Accepted Manuscript

Investigation of stress transfer in carbon nanotube reinforced composites using a multi-scale finite element approach

K.N. Spanos, S.K. Georgantzinos, N.K. Anifantis

PII: S1359-8368(14)00136-X
DOI: http://dx.doi.org/10.1016/j.compositesb.2014.03.020
Reference: JCOMB 2978

To appear in: *Composites: Part B*

Received Date: 13 November 2013
Revised Date: 14 March 2014
Accepted Date: 31 March 2014

Please cite this article as: Spanos, K.N., Georgantzinos, S.K., Anifantis, N.K., Investigation of stress transfer in carbon nanotube reinforced composites using a multi-scale finite element approach, *Composites: Part B* (2014), doi: http://dx.doi.org/10.1016/j.compositesb.2014.03.020

Investigation of stress transfer in carbon nanotube reinforced composites using a multi-scale finite element approach

K.N. Spanos, S.K. Georgantzinos, N.K. Anifantis*

Mechanical and Aeronautics Engineering Department
University of Patras, 26500 Rio, Patras, Greece

Abstract

This paper describes a micromechanical hybrid finite element approach to study the stress transfer in single-walled carbon nanotube reinforced composites. A three-dimensional representative volume element of composite has been considered in this analysis. The nanotube is modeled taking into account its atomistic microstructure. The matrix material is modeled as continuum utilizing appropriate solid finite elements. Spring-based elements are used to describe the behavior of the single-walled carbon nanotubes. The interfacial effects between the two materials are simulated by appropriate stiffness variations defining a heterogeneous region. The model presents a reasonable behavior, with respect to composite effective mechanical properties, comparing with results available in the literature. The effects of carbon nanotube volume fraction, interfacial stiffness and elastic modulus of matrix on stresses are analyzed in details.

Keywords: A. 3-Dimensional reinforcement; B. Interface/interphase; B. Stress transfer; C. Finite element analysis (FEA); Nanocomposite.

* Corresponding author: E-mail address: nanif@mech.upatras.gr