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Experimental and numerical investigation on the uni-axial tensile response and failure of fiber metal laminates

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Abstract

Fiber metal laminates (FMLs) consist of layers of thin metallic sheets and fiber reinforced composite layers bonded together. In the present study, the tensile response of FMLs consisting of aluminum 2024-T3 (Al) sheets of thicknesses 0.2, 0.4, and 0.6 mm and uni-directional glass-fiber reinforced composite layers are investigated. FMLs having three different stacking sequences, all having the same total metal layer thickness were prepared using the hand layup process. The results of the tensile tests indicated that the layup sequence did not have any influence on the initial modulus of the FMLs. However, the ultimate strength and the post ultimate strength behavior of the FMLs are significantly affected by the layup sequence. In order to gain more insight into the sequence of damage evolution, a detailed finite element analysis (FEA) of the tests was also carried using the commercial software ABAQUS. The Hashin failure criterion was used to model failure of composite layers and cohesive surface interaction was used to capture inter-layer delamination.

Keywords: Fiber metal laminates; delamination; damage evolution, fiber bridging