Title

THE EFFECTIVE PROPERTIES AND DEBONDING EFFECT OF CARBONNANOTUBE-REINFORCED COMPOSITES

Abstract text

This paper deals with a constitutive model of carbon nanotube (CNT)-reinforced composites which describe the debonding damage of reinforcements on mechanical properties of nanocomposites. An incremental damage model based on the Mori-Tanaka's mean field concept is developed to consider the debonding of reinforcements in nanocomposites. The mechanical properties of composite are increased by reinforcing with CNTs, but the improvements in modulus are remarkably less than the micromechanical prediction assuming bonded nanotubes. It is shown that the weak bonding assumption lead to inaccurate composite stiffness prediction. Based on the present model, analysis of stress-strain response for CNT/polymer composites under uniaxial tension is carried out. When the debonding damage starts to occur, the stress-strain curve for the damaged nanocomposite deviate to lower stress from those for the perfect composite. At constant strains while considering interfacial debonding of inclusions, the area under the stress-strain curve is lower and therefore based on a qualitative assessment the composite has poor toughness. To validate the predictions of the proposed model, the results are compared to those obtained from the experimental results presented by literature. The proposed model and the experimental results are in good agreements. Moreover, the results indicate that progressive debonding leads to a loss of stiffness in the axial direction. The reduction of stiffness is initially gradual, and then debonding takes place and Young’s modulus experiences a drastic reduction.

Keywords

NANOCOMPOSITES, DEBONDING, CARBON NANOTUBES, MICROMECHANICAL MODELING

Authors **2**

NAFAR DASTGERDI, JAIRAN (AALTO UNIVERSITY)

MARQUIS, GARY (AALTO UNIVERSITY)