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Effect of Molecular Weight on Load Transfer in Nanotube / Polymer Composites MINFANG MU, Department of Materials Science and Engineering, FANGMING DU, Department of Chemical and Biomolecular Engineering, RETO HAGGENMUELLER, KAREN WINEY, Department of Materials Science and Engineering — The tensile moduli of nanocomposite fibers are being investigated with attention to the molecular weight of the polymer. Nanocomposites composed of single wall carbon nanotube (SWNT) and poly(methyl methacrylate) (PMMA) were prepared by our coagulation method and processed into composite fibers using melt fiber spinning. SWNT in the fibers are aligned and the nanotube - nanotube interactions are diminished, so that, the mechanical load on SWNT is mainly from polymer - SWNT interactions. The tensile moduli along the direction parallel to the SWNT were characterized at 1.0 mm / sec with the fiber length of 25.4 mm. At a weight-average molecular weight (Mw) 25 kDa, the tensile moduli of PMMA are the same with the composites. However, when the Mw is increased to 100kDa, the tensile moduli are improved greatly by adding SWNT. This indicates that the load in the composites is transferred to the SWNT more efficiently at 100 kDa molecular weight. A micromechanics model was used to relate the elastic shear stress on the polymer - SWNT interface to the polymer chain length. It showed that with increasing polymer chain length, the interfacial shear stress was enhanced. This study demonstrates the importance of the molecular weight of the polymer matrix to the load transfer in nanocomposites.

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