible properties of basalt woven materials enable it to resist flames for long periods that make basalt tapes effective as an extra fine resistant insulation for electrical cables and underground ducts. Basalt-fabrics hoses may be useful for reinforcing cables, repairing the interior and exterior of tubes and pipelines.

## Technical characteristics of basalt fabrics

Name	Weaving Type	Breaking load N (kgf)		Surface density, g/m <sup>2</sup>	Thickness	Width, cm
		Warp	Weft			
BF-5	Linen	882 (90)	539 (55)	160	0,15	100
BF-8	Linen	931(95)	784 (80)	210	0,18	100
BF-10	Satin	931(95)	980 (100)	225	0,17	100
BF-11	Satin	1715 (175)	980 (100)	385	0,27	100
BF-13	Linen	1225 (125)	178 (80)	250	0,22	100
BF-100	Linen	784 (80)	178 (80)	210	0,19	100
BFS-220	Satin	(80)	(80)	220	0,18	90
BFL-240	Linen	(104)	(107)	240	0,22	90
BFL-270	Linen	(123)	(86)	270	0,22	90
BFA-350	Atlas	(182)	(73)	350	0,23	90
BFL-580	Linen			580	0,52	150
BFL-750	Linen	(335)	(320)	750	0,65	150
BLS-750	Twill	(450)	(220)	750	0,75	150
BFL-100	Linen	(487)	(281)	1000	0,92	150
BFS-100	Twill	(497)	(281)	1100	0,86	150

Note. With regards to fabrics for electrical uses, basalt-getinakses and basalt-textolites are available these are particularly useful in electrical and electronic engineering. Their characteristics are

# LONG-LASTING BASALT PREPEGS

Long lasting prepegs are highly process able semi-products based on continuously or discrete basalt fibres impregnated with modified polyester (resin) for the production of various basalt-plastic products.

Long lasting prepegs have a long life (at least 4 years) under storage conditions sheltered premises hermetically packed at a temperature not over 40 °C.

The "FEBOTEX" prepeg is produced on basalt fabrics and is useful for processing to manufacture articles by winding laying-out followed by direct pressing autoclave and vacuum moulding.

The "FEBONITE" prepeg is produced based on discrete threads or fibres and it's useful for producing articles by transferee moulding and die-casting.

## Physical- chemical properties of long lasting prepegs

<b>Binder</b>	<b>32 to 45 %</b>
<b>Volatiles</b>	<b>7 to 3 %</b>
<b>Binder soluble</b>	<b>85 to 8 %</b>
<b>Flow ability</b>	<b>3 to 25 %</b>

## Physical-mechanical properties of basalt-plastics, based on long-lasting prepegs

<b>Characteristics</b>	<b>Febotex</b>	<b>Febonite</b>
Ultimate bending strength, MPa:	238,0	83.0
Bonding modulus, MPa x 10:	1.95	0,8
Ultimate compressive strength (along the reinforcement), MPa	86,0	126.0
Compressive modulus, MPa x 1 0	2.31	0.88
Ultimate tensile strength, MPa	302.0	23,0
Tensile; modulus, Mpa x10	2.10	0,8
Thermal conductivity, W (m x K)	0,26	0,25
Density, g/cm <sup>3</sup>	2,0	1,82
Bending strength, after heat treatment for 3.5 h (+850°C), MPa	75	
Volatile evolution under heating up to 350°C, %	10	
Volatile evolution under heating up to 850°C, %	15-20	

# REINFORCEMENT RODS

Rods of unidirectional basalt composite successfully replace metal reinforcement. At higher specific strength and resistance to aggressive media 1 kg of the basalt reinforcement replaces 9,6 kg of metallic.

They are used in production of building components, panels' barriers sidewalk, pavement and facing slabs, and many other structural components.

In view of their high electro insulation properties, basalt bars are used for making insulators for high voltage power lines.

An especially successful application of bars is for reinforcement of concrete slabs in hydraulic engineering and construction in seismically hazardous regions, in view of the fact that due to its chemical inertness the basalt reinforcement is compatible with concretes having different "pH", having actually the same coefficient of thermal expansion and no residual deformation under bending.

## Technical data

Density, g/cm <sup>3</sup>	1.95
Thermal conductivity, kcal/m x h x deg	0.3
Ultimate strength, Mpa:	
tensile	1200
compressive	420
bending	800

# Basalt-Plastic Pipes

Basalt fibre composite pipes are obtained by winding basalt threads, fabrics, prepegs impregnated with a binder.

The pipes may be useful as components for shafts linings, building components, for transporting corrosive liquids and gases in the construction, industrial, agricultural and public services sectors.

Other possible areas of application for basalt pipes are: masts, aerials frames various pipes in construction, communication, etc.

At present when the price difference between metal and composite pipes is becoming smaller and in view in substantial advantages of the composite pipes, the use of repair o old pipelines and construction of new ones is growing dramatically.

1. The weight of one meter of basalt-plastic pipes is 3 to 4 times less than the one of steel pipe. This is not only simplifies handling operations, but also essentially reduces cost for transporting load-lifting and installation work.
2. The strength of a plastic-plastic pipe is several times stronger than that of glass-fibre pipes and of the majority of steel-pipes. This quality of basalt-plastic makes it possible to create high pressure systems of higher reliability, i.e. over 1000 atm, which is not practically with metal pipes.
3. High chemical resistance to aggressive media makes it possible to manufacture pipelines for transporting hydrogen sulphide, acid alkalises etc.
4. And as a result of the above, there is no need for insulation and anti corrosion measures.
5. Basalt pipes are resistant to the action of fungi and micro organisms
6. Basalt-plastic has low thermal conductivity, thereby preventing the deposition of salts and paraffin's in pipelines and requiring no additional heat insulation.
7. Being insulators, basalt-plastic pipes are resistant to electrochemical corrosion. All this makes it possible to increase the guaranteed service life of basalt-plastic pipes to 60 – 80 years, i.e. 2 to 3 times as that of metallic ones.
8. The equipment intended for producing of fibreglass plastic pipes can be adapted to manufacture pipes of various diameters and wall thickness.

## Fields of application:

Electrical engineering. All simple a complex parts which need high dielectric properties.

Construction: Parts made of basalt-plastic resistance to the action of moisture, snow, temperature, and solar radiation, alkaline and acidic media.

Machine building, Parts or, blocks of machines operating under high temperatures or gas stream, For example the heat shield for a re-entering space vehicle.

Non-metallic fittings

The unique properties of long-lasting prepregs make possible to unboundly use them depending on (ha user's requirements,

### CONSTRUCTION

Reinforcement of bridges, tunnels.

Production of sandwich-panels based on basalt and carbon-basalt fibres

External] and internal heat and sound insulation.

Insulation of panel butt joints.

Directional and depressive reinforcement of concrete.

Repair (healing) of cracks, local damage to building&, bridges, building constructions,

Soft roofing made of non-combustible baraltinsol and basaltoplastic

Rigid roofing (of slate and tile type).

Reusable shutters,

Internal waste pipes

Reinforced structures

Heat-supply systems, cable conduits,

Hydraulic construction.

Cable-conduit, telephone systems

protected against electromagnetic fields and information leakage through electronic surveillance.

Highly efficient seals and linings for pipelines.

Pipes for chemical products and transportation of aggressive media.

Pumps for aggressive media.

### AGRICULTURE

Land drainage pipes-

Pipes for irrigation and hosing.

Raising vegetable and seeding (hydroponics)

Basalt super thin fibres.

Agricultural construction,

Agricultural machine construction.

### UNDERGROUND CONSTRUCTION

Anchors, pillars, ceilings vaults.

Pipelines for various purposes.

Foundations for building and constructions. less laying of pipelines.

### MACHINE CONSTRUCTION

Case and body parts.

Thermo constant body containers

Refrigerators.

Completely incombustible thermal and sound insulation for cabins, motor compartments. metro carriages, ships and aircraft.

Electro technical and electronic circuit

boards, brake pads for automobiles, aircraft,

### ROAD CONSTRUCTION

Reinforcement of concrete and asphalt pavements and runways.

Construction of sound-absorbing barriers for highways, railways, and underground metro lines.

Curbstones, pavement linings (basalt casting),

Small moulds

### ENGINEERING NETWORKS

Pipelines for heating and hot, water supply.

Pipelines for heat supply.

Canalisation,

Oil and gas pipelines

metro carriages and coaches.  
Friction disks for auto tractor facilities.  
Reinforcement for industrial rubber and other articles. and articles.  
Belts for heavy-loaded conveyers

radiation and information read-out.  
New generation body armour for individual and collective protection,  
Fireproofing and heat protection working clothes  
Containers for burial of extremely toxic waste,  
Basalt-carbon heaters for clothes, rooms, incubators, etc.

## ENVIRONMENTAL SAFETY

Protection screens against electromagnetic

## Technical characteristics of basalt-getinaks

Dielectric permeability	5,0 to 5,5
Loss-angle tangent	0,01 3 to 0.01 8

## Technical characteristics of basalt-textolites

Surface resistance, Ohm	$1,0 \times 10^{12}$
After one hours heat exposure (125°C), 20% humidity	$1,0 \times 10^{11}$
Volume resistivity, Ohm/m	$4,0 \times 10^{10}$
After one hours heat exposure (125°C), 20% humidity	$6,0 \times 10,1$
Dielectric permeability	5,5
Loss-angle tangent after heat exposure for 90 hours, (40°C), 93 % humidity	0.020
Tear-off strength of the contact area H	120

## Comparative characteristics of basalt and asbestos fabrics

Characteristics	AT-1	BFS-1000
Width, mm	1040	1500
Thickness, mm	1,6 ,	1,6
Mass of 1 m <sup>3</sup> in g	1000	1000 + 10%
Number of threads per 100 min, warp/weft	80/40	80/40
Breaking load, kgf, warp/weft	65/30	250/200
Cachinnation losses, %	29	
Operating temperature, °C	130 400	up to 500

## Electro technical characteristics

Propertis	Indices
Volume resistance, Ohm x m	$4.0 \times 10^{11} - 6,0 \times 10^{12}$
Relative dielectric permeability (at 1 MHz)	1,8 ... 2,0
Density, g/cm <sup>3</sup>	2.7 to 3,0
Binder content, %	28 to 32

## Comparative characteristics of pipes for industrial water pipelines at 50 atm pressure (outer diameter 500 mm)

Characteristic of articles	Seamless, pipes, Tentative wall Thickness; is 10 mm.	Welded pipes Made of stainless steel, steel 12 x 18 HIOT Wall thickness is 5 mm	Basalt plastic pipes Wall thickness is 5 mm
Service life, years	3 to 7		30 to 90
Electrocorrosion	Yes	Yes	No
Thermal conductivity, arb. Units	200	200	
Hydraulic resistance (new/corroded)	1.3/3.5	1,1/1,2	1/1
Weight of 1 run m, kg	128,24	65	15
Price of 1 run m, %	80	240	100
Labour Input, arb. units.	5 6	5 6	1 3

## Comparative characteristics of steel, glass-plastic and basalt pipes

Characteristic	Steel	Glass-plastic	Basalt-plastic
Ultimate tensile strength, Mpa	200	140	(300)*
Tensile modulus, GPa	210	56	70 (160)*
Density, kg/m <sup>3</sup>	7800	1900	1700
Thermal, conductivity,	47	0,5	0,3
Volume resistivity, ohm/m	Conductor	1 x10 <sup>10</sup>	4 x10 <sup>12</sup>

\*Note, In the brackets are values for pipe winding from hybrid basalt-carbon fibres. These properties indicates may be much higher.