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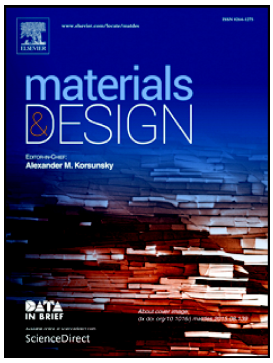

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Influence of Z-pin embedded length on the interlaminar traction response of multi-directional composite laminates

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Abstract

The work in this paper investigated the performance of composites through-thickness reinforcing Z-pins as a function of their embedded length in pre-preg laminates. Single Z-pins were inserted into multidirectional carbon fibre laminates with increasing thicknesses, corresponding to embedded lengths from 1mm to 10mm and tested through a range of mixed mode displacement ratios to investigate their interlaminar bridging traction response. Detailed analysis of the tests revealed a non-linear tangential friction response and its strong dependence on the embedded length of the Z-pin. Using a new power law empirical relationship for the tangential friction force per unit length, a modified Z-pin bridging traction analytical model was proposed, giving good predictions of the full mixed mode bridging mechanics of a CFRP Z-pin in a multidirectional composite laminate of varying thickness. Several characteristics of the model are discussed and their influence on the predicting the Z-pin bridging energy response have been analysed.

Keywords

Structural composites; Z-pins; Delamination; Fracture toughness; Analytical model