Transport mechanisms and dielectric relaxation of epoxy nanocomposites in dc to microwave range

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Abstract

We have used several methods to measure the effective complex permittivity of epoxy composites filled with carbonaceous (carbon black (CB), single wall CNT (SWCNT), and multiwalled carbon nanotube (MWCNT) over nine decades of frequency. The composite samples were fabricated by shear mixing. The spectral analysis of permittivity of these nanocomposites is in good agreement with Jonscher's modelling. We point out, taking these examples, that the experimental frequency dependence of the effective permittivity has a range of interesting properties. Firstly, the likely transport mechanisms responsible for the dielectric relaxation in these samples can be modeled by the dipolar relaxation and anomalous low-frequency dispersion below and above percolation, respectively (Fig. 1).

Figure

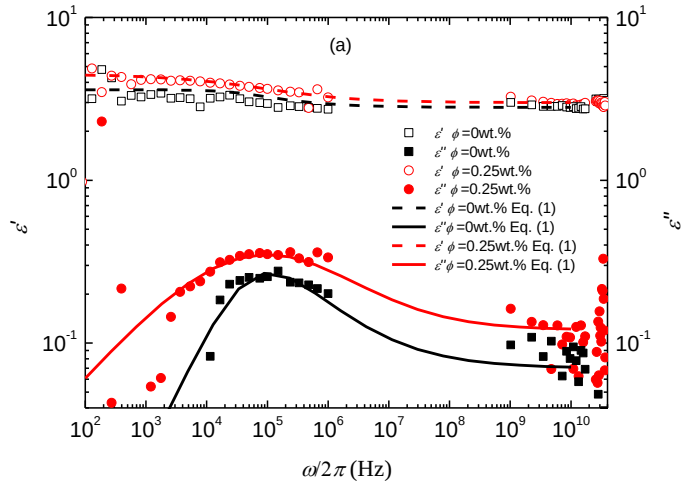

Figure 1. Effective permittivity spectra of MWCNT-filled diglycidyl ether of bisphenol-A samples at various MWCNT weight fractions below the percolation threshold