



STUDY OF THE INFLUENCE OF EXTERNAL FACTORS ON FLEXIBLE CABLE COATINGS MADE UP OF POLYMER MATERIALS, THE APPLICATION OF TRANSPORT IN THE ELECTRICAL SUPPLY SYSTEM AND MINING ELECTRICAL EQUIPMENT.

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Abstract: The effect of external factors on flexible cable coverings made of polymer materials was studied and conclusions were drawn based on the scientific experiments. The influence of external factors on cable coverings according to their types has been studied and comments have been made on the required parameters.

Key words: elasticity, electrical, polymer material, fluoropolymer, PVX-plastic, temperature, fluoroplastic.

In order to study the influence of external factors on flexible cable coatings made up of polymer materials, I read about the experiments conducted by scientists Leonov Andrei Petrovich and Materi Tatyana Mikhailovna and the results obtained from this work. In this work, an assessment of the strength of insulating materials was carried out, in which a complex of factors effects on flexible cable material fluoropolymer, PVC compound, ethylenpropylene rubbers used in production was studied, the characteristic procedure for expulating transport and mining electrical equipment was determined: mechanical loading, temperature drop, aggressive environment of low molecular weight hydrocarbons.

Reversed: the main structural element of flexible cables is that the shell is a function of its reliability and accident-free operation. The strength limit of the shell changes under the influence of expulative factors i.e. cracks, stretches and bends in the installation. It can be seen that the drop in temperature on the studied materials practically does not affect the physical and mechanical characteristic. The sample strength change limit is 4.9% in fluoropolymers, 2.0% in PVC compound, and 5.8%

in ethylene-propylene rubbers. After holding at low temperatures, the relative elongation of the samples varies negligibly and does not increase by 15%: ethylene propylene is 9% for rubber, PVC compound is 14.9%, fluoropolymer is 1.6%. Samples fluoropolymer and ethylenpropylene rubber underwent an advanced test, which was installed tilting and tilting at a temperature of -60°C. Test results showed that the most resistant material as transformer oil and diesel fuel is fluoroplastics. The change in physical and mechanical parameters did not exceed 10%. The resistance of fluoroplastic to hydrocarbon liquids is due to the high value of the “carbon-fluorine” bond energy, the nature of the melting of the contact materials takes into account their polarization. The prospect of using the material being installed as an adaptive cable coating, which has been given recommendations in this regard, is used to power the electrical systems of transport and mining equipment.

The amount of cold resistance in polymers is determined by temperature, polymers retain the required physical and mechanical parameters and properties during a sudden drop in temperature, for example: elasticity, strength, resistance to stretching, flexibility, etc. The evaluation criterion at low and room temperature shows that the calculated coefficient evaluates the physical and mechanical properties. Polymers are viscoelastic materials, their aging process is considered irreversible. The unusability of a polymer directly depends on the speed of sensing the load acting on it, including negative temperatures. The most important known for polymer materials is the change in their mechanical properties. Physico-mechanical properties of polymers breaking strength at low temperature σ_b (MPa) relative elongation at break ϵ_b %.

Cable products for testing were selected in accordance with GOST 17491-80 without mechanical damage, cracks, pollution and defects. The samples were 1.5 meter long pieces of cable and wire. Their shells are made of PVC coating plastic compound, fluoroplastic and ethylene-propylene rubber. Each sample was wrapped on a metal rod at low temperature, the number of wraps was taken depending on the

diameter of the metal rod. Samples were stored in a cold chamber from -30°C to -60°C for 4 hours. The general appearance of the sample is shown in Picture 1.



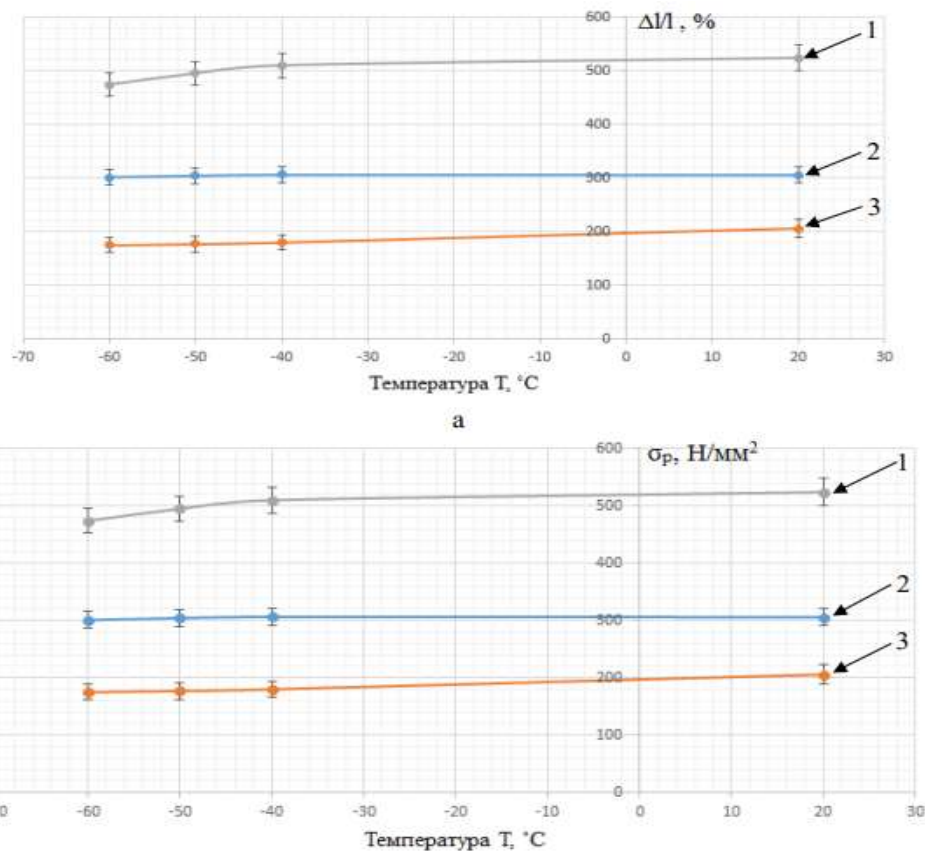
Picture-1. General view of the sample for testing the installation tilt.

GOST IEC 60811-1-1-2011 recommended "General methods of testing electrical and insulating materials and optical cables" in the production of tensile strength σ_b (MPa) and relative elongation $\Delta l/l$ %. Measuring thickness and organization. Methods of mechanical assistance. " methodology was used. Consecutive samples are kept in a cold chamber for at least 4 hours. After this time, they will live and at least 16 hours of normal climate control. strength limit (MPa) and relative elongation $\Delta l/l$ % implementation on a br uzil machine, and the data in table 1.

Table 1. strength properties of typical insulating material of ordinary cable insulation.

Physical and mechanical properties of the material	coating material, sample diameter		
	Fluoropolymer 2.78mm	PVX- plastic 2.72mm	Rubber of Ethylene Propylene3.34mm
Limit of durability	27.7	14.3	17.3
Stretching $\Delta l/l$, %	305.9	205.8	524

The results of the change of strength limit σ_r (MPa) and relative elongation $\Delta l/\%$ are shown in Picture-3.



Picture-3. Changes in the relative elongation (a) and strength limit (b) of the samples after exposure to negative temperatures:

1. Ethylene-propylene rubber
2. Fluoropolymer
3. PVC compound

The results of the change of tensile strength σ_r (MPa) and relative elongation $\Delta l/\%$ after keeping the samples in diesel fuel and transformer oil evaluate the oil resistance of polymer materials.

Samples are stored at room temperature for 1000 hours. The general appearance of the samples is shown in Fig. 4. Every 50 hours, a batch of samples is removed, determination of breaking strength is carried out through strength limit σ_r (MPa) and relative elongation $\Delta l/\%$.



Picture- 4. General view of samples

The results show that:

1. After keeping the sample at negative temperature, it was shown that the relative elongation at negative temperature 1/1% is insignificant and does not exceed 15%. This is allowed because according to regulatory and technical documents, the relative elongation of electrical insulation materials for cable products is set at more than 50%.

2. The final change in strength limit σ_b (MPa) of the studied samples at fracture should not exceed 6%. According to the normative technical documents, the change in the strength limit should not exceed 50%, therefore, according to these indicators, all materials have successfully passed the test.

3. After installation bending tests, surface cracks were found in the samples of PVC composite coatings. Non-polar polymers (fluoropolymer, ethylene-propylene rubber) are macromolecules with a high kinetic flexibility of the polymer chain and, due to a small potential barrier, the flexibility of the chain has been preserved at significantly low temperatures (below -70°C).

4. The fluoropolymer samples showed good durability in diesel fuel and transformer oil. As can be seen in Figure 5, the change in strength at break shows

that the relative elongation does not exceed 10%. The durability of the fluoropolymer is explained by the high value of the "carbon-fluorine" bond energy under the influence of hydrocarbon liquids, the macromolecules of fluorine atoms have completely "screened" the carbon skeleton, thereby expressing the uniqueness of the structure of the polymer macromolecules.

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