Abstract of thesis

Title- "Studies on design and development of light weight composites for ballistic protection"

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The use of lightweight protection systems by security forces against ballistic threats is one of the important research areas in defence applications. It is very important to provide appropriate protection level with desired mobility for military applications. The high weight drawback of metal based armours directed researchers to explore different types of materials and material combinations to get lighter armour materials fulfilling similar or better level of protection in armour systems but at lower weight.

In this research work, different possibilities of using novel high performance materials were investigated as stand-alone body armour for higher protection levels, while also investigating suitable configurations of composite laminates to enhance ballistic strength and reduce back face signature. It was clearly established that a composite light armour consisting of advanced materials with both the high-strength/stiffness and high-ductility/toughness, if properly configured, can have superior ballistic performance.

In order to optimize the processing conditions so as to achieve optimal high strain rate properties, the effect of compression pressure and temperature on high strain rate behavior of composites is also established and the resultant ballistic strength is estimated by using high strain rate behavior using a Split Hopkinson Pressure Bar (SHPB) set-up.

Ballistic test standards, specifications and protocols are largely dependent on the geography since the threat perception, weapons and ammunitions used by adversaries, environmental conditions and physiology and anatomy of the wearer are different for different situations, geographies and people. In this research India specific test standards and protocols are proposed with specific focus on permissible back face signature.

This research lead to the development of Indian standards of body armour and also to a novel design of body armour including newer materials and methods under optimized processing conditions.