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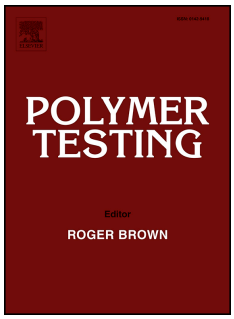

The role of patch-parent configurations on the tensile response of patch repaired carbon/epoxy laminates

Gursahib Singh Bhatia, J. Jefferson Andrew, G. Balaganesan, A. Arockiarajan

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Product Performance

The role of patch-parent configurations on the tensile response of patch repaired carbon/epoxy laminates

Gursahib Singh Bhatia, J. Jefferson Andrew, G. Balaganesan, *A. Arockiarajan

Department of Applied Mechanics, Indian Institute of Technology Madras, 600036 Chennai, India.

Abstract:

This work investigated the individual and associated effects of parent laminate and patch orientations with stacking sequence on the tensile response of adhesively bonded external patch repaired carbon/epoxy laminates. Four kinds of parent laminates ($[0]_4$, $[45]_4$, $[0/45]_s$, $[45/0]_s$) were repaired with double sided external patches of four different configurations ($[0]_2$, $[45]_2$, [45/0], [0/45]), having two laminae on each side. Real time Digital Image Correlation (DIC) was employed to capture the two dimensional strain field, damage onset and damage growth of the repaired specimens during the tests. The results reveal that the angle of orientation of plies of both the patch and the parent laminate is a key design parameter which affects the performance after the repair. The results reveal that the repair of main load bearing plies (0^o) of parent laminate with $[45]_2$ patches presented the most favourable residual tensile behaviour by effectively releasing the stress concentration in the damaged area. The maximum residual strength after repair with $[45]_2$ patch for $[0]_4$, $[45]_4$, $[0/45]_s$, $[45/0]_s$ laminates was approximately 70%, 115% , 90% and 80% respectively.

Keywords: Patch Repair Composites, Digital Image Correlation, Tensile, Failure modes, Stacking Sequence, Residual Strength

1. Introduction:

Composite materials exhibit various advantages such as high strength to weight ratio, high stiffness to weight ratio, superior corrosion resistance, tailored mechanical properties, etc.[1,2]. These properties make composites a befitting replacement for metals in various engineering applications. Composite laminates with various lay-up configurations (namely, zero, angle and quasi-isotropic configuration) are extensively used in high performance structures. At present, composite materials are being employed in a wide variety of applications ranging from aerospace, automotive, naval, sports goods, wind turbines and many more [3–5]. During the service life, the components may experience damage due to environmental degradation, impact loads, fatigue, etc. In general, one of the most common loading modes which damages the composites is sudden impact which could be due to dropping of tools, bird strikes, hailstorms, etc. [6]. An impact zone has typical damage in the form of fiber breakage, delamination, surface