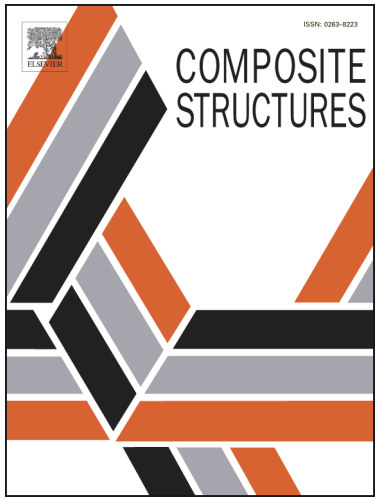

An experimental study on drilling of unidirectional GLARE fibre metal laminates

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An experimental study on drilling of unidirectional GLARE fibre metal laminates

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Abstract

Drilling operations in glass laminate aluminium reinforced epoxy (GLARE) hybrid laminates require different optimisation of machining parameters from those used in the drilling of its constituents, aluminium alloy and glass fibre reinforced polymers (GFRP). Accurate selection of drilling parameters is essential in order to achieve high quality holes and to minimise any defects that may compromise the long-term structural integrity of the machined component. This work conducted drilling experiments on unidirectional (UD) grade 2B and 3 GLARE composites using ϕ6 mm solid carbide TiAlN coated twist drills. The drilling parameters were analysed to study their impact on the thrust force, torque and surface roughness, whereas hole quality and tool condition were inspected using optical microscopy techniques. The results indicated that the ply orientation had no effect on the cutting forces, and surface roughness was found to be higher for grade 3 than for grade 2B for similar cutting parameters. Both feed rate and cutting speed showed to have a significant impact on the cutting forces and the hole quality.

Keywords: Fibre Metal Laminates, GLARE, Drilling, Surface roughness, Cutting forces.

Introduction

Fibre metal laminates (FML) are widely used in aerospace and defence industries, their applications in structural components are consistently growing due to their unique features which combine fatigue and impact resistance with relatively low density, flame (high burn-through) and corrosion resistance. Moreover they possess good damping and insulation properties. FML such as glass laminate aluminium reinforced epoxy (GLARE) and aramid aluminium laminates (ARALL) were mainly developed for their application in aircraft components where fatigue resistance is required [1], such as the lower wing and upper fuselage skins of an aircraft. However, these materials are suitable to be used in other areas such as flap skins, cargo bay liner floors and