New Electric Conductive Polymeric Nanocomposites Based on Graphene

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The unusual mechanical and electronic properties of graphene make it a promising candidate for future devices. While these applications are a focus of further investigations, there are some areas where graphene can be used straightway. Graphene has attracted increasing attention for optoelectronic devices, super-capacitors, gas, pH, chemical, strain and bio-sensors, transparent films for liquid crystal devices, biodevices, DNA transistor, and nanocomposite applications. Proposed applications have enhanced properties comparing to carbon nanotube materials [1].

Here we report the results on polymeric nanocomposites based on the elastomeric matrix, namely styrene-isoprene-styrene copolymer and expanded graphite. As a source of graphitic nanofiller, expanded graphite having an average particle size of 50 microns was used. This dispersion was firstly prepared by sonication, followed by mixing with polymer solution and the thin films were casted onto a Teflon array. Thin films having a concentration of nanofiller up to 10 wt.%, with an average thickness around 400 microns, were prepared and tested.

Dispergation of nanofiller within the polymeric matrix as well as the effect of exfoliation of expanded graphite into the individual graphene layers was investigated by scanning electron microscopy. The prepared nanocomposites shown the percolation threshold around 2 wt% of the filler. The increase in the storage modulus up to 80% in the glass state and up to 500% in the rubber state was observed by dynamic-mechanical analysis. Broadband dielectric spectroscopy in the range between 40 Hz up to 2.7 GHz was used to characterize the relaxation of polymer chains in the presence of graphene particles.

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References

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