MICROMECHANICAL MODELING OF WOVEN METAL MATRIX COMPOSITES pdf

1: Micromechanical Modeling for the Evaluation of Elastic Moduli of Woven Composites

Abstract This report presents the results of an extensive micromechanical modeling effort for woven metal matrix composites. The model is employed to predict the mechanical response of.

The results obtained showed that the towpreg consolidation could be successfully predicted using the model under study. Light-metal matrix composites with tailor-made fiber reinforcements offer a good balance between weight saving and high strength, a key feature for lightweight design in structural applications for the automotive and aerospace industry. Light-metal MMCs manufactured by thixoforging of thermally sprayed prepregs additionally exhibit superior mechanical properties of the matrix material as well as low fiber damage during infiltration of the reinforcement fabric. However, one of the difficulties during manufacturing of these materials is the difference in the thermal expansion coefficients CTE of matrix and fiber material. Different thermal expansions lead to the development of residual stresses during the cooling process that can deform the reinforcement fibers and hence, lead to a decrease of the mechanical properties of the reinforced component. Modeling by means of finite elements and numerical simulation is used in order to study parameter variations during the cooling procedure and to select an optimized process route. The modeling and simulation was performed in a collaborative work between the Institute for Manufacturing Technologies of Ceramic Components and Composites, University of Stuttgart, and the Polytechnic University of Cartagena. The SiC matrix is then deposited with a given thickness. The different interphase structures will be described. The interface behaviour was characterized by indentation method. The load is applied on the fibre-end at a polished cross-section of the composite, and the displacement of that fibre-end is measured. The push-in test on thick specimens shows that the fibre debonds at a given fibre stress and then slides under a certain frictional shear stress. Both parameters increase when the TiC layers become discontinuous, like aligned TiC clusters in a Pyrocarbon matrix. The load-displacement behaviour is in very good agreement with theory when the interfacial shear stress is kept constant, non depending on relative slip displacement. The push-through test on thin composite slices gives directly access to sliding resistance because the fibre is less compressed. The load displacement curves obtained will be described and analysed. For example, sliding velocity jumps revealed a slight increase in sliding resistance with velocity. During push-back, a seating drop was recorded as the fibre returns in its initial position, illustrating a certain effect of roughness. A Micromechanical Based Approach Authors: Sierra Beltran, Erik Schlangen Abstract: In this paper a micromechanics-based design is proposed for the development of a material with enhanced ductility and flexural strength combined with low production cost. The composite performance is described by 11 micromechanical properties of the system consisting of cement matrix, fibres and fibre-matrix interface. Most of these properties are defined through laboratory tests. A strain-hardening behaviour with multiple microcracks prior to failure is is the goal for the composite with enhanced ductility. The amount and size of the fibres needed for bridging the microcracks as well as the composition of the cement matrix will be determined in order to achieve this behaviour. Vinney, Mihai Dupac Abstract: The use of high performance composites is becoming increasingly common in safety critical components. The key driver behind this research is the need to develop a better understanding of through thickness stresses where fibres and matrix are not uniformly distributed throughout the thickness. Classical distribution of composite is not always possible due to problems associated with manufacturing processes. Poor fibre distribution through the thickness affects the through thickness properties and can compromise the structural integrity. This paper presents a semi-analytical tool that can be used for modelling of fibre group optimisation. It can be used for analysis at both microscopic fibre resin interactions and macroscopic composite laminate levels. At each level the components reactions to externally applied load have been investigated through its load transfer mechanisms. The effects of anisotropy, edge distance and pitch between fibres, numbers of rows and finally dissimilar fibre materials and fibre cross section have been considered.

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2: Micromechanics-Based Modeling of Woven Polymer Matrix Composites | Brett Bednarcyk - www.engan

This report presents the results of an extensive micromechanical modeling effort for woven metal matrix composites. The model is employed to predict the mechanical response of 8-harness (8H) satin weave carbon/copper (C/Cu) composites.

3: CiteSeerX â€” Micromechanical Models for Bending Behavior of Woven Composites

This report presents the results of an extensive micromechanical modeling effort for woven metal matrix composites. The model is employed to predict the mechanical response of 8-harness (8H) satin.

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