Impedance and Dielectric Spectroscopy of Nano-Graphite Reinforced Silicon Elastomer Nanocomposites

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ABSTRACT

Impedance and dielectric spectra of silicone elastomer nanocomposites were used to study their secondary (α* or β) relaxation behavior as a function of nano-graphite loadings in the frequency range of 10^{-1} to 10^{6} Hz. The effect of nano-graphite loadings on real and imaginary parts of complex impedance was distinctly visible and explained on the basis of interfacial polarization of filler and relaxation dynamics of polymer chains. The effects of nano-graphite loadings on loss tangent, dielectric permittivity, complex dielectric modulus and electrical conductivity have also been studied. The dielectric permittivity of the composites strongly depends up on the extent of nano-graphite concentration and temperature. The conductivity and relaxation phenomenon have been investigated through dielectric modulus formalism. Nyquist plots, Cole-Cole plots and Argand diagram confirm the existence of non-debye relationship. The frequency dependence of ac conductivity has been investigated by using Percolation theory. The percolation phenomenon has been discussed from electrical conductivity and dielectric permittivity. The percolation threshold was found to be at 6 phr nano-graphite loading. SEM photomicrographs shows well dispersion of nano-graphite.

Keywords: Elastomer; nano-graphite; impedance; dielectric; relaxation; conductivity; percolation.

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