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Synthesis and Viscoelastic Properties of UV Cured Polyurethane Acrylate/Silicon Carbide Nanocomposites

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Extended Abstract

In the present work, a new semiconductive UV cured polyurethane acrylate/ SiC nanocomposite (UV-PUA/SiC) was prepared. Subsequently, the effect of SiC concentration on the conductivity of nanocomposites was studied. UV curable polyurethane acrylate was synthesized by the reaction of isophorone diisocyanate (IPDI), 1,6 hexan diol (1,6 HDO) and 2-hydroxyethyl methacrylate (HEMA) using dibutyltin dilaurate (DBTDL) as a catalyst. Following the sonication of nanocomposites, the samples containing 1, 3, and 5wt% of SiC were cured using ultraviolet radiation. The samples were characterized by FT-IR, TGA and SEM analyses. The best morphology in terms of the nanoparticles dispersion was obtained for the nanocomposites containing 1 wt% SiC. Four-probe method was used to investigate the electrical conductivity of nanocomposites. A monotonic enhancement of electrical conductivity was obtained with SiC concentration.

The viscoelastic properties were studied using dynamic mechanical thermal analysis (DMTA). The glass transition temperature (T_g) was determined as the peak temperature of the tan δ curve. UV-PUA containing 1 wt% of SiC nanoparticles showed a higher glass transition temperature of about seven degrees in comparison to the neat polymer. The addition of one wt% of silicon carbide nanoparticles to the UV cured polyurethane acrylate affected significantly the viscoelastic properties of samples. SEM analyses confirmed the results of DMTA regarding the state of dispersion of SiC nanoparticles. Furthermore, the network heterogeneity, crosslink density of the nanocomposites, activation energy for glass transition of (UV-PUA/ 1% SiC) and the William–Landel–Ferry (WLF) constants were investigated by DMTA analysis.