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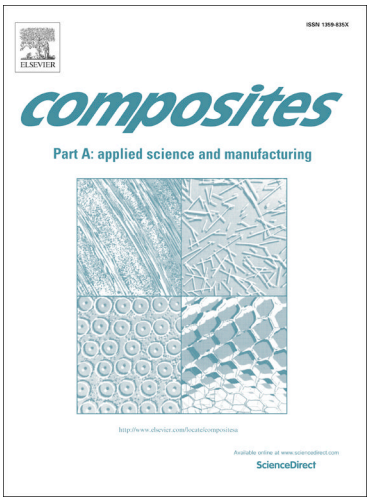

Review

Multiphysics Analysis of Lightning Strike Damage in Laminated Carbon/Glass Fiber Reinforced Polymer Matrix Composite Materials: A Review of Problem Formulation and Computational Modeling

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Multiphysics Analysis of Lightning Strike Damage in Laminated Carbon/Glass Fiber Reinforced Polymer Matrix Composite Materials: A Review of Problem Formulation and Computational Modeling

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Abstract

Laminated carbon/glass fiber reinforced polymer matrix composite structures experience rapid temperature rise, resin decomposition, delamination, thermal ablation, and possible dielectric breakdown subjected to lightning strikes. The predictive analysis of these damage is challenging due to the complicated electric-thermal-mechanical-chemical coupling effects. In this paper, the basic physics, problem formulations, and numerical approaches for such multiphysics analysis are thoroughly reviewed. Limitations of the existing problem formulations and numerical approaches are extensively discussed. Possible solutions to overcome those limitations and future directions on improving the fidelity and accuracy of such predictive analysis are also provided. In addition, part of the material properties that are required for these analyses, such as the temperature-dependent thermal, electrical, and mechanical properties of the composite lamina, the fracture properties of the interface resin, and the dielectric breakdown strength of the composite laminate are collected from various sources and are provided in this paper.

Keywords: Lightning strike damage; Polymer-matrix composites (PMCs); High-temperature properties; Finite element analysis (FEA)

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