

[PO-F2]Poster Session 2

Symposium F

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[P2-49]A Functionally Graded Multi-Phase Micromechanical Model for Carbon Nanotube - Polymer Composites

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Carbon nanotubes (CNT) are widely known for their superior stiffness as well as strength since their discovery in 1991. While our current level of understanding of carbon nanotubes prevent us from using them in structural parts per se, embedding them in polymers for strengthening and stiffening purposes shows a great potential. However practical efforts towards designing, manufacturing and employing such nanocomposite materials have not yet fully culminated largely due to a lack of understanding of the bonding between the nanotube and the polymer.

Latest experimental and molecular mechanical observations of the region around a carbon nanotube embedded inside a polymer indicate the presence of at least four distinct “phases” in nanocomposites; the CNT, the thin interfacial gap between the CNT and the polymer, a large portion of polymer around the CNT with linearly varying properties, and the bulk polymer phase.

Hence, to accurately model nanocomposite material the varying nature of polymer in the proximity of the CNT has to be taken into account, among other things.

We adopt a multi-phase micromechanical model that allows gradual degradation/upgradation of the constituent phases to study the mechanical properties of CNT-Polymer composites. Using this model the mechanical properties of the polymer is gradually enhanced in the vicinity of the CNT. We also study the effect of the gap between the CNT and the polymer and the role it plays in such nanocomposites. The results of our analyses are then compared to experimental data and discussed in detail.