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XC. Sun, LF. Kawashita, AS. Kaddour, MJ. Hiley, SR. Hallett

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Comparison of Low Velocity Impact Modelling Techniques for Thermoplastic and Thermoset Polymer Composites

XC. Sun ^{*a}, LF. Kawashita ^a, AS. Kaddour ^b, MJ. Hiley ^b, SR. Hallett ^a

^a Bristol Composite Institute (ACCIS), University of Bristol, Queen's Building, University Walk
Bristol, BS8 1TR, UK

^b Air and Space Division, QinetiQ, Ively Road, Farnborough, GU14 0LX, UK.
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Abstract

This paper presents comparisons between experimental and numerical studies of low-velocity impact damage for thermoplastic (IM7/PEEK) and thermoset (IMS65/MTM) carbon fibre reinforced composites. The experiments were conducted at two key impact energies (8 and 30J) under identical conditions allowing a systematic comparison to be made. Three LS-DYNA Finite Element Analysis (FEA) models (standard, continuum damage mechanics (CDM) and discrete) were implemented, all using cohesive interface elements for delamination. The role of Mode II fracture toughness is highlighted. The predictive capabilities of different modelling techniques are compared and discussed and the CDM model gave better correlation with experiments. Fibre failure was predicted by the numerical approaches. The thermoplastic materials did not show noticeably superior behaviour to the thermoset materials and were governed by unstable delamination damage propagation for the same impact energy.

Keywords: Thermoplastic; Thermoset; Composite; Low-velocity impact; Finite Element Analysis (FEA)

* Author to whom correspondence should be addressed. Email: ric.sun@bristol.ac.uk

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