Effects of Moisture Diffusion in Sandwich Composite Structures

Mark Tuttle
University of Washington
Seattle, WA

ABSTRACT

The overall objective of this study is to determine if long-term exposure to airborne water molecules (i.e., humid air) coupled with the extreme thermal cycles encountered by transport aircraft structures is detrimental to the mechanical properties of sandwich composites. Specifically, does exposure to these environmental factors alter the interfacial fracture toughness, G_c, associated with the facesheet-to-core interface? G_c was measured using the Single Cantilever Beam (SCB) test geometry. SCB specimens were produced at the University of Washington and consisted of 3-, 4-, and 8-ply facesheets and four different honeycomb core types. Facesheets were bonded to the core during a secondary bonding process. G_c was measured for two conditions: 1) As-produced "dry" SCB specimens (i.e., for specimens with an internal core humidity of less than 8%RH), and 2) "Conditioned" SCB specimens that had been subjected to 65°C and 90% RH for 2-months (causing humidity within the core volume to increase to 70% RH), followed by 150 one-hr thermal cycles from 30°C to -50°C. G_c, measured under these conditions will be presented. A related task is to study the resistance to delamination for as-produced versus conditioned panels subjected to ground-air-ground pressure cycles. An experimental set-up to study this effect has been developed, and preliminary measurements will be presented.