

Nanocomposites and nanomaterials

Influence of $\text{BaFe}_{12}\text{O}_{19}$ on AC and DC conductivity of nanocarbon-polymer composite

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For the study of AC and DC conductivity of polymer nanocomposites with hybrid filler two systems have been prepared: two-component system where graphite nanoplatelets (GNPs) or multi walled carbon nanotubes (MWCNTs) were used as fillers; three-component system where barium hexaferrite ($\text{BaFe}_{12}\text{O}_{19}$) were used as second filler. Graphite nanoplatelets were obtained by ultrasonic dispersing of thermally expanded graphite. Their diameter is about 0.2-30 μm and their thickness is about 5-65 nm . The multiwalled carbon nanotubes, purchased from Cheap Tubes Inc. with purity $\geq 90\%$.

As the polymer matrix we have used the epoxy resin modified with organosilicon compounds - SEDM-2. The content of carbon fillers in CMs varied from 0.005 to 0.06 vol. fr. The electric resistance of the samples was measured by two-probe and four-probe method or teraohmmeter E6-13 ($R = 10^9\text{--}10^{13} \Omega$). AC conductivity was measured in the frequency range 30 Hz – 10 MHz at two temperatures (77 K and 293 K).

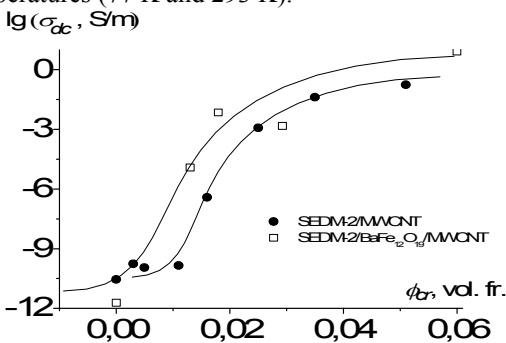


Figure 1. Dependence of electrical conductivity on the concentration of MWCNTs by adding powder $\text{BaFe}_{12}\text{O}_{19}$ and without it.

It is established that the addition of the dielectric filler $\text{BaFe}_{12}\text{O}_{19}$ in composite materials with different nanocarbon (Fig. 1), increases the electrical conductivity, shifts the percolation transition to lower concentrations and the critical frequency to higher frequencies.