Nanocomposites and nanomaterials

Influence of conductive filler distribution on electrical conductivity and EMI shielding properties of nanocarbon composites

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In this work the results of measurements of concentration dependences of DC conductivity and shielding characteristics in the range of 25.5-37.5 GHz of polymer composites containing different types of nanocarbon fillers have been studied. As polymer matrix there were used ultra-high-molecular-weight polyethylene (UHMWPE), polypropylene (PP), and epoxy resin (ER). As fillers we used thermally treated anthracite, graphene sheets, thermally exfoliated graphite (TEG) and graphite nanoparticles (GNPs).

Two types of composites were formed: 1 - with random distribution of conductive particles, 2 – with ordered distribution of filler (segregated system).

Fig. 1. Shielding efficiency of polymer composites versus electrical conductivity

It was found the percolation behavior of conductivity for all kinds of composites studied with different values of percolation threshold $_c$. Essential decrease of $_c$ down to 2 vol.% (in ~10 times) was observed for composites with ordered structure of anthracite particles as compared for random filler distribution. As it is seen from Fig. 1, the increase of electrical conductivity of composites $_{DC}$ along the increase of carbon filler content leads to essential increase of EMI shielding efficiency SE_T.