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Nanocomposite coatings for protective firefighter uniforms with improved performance characteristics

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It is known that the intensive development of science and technology generates the emergence of increasingly complex emergencies, which are accompanied by fires, including man-made disasters. This circumstance requires more and more sophisticated means of protecting rescuers. Fireman's clothing, as a means of protection, is designed to compensate for the influence of dangerous and harmful factors and contribute to the high and stable performance of the rescuer. Trends and prospects for the development of modern protective clothing were considered in [1]. The conclusion is made about the prospects of creating new types of fibers and polymers, as well as the feasibility of improving existing fire resistant materials due to changes in their structure and surface properties.

This report is devoted to a review of current achievements in the field of obtaining polymer coatings for protective clothing using nanotechnology. New types of coatings based on various polymer binders with the use of inorganic nanoparticles (hydroxides, layered silicates, carbonates, metal oxides) as fillers and flame retardants, as well as methods of their application are considered. Attention is focused on the advantages of nanosized fillers, which consists in their high dispersity (the average size does not exceed 100 nm), which allows to distribute the particles uniformly in the matrix and significantly reduce the concentration of the filler. Textile materials can be given such properties as fire resistance, superhydrophobicity, as well as self-cleaning properties. It is shown that in nanocomposite polymeric materials, nanoparticles interact with the polymer matrix not at the macro level, but at the molecular level. As a result of this interaction, a material is formed that has high adhesion strength of the polymer matrix to the nanoparticle. A method for increasing the fire resistance of textile materials by modifying their surface and obtaining grafted siloxane coatings comprising of phosphorus-containing groups is described. The effectiveness of the use of organosilicon compounds, in particular, AGM-9 monomer, is shown to better combine inorganic oxide nanoparticles with a polymer matrix.

1. E.V. Tarakhno, L.A. Andryushchenko, A.M. Kudin, L.N. Trefilova, Problems of Fire Safety. **36** (2014) 243