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Benjamin Raju, S.R. Hiremath, D. Roy Mahapatra

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A Review of Micromechanics based Models for Effective Elastic Properties of Reinforced Polymer Matrix Composites

Benjamin Raju, S R Hiremath, D. Roy Mahapatra [1]

Department of Aerospace Engineering, Indian Institute of Science, Bangalore 560012, India.

Abstract

Micromechanics based models are used for predicting the effective mechanical properties of reinforced polymer matrix composites. This paper reviews micromechanics based models for fiber reinforced polymer composites starting with the bounds established by Voigt and Reuss models, Hashin-Shtrikman model and then on to well-known micromechanics based models like Mori-Tanaka model, Self-consistent model and Differential scheme based models. The main objective is to critically review the areas in which these micromechanics based models hold good and analyse the limitations of these models. One of the limitations of the above mentioned models is the assumption of dilute dispersion and this is overcome in this paper by revising the Mori-Tanaka model by combining the differential scheme with Eshelby's model to take into account the non-dilute dispersion effect. Numerical results are verified by finite element based simulation of the representative volume element (RVE). Experiments were carried out to estimate the effective elastic constants for different fiber volume fractions. Theoretical results are reviewed with reference to experimental measurements.

Keywords: Micromechanics; Mori-Tanaka Model; Self-Consistent Model; Dilute dispersion; Composite Materials; Effective Mechanical properties of materials.

[1] Corresponding Author E-mail: droymahapatra@iisc.ac.in; Tel: +91 8022932419; Fax: +91 8023600132