Carbon Nanotube Reinforced Polymer Nanocomposites: Engineering the Interface at the Nano-Domain

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In this study, chemical or physical modifications on the surface of multi-walled carbon nanotubes are carried out using either a three-step chemical treatment or a surfactant method. In the first scheme, following the conventional nanotube oxidation procedure, a novel reduction step involving the conversion of all the miscellaneous functional groups on the nanotube surface to hydroxyl groups is employed. As a result, the surface distortion and the chance to introduce further defects during subsequent reactions are significantly reduced. Finally, chemical treatments are performed based on the hydroxyl chemistry by grafting chemical chain sectors of varied lipophilicity, length, and reactivity onto the nanotube surface. In a second scheme, surfactants are used to tailor the nanotube/polymer interactions by varying the nature of the surfactants (wrapping, functional group reactivity, length, etc.). For both schemes, a three-phase (the polymer matrix, the nano-inclusion, and the interface) model can be employed to elucidate the properties of these polymer nanocomposites.