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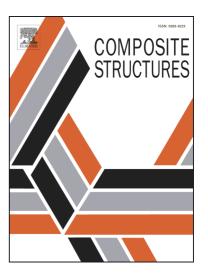
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Interfacial effects on the damping properties of general carbon nanofiber reinforced nanocomposites-A

multi-stage micromechanical analysis

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Abstract: Damping properties of polymer matrix nanocomposites (NC) reinforced by vapor grown

carbon fiber (VGCF) are investigated by presenting a multi-stage analytical micromechanical model. A

third phase as interphase is considered due to the complex chemical and physical state in the region

near to matrix/fiber interface. Both uniform and graded properties of the interphase through the

thickness are considered. Acceptable agreements in comparison with experiments and appropriate

mesh sensitivity analysis prove the efficiency and accuracy of the proposed model. The effects of

various meaningful parameters, including the interphase bonding strength, thickness and types and also

the VGCF volume fraction, aspect ratio, orientation, diameter, waviness and cone angle are

investigated. Stored and dissipated energy in the NC constituents are obtained as well. It is concluded

that the NCs reinforced by long nanofiber possess greater storage and loss modulus than the NCs

owing short fiber. However, the specific damping capacity picks lower values. Higher bonding strength

and lower thickness of the interphase enhance the NC effective damping properties. Increasing VGCF

diameter, waviness and cone angle result declining in the damping properties. The interphase portion in

the stored and dissipated energy increases by decreasing the interphase bonding strength and increasing

the interphase thickness.

Keyword: Damping properties, Polymer nanocomposites, Interfacial effects, Micromechanics.

1- Introduction

Structures experiencing dynamic loadings can be exposed to a high level of vibration which causes unwanted

high noise level and human discomposure [1, 2]. Damping is beneficial in the realm of suppression of resonant

and near-resonant vibrations [3, 4]. Hence, vibration damping forms an important aspect of structural health of

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