

Bearing and bearing-bypass of pseudo-ductile thin-ply carbon/ glass hybrids

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The aim of this work was to investigate the bearing and bearing-bypass behaviour of thin ply pseudo-ductile carbon/glass hybrid laminates in tension. Therefore, a series of tests were performed based on ASTM D7248/D7248M–12 on a Quasi Isotropic (QI) thin-ply carbon/glass hybrid laminate consisting of thin-ply carbon TC35/standard thickness S-glass prepregs. For comparison, all S-glass and all TC35-carbon laminates were investigated as well. The results for the bearing tests showed that all the investigated configurations have a similar load-displacement manner with slight improvement in stiffness of the hybrid laminate compared with the all glass laminate. In the bearing tests, the hybrid and all-glass laminates experienced a mixed of shear out and bearing failure modes, whereas the all-carbon laminate experienced a mixture of shear out, bearing and cleavage failure modes. For the bearing-bypass tests, the hybrid laminate and all-glass laminates experienced higher displacement with a gradual failure compared with the all-carbon laminate that failed catastrophically with a sudden load drop. The hybrid configuration had the highest maximum load in the bypass loading and experienced a higher stiffness compared to the all-glass samples. The hybrid and all-glass laminates showed progressive and gradual failure modes in the bypass tests, with a mixture of shear out, bearing and net section failure modes, whereas the all-carbon laminate showed a mixture of bearing and net-section failure modes. Overall, the hybrid configuration showed similar mechanical properties to the baselines for the bearing tests. On the other hand, they behaved better than the all-carbon (higher displacement and more gradual failure) and better than the all glass laminate (higher initial stiffness and maximum load).