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PVB/IF-WS₂ System for Impregnation of Polyester Knitwear

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Introduction

Different types of textile materials are being used for military purposes. Cotton fabrics are the most commonly used for army personnel protection. Therefore lots of different approaches have been developed for camouflage prints. On the other hand, different polymers are used as impregnation of fabrics for this reason, and nowadays, nanotechnologies play important role in enhancing the textile materials. In our previous study the possibility of camouflage textile impregnation has been examined, with a polymer and nanostructures that was earlier proven to be beneficial in aspects of decreasing friction and wear, increasing mechanical resistance and enhancing camouflage properties [1-3, 4, 5]. Polyvinyl butyral, PVB was chosen as

impregnating polymer which does not dissolve in water, i.e. resistant to wetting. Fullerene-like nanoparticles of tungsten disulfide, IF-WS₂, were used as a nanoreinforcement due to their mechanical resistance and solid lubricating behavior [3, 4]. Also, in our earlier research, a positive effect on spectrophotometric characteristics of military camouflage paints was shown [5, 6]. As a base material, in this research polyester knitwear was used, intended for protective clothing and other items that need to be camouflaged.

Experimental

Polyester knitwear was dyed with the camouflage paint and then impregnated with 3wt.% solution of PVB in ethanol with and without nanoparticles of IF-WS₂. The impregnation was evenly applied onto the fabric by immersion assisted with ultrasonication.

Concentration of IF-WS₂ was 2 wt.% regarding the mass of PVB. After solvent evaporation the fabric samples were analyzed regarding the effect of the added nanostructures on impregnated material properties. Spectrophotometric properties were observed to evaluate the camouflage behavior. Specular gloss at angle 85°, which is important for fabric materials in the field of military camouflage, was measured. Diffuse reflection was measured on UV VIS NIR spectrophotometer and color coordinates were determined as well on light green, beige green and dark green shades.

Results

The results show that impregnation did affected camouflage behavior of the material and for the better. The significant drop in values of the diffuse reflection of all three shades were observed. Before impregnation the diffuse reflectance values were very high but the IF-WS₂ changed these values resulting in obtaining lower diffuse reflectance curves. Moreover, visually the change was not observed, and that was confirmed by colour coordinates values. Specular gloss, as well, did not change. This means that PVB/IF-WS₂ could be used for the camouflage improvement not just for the natural fabrics but for the polymer threads and yarns as well.

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