DEVELOPMENT OF LEATHER CLAD BALLISTIC PROOF FABRIC COMPOSITE: A NEW APPROACH

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Abstract

The need for multifunctional lightweight ballistic protective fabrics has grown in significance with the current global scenario. A novel methodology has been followed to develop leather based antiballistic composite fabric. The “state-of-the-art” H1 technology needlepunching nonwoven machinery has been effectively used to develop next-to-skin nonwoven/antiballistic composite. The Institute of Environmental and Human Health at Texas Tech University is the first facility in the US to house the modern needlepunching machinery. Apparel grade bovine leather has been used as the outer layer for the novel antiballistic composite. The antiballistic properties were achieved with the help of high-density polyethylene filament fabrics. The composite imparts the necessary next-to-skin comfort properties due to the nonwoven layer. The top leather layer provides the overall fit and abrasion resistance. The antiballistic layers provide the necessary countermeasures against ballistics. The composite body armor structure is delineated in Figure 1. The leather component adds to the total strength and more particularly to the abrasion resistance of the total composite. The crux of the work is to develop an antiballistic composite material that can offer protection at Level IIA protection level. Level IIA is the protection that is characteristic of soft body armor. Antiballistic properties were measured using Test for \(V_{50}\) Limit method.

Results showed that 17 layers of Spectra were not able to resist the penetration of bullets. However, 20 layers of Spectra resisted the penetration of bullets. The presence of the leather (top) layer and the bottom nonwoven layer adds to overall ballistic resistance of the composite resulting in the reduction of antiballistic (Spectra) layers.

![Diagram of Protective Body Armor Substrate]

Figure 1: Protective Body Armor Substrate
Results obtained from this study have shown that the needlepunching composite technology that has been followed in the study adds to the next-to-skin comfort properties as well the impact resistance of the composite. The leather/antiballistic/nonwoven composite has been found to offer Level IIA protection with a reduction in the number of Spectra layers thereby reducing the weight and the cost of the composite.

Figure 2 shows the trapping of the 9mm FMJ bullet within the composite structure. It has been observed that 20 layers of antiballistic material is normally less than the number of layers that are currently used in the trade. The research work has come-up with a leather based antiballistic composite that could impart Level IIA protection with a reduction in the number of antiballistic layers and also provide a next-to-skin wearable armor shield.