Crystalline Morphology and Properties of Multi-Walled Carbon Nanotube Filled Isotactic Polypropylene Nanocomposites: Influence of Filler Size and Loading

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ABSTRACT

Isotactic polypropylene (PP) nanocomposites with multi-walled carbon nanotubes (MWCNTs) of various diameters (10–50 nm) were fabricated by extrusion and compression-molding techniques and characterized by X-ray diffraction measurements, differential scanning calorimetry, scanning electron microscopy, mechanical test and differential thermal analyses. The pure PP exhibits both the *a*- and *b*-axes oriented α-crystal, whereas the MWCNTs induce the *b*-axis orientation of the α-crystal along with the formation of minor γ-phase crystal in nanocomposites. Crystallinity, long period of lamellae, tensile strength, tensile modulus (*TM*) and microhardness (*H*) of PP considerably change by different loading and sizes of MWCNTs. The estimated values *H*/*TM* = 0.09–0.10 for all samples approach the predicted value of 0.10 for polymers. The increase in crystallinity has been demonstrated by both XRD and DSC studies. Mathematical models have been invoked to explain the changes in mechanical properties. An increase in thermal stability of polymer matrix occurs with increasing MWCNTs size and loading.

KEYWORDS: A. Polymer-matrix composites (PMCs); A. Nano-structures; B. Mechanical properties; B. Surface properties; E. Compression moulding

DOI: 10.1016/j.compositesa.2013.05.011