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Compounding of Polystyrene/Titanium Dioxide Nano Composites via Melt Extrusion for Optical Applications

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One of the advantages that polymer nanocomposites offer when compared to other conventionally filled polymers is the theoretically possible optical clarity and improved refractive index due to negligible intensity loss by light scattering of nanoscale particles and the high refractive index of nanoparticles, respectively. In this study, alumina and crystalline silicon nanoparticles were separately blended with polycarbonate via the solution method for potential applications in optically transparent nanocomposites. The nanoparticle dispersion was performed in tetrahydrofuran with the presence of a silane surfactant under ultrasonic vibration to enhance further dispersion. Dissolved polycarbonate in tetrahydrofuran was then mixed with the nanoparticle solution, followed by precipitations in methanol. The resulting nanocomposite powder was dried and then injection molded into standard tensile test specimens. Agglomerates of approximately 100nm or less were observed on the fractured surface, with improved modulus for the polycarbonate/alumina nanocomposites. In addition, the polycarbonate/alumina nanocomposites retained their transparencies close to that of the virgin polycarbonates. However, both nanocomposites exhibited brittle behaviors, and the crystalline silicon nanocomposites did not exhibit any transparencies to visible light.