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On the mechanical response of 2D plain woven and 3D angle-interlock fabrics

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Abstract

The present study compared the tensile and low velocity impact (LVI) response of Kevlar/basalt fabrics. Homogeneous and hybrid fabrics with structures of two dimensional plain woven (2D-P) and three dimensional angle-interlock (3D-A) were woven with Kevlar and basalt yarns. Interlacing of brittle basalt yarns with high-ductility/high-toughness Kevlar yarns enhanced the tensile strength of 2D-P fabrics by 5.39-50.29% and 3D-A fabrics by 14.80%. Similarly hybridization enhanced the energy absorption of 2D-P fabrics by 8.58-37.71% and 3D-A fabrics by 13.45-20.14%. Change in the architecture from 2D-P to 3D-A also enhanced the tensile and impact resistance of fabrics. Different failure modes induced due to tensile and LVI loads were identified.

Keywords: A. Hybrid; A. 3-Dimensional reinforcement; B. Impact behaviour; B. Mechanical properties; Kevlar/basalt;

1. Introduction

Fabrics are widely used in traditional applications such as apparels and protective clothing. With recent advancements of fabric technologies, these have also become an integral part in many non-traditional applications like composite technology, where fabrics are used as a reinforcement for textile composites. In addition, development of high strength, lightweight fabrics offers an opportunity to utilize in defence and aerospace applications **[**1**]**. Fabrics with

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