High velocity impact damage analysis for glass epoxy - laminated plates

ABSTRACT

The ultimate objective of the current work is to examine the effect of thickness on fiberglass reinforced epoxy matrix subjected to high velocity impact loading. The composite material chosen for this research was from type C-glass/epoxy 200 g/m2 and type C-glass/epoxy 600 g/m2. This material is used as a composite reinforcement in high performance applications since it provides certain advantages of specific high strength and stiffness as compared to metallic materials. This study investigates the mechanical properties, damage characterisation and impact resistance of both composite structures, subjected to the changes of impact velocity and thickness. For mechanical properties testing, the Universal Testing Machine (UTM) was used while for the high velocity impact, a compressed gas gun equipped with a velocity measurement system was used. From the results, it is found that the mechanical properties, damage characterisation and impact resistance of type C-glass/Epoxy 600 g/m2 posses better toughness, modulus and penetration compared to type C-glass/Epoxy 200 g/m2. A general trend was observed on the overall ballistic test results which indicated that as the plate specimen thickness continues to increase, the damage at the lower skin decreases and could not be seen. Moreover, it is also found that, as the plate thickness increases, the maximum impact load and impact energy increases relatively. Impact damage was found to be in the form of perforation, fibre breakage and matrix cracking. Results from this research can be used as a reference in designing structural and body armour applications in developing a better understanding of test methods used to characterise impact behaviour.

Keyword: Fibre breakage (FB); Fibre cracking (FC); Fibre pullout (FP); High velocity impact (HVI); Impact damage (ID); Matrix breakage (MB); Matrix cracking (MC); Single stage gas gun (SSGG); Universal Testing Machine (UTM)