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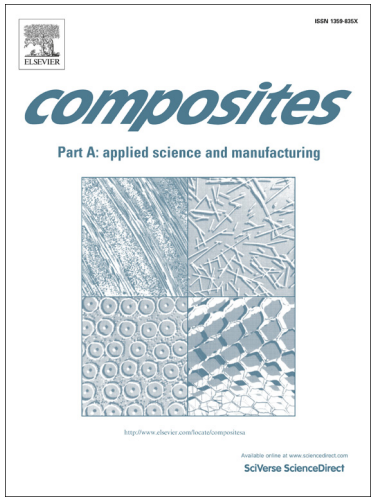

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Demonstration of pseudo-ductility in unidirectional hybrid composites made of discontinuous carbon/epoxy and continuous glass/epoxy plies

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Abstract

A new, partially discontinuous architecture is proposed to improve the mechanical performance of pseudo-ductile, unidirectional (UD) interlayer carbon/glass hybrid composites. The concept was successfully demonstrated in different laminates with high strength and high modulus carbon and S-glass epoxy UD prepregs. The novel hybrid architecture provided pseudo-ductile tensile stress-strain responses with a linear initial part followed by a wide plateau and a second linear part, all connected by smooth transitions. The best hybrid configuration showed 60% improvement in modulus compared to pure glass, 860 MPa plateau stress and 2% pseudo-ductile strain. The initial modulus, the plateau stress and the overall tensile stress-strain response of each specimen configuration were predicted accurately.

Keywords:

Discontinuous-ply composites; B. Delamination; C. Damage mechanics; D. Mechanical testing;

1. Introduction

High performance composites provide excellent specific strength and stiffness properties especially in comparison with higher density metallic materials but fail to deliver a safe failure mode similar to metals' progressive yielding and strain hardening with detectable warning and a wide margin before final failure. The failure of fibre reinforced composites is usually sudden and catastrophic with insufficient warning and low residual load bearing capacity. This unfavourable failure character results in conservative structural design incorporating cautious limits preventing the full exploitation of the outstanding mechanical performance of a