

COMPOSITE MATERIALS AND ARTICLES TECHNOLOGIES



JSC «Shipbuilding & Shiprepair Technology Center» (JSC SSTC) develops technologies and manufactures composite materials and articles for shipbuilding, ship repair and other industries.

Activities of JSC SSTC in field of composite materials:

- Development of production procedures and assistance in construction and repair of composite vessels;
- Development of composite shipbuilding sites at shipyards;
- Development of fiberglass coating technology for propulsion and stern shafts;
- Development of technology and fabrication of structures by means of winding method using various reinforcing and epoxy binders;
- Fabrication of sealings for ship fittings and heavy-duty friction assemblies based on modified polyetheretherketone compounds;
- Development of technological procedures for appliance of multi-purpose coatings;
- Calculation of airborne noise and hull vibration rates in vessel's compartments at design stage and measurement of the same at all vessel trials stages;
- Study of physical-mechanical, acoustic and vibration-damping properties of materials in test center CSC Sudoplast, certified by Russian Maritime Register of Shipping.

FABRICATION OF STRUCTURES ON FOUR-AXIS WINDING MACHINE BY MEANS OF WET WINDING METHOD

FABRICATED ITEMS SPECIFICATIONS

Length, m	max. 4
Diameter, m	max. 1
Winding angle	0 — 90°

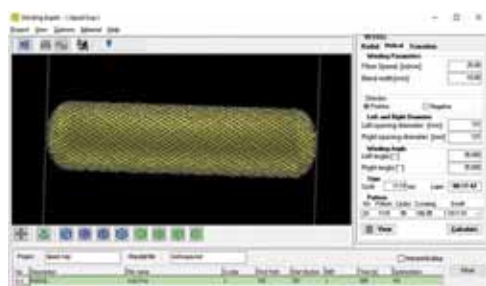


Process materials:

- Epoxy binder;
- Reinforcing materials of various texture forms: carbon, glass, organic, basalt fiber.

Software:

- Software with embedded option for creation and edition of winding programs



MANUFACTURING OF ELECTRIC INSULATION DECOUPLINGS

JSC SSTC manufactures axial insulation decouplings, which operate at temperature exceeding 4.5 K and perform galvanic separation at 30 kV.

Production method: winding of saturated glass-roving as per spiral-tangential trajectory.

Edge lines are made from 316L steel.

Maximum length of insulator: 800 mm.

Working environment: helium at 300-4.5K temperature

The insulator can withstand 56 kV, DC under 300 K.

Environment:

Outside: air;

Inside: fluid helium under 1.2 atm pressure.



COMPOSITE CASINGS OF ANTENNA COMMUNICATION BUOYS

Meet the following requirements:

- Radio transparency;
- Positive buoyancy of the article up to 600 m depth;
- Article remains operable under external hydrostatic pressure;
- Decrease of casing weight by 20-30%;
- Increase of lifting capacity in 1.5-2 times;
- Casing materials: organic plastic, fiber glass.
- Total service life of the article - 12 years.



ANTI-FRICTION COMPOSITE MATERIALS «SFERA» FOR HEAVY-DUTY FRICTION ASSEMBLIES AND SEALINGS OF SHIP VALVES

Anti-friction composite materials SFERA on basis of polyester-ketones were developed as an alternative to Grafelon 20M material used in ship ball valves sealing.

Application of SFERA materials helps to exclude hazardous import components comprising phenilone C2 (binding material for Grafelon-20M). Also, SFERA materials do not cause dimensional changes of the valve unlike Grafelon-20M with high hydroscopic rate. Mechanical properties of SFERA materials are similar to Grafelon-20M, while its tribotechnical characteristics are better.

These materials can be used both in sea and fresh water under 5-25 MPa unit pressure and up to 3 m/s gliding speed.

Parameter	Grafelon 20M	Material modifications	
		SFERA T	SFERA TD
Physical and mechanical properties			
Breaking compression stress, MPa	250.0	272.6	239.0
Impact viscosity, kj/m²	21.0	30.0	17.5
Breaking stress at static bending, MPa	160.0	190.5	150.9
Water consumption for 24 hrs at 20°C, %	0.30	0.05	0.05
Density, kg/m³	1320–1360	1322–1335	1402–1410
Tribotechnical properties at reciprocation in sea water			
Friction factor	0.198	0.177	0.171
Wear rate, µm/min	1.55	0.233	0.183
Wear intensity, lh*10 ⁻⁷	3.24	0.49	0.38

ANTI-FRICTION COMPOSITE MATERIALS SFERA-40 FOR FRICTION BEARINGS OF SHAFT LINES AND PROPULSION SHAFTS

Anti-friction composite materials SFERA-40 on basis of fluorine plastic-40 were developed as an alternative to graphite fluorine plastic ANITA-40 used for manufacturing of friction bearing inserts.

ANITA-40 is based on fluorine plastic-40 with addition of colloid-graphite compound. Tribotechnical properties of SFERA-40 materials are similar to ANITA-40, while its physical and mechanical characteristics are better. Advanced properties of SFERA-40 help to extend application area of friction bearings made from fluorine plastic.

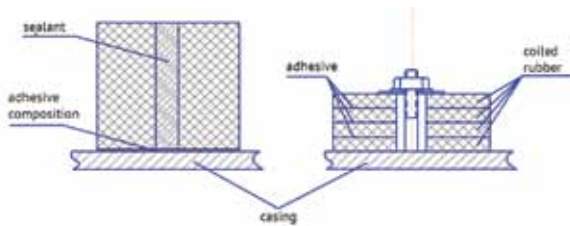
These materials can be used both in sea and fresh water under 20 MPa unit pressure and up to 5 m/s gliding speed.

Parameter	ANITA-40	Material modifications	
		SFERA-40 T	SFERA-40 TD
Physical and mechanical properties			
Breaking compression stress, MPa	70.0	95.6	95.0
Impact viscosity, kJ/m²	17.0	21.0	23.0
Breaking stress at static bending, MPa	53.0	80.0	80.0
Maximum tensile stress, MPa	32.0	51.0	46.0
Brinell hardness, MPa	105	130	140
Density, kg/m³	1880	1550	1650
Tribotechnical properties under rotation			
Friction factor at friction bearing startup	0.17	0.13	0.16

DEVELOPMENT OF PROCESS PROCEDURES FOR APPLICATION AND INSTALLATION OF SPECIAL COATINGS

Development of procedures for preparation, installation and sealing of special coatings:

- Development of organizational and technological projects for preparation, installation and sealing of special coatings;
- Development of principal, standard and detailed procedures for preparation, installation and sealing of special coatings;
- Selection and development of design documents, equipment delivery for facilities being established;
- Technological support of works on preparation, installation and sealing of special coatings;
- Technical consultations in field of preparation, installation and sealing of special coatings;
- Quality control of preparation, installation and sealing of special coatings;
- Personnel training on preparation, installation and sealing of special coatings;
- Calculation of stresses and deformations in fixture and sealing assemblies of special coatings using finite element methods;
- Justification and extension of special coatings service life for the specified period.



DEVELOPMENT OF VIBROACOUSTIC PROTECTION MEANS

The following works to be performed:

- Calculation of noise level at working places in production facilities, residential and public buildings using modern 3D-modeling software upon construction and exploitation of capital structures;
- Calculation and measurement of crew-affecting noise and vibration rate in shipboard compartments at design and delivery-acceptance stage;
- Measurement of sound insulation and absorption in reverberant acoustic chambers mounted on insulated foundation with use of Bruel&Kjaer - multichannel data measurement and collection systems;
- Rapid estimation of vibroacoustic properties of materials with use of impedance tubes, Oberst bar, intensimetric probes and shock table;
- Development of application procedure for vibroacoustic coatings for marine equipment with enhanced sound-insulating and vibration-absorbing properties.

