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Effect of $CaCO_3$ Contents on the Properties of Polyethylene Nanocomposites Sheets

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Abstract: Nanocomposites of high-density polyethylene/linear low-density polyethylene (HDPE/LLDPE) filled with untreated and surface treated nano-calcium carbonate (nCC) were prepared. The influence of isopropyl tri-(dioctylpyrophosphato) titanate (JN114) treatment of nCC on the morphology, mechanical, crystallization and flow properties of the nanocomposites were studied. The results of scanning electron microscopy (SEM) showed that JN114 treated nCC was better dispersion in the matrix than the untreated one. A fine dispersion of the treated nanoparticles in the nanocomposites was observed by transmission electron microscopy (TEM). The FTIR spectrum analysis revealed that the JN114 could change the surface properties of nCC, resulting in greater hydrophobicity of the surface and enhanced compatibility with nonpolar matrices. The tensile elastic modulus (E_c) and Izod impact strength (S_{IC}) of nanocomposites increased with the increasing of nCC content while tensile fracture strength (σ_b) decreased. The JN114 treated nanocomposites had superior mechanical properties to those of the untreated ones. The compatibility of these nanocomposites was examined by DSC to estimate melting point (T_m) and crystallization temperature (T_c). Furthermore, the melt flow index (MFI) of the nanocomposite materials were measured. It was found that the MFI decreased with the addition of weight fraction of the nCC particles.

Keywords: HDPE/LLDPE blend, Nano-$CaCO_3$, Morphology, Mechanical properties, Crystallization, Melt flow index (MFI)