

Accepted Manuscript

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PII: S1359-835X(15)00066-4

DOI: <http://dx.doi.org/10.1016/j.compositesa.2015.02.014>

Reference: JCOMA 3858

To appear in: *Composites: Part A*

Received Date: 29 October 2014

Revised Date: 4 February 2015

Accepted Date: 14 February 2015

Please cite this article as: Yu, H., Longana, M.L., Jalalvand, M., Wisnom, M.R., Potter, K.D., Pseudo-ductility in intermingled carbon/glass hybrid composites with highly aligned discontinuous fibres, *Composites: Part A* (2015), doi: <http://dx.doi.org/10.1016/j.compositesa.2015.02.014>

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Pseudo-ductility in intermingled carbon/glass hybrid composites with highly aligned discontinuous fibres

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Keywords: A. Hybrid; A. Discontinuous reinforcement; B. Fragmentation; E. Preform

Abstract

The aim of this research is to manufacture intermingled hybrid composites using aligned discontinuous fibres to achieve pseudo-ductility. Hybrid composites, made with different types of fibres that provide a balanced suite of modulus, strength and ductility, allow avoiding catastrophic failure that is a key limitation of composites. Two different material combinations of high strength carbon/E-glass and high modulus carbon/E-glass were selected. Several highly aligned and well dispersed short fibre hybrid composites with different carbon/glass ratios were manufactured and tested in tension in order to investigate the carbon ratio effect on the stress-strain curve. Good pseudo-ductile responses were obtained from the high modulus carbon/E-glass composites due to the fragmentation of the carbon fibres. The experimental results were also compared with an analytical solution. The intermingled hybrid composite with 0.25 relative carbon ratio gave the maximum pseudo-ductile strain, 1.1%, with a 110 GPa tensile modulus. Moreover, the initial modulus of the intermingled hybrids with 0.4 relative carbon ratio is 134 GPa, 3.5 times higher than that of E-glass/epoxy composites. The stress-strain curve shows a clear “yield point” at 441 MPa and a well dispersed and gradual damage process.

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