

The Fabrication and Characterization of Hierarchical Carbon Nanotube/Carbon Fiber/High-Density Polyethylene Composites via Twin-Screw Extrusion

Authors : Chao Hu, Xinwen Liao, Qing-Hua Qin, Gang Wang

Abstract : The hierarchical carbon nanotube (CNT)/carbon fiber (CF)/high density polyethylene (HDPE) was fabricated via compound extrusion and injection molding, in which to author's best knowledge CNT was employed as a nano-coatings on the surface of CF for the first time by spray coating technique. The CNT coatings relative to CF was set at 1 wt% and the CF content relative to the composites varied from 0 to 25 wt% to study the influence of CNT coatings and CF contents on the mechanical, thermal and morphological performance of this hierarchical composites. The results showed that with the rise of CF contents, the mechanical properties, including the tensile properties, flexural properties, and hardness of CNT/CF/HDPE composites, were effectively improved. Furthermore, the CNT-coated composites showed overall higher mechanical performance than the uncoated counterparts. It can be ascribed to the enhancement of interfacial bonding between the CF and HDPE via the incorporation of CNT, which was demonstrated by the scanning electron microscopy observation. Meanwhile, the differential scanning calorimetry data indicated that by the introduction of CNT and CF, the crystallization temperature and crystallinity of HDPE were affected while the melting temperature did not have an obvious alteration.

Keywords : carbon fibers, carbon nanotubes, extrusion, high density polyethylene

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