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A novel interface-treated micromechanics approach for accurate and efficient modeling of CNT/polymer composites

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Abstract

In this paper, a two-step incremental micromechanics formulation in conjunction with FEM and weakened interface model is utilized to characterize elasto-plastic behavior of CNT/polymer nanocomposites. For the validation purpose, results corresponding to the perfect bonding assumption are compared with the experimental data. The micromechanics approach considering the weakened interface is extended to represent the nanotube, its surrounding polymer and the interfacial interactions via an equivalent fiber. The most important factor in the developed method is the sliding parameter determined through comparing the results of the model with that of a molecular structural mechanics-finite element multiscale approach at various loading conditions. Subsequently, employing several case studies, various aspects of the effects of interfacial strength on the elastoplastic behavior of these nanocomposites are systematically examined. The results show that the interfacial bonding characteristics plays a crucial role in enhancing the mechanical behavior of the host polymer and thus, should be thoroughly studied.

Keywords:

Nanocomposite; Nanotube; Two-step micromechanics; Interface; Elasto-plastic behavior

1. Introduction

Polymeric matrix composites (PMCs) are a class of material, which receives a great deal of attention due to their unique properties such as strength to weight ratio and high energy absorbance. These inherent characteristics have led to a wide range of industrial applications for

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