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PHYSICO-CHEMICAL PROPERTIES OF INNOVATIVE MATERIALS WITH MAGNETITE NANOCOATING

Purpose. *Investigation of physico-chemical properties of magnetite nanoparticles, that synthesized and contained in nanocomposites on the textile base.*

Keywords: *nanocomposites, magnetite, textile materials, properties.*

Objectives. The main task of this work is to study the physico-chemical properties of magnetite nanoparticles contained on treated cellulosic textile materials (TM) when obtaining nanocoatings developed according to [1].

Methodology. Method of nuclear gamma resonance (NGR), (Messbauer spectroscopy (MS)), method of chemical elemental analysis.

Research results. Using the method of nuclear gamma resonance (NGR), MS, the question of the phase composition of magnetite compounds obtained in TM was investigated, the peculiarities of the crystal chemical state of iron cations in the structure of these compounds and their stability during mechanical grinding of samples of nanostructured magnetite (Fe_3O_4) were studied, which indicates obtaining magnetic properties resistant to external influences, which will remain unchanged and prove the stability of magnetic properties during the operation of the developed textile materials containing nanomagnetite (Fig. 1).

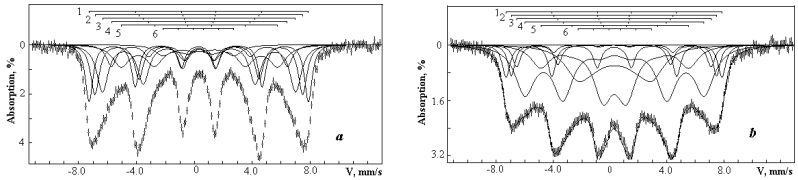

Fig. 1 – **MS of the original (a) and sample with nanomagnetite after friction (b).**

It was established that magnetite nanocoatings with particles of iron oxide compounds are less than 100 nm in size. With the use of SEM, the elemental composition was analyzed and the morphology of the formed coatings was

investigated. The study of the elemental composition (Table 1) and the surface structure of the processed cotton TM showed that the sample has a smooth surface and a uniform structure, and the textile material itself contains the main elements of the cellulose molecule. It was determined that the use of different ratios of iron salts in magnetite affects the different fixation of particles of iron oxide compounds on the surface of the TM (for example, knitted fabric or non-woven materials) and, as a result, changes in the saturation magnetization from 4 to 10 $A \cdot m^2/kg$.

Table 1 - **Chemical elemental analysis of the treated sample with nanomagnetite**

Elements / Areas of analysis	C	O	Fe
	Content, %		
	67,91	32,09	-
Source sample, spectrum 1	62,81	37,19	-
Source sample, spectrum 2	69,13	30,87	-
Source sample, spectrum 3	50,69	19,47	29,85
The treated sample, spectrum 1	55,82	19,39	24,79
The treated sample, spectrum 2	49,38	24,95	25,67
The treated sample, spectrum 3	50,69	19,47	29,85

Conclusion. Mechanisms of action of the magnetic field on the human body are determined by the action of this field on the driving electrons of atoms; ions that make up blood, liquid crystals of cell membranes, erythrocytes, quasi-crystalline and other formations. It is also known that nanoparticles of magnetite have unique characteristics that make them promising tools for use in medicine. When developing new magnetite TM, both the content of the nanosized iron oxide component and their physico-chemical properties can be taken into account as a significant factor that increases the effectiveness of the created TM. Thus, as a result of the conducted research, it is shown that the use of innovative TM containing magnetite nanocoating has the prospect of application in medicine for the creation of wound coverings or applications that do not change their physico-chemical properties during long-term use.

References

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