# THE INFLUENCE OF THE PHYSICAL FIELDS ON THE PHYSICAL PROPERTIES OF EPOXY COMPOSITE MATERIALS

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Physical modification is a simpler and more economical method of obtaining new materials than the synthesis of new polymers. Physical modification of polymers is divided into chemical, physico-chemical and physical methods. The molecular structure of polymers change in physico-chemical modification. And only when using the physical modification the chemical composition and molecular structure are stable. Physical modification of polymers arises under the influence of various force fields (mechanical, electrical, magnetic, etc.) or as a result of thermal effects. The important role in the influence of magnetic and electric fields is the processes of orientation of macromolecules.

This work is devoted to the study of the effect of external permanent magnetic and electric fields on the structure, thermophysical, dielectric properties of epoxy polymers and their composites containing $Cr_2O_3$.

Samples of nanocomposites were formed from epoxy resin ED-20 and triethylenetetramine. Stoichiometric ratio was 1 mole of epoxy resin to 0,18 mole triethylenetetramine. Powder $Cr_2O_3$ was used as filler. The content of metal oxide was 3 vol. %. Samples of nanocomposites were subjected to curing with different conditions. The influence of constant magnetic and constant electric fields was $2 \cdot 105$ A/m and $1.5 \cdot 104$ V/m respectively. All curing processes were done at 293 – 297 K for 24 hours. Then all polymeric samples were carried out temperature stabilization at 333 ± 2 K for 24 hours.

System studies of structure, thermophysical, thermomechanical and dielectric properties of composites filled with $Cr_2O_3$ formed under the influence of external constant physical field were carried out for the first time. Patterns of connection between the structure and the physical and mechanical properties of epoxy composites were first established.

The introduction of inorganic filler causes the epoxy polymer to dissolution of the structure and reduces the glass transition temperature of the epoxy composite. The estimation of the influence of constant physical fields on the tangent angle of the dielectric losses of the filled composites shows that the orientation effect of constant physical fields increases the free volume of molecular chains of the chemical network of the epoxy polymer. As a result of the directed action of constant physical fields an orientation effect is observed that causes the structure and compaction of macromolecules and inorganic filler in epoxy composites to be streamlined. Also, the gel fraction of the epoxy polymer and its composites was calculated. The values are constant and range from 99,2 % to 97,98 % while the gel fraction of the polyepoxide matrix is 99,97 % to 99,3 %.

The obtained research results can be used as a scientific basis for finding optimal conditions for the formation of the structure of polymer composites filled with dispersed fillers, which will allow obtaining materials with the necessary pre-determined physical, mechanical, electrophysical and thermophysical properties.