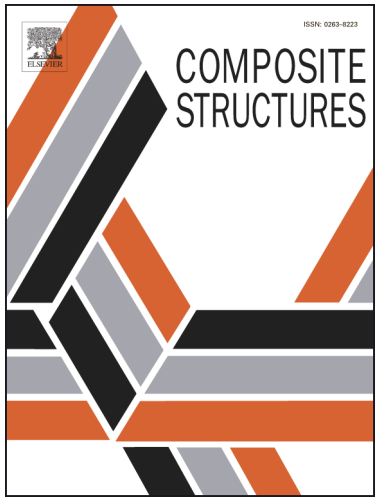

Comparative assessment of the explosive blast performance of carbon and glass fibre-polymer composites used in naval ship structures

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COMPARATIVE ASSESSMENT OF THE EXPLOSIVE BLAST PERFORMANCE OF CARBON AND GLASS FIBRE-POLYMER COMPOSITES USED IN NAVAL SHIP STRUCTURES

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Abstract

An experimental investigation is presented into the explosive blast response of fibre-reinforced polymer laminates used in naval ship structures. Blast tests using plastic explosive charges were performed in air on square target plates made of carbon-polyester, glass-polyester, carbon-vinyl ester or glass-vinyl ester laminates, which are composite materials used in naval ships. The laminates were dynamically loaded by shock waves of increasing pressure and impulse, and the deformation, damage and residual mechanical properties were determined. The amount of blast-induced damage and the post-blast mechanical properties depend on both the fibre reinforcement and polymer matrix. E-glass laminates have higher resistance to blast-induced delamination cracking and tow rupture than carbon fibre composites. Furthermore, glass or carbon fibre laminates with a vinyl ester matrix have superior blast damage resistance compared to composites with a polyester matrix. The higher damage resistance is attributed to the higher flexural strain energy capacity and interlaminar fracture toughness properties of laminates containing glass fibres or vinyl ester matrix.

Keywords: blast; composites; damage; explosion; mechanical properties