Nanocomposites and nanomaterials

Properties of graphene nanoparticles and their composites with Polychlortrifluoroethylene

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A new effective method of graphene nanoparticles (GNP) synthesis by means of dense material anodic oxidation from exfoliated graphites (EG) is reported [1] GNP obtained by this method are characterized by a Laser Correlation (LKS), Raman (RS) and Impedance (IS) spectroscopy, X-ray diffraction (X-ray), and Differential-thermal gravimetric analysis (DTA, DTG), scanning electron microscopy (SEM). It is investigated the real (ε') and imaginary (ε") components of complex permittivity in the microwave range of 8-12 GHz and the dependence of the complex electrical conductivity determined by calculation of the impedance spectra in the frequency range 10^{-2}–10^{6} Hz for the system polychlorotrifluoroethylene (PCTFE) - GNP. GNP is multi-layered system containing 7-9 graphene layers. As shown in Fig. 1, graphene nanoparticles form the "flower" structure on the substrates reducing, thus, their surface energy. As a result of the DTA-DTG analysis, the ratio of GNP mass to polycrystalline graphite mass (3:1, respectively) is estimated. This result is qualitatively confirmed by the X-ray results showing the presence of two phases as namely, polycrystalline graphite and nanoscaled carbon material with graphite-like structure. The data of GNP conductivity investigation and dielectric constant of the PHTFE - GNP composite showed that GNP conductivity is caused by the high level of the electronic component. The value of real and imaginary components of the complex permittivity in the microwave range and conductivity at low frequency is non- linearly dependent on the content of GNP in the PHTFE - GNP composites due to the presence of percolation threshold. The percolation threshold for the system is ~ 0.45 wt%. These composites can be used as promising materials for the design of the catalysts and conductive materials.

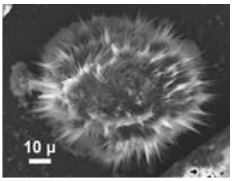

Fig.1. SEM of GNP.

1. *Sementsov Yu.I., Dovbeshko G.I., Mahno S.M. et al. Electrochemical methods of production nanoscale graphene material. Modern problems of Condensed Matter. Proceedings of the IV international Conference 07-19 October 2015, T. Shevchenko Kyiv National University, Ukraine, P. 80-82.*