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Development of CGLARE: Design, Fabrication and Characterisation

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Abstract

Fibre Metal Laminates (FMLs) are hybrid materials consisting of metal layers bonded to fibre-reinforced polymer layers. CGLARE is an FML developed at NAL consisting of thin aluminum foil combined with carbon-epoxy and glass-epoxy prepreg materials. CGLARE is proposed as the candidate material for the leading edges of wing and empennage of an aircraft as it has superior characteristics in terms of shape retention (due to highly linearly elastic material like carbon/epoxy), energy absorption capability (due to layered structure and plastic deformation), lightning protection (due to the presence of aluminum layers), and also due to its cost effectiveness (lightweight construction and simple production techniques). This paper describes the issues regarding the development of CGLARE such as surface preparation of aluminum foils and bonding of aluminum with glass. Tensile, Compression, ILSS and Flexure testing of ASTM standard CGLARE specimens for different layups have been done. An important design issue is the internal residual stresses built into the laminate during curing due to differential coefficients of thermal expansion of the different material systems. The paper presents these results that indicate some properties of these material systems that could be exploited for energy absorption in the leading edges of the aircraft.

Keywords: CGLARE, FML, energy absorption, stiffness, residual stress

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