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Structure and Properties of Polymer Composites from Infiltrated Aligned Multiwall Carbon Nanotubes

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Densely-packed, vertically-aligned multiwall carbon nanotubes (VA-MWNTs) can be grown to near millimeter thicknesses, offering the opportunity for thick, pre-aligned polymer composites with anisotropic thermal and electrical properties. Vertically-aligned arrays of MWNT were infiltrated with aminoepoxy and polymer solutions and cured. The resulting nanocomposite films were characterized by nanoindentation, SEM and optical microscopy, and microRaman spectroscopy. We found that the mechanical properties are strongly dependent on the nanotube orientation in the composites. For aminoepoxy, the height of the VA-MWNTs was preserved in the polymer composite. Enhancements in Young's modulus over pure epoxy were found in both parallel and perpendicular nanotube orientations, and ranged from 25% (perpendicular) to 50% (parallel). The hardness of the composite (using unmodified MWNT) was nearly unchanged compared to pure epoxy. The aminoepoxy composite was electrically conductive (average resistivity 2k-Ohms/cm) but dependent on percolation paths caused by partial aggregation of the aligned nanotubes in the composite. The structure and properties of composites using VA-MWNTs infiltrated with other polymers will be discussed.

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