

Effect of kenaf fibres on trauma penetration depth and ballistic impact resistance for laminated composites

ABSTRACT

Combat helmets have been utilized to provide protection against a variety of ballistic threats, by reducing traumatic head injuries and fatalities. Nevertheless, head protection from injury is critical to function and for survivability. Soldiers and civilians incur Traumatic Brain Injury (TBI) most commonly from exposure to homemade bombs or improvised explosive devices. Although the Personal Armor System for Ground Troops (PASGT) helmet is expensive, environmental issues are some technical advantages that encourage using natural/synthetic hybrid laminated composites. The effects of different configuration patterns of kenaf fibers on the Backface Signature and energy absorbed by a military helmet (PASGT) were investigated. The ballistic behaviors of the 19 layers of aramid composite and plain woven kenaf composite were compared to hybrid laminated composites. The ballistic impact tests were performed using a 9 mm full metal jacket bullet and fragment simulating projectiles at various impact velocities, using a powder gun on fabricated square panels and helmets. The results showed the positive effect of hybridization in terms of energy absorbed (i.e. penetration), Backface Signature and damage mechanisms for ballistic impact and NIJ (National Institute of Justice) tests. Hybridization of plain woven kenaf/Kevlar laminated composites will open new avenues to reduce the dependency on the ballistic resistance component (Kevlar) in the helmet shell.

Keyword: Ballistic; Trauma; Aramid; Kenaf; Helmets