Production of Alternative Ballistic Protection Vest from “Shear Thickening Fluid” (STF) Based Silica Nanoparticle Containing Composite Fabric

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Ballistic products have the life-saving importance that is likely to be useful only once in life of people.However, in some circumstances the weight of steel vests may adversely affect the movement and operation ability of counter-terrorism units and other security forces.Therefore, the purpose of our project is the production of alternative ballistic protection vest from “Shear Thickening Fluid” (STF) based silica nanoparticle containing composite fabric. For this purpose, STFs containing 20% of hydrophilic fumed silica and 80% polyethylene glycol (PEG200) were prepared. After addition of ethanol (EtOH) STF was divided in two equal volumes and both were impregnated with 12-fold Kevlar, and then samples A and B were obtained. In rheology analysis, particle size distributions and viscosity measurements of prepared samples were performed and it was observed that prepared STFs contain nanometer-sized particles and they have shear thickening behavior. In order to perform ballistic tests, composite fabrics and witness samples were shot from 5 m away by Pietro Beretta pistol with 9 mm diameter at the shooting range. As a result of ballistic tests the deformation in STF containing composite fabrics was about 7 times less than the deformation in witness sample. After these results, a new hybrid composite preparation step was initiated. In addition, with using the same size of fabrics the number of fabrics was increased and also the order of them was altered. In the same conditions, both of them resisted to the bullets. In addition to that, the penetration depth in witness sample was 770 mm, but in “Hybrid” sample it was reduced to 490 mm. Hence, 36 % reduction was provided in penetration.

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