World Academy of Science, Engineering and Technology
International Journal of Mechanical and Industrial Engineering
Vol:12, No:10, 2018

Micromechanical Determination of the Mechanical Properties of Carbon Nanotube-Polymer Composites with a Functionally Graded Interphase

Authors : Vahidullah Tac, Ercan Gurses

Abstract : There have been numerous attempts at modelling carbon nanotube – polymer composites micromechanically in recent years, albeit to limited success. One of the major setbacks of the models used in the scientific community is the lack of regard to the different phases present in a nanocomposite. We employ a multi-phase micromechanical model that allows functionally grading certain phases to determine the mechanical properties of nanocomposites. The model has four distinct phases; the nanotube, the interface between the nanotube and polymer, the interphase, and the bulk matrix. Among the four phases, the interphase is functionally graded such that its moduli gradually decrease from some predetermined values to those of the bulk polymer. We find that the interface plays little role in stiffening/softening of the polymer per se , but instead, it is responsible for load transfer between the polymer and the carbon nanotube. Our results indicate that the carbon nanotube, as well as the interphase, have significant roles in stiffening the composite. The results are then compared to experimental findings and the interphase is tuned accordingly.

Keywords : carbon nanotube, composite, interphase, micromechanical modeling
Conference Title : ICCFSM 2018 : International Conference on Computational Fluid and Solid Mechanics
Conference Location : Paris, France
Conference Dates : October 29-30, 2018