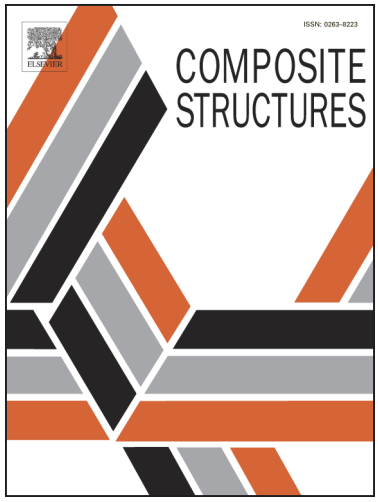

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The influence of strain-rate on the perforation resistance of fibre metal laminates

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Abstract

The rate-sensitivity of a range of fibre metal laminates (FMLs) has been investigated though split Hopkinson bar, quasi-static perforation and low velocity impact tests. Initial attention focused on assessing the rate-sensitivity of the constituent materials, that is the glass fibre reinforced epoxy and the three aluminium alloys. This was followed by a series of perforation tests on multilayer configurations.

It has been shown that both the composite and the aluminium substrates exhibit a low degree of rate-sensitivity, with both the tensile strength and the perforation energy increasing slightly in passing from quasi-static to dynamic rates of loading. Similarly, FMLs based on combinations of the composite and metal constituents exhibit a low degree of rate-sensitivity, with the impact perforation energy and the maximum impact force being only ten to fifteen percent higher than their quasi-static values. An examination of the cross-sections of the failed laminates indicated that the failure processes were similar at both quasi-static and dynamic rates of strain. Also, similar levels of plastic deformation, fibre fracture and delamination were observed at both rates. Finally, it has been shown that the energy to perforate the various FMLs is directly related to the aggregated perforation energies of their constituent parts.

Keywords: fibre metal laminates; impact behaviour; rate-sensitivity; perforation resistance; energy absorption

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