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PARTICLE SIZE DISTRIBUTION METHODS AS ADOPTED FOR TEXTILE MATERIALS

Purpose. *Application of the particle size distribution (PSD) method for textile materials containing functional nanosized particles.*

Keywords: *particle size distribution nanocomposites, magnetite, textile materials, properties.*

Objectives. The main task of this work is to study the morphological properties of nanocomposites based on textile materials (TMs) containing an inorganic phase, developed according to [1], with obtaining particle size distribution curve.

Methodology. DLS measurements were performed at Malvern Zetasizer Nano-ZS (Malvern, UK).

Research results. Information on the particle size, shape, porosity and pore distribution of the constituent materials is very important for their selection and appropriate use. Known methods of particle size distribution (PSD) are suitable for materials of a certain range of size, shape, nature and distribution, while improved methods can be adapted for other purposes, as in this one for the determination of particle size distribution in textile materials. Analysis of materials of different grain size, shape and nature, performed by the PSD method (DLS measurement and scanning electron microscopy), is described in this paper to evaluate their suitability and performance for a particular material. The study showed that the choice of starting material and surfactant is effective for the synthesis of iron oxide compounds with a size range within 100 nm, it was also noted that PSD is suitable for materials with fine particles, but gives inadequate results when adopted for very fine materials prone to agglomeration particles.

Particle structure is defined as the spatial disposition and volume concentration distributions of the different domains that conform the particle as well as its shape, size, porosity, and roughness.

The PSD of colloidal/disperse suspensions present in mixtures or composites during textile processing affects both the manufacturability and the properties of the final product. The saturation magnetization, stability of properties, and shielding efficiency depend on the size of the magnetite particles, so the formation of aggregated conglomerates or their clusters is undesirable. The size of the particles in the fiber-forming matrix by the in situ method is influenced by the nature of the fiber and the ratio of amorphous-crystalline regions. If magnetite is synthesized by the mechanism of heterocoagulation, then the size of the particles is regulated by the content of surfactants and their surface activity. Fig. 1 shows that the formed particles in the viscose-based composite have an average particle size of up to 103±52 nm and are characterized by a uniform distribution of nanoparticles of the inorganic phase on the TM surface. To a certain extent, this is facilitated by the specific uneven shape of the surface of viscose TMs. As a result, the degree of surface coverage of TMs reaches 73% (calculated when comparing surfaces with different electron densities). The layer of nanoparticles looks quite uniform without a large number of cracks, which indicates a relatively slow deposition of nanomagnetite. The surface of the nanocomposite is also characterized by a small number of areas with individual nanoparticles.

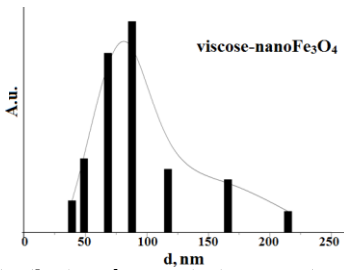

Fig. 1. **Partical size distribution of magnetite in composite on the base of viscose.**

Due to the application of the particle size distribution method, it is possible to regulate the action of surfactants and control the synthesis of functional particles in a narrow size range, which affects the effectiveness of the required properties.

Conclusion. Thus, for the first time in Ukraine, KNUTD managed to adapt methods of particle size distribution specifically for textile materials containing nanocomponents, and to analyze the obtained data from the standpoint of nanotechnology.

References

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