Improvement of Interaction Between Pre-Dispersed Multi-Walled Carbon Nanotubes and Unsaturated Polyester Resin

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ABSTRACT
Efforts are being given to the development of well-dispersed nanoparticle-reinforced polymer nanocomposites in order to tailor the material properties. In this perspective, well dispersion of multi-walled carbon nanotubes (MWCNTs) in unsaturated polyester resin (UPR) was prepared using pre-dispersed MWCNTs in tetrahydrofuran solvent with ultrasonication method. Then the well-dispersed MWCNTs reinforced UPR nanocomposites were fabricated through solvent evaporation. Fourier-transform infrared spectroscopy indicates a good interaction between matrix and MWCNTs. This along with homogeneous dispersion of nanotubes in matrix has been confirmed by the field emission scanning electron microscopy. At low shear rate, the value of viscosity of UPR is 8,593 mPa s and that of pre-dispersed MWCNT–UPR suspension is 43,491 mPa s, showing implicitly a good dispersion of nanotubes. A notable improvement in the crystallinity of UPR from 14 to 21 % after MWCNTs inclusion was observed by X-ray diffractometry. The mechanical properties, such as tensile strength, tensile modulus, impact strength, and elongation-at-break, of nanocomposite were found to be increased to 22, 20, 28, and 87 %, respectively. The estimated melting enthalpy per gram for composites as analyzed by differential scanning calorimetry is higher than that of UPR. The onset temperature of thermal decomposition in the nanocomposites as monitored by thermogravimetric analysis is found higher than that of UPR. Correlations among MWCNTs dispersion, nucleation, fracture morphology, and various properties were measured and reported.

KEYWORDS: Multiwall carbon nanotubes; Pre-dispersion; Polyester resin; Solvent evaporation; Reinforced polymer nanocomposites