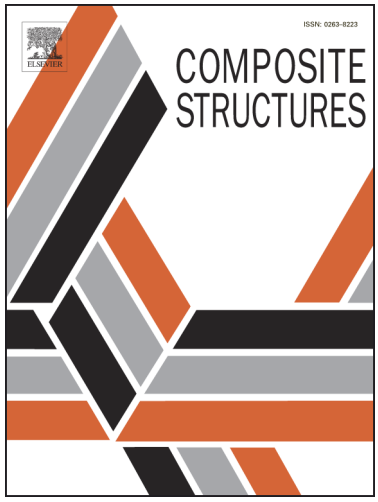

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Axial Crushing of Triaxially Braided Composite Tubes at Quasi-static and Dynamic Rates

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Abstract

This paper presents the results of an experimental investigation into the behaviour of braided CFRP tubes subjected to quasi-static and dynamic axial crushing. Tubes of six different geometries, with round, rectangular or square cross-sections, with 2 to 4 plies of triaxial braids, were tested. Two types of square tubes were also tested with a plug initiator. Comparisons were made by examining the failure modes, load-displacement curves, specific energy absorption (SEA), and the ratio of the peak load to the average progressive crush load. When tested without a plug initiator, the crush characteristics of these tubes differed significantly under the two loading rates. Under quasi-static crush, tubes showed a greater tendency to fail in an unstable manner, characterized by global buckling, folding of the walls and crushing at both ends of the tube. Therefore, quasi-static crush testing should be used with caution when evaluating dynamic response of a structure. In dynamic testing, seven out of the eight configurations failed in a stable manner, with damage initiating at the bottom and propagating up the length of the tube in a splaying type failure mode. The smaller square and the round tubes performed the best, displaying higher SEA and lower load ratio values.

Keywords: Braided Composite Tubes; Axial Impact; Progressive Crushing; Energy Absorption; Rate Effects

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