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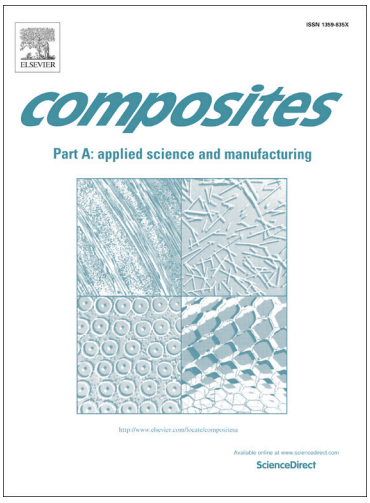

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The Effects of Fiber Orientation and Adhesives on Tensile Properties of Carbon Fiber Reinforced Polymer Matrix Composite with Embedded Nickel-Titanium Shape Memory Alloys

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Abstract

Tensile tests of Nickel-titanium (NiTi) shape memory alloys (SMA) embedded within carbon fiber reinforced polymer matrix composite (CFRP/PMC) laminates were evaluated with simultaneous monitoring of modal acoustic emissions (MAE). Three different layup configurations utilizing two different thin film adhesives were applied to bond the materials. Ultimate tensile strengths, strains, and moduli were obtained along with cumulative AE energy of events and specimen failure location. Scanning electron microscopy was used to examine the break areas of the specimens post-test. Microscopy was used to validate failure locations revealed from MAE analysis. A unique finding within this research showed that 90° plies in the outer ply gave the strongest acoustic signals as well as the cleanest fracture of the specimens tested. Overlapping 0° ply layers surrounding the SMA was found to be the best scenario to prevent failure of the specimen itself.

Keywords:

A. Layered Structures

B. Polymer Matrix Composite

C. Acoustic Emissions

D. Mechanical Testing