

MATERIALS AND STRUCTURES SYMPOSIUM (C2)
New Materials and Structural Concepts (4)

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EFFECT OF ENVIRONMENTAL CONDITIONS ON THE STRENGTH OF CARBON/EPOXY
COMPOSITE SINGLE-LAP BONDED JOINTS**Abstract**

Bonded joints do not require drilling holes for fastening like mechanical joints. In addition, a relatively uniform stress distribution over a bonded area is an advantage. However, bonded joints are difficult to disassemble and assemble without damage. Bonded joints are also sensitive to the environmental factors such as temperature, humidity and surface treatment. For the bonded joints to be used for primary structures, the effects of the parameters on the joint strength should be intensively investigated. In this paper, a parametric study on the adhesively bonded composite single-lap joints was conducted by experiment. A high strength adhesive EA 9696 by Henkel was used for bonding composite adherends made by T700GC-12K-31E/#2510 unidirectional prepreg from Toray. The main objective of this study is to investigate the effect of environmental conditions on the failure behavior of single-lap joints with different geometries and manufacturing methods. Three environmental conditions were investigated cold temperature dry (CTD), room temperature dry (RTD), and elevated temperature and wet (ETW) conditions. Manufacturing processes examined include the secondary bonding, co-bonding, co-curing with adhesive, and co-curing without adhesive process. The experiment revealed an interesting result that the joints tested in ETW (71oC and 95 percent relative humidity) condition supported about 10 percent higher load than those in RTD for all considered manufacturing methods. However, failure loads of the specimens tested in the CTD condition (-51oC) are about 10 percent lower than those of RTD joints except for one case. In terms of manufacturing methods, co-curing without adhesive shows highest strength and followed by secondary bonding, co-curing with adhesive and co-bonding methods.