

128c Effect of Structural Morphology on the Mechanical Properties of Carbon Nanotube/Polypropylene Composites

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The mechanical properties and morphology of multi-wall carbon nanotube (MWNT)/polypropylene (PP) nanocomposites were studied as a function of nanotube orientation and concentration. Through melt mixing followed by melt drawing, using a twin screw mini-extruder with a specially designed winding apparatus, the dispersion and orientation of multi-wall carbon nanotubes was optimized in polypropylene. Tensile tests showed a 32% increase in toughness for a 0.25 wt % MWNT in PP (over pure PP). Moreover, modulus increased by 138% with 0.25 wt % MWNTs. Transmission electron microscopy (TEM) and scanning electron microscopy (SEM) all demonstrated qualitative nanotube orientation. Wide angle X-ray diffraction was used to calculate the Herman's Orientation Factor for the composites as function of nanotube loading and orientation. No significant changes in PP crystal orientation were found indicating that the alignment of the nanotubes did not significantly affect the orientation of the PP crystals. In addition, differential scanning calorimetry (DSC) qualitatively revealed little change in overall crystallinity. In conclusion this work has shown that melt mixing coupled with melt drawing has yielded MWNT/PP composites with a unique combination of strength and toughness suitable for advanced fiber applications, such as smart fibers and high performance fabrics.