Design of Composite ENF Specimens and Conduct Three-Point Test to Calculate Mode II Fracture Toughness

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ABSTRACT

Fiber reinforced composite laminate have tremendous potential in weight critical applications. However, a serious concern in designing with these laminate is their inherently poor damage tolerance for delamination. The resistance of composites to delamination can be well characterized by the delamination fracture toughness. Delamination in composites can occur due to tensile stress (mode I), in-plane shear stress (mode II), and out-of-plane tearing stress (mode III). In this report, the end-notched flexure (ENF) specimen is designed and performed the test for measuring the resistance to delamination under mode II loading. Students have to understand the characteristics of composite materials first, then they have to learn how to design and make the ENF specimen. At the same time, they have to learn how to operate the INSTRON test machine and how to record the loading-deflection curves for calculating the mode II fracture toughness. Students also have to design and make fixtures for three-point test referred to ASTM standards. I-Lan university is pursing an in-depth study of the composite ENF test in which the effects of matrix material, strain rate, specimen dimensions, stacking sequence, and environment are being investigated. Through this learning project, students will have the capabilities to design and make the ENF specimen and can measure mode II delamination fracture toughness under different loading and environmental conditions.

KEYWORDS: composite material, delamination, fracture toughness, ENF, three-point test, virtual simulation technology