## Nanocomposites and nanomaterials

# Electrical properties of epoxy-based composites with graphite nanoplatelets and magnetically aligned magnetite

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Optimization of electrical, thermal, mechanical properties of polymer-based composites (CMs) is effectively achieved by the reinforcement of them with carbon nanoparticles [1]. But for application as shields CMs which have both conducting and magnetic properties are more interesting. One of the promising fillers in this field is magnetite [2].

The aim of present work was to investigate electrical properties of polymer CMs of the same constituents but with magnetically aligned and randomly distributed fillers.

Magnetite ($Fe_3O_4$)/graphite nanoplatelets (GNPs)/epoxy CMs were fabricated by the method of ultrasonication. At curing process the epoxy CMs were subjected to continuous ultrasonic action of 800 kHz frequency to prevent agglomeration of the fillers and provide uniform and random distribution of fillers. To obtain CMs with oriented distribution of fillers mixture was exposed to a low magnetic field (~0.9 T) for 3 hours.

The electrical conductivity of CMs with aligned and uniformly distributed magnetic component of the filler was investigated by 2- and 4 probe methods. It was found that $Fe_3O_4$ form a fiber-like structure in polymer matrix due to magnetic field action and its leads to increase of the CM conductivity. Conductivity increased by two orders for the magnetic field influenced $Fe_3O_4$/GNPs/epoxy CMs versus non-influenced. Besides, the magnetite addition results in conductivity increase in compare with CMs with carbon filler only.

**1.** *Bauhofer W., Kovacs J. Z.* A review and analysis of electrical percolation in carbon nanotube polymer composites // Compos Sci Technol.-2009.-**69.**-P. 1486-1498.

**2.** *Zhou W., Hu X., Bai X., Zhou S., Sun C., Yan J., Chen P.* Synthesis and electromagnetic, microwave absorbing properties of core–shell $Fe_3O_4$–poly(3, 4-ethylenedioxythiophene) microspheres // ACS Appl Mater Interfaces.-2011.-**3.**-P. 3839-3845.