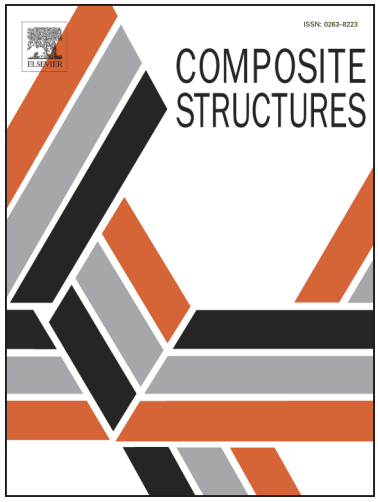

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Prediction of yield strength of MWCNT/PP nanocomposite considering the interphase and agglomeration

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Abstract

The yield strength of multi-walled carbon nanotube/polypropylene (MWCNT/PP) nanocomposite of 2 wt% is predicted using a two-scale continuum model. In the nano-scale, FE models of representative unit cells (RUCs) consisting of MWCNT agglomerates, the surrounding PP matrix and the interphase between them are developed using TexGen software and ANSYS Workbench. The geometries of the agglomerates were determined from processing and analysis of scanning electron microscopy images of the MWCNT/PP material. The characteristics of the interphase were determined from atomic force microscopy images and nanoindentation tests conducted on MWCNT/PP specimens. The FE models of the RUCs were solved using the LS-DYNA explicit FE code. The non-linear behavior of the PP material was modeled using an elastic-plastic material model for which input data were obtained from uniaxial tension tests. The simulated behavior of the RUCs was assigned to the elements of the FE model of a tension specimen which was used to predict the yield strength of the MWCNT/PP material. The model predictions show a high sensitivity of yield strength with the characteristics of the MWCNT/PP interphase.

Keywords: Carbon nanotubes, Nanocomposite, Multi-scale modeling, Yield strength, Finite element analysis

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