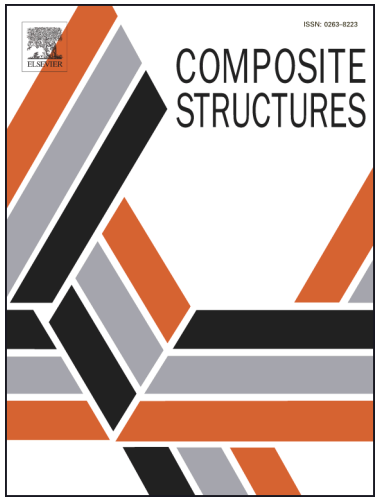

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Impact damage of composite sandwich structures in arctic condition

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Abstract

This study investigates the impact response and damage mechanisms of composite sandwich structures in arctic condition. Carbon fiber reinforced composite sandwich panels with polyvinyl chloride (PVC) foam core are subjected to low-velocity impact at extreme low temperatures, representative of the harsh arctic environmental condition. Force-time history curves evidently show that test temperature has a significant influence on the impact damage behavior. Specimens impacted at extreme low temperature (-70°C) exhibit less strength, and higher susceptibility to damage, resulting in severe penetration by the impactor. X-ray micro-computed tomography technique is employed to reveal multiple complex impact damage modes. Specifically, results from this work elucidate arctic temperature influence on detrimental failure mechanisms: large facesheet-core debonding, extensive composite facesheet delamination, significant core shearing and crushing, and severe facesheet fiber fracture. This work provides an important fundamental knowledge for future design of naval composite sandwich structures with enhanced impact performance at low temperature arctic condition.

Keywords: Sandwich structures; Damage tolerance; Impact behavior; Micro computed tomography