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Impact Response of Hybrid Laminates Made with GFRP, TPU and Rubber

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ABSTRACT

Thermoplastic polyurethane (TPU) offers a superior impact and perforation resistance. This paper presents a study on manufacturing a range of hybrid laminated structures made of TPU, glass fibre reinforced plastic (GFRP), styrene-butadiene rubber (SBR) and metal mesh materials, and further on investigating the structural response of the TPU based composite sandwich laminated structures. These laminated structures were tested under quasi-static perforation and low velocity impact loading to determine their structural responses and energy absorption characteristics. It has been shown that three-layer and five-layer laminates with lay-ups of GFRP-TPU-GFRP or TPU-GFRP-TPU and GFRP-TPU-GFRP-TPU-GFRP or TPU-GFRP-TPU-GFRP-TPU subjected to quasi-static perforation indicate the increased peak load and stiffness with the core thickness from 1 mm to 4 mm. However, the TPU core laminates show a superior ductility in comparison to their GFRP core counterparts. The energy absorption values of the three-layer and five-layer TPU and GFRP based laminated structures under low velocity impact are higher than those under quasi-static loading due to strain-rate effect. However, the hybrid laminates with SBR and wire mesh as a core do not give much improvement on the impact resistance on the impact perforation resistance of the laminates with the different size of wire mesh, as metal mesh plays a less important role in the laminated structures. In overall, TPU-GFRP-TPU-GFRP-TPU structure with 4mm thick GFRP core produces the highest peak force, and the GFRP-TPU-GFRP-TPU-GFRP structure with 4mm thick TPU core provides the highest energy absorption.

KEYWORDS

Hybrid laminates; TPU; GFRP; styrene-butadiene rubber; impact

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