

Preparation and Characterization of Polymer Nanocomposites Dispersed with Surface-Functionalized Detonation Diamonds

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Detonation nanodiamonds become increasingly important as a reinforcing source for polymer composite materials, owing to its excellent optical, mechanical and thermodynamic properties. There exist a few reports applying pristine nanodiamonds to polymer nanocomposites, but, no systematic work has emerged with surface-functionalized diamond nanoparticles. We have prepared various functionalized nanodiamond compounds having hydroxyl, carboxyl, amino, amide group in the solution phase by chemical methods. Their identifications and characterizations were investigated by employing electron microscopy, atomic force microscopy, X-ray, IR, dynamic light scattering, solubility, and zeta potential measurements. These surface-functionalized nanodiamonds were dispersed into polymers including poly(methyl methacrylate), polycarbonate, and blends. Dried polymer nanocomposites which contain the ND contents from 0 up to 10% were subjected to the measurements of surface morphology, friction coefficient, wear resistance, and calorimetry. We found that those properties depend strongly on polymer compositions, surface functional group, and ND contents, thus their combinatorial optimization should be an important factor when polymer nanocomposites dispersed with nanodiamonds are put into various applications.