

## ENERGY SAVING

## 7.3. New sealing and fire-proof materials for power enterprises

## 7.3.9. Thermoexpanded fire-protective materials

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The «passive» means, providing the fire safety due to flame-retardant coats with special composition find the wider application increasing the fire safety. The special features and main advantages of such «passive» protection means consists in the fact that their protective action is explained by their physicochemical properties of coating substances and works in all situations, i.e. in this case it is impossible that the primary sensors are not acted, the system of fire fighting doesn't activate, the electrical disturbance of fire fighting system takes place, etc. The «passive» fire fighting system always operates, and therefore, the interest to such systems is constantly increasing in the world.

Fire-proof materials of various types with different efficiency at their application are suggested in the Russian market. Many of them are made on the basis of silicates (in particular, of liquid glass). They are comparatively cheap; however they require the coats of considerable thickness. It is difficult to receive the flexible coats on their base, that is important for protection of flexible cables. They are soaking at excessive moisture, shrinking at low moisture and, therefore, are comparatively nondurable — the guaranteed operation life makes from 1 to 5 years.

As the world experience shows, the most efficient methods of «passive» protection from fires are connected with using the fire-proof materials of thermoexpanded type. Such materials under influence of flame (or thermal shock) are sharply increased in volume — by tens times — forming a foam layer with low thermal conduction and high stability

relatively to the fire. The formed foam layer covers the protected surfaces, fills the gaps and openings, and isolates the seat of fire. The efficiency of materials of thermoexpanded type is estimated by the fact that for protection from fires it is sufficient to use quite thin coatings — with thickness from some tenth shares of millimeter to some millimeters, transforming under fire influence in foam layers with thickness of some centimeters.

The fire-proof materials of thermoexpanded type represent the more expansive compositions, however just in this case it is necessary to have the coats with thickness of the shares of mm. They possess the good adhesion to polymeric shells of cables, metallic and wooden surfaces, allow obtaining the flexible coats characterized by the quite high water and weather resistance, durability (up to 25 years). The new Russian fire-proof materials of series "OGRAX", produced by SPA "Unikhimtek", relate just to this group.

The material "OGRAX" is widely used for protection of electric and communication cables, metal and wooden constructions, for manufacturing the fire doors, fire retarding ventilation dampers, cable systems etc.

The materials "OGRAX" can be divided in two groups: one group is made on the bases of high-molecular ammonium phosphate, another one — on the bases of intercalated graphite.

The produced materials of series "OGRAX" of polyphosphate type are presented in fig. 7.27.

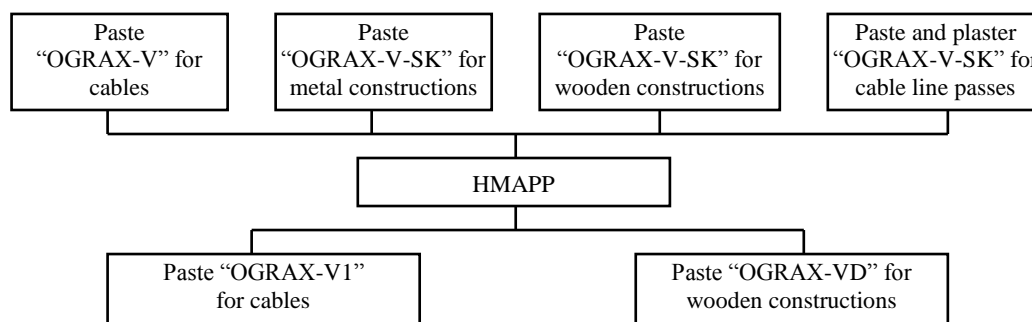


Fig. 7.27. Fire-proof materials "OGRAX" on the base of high-molecular ammonium polyphosphate (HMAPP)

The water-dispersed paste "OGGRAX-V" is widely used for protection of electric and communication cables. The coats on its base have the high elasticity and good adhesion to cables insulation, while for their protection it is necessary to have the coating with thickness only of 0,8 mm. The modification of this paste "OGRAX-V1" is currently developed, and it will possess just higher efficiency.

The experiments were carried out in RF VNIPO MVD for choosing the fire-proof materials, intended for fire protec-

tion of Ostankino TV tower (Moscow city), suffered from fire in 2000. These experiments showed that the paste "OGRAX-V" efficiently protects the feeders of high-frequency TV-antennas too. The water-dispersed paste "OGRAX-V-SK" is intended for protecting the bearing steel structures and corresponds to the 4<sup>th</sup> group of fire-proof efficiency (45 minutes) with coat thickness of 1,18 mm and the 5<sup>th</sup> group (30 minutes) — with thickness of 0,6 mm.

The testing of a sample with protective coating (“OGRAX-V-SK”) showed that the protective coating disruption began only after 45 minutes of flame action on the sample. Even after the termination of tests (in 1 hour) the part of protective coating is still kept on the surface of the

sample.

The materials “ORRAX” on the basis of intercalated graphite are presented in fig. 7.28.

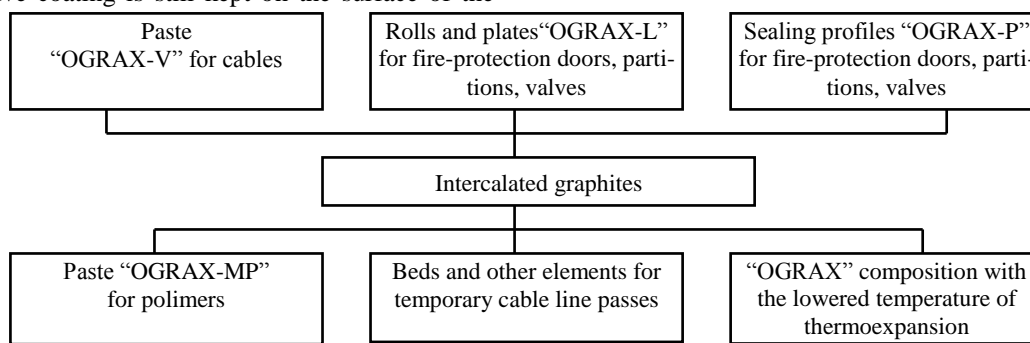


Fig. 7.28. Fire-protective materials “OGRAX” on the basis of the intercalated graphite: produced (the upper row) and developed (the low row)

First of all, it is the paste “OGRAX-M” intended for protection of electric cables and communication cables. The gumming of coating with thickness of 0,8 mm is necessary for it. A mixture of ethyl acetate and nefrace is used as a solvent. The coating “OGRAX-M” has very high indicators, characterizing the water- and weather resistance, flexibility and adhesion to the cable insulation.

Flexible materials: rolls and plates “OGRAX-L” and sealing profiles “OGRAX-P” are also of a great interest. These materials are used for manufacturing the fire doors, baffles and fire retarding ventilation dampers. Materials and elements for the temporary cable passes are also developed.

Some data on efficiency of coating or series OGRAX and their comparison with foreign analogues are presented in tables 7.9 and 7.10.

The analysis of data presented in tables 7.9 and 7.10 showed that the materials “OGRAX” with the same efficiency as other materials, have much less consumption, and it provides their higher cost effectiveness.

Domestic fire-protective materials “OGRAX” differ by high efficiency, environmental safety during coating, have no harmful emissions under fire action and don’t form the toxic compounds in the presence of other substances and factors,

allowing to protect different objects from fire without deterioration of ecological conditions.

Table 7.9. Fire-proof compositions for cables

| Name of coating             | Layer thickness, mm | Product manufacturer |
|-----------------------------|---------------------|----------------------|
| “OGRAX-V, OGRAX-M”          | 0.8                 | Russia, “Unikhimtek” |
|                             |                     | German firms         |
| PYRO-SAFE FLAMMO-TECT A     | 2.0                 | Svt Brandschutz      |
| PYRO-SAFE FLAMMO-PLAST KS-1 | 0.8 ± 0.1           | Svt Brandschutz      |
| UNITHERM K 38104            | 1.8                 | Herberts GmbH        |
| Promatec-285                | 1.6 + 0.2           | USA, “Promatec”      |

All the materials “OGRAX” presented above have the starting expansion temperature ( $t_v$ ) OF about 200°C or higher. However, it is desirable (or even necessary) in some cases to use the coating with lower temperature  $t_v$ . Therefore, we are also developing the materials “OGRAX” with  $t_v = 140...150^\circ\text{C}$ .

Table 7.10. Fire-proof compositions for steel structures

| Name of coating  | Layer thickness of, mm | Group of fire-proof efficiency on SFS 236-97 | Manufacturer of product                  |
|--|------------------------|--|--|
| “OGRAX-V-SK”   | 1.18<br>0.6            | 4<br>5                                       | Russia, «Unikhimtek»                     |
| UNITHERM D 38320 with finishing varnish<br>UNITHERM170-07363 | 2.0                    | 4  | Company of Germany:<br>Herberts-PERMATEX |
| UNITHERM 38091 with finishing varnish<br>UNITHTRM 170-07854  | 1.6                    | 4  | Herberts-PERMATEX                        |
| PYRO-SAFE Flammoplast CP-A2                                  | 1.0                    | 5  | Svt Brandschutz                          |
| Firairflex with cover color Duranol                          | 1.4                    | 4  | Finland, Tikkurila Oy                    |
| Hensotherm 4 KS with protective color 300D                   | 1.55                   | 4  | Sweden, Hensotherm AB                    |
| S607   | 1.5                    | 4  | Gret Britain, Nullifire Ltd              |
| PYRO-TECH SP   | 1.5                    | 4  | England, E. wood Limited                 |

Today the new fire-protective composition for cables was developed. It is waterproof, has the water base and has not domestic and foreign analogue. The development of this protective coating allowed to solve the problem of “passive” fire protection of cables operating with 100%-moisture and at the free air.

The scientists of M.V.Lomonosov Moscow State University and the specialists of SPA «Unikhimtek» created the fire-protective composition for cables “OGRAX-VV” of thermoexpanded (bloating) type. The composition is prepared on the basis of water dispersion with the purposeful mineral filler. At that the coating is absolutely moisture-resistant after dry-

ing. The composition passed the tests and was certified in VNIPO of Emergencies Ministry of Russia.

The material "OGRAX-VV" protects from the ignition, appearing as a result of short circuit from the outside fire hazard and the spreading of combustion of single cable and bundled cables of any types: power, communication, pilot cables and cables, having the rubber and polymer covers, including the polyethylene ones. The material has a high fire-proof efficiency with the coat thickness of only 0.8 mm that corresponds to the material consumption of 1.35 kg/m<sup>2</sup>. The thin layer of coat under action of flame or thermal shock sharply increases its volume by tens times with forming the foam layer having the low thermal conductivity and high fire resistance. The formed foam layer covers the protected surfaces, filling the slots and openings and insulation the seat of fire. The coat "OGRAX-VV" is stable to the environmental impact and the influence of water, fire-extinguished means, and decontaminants and could be used in rooms and outdoors at 100%-moisture with temperature changing from -50 to +60°C.

The coat has a good thermal conductivity, that means it doesn't deteriorate the heat removal and doesn't result in the overheating of cable even with the allowable prolong load current. Therefore, it is not required to reduce the load currents. The treated cables are easily detached one from another that allows carrying out their relaying without violation of fire-proof coat.

The fulfilled accelerated environmental testing allowed estimating the operating life of fire-proof coat in the different conditions. As a result of tests it was established, that the maintenance properties of coat are kept in the range of temperatures from -50 to +60°C during 30 years.

The composition "OGRAX-VV" is supplied to the consumer being ready for application. The coat is deposited by airless or air atomization, by paintbrush or roll on the pure surface of cables. Protection is carried out for already mounted cable communications, and at that the de-energization of network is not required during coating.