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## The role of adhesively bonded super hybrid external patches on the impact and post-impact response of repaired glass/epoxy composite laminates

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### **Abstract:**

This paper investigates the influence of homogenous and super hybrid external patches based on plain weave woven glass fabric and aluminium alloy sheet (2024) on low velocity impact and quasi-static tensile after impact (TAI) response of adhesively bonded external patch repairs in damaged glass/epoxy composite laminates. The intent of using super hybrid external patches is to combine the excellent high displacement to failure property of aluminium as a ductile reinforcement with the superior mechanical property of glass fiber as a brittle reinforcement. The undamaged normal specimens were taken as the standard specimen for evaluation of residual mechanical properties. Four various types of external patches with different contents of glass (100%, 50% with two different lay-up configuration, and 0%) were used for performing the repair. In all hybrid patches, the proportion of aluminium and glass fiber were equal (i.e. 50% of aluminium and 50% of glass by volume fraction), while lay-up configuration were different. This further allows studying the associated effects of hybridization and lay-up configuration on low velocity impact and TAI response of the repaired laminates. The effect of glass/aluminium content on impact response and TAI response was investigated at various nominal impact energy levels, namely 2, 4, 6 and 8 J. Results show that super hybridization and lay-up configurations of the external patches play a significant role on low velocity impact and post impact response (i.e. absorbed energy, peak contact force, ultimate load, stiffness, residual deformation, displacement to failure and damage pattern) of the repaired specimens. Results indicate that repaired specimens having external patches with outer layer of aluminium and inner layer of glass fiber exhibited better impact properties and damage tolerance capability than that of the specimens conventionally repaired using homogeneous glass patches. Damage profile analysis was in a good correlation with the experimental results.

**Keywords:** Composite repair, Adhesively bonded external patches, Super hybrid patches, Low velocity impact, Quasi-static tensile test.

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