Development and Evaluation of Fracture Mechanics Test Methods for Sandwich Composites

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ABSTRACT

The objective of this research investigation is to develop test methods for characterizing both the Mode I and Mode II energy release rate associated with facesheet/core delamination growth in sandwich composites. Following the evaluation of several candidate test methods, the selection of a recommended test configuration has been made for both Mode I and Mode II testing. For Mode I testing, the plate-supported Single Cantilever Beam (SCB) test appears to be well suited for a wide range of sandwich materials and configurations. For Mode II testing, an End Notched Shear (ENS) test has been developed. Following the selection of these test configurations, research has focused on establishing recommended specimen dimensions and test procedures towards the development of draft testing standards. Current research is focusing on assessing the range of usage for both the proposed Mode I and Mode II sandwich fracture test methods. Of interest are both the geometric parameters (ex: core and facesheet thickness) and material parameters (ex: elastic properties of facesheet and core) of the sandwich specimen. A final round of testing and analysis is underway to identify a final test fixture design, specimen configuration, data analysis methodology, and range of acceptable sandwich materials and geometries for both Mode I and Mode II fracture toughness testing. The final task of this investigation will be the preparation of draft ASTM standards for determining both the Mode I and Mode II fracture toughness of sandwich composite materials. Expected benefits to aviation include standardized and industry-accepted fracture mechanics test methods for sandwich composites that may be used in predicting facesheet/core delamination growth in sandwich structures on aircraft.