

6th Global Experts Meeting on

Nanomaterials and Nanotechnology

April 21-23, 2016 Valencia, Spain

Manufacturing and performance assessment of injection molded HDPE-TiO₂ nanocomposites for biomedical applications: Effects of barrel temperature and residence time

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In various fields of engineering, polymeric nanocomposites play a crucial role in the development of advanced materials. Sustainable amount of research is done in order to design these composites in a safe and efficient manner. In the present study, influence of barrel temperature and residence time on the HDPE-TiO₂ nanocomposites was evaluated where the filler concentration was kept constant at 5%. From tensile tests, the highest modulus was observed at a barrel temperature of 250°C and percent elongation consistently increased with an increment in temperature, tensile strength however, showed little effect. Residence time on the other hand did not have a significant effect on elongation of the samples. Degradation and melting temperature decreased with a rise in barrel temperature, rate of crystallization reached a maximum of 75% when both the parameters were varied. FTIR analysis of the fabricated nanocomposites confirmed the titanium dioxide particles were well dispersed. XRD traces showed that neither of the properties had a prominent effect on the crystal structure of the nanocomposites. A uniform distribution of the titania was seen on the polymeric matrix through the SEM micrographs, which was supported by EDS mapping and point analysis.

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