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EXPERIMENTAL INVESTIGATION ON THE DAMAGE BEHAVIOUR OF HONEYCOMB SANDWICH WITH KEVLAR EPOXY COMPOSITE FACE SHEETS UNDER HIGH VELOCITY IMPACT AT ELEVATED TEMPERATURES

Abstract

Honeycomb sandwich structures are widely used in aerospace industries due to its high strength and stiffness to weight ratio and energy absorption characteristics. However, the face sheets used for the sandwich structures are highly vulnerable to impact load that obtained through runway debris, bird hit, hail stones and micro meteoroids. In order to endure the high velocity impact, the face sheets with high impact resistance incorporated with energy absorbing honeycomb is essential. The damage behaviour of honeycomb sandwich structures with Kevlar epoxy composite face sheets under high velocity impact at elevated temperatures are presented in this work. The Kevlar epoxy composite face sheets were manufactured by vacuum assisted resin transfer molding techniques and sandwich structures were prepared using aluminium 3003-H19 honeycomb core. The experiments were carried out with the aid of single stage gas gun using hemispherical projectile. The threshold impact velocities were investigated for the various layers of face sheet and honeycomb core height. Also, the effect of thickness was examined through constant impact velocity and its associated damage mechanism was analysed. The accumulation of localised damage occurred through repeated impact were studied and damage propagation was mapped. To understand the real time impact by various impactors, three different projectiles with varying density namely steel, teflon and wood were used in the present study. The behaviour of the sandwich structures at elevated temperatures under impact load were compared with environmental condition. The residual tensile strength of Kevlar composite was obtained for the impacted specimen and compared with the neat specimen. During the post analysis, the damage area and central deflection of the sandwich structures was ascertained. The adhesion between the fibre and matrix and its damage behaviour under impact was studied through SEM analysis. The debris analysis was also carried out for the samples tested at the high velocity impact by collecting the debris in the test section. The knowledge of the damage behaviour at various impact scenarios and its associated residual properties are essential for designing a crashworthy structure in the field of impact engineering.