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Strength of composite bonded joints with various manufacturing methods

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Summary

This paper addresses experimental results on the strength of single-lap composite bonded joints with different manufacturing methods and configurations. The joints were fabricated with 4 different methods; Co-curing with additional adhesive (CCA) and without additional adhesive (CCN) between composite adherends, Co-bonding (COB) and secondary bonding (SEB). Joints have 5 different overlap lengths(l), 3 different lay-up patterns and 4 different thicknesses(t), respectively. Width of the joints(w) is constant at 25.4 mm. A total of 389 single-lap specimens were tested in tension. In the test to examine the effect of manufacturing methods and overlap lengths, the joint CCN showed the highest failure loads at all the overlap lengths except for one case and was followed by the methods SEB, CCA and COB. When the ratio of l/w is 2.0, failure load of the CCA is slightly higher than CCN. Failure load of COB is always the lowest. In the test for the joint with different thicknesses as well, failure load of the joint CCN is the highest and the joint COB shows the lowest load. To investigate the effect of lay-up patterns, the proportions of the layers in 0°, 45°, 90° were changed in (1) (25/50/25), (2) (10/80/10) and (3) (50/40/10) keeping the similar thicknesses. In the patterns (1) and (3), the joint CCN fails at the highest loads. But in the pattern (2), CCA shows slightly higher load than CCN. With limited exceptions, CCN shows the highest failure loads for the most of the joints with various configurations. Test results also show the failure loads of the joints are closely related to failure modes. In most case, the joint showing cohesive failure is high and the delamination failure load is the next. The joints dominated by debonding fail at the lowest loads generally.

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