Nanocomposites and nanomaterials

Dielectric properties on carbon polymer composites in a wide frequency range

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The rapid development of radio-electronic equipment, particulary the development of radiophones, discovery of the Internet, satellite communications etc. during the last hundred years has led to new problems, which previously were never encountered, such as radio noise and polluting electromagnetic radiation. In the absence of electromagnetic protection, electromagnetic radiation can disrupt normal operation of devices, result in damage of equipment and even affect human health [1]. That is why this paper investigated of polymer hybrid nanocomposites with two nanocarbon fillers (carbon nanotubes (MWCNTs) and graphite nanoplatelets (GNPs)), which can solve these problems [2].

To study the dielectric characteristics of polymer nanocomposites, carbon composite samples with ordinary and hybrid fillers were created. The content of ordinary nanocarbon (GNPs or MWCNTs) filler were varied from 0.5 to 8 wt. %. Hybrid filler consists of two types of nanocarbon (GNPs and MWCNTs), which were mixed in different proportions. As the polymer matrix we used epoxy resin Larit285 (viscosity of 600 – 900 mPa·s) with hardening agent H285 (viscosity of 50 – 100 mPa·s). Measurement of dielectric constants was made by Keysight Network Analyzer N5227A with sensor Agilent Dielectric Probe in the frequency range from f =1 GHz to f = 50 GHz.

We showed that in composites with ordinary filler absolute value of ε' grows as concentration of nanocarbon particles increases. In samples with hybrid filler anomalous dependence of ε'(c), ε"(c) were observed. When the total concentration of hybrid filler is equal to 3 wt. % maximum is observed for concentration dependence of ε'(c), its position does not depend on frequency.

[1] *Geetha, S., Satheesh Kumar, K. K., Chepuri, R. K., Vijayan, M., Trivedi, D. C.* EMI Shielding: Methods and Materials—A Review // Journal of Applied Polymer Science.-2009.-112.-P. 2073–2086.
[2] *Qin, F., Brosseau, C.* A Review and Analysis of Microwave Absorption in Polymer Composites Filled with Carbonaceous Particles // J. Appl. Phys.-2012.-111.-P. 061301.