PHYSICAL MODIFICATION OF EPOXY COMPOSITE

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The use of physical fields is quite cheap and safer method. Functional materials with distinct physical and chemical properties can be obtained. The resulting material can be used for the production of thermistors, switches ionic current elements of microelectronics and supercapacitors. But despite considerable interest of researchers the mechanism and magnetic and electric fields of polymeric materials is not well understood.

Magnetic properties of substances are caused by spin and orbital magnetic moments of electrons and magnetic moments of atomic nuclei. In all the metals spin magnetic moment plays an important role in the creation of the magnetic moment of the atom. For the presence of the magnetic moment of the atom should be compensated by the magnetic moments of the spins. This is possible in atoms with unfilled shells. These are the elements of transition groups, and other rare earth elements. But the presence filled orbitals in an atom is still not sufficient condition for the existence of ferromagnetism. Between the spins of neighboring atoms should be strong electrical interaction quantum of mechanical nature (exchange forces). This leads to the spontaneous magnetization when the magnetic moments of the atoms are oriented in very small quantities (domains) in a single direction (ferromagnetic) or in opposite directions (antiferromagnetic).

Samples of composites were formed from epoxy resin ED-20 (Russia) and hardener – triethylenetetramine (TETA) company "Fluka" (USA). Stoichiometric ratio was 1 mole of epoxy resins to 0,18 mol TETA. Powder metal oxides CdO, PbO and Cr_2O_3 company «Merck Chemicals» (USA) and polyaniline (PANI) were used as fillers. Particle size of metal oxides evaluation was performed by laser granulometry on the device «Zetasizer HS 1000» company Malvern (UK). The method of obtaining of composite materials has been presented in the manuscript [5]. The content of metal oxides was 3 vol. % and PANI – 1 vol. %.

Samples were subjected to hardening under normal conditions (NU), and under the influence a constant magnetic field (CMF) with intensity $H = 2 \cdot 10^5$ A/m or constant electric field (CEF) tension $E = 1.5 \cdot 10^4$ V/m for 24 hours and the temperature of 293 – 297 K. Created polymeric composites subjected to temperature stabilization at 333 ± 2 K within 24 h, after which the sample was considered ready for research. There were determination of the sol-fraction in the epoxy polymer samples and its composites with metal oxides formed under different conditions of curing.

The specimens of polyepoxy and composites with fillers CdO, PbO, Cr_2O_3, or mixtures thereof in the presence of polyaniline have been studied by thermomechanical of method. The value of the activation energy is changed in samples from PbO more pronounced compared to CdO, due to different interaction of molecules polyepoxy and metals oxides. The introduction of the polyepoxy 3 vol. % metal oxides promotes certain chemical loosening grid and therefore reducing the activation energy, but also the appearance among polar polymer filler led to restrictions kinetic mobility of interstitial fragments manifested in the growth of glass transition temperature. Interestingly, the imposition of a similar system of physical fields from the beginning of the formation of chemical flow creates additional free grid capacity, and thus removes restrictions on the mobility of interstitial fragments, which leads to falling value of glass transition temperature composite of 360 K to 114 K, depending on the properties of the oxide metal. Also, the composite sol-fraction is kept constant in the range 99,2–97,98 %.