## Nanocomposites and nanomaterials

# Electrophysical properties of polymer composites filled with nano- and micro-carbon fillers

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Modern technologies require new advanced conductive polymer composites with specific electrical properties. Segregated polymer composites (SPC) can be a good solution for this demand. In SPC conductive filler creates an ordered framework in the polymer matrix. The local concentration of the filler in the wall of SPC framework is much higher than mean filler concentration related to the whole volume of polymer matrix. Owing to this the percolation threshold is much lower than for the random distribution of filler in polymer composites.

For our experiments, SPC were formed by hot compacting method. SPC were based on the ultra-high-molecular-weight polyethylene (UHMWPE), as the fillers were used microsized anthracite (A) and nanosized graphene (Gr), thermally expanded graphite (TEG) and graphene nanoplatelets (GNP). For comparison, there were produced extruded composites based on polypropylene with random distribution of anthracite filler (PP-A) and a hybrid nano-micro series UHMWPE-(Gr+A) with fillers ratio 1/3.

The concentration dependence of conductivity is described by a well-known percolation scaling model. The values of percolation thresholds of SPC are much lower than for random composite PP-A. Percolation threshold for nanosized composites UHMWPE-Gr, UHMWPE-TEG and UHMWPE-GNP – are 0.21, 0.49 and 0.79 vol.% respectively, for mictosized composites UHMWPE-A – 2.95 vol.%. For the composites with random filler distribution PP-A the percolation threshold equals to 24.8 vol.%. Latter result can be explained by existing of ordered conductive framework in SPC with much higher local concentration.