Department of the Navy

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8. Deck Coverings

The relative weight of deck coverings in the total weight of a ship's outfittings, especially on a passenger ship, is very great. For example, the weight of the coverings of the interior decks of the turbine powered passenger vessel, the SOVETSKIY SOYUZ, exceeds 100 tons. Also, the preservability of metal decks depends on the composition of the deck coverings. The replacement of deck coverings is an extremely expensive and labor consuming task, so the long life of covering materials has a substantial effect on the cost of ship repair.

Wooden deck coverings are susceptible to fires, require labor-consuming upkeep, are very heavy and expensive to look after. Deck lumber is one of the scarcest types of lumber material. For this reason, shipbuilders and chemists have been working for many years on the development of synthetic deck coverings which are free of the defects enumerated above.

At the beginning of the 1920's the mastic covering "Xylolite" was developed. It has also been known under the name "Litozillo". This covering was installed on the first series of passenger ships on the Black Sea and was entered as a recommended material in the Regulations for the Construction and Outfitting of Ships' Spaces of the Registry of Shipping of the USSR published in 1940.

Xylolite is a mixture of magnesia cement with wood shavings. Single layer xylolite is used as a smoothening mastic under linoleum or plastic coverings. It is used in two layers together with an upper, separating, wear-resistant layer. In this case, the basic 30mm thick layer is covered by a separating layer 10 mm thick whose composition includes sawdust sifted through a fine mesh, talc for increasing elasticity and wear and tear, and a pigment (red lead, ochre, chrome yellow, etc.). After hardening, the surface is polished and impregnated three times with drying oil which increases the waterproofing and elasticity of the covering. It is then polished with wax paste. It is fastened to the deck by means of staple-clamps, since the adhesion of xylolite to metal is poor.

Xylolite covering has the following characteristics:

Weight of 1 m^2 of material with thickness of 35-40 mm	56-70 kg
Compression strength	300-400 kg/cm^2
Bending strength	14-16 kg/cm^2
Specific heat conductivity	0.35kcal/m hr/degree

Such a covering is about three times cheaper than wooden planking and is practically non-combustible: a layer of xylolite 40 mm thick with a metal sheet withstands the standard fire resistance test for class A fire bulkheads.

For these reasons, xylolite obtained world-wide use right through the 1930's when, in repairing the first ships to use xylolite, it was discovered that the steel decks were intensely corroded by the weak solution of hydrochloric acid formed in the hydrolysis of the solution of magnesium

ochre for yellow, etc. The pigments are added while appropriately reducing the sand content. The colored mastic is applied by trowel in 2-3 layers each 1.0 - 1.5 mm thick and the surface is covered with a cloth sprinkled with damp sawdust. 2 or 3 days later the dried painted layer is buffed and polished with wax.

Mastic Neva I has the following characteristics:

Weight by volume in dry state, max.	1000 kg/m^3
Practical drying time	3 days
Adhesion to steel surface, minimum	5 kg/cm^2
Minimum compression strength in dry state	20 kg/cm^2
Impact resistance, minimum	50 kg/cm^2
Heat conductivity coefficient	=0.35 kcal/m hr$^\circ$
Temperature resistance (without impairment)	+80° to -40°C

Modifications of Neva have been developed: Neva II, Neva III, which are distinguished by less weight by volume and less shrinkage. These mastics are designed for covering interior and exterior decks. They have been used experimentally.

Mastic MSL can be used as a covering for inner decks in compositions with other materials. The composition of MSL includes sovelit powder* caustic

*Translator's Note: Sovelit is a mixture of MgO, $CaCO_3$ and abbestos. See Hoseh & Hoseh Russian-English Dictionary of Chemistry and Chemical Technology. N.Y. Reinhold 1964 under entry for sovelit.

magnesite, aqueous solution of magnesium chloride, latex and a stabilizer consisting of casein and an acid and aqueous solution of soda ash. In order to produce the mastic, solutions of magnesium chloride, stabilizer and dry mixture are prepared separately. The density of the magnesium chloride solution should be 22° Be. The stabilizer solution contains acid casein (70-80°), soda ash and latex. The dry mixture consists of sovelit and caustic magnesite.

The solution of magnesium chloride is poured into the dry mixture and stirred carefully. Then the mixture of latex with the stabilizer is added to the solution thus obtained and stirred until a homogeneous consistency is obtained.

Mastic ready for use is grey. A mass should be selected for mixing in quantity which can be applied in two hours. After this period the mastic begins to set and becomes unsuitable for use. This mastic is not moisture resistant, so it is applied on a primer* and not on metal. After a rain it

*Ethinol paints such as vinyflex and selalit can used as a primer.

should be protected by a layer of another, water resistant, mastic.

In order to apply a layer of MSL mastic of a given thickness t on a layer of primer, wooden strips of height t are placed on the area to be painted and their level is checked by means of a declivity board and level. The mastic

is applied to the primer surface between the strips and evened out until an even thickness is obtained. Then the strips are removed, the channels filled with mastic, tamped down and smoothed out to be even with the entire surface. The material is not allowed to dry through and a protective waterproof mastic is applied in three layers of 5 mm total thickness not later than after 24 hours. The application of a protective mastic on an incompletely dry layer of MSL prevents the upper face layer from cracking.

MSL mastic has the following physical and mechanical properties:

Weight by volume in dry state	max. 1100 kg/m^3
Fire resistance	does not burn at 250-300°C for one minute
Frost resistance	does not crack at 40°C
Practical drying with layer thickness of t = 40mm	max. 3 days
Complete drying when t = 40 mm	10-20 days
Adhesion to primer	5-6 kg/cm^2
Ultimate compression strength	15 kg/cm^2
in dry state	7-8 kg/cm^2
with 100% humidity	3-4 kg/cm^2
after being in water for 24 hours	

Neva and MSL mastics are employed for deck coatings and as heat insulation material. No-slip mastic NM-42, which only protects against corrosion, differs from them.

NM-42 mastic is used for coating the passageway sectors of outer decks. Its composition includes: primer (primer No. 138) -45% weight; polychlorvinyl resin -3.7%; solvent D-20.8%, asbestos -3%; cement -18%; sand -9.5%. The standard of consumption of the mixture is 380 k/100m^2. The material is applied in three or four layers with a total thickness of 1.5$\pm$ 0.2mm, dry weight 2kg/m^2. Each layer must be dried until it begins to harden. This requires 12-18 hours at a temperature of 15-20°. The mastic poses excellent adhesion to steel decking, high wear resistance, resistance to impact, petroleum products and water. NM-42 coating does not burn. Damaged areas are easily restored by the direct application of a new coat on the old covering without removing the old sectors, which adhere firmly to the deck.

The mastic covering celalite is applied in combination with ceramic or synthetic tiles. It is manufactured in two compositions: No. 1 and No. 2, and a base for tiles. (Table 12).

Celalite is applied in the following procedure. After careful cleaning of the steel planking, compound No. 1 is brushed on, and then compound No. 2 is applied in a thickness of 4-5mm by special trowel applicator to the unset coat. The fresh coat is moistened with compound No. 1 after which the ceramic or synthetic tiles are laid.

Linoleum has been used for more than 50 years as a covering for the interior decks of ships' spaces. Linoleum is usually produced in one color:

straw, pale, blue, green, red, brown, and other colors. If a design is imparted to the linoleum by applying enamel paints, it is called printed linoleum.

TABLE 12

Material	Contents %		Norm of consumption of material 100m^2 in kg	
	No.1	No.2	No. 1	No. 2.
Latex (min.concentration 30%)	28.6	21.7	8.5	174
Stabilizer K (composition: acid casein -14%, soda ash-1%, fresh water-85%)	8.6	6.5	2.5	52
Portland cement brand no lower than 400	62.8	69.6	19	557
Fiber	----	2.2	-----	17
Total	100	100	30	800

In foreign countries "Jaspe", "Inland" (encrusted) and "Gragoy" brands are produced. They differ from printed linoleums in that their designs consist of two or several colored linoleums rolled so that incomplete mixing of colors occurs and the linoleum appears to consist of colored threads. The design of such linoleum is retained in spite of wear.

Recently, plastic coverings, which are less combustible and possess great wear resistance, have found wide application in shipbuilding and repair in place of the traditional linoleum. Polychlorvinyl linoleum, which covers the decks of living and service spaces of the majority of new ships in the merchant fleet, and nitrolinoleum have found the widest distribution.