# SELF-HEALING CFRP FOR AEROSPACE APPLICATIONS

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Today's aerospace industry is increasingly exploiting the advantages of fibre reinforced polymer (FRP) composite materials for structural components within aircraft. However, their susceptibility to impact damage, in particular barely visible impact damage (BVID), gives rise to several issues regarding damage detection and repair. A novel concept aimed at addressing some of these issues, and one which is receiving increasing attention, is a bio-inspired approach to create structural fibre reinforced laminates that offer the ability to autonomously self-heal. Two concepts have been developed for use in FRP composites. One method considers resin bearing hollow glass fibres (HGF)[1-5] and the other considers urea-formaldehyde microcapsules as the containment vessel[6-12].

The University of Bristol is developing the former, utilising a bespoke fibre making facility which can manufacture of HGF with external diameters between 30-100μm and hollowness ~50%. Studies to date[4,5] have investigated the use of hollow fibres for self-repair in glass fibre reinforced plastic (GFRP). This paper considers the extension of this work, using HGF to add self-healing functionality to CFRP. The challenge arises in incorporating healing resin filled HGF's within CFRP without an unfavourable reduction to in-plane mechanical performance. An optimisation of HGF placement within CFRP was required to provide adequate healing potential whilst limiting the detrimental effects of their inclusion.

Flexural testing was conducted (ASTM-D6272-02) in order to assess the influence of the HGF on the properties of T300/914 epoxy CFRP (Hexcel Composites). The relative performance of laminates with 'tows' of five HGF spaced incrementally at 10mm and HGF overwound as a continuous layer on CFRP pre-preg were assessed. Specimens were tested undamaged, damaged and healed using a commercial two-part epoxy healing resin (Cycom 823). Microscopic characterisation of the HGF embedment and healing within the CFRP laminate provided an understanding of the effect on the host laminate.

Further characterisation of the self-healing Carbon Fibre composite was achieved via Compression after Impact testing (CAI), using a Boeing standard (BSS 7260) test rig, modified for smaller, thinner coupons in accordance with work conducted by Prichard and Hogg[13]. CAI was selected in order to provide a more stringent assessment of the disruption caused by the healing fibres to the laminates and the healing potential of the various healing. Results from both testing procedures will be presented.

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