E.M. Attenuation Performance of Exfoliated Graphite Composites for Microwave Applications

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Abstract

The latest trends, techniques and applications of microwave radiation in wireless network technologies, cellular phones, targeting radars, vehicle speed detection, and electron spin resonance apparatus, etc stimulate searching of new materials with desirable mechanical and thermal properties providing high electrical conductivity and electromagnetic interference shielding effectiveness (EM SE). For that purpose, a series of composite samples were prepared, based on epoxy resin (Epikote 828), a curing agent called A1 (a modified TEPA) and up to 2.0 wt.% content of exfoliated graphite (EG). EG was obtained by intercalation of natural graphite flakes, subsequently submitted to a thermal shock. Accordion-like particles were thus produced, leading to a material of low packing density, around 3 g/L [1]. The complex dielectric permittivity $\varepsilon^* = \varepsilon' - i\varepsilon''$ was measured by a LCR meter HP4284A in the frequency range 20 Hz–1 MHz at room temperatures. The spectra of S–parameters of epoxy/EG composites were measured in microwave range (26-37 GHz) with scalar network analyzer. The average value of power transmitted through the samples is 60%, 30%, and close to 0 for 0.25, 1 and 2 wt.% of EG embedded, respectively. Along with high EM performance in microwave range, graphene platelets are much more easily processable than composites filled with CNTs. Concluding, giving the benefit of being lightweight, using EG leads to exceptionally good EM attenuation ability, along with high dielectric permittivity in low frequency range (see Fig.1).

Figure

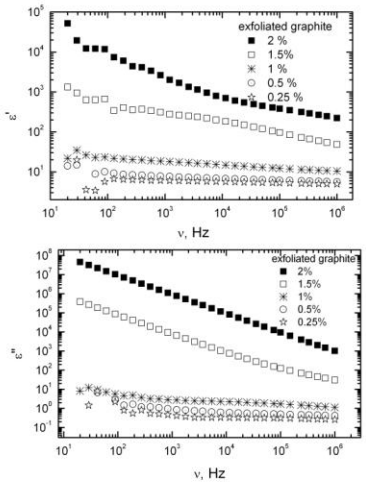

Figure 1. Dielectric permittivity of epoxy/EG in low frequency range