



Lightweight flexible hybrid composite material for projectile-proof clothing

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Abstract

The analysis of nine factors of resistance to projectile impact in a protective material is presented. The experimental results of the normal law of distribution of a warp and a weft threads strain in structure of a woven fabric concerning a projectile are established. Five stages of projectile kinetic energy reduction in a protective material are considered. Further interpretation of functional features and structure of all elements of a protective material were examined and the technology of a sandwich with observance of the accepted law of projectile kinetic energy reduction and a method of calculation of pressure of a sandwich to human body in a place of impact were addressed.

Key words: *Protective textile, Kinetic energy, Structure, Protective sandwich, Composite body armor*

1. Introduction

Practice shows that manufacture of composite textile materials tends to expand for use in ballistics use as protective means from being hit by a projectile.

In opinion (Jun *et al.*, 2002), essential advantage of composite textile materials is the high degree of kinetic energy (E_k) absorption of a projectile in comparison with metallic materials of the same weight ratio. (Kanemasu *et al.*, 2004) and (Hull, 1991) consider, that composite materials possess features not only in the form of small weight, but also high energy absorption at the progressive

failures, surpassing absorption of energy at deformation of metal.

But in ballistics conditions, synthetic para-aramide fiber is used as a protective material that exhibits high-strength. The basic manufacturer of this fiber is DuPont Company (2004). KEVLAR[®] is considered probably the best known fibers for human's protection against enemy attack protective because of its high durability (five times stronger than steel with equal weight). Other, high-strength fibers for the use in ballistics, are, Zylon, Twaron and other similar types of materials.

(Revilock *et al.*, 2002) tested three variants of Kevlar fibers and two variants of Zylon and established