Effect of atmospheric moisture on the transmittance and wetting angle of the nanostructured crystal based on potassium bromide

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The "soft" optical material based on potassium bromide (which has the highest spectral range up to 30000 nm) has been chosen for the research. These materials are generally operated in the wide IR spectral range and used in the different spectroscopic devices. It has been shown that the spectral range and wetting angle can be optimized via nanostructurization procedure.

Among "soft" optical materials operated in the UV and IR spectral ranges the potassium bromide occupies the special place. It is known that these materials are a useful matrix for research in a wide spectral range. But their hydrophobic features are not so good and should be optimized. In paper [1] it has been shown some results of study KBr surface via treatment by different sizes of grain and spectral evidence after this treatment.

Still on the subject of paper [2-4] where the researchers have worked with different materials of UV-IR optimized by carbon nanotubes, including those appearing on the KBr nanocoating substrate without contact laser deposition of oriented carbon nanoparticles [5], the improved transmission spectrum for nanostructured material has been obtained.

The results of the previous works are applied in this study in order to analyze the properties of nanostructured hydrophobic surfaces of potassium bromide. To estimate the uniformity of the transparent in the spectral range of 1500-28000 nm coatings, the Fourier spectrometer "Infralum FT-08" (Russia) has been used. Transmission spectra of the coatings representing on the discs with diameter of 35 mm and the thickness of 8 mm have been previously measured. The nanotubes have been placed on the two surfaces, namely A and B of KBr substrate. The thickness of the layer was 100 nm. At their end a waterproof varnish was applied, see Fig. 1.

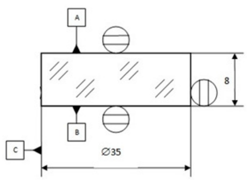

Fig.1. Scheme of nanocoating applying

After applying a layer of nanotubes on the specified protective surface on the sides of the samples, the transmission spectra at baseline and after exposure to moisture on the samples have been registered, see Figure 2. In parallel, the wetting angles were studied before and after nanoprocessing. The final results for the wetting angle of the optical material are presented in Figure 3.

Thus, analyzing the data of the present work, we can conclude that in samples with nanostructuring, even in a humid atmosphere, there is the significantly improvement of the transmission spectra, compared to the pure materials, as evidenced by contact angle measurement, and also makes it possible and promising to use nanotubes as protective for example, optical coating of KBr material. Moreover, it should be noticed that the present results are in good agreement with previous data. Indeed, the lack of transmission lines in the spectrum of water, obtained in paper [1], as well as conducting the study of the transmission spectra for nanostructuring, in papers [2-4] it is shown that the direction for using of the nanotubes as protective coatings via method shown in publication [5] is perspective.

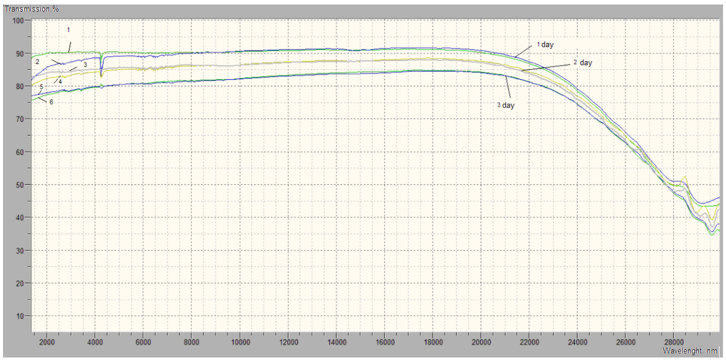

Fig.2. Comparative graph with IR transmission spectra of pure and structured sample KBr: 1 - Nanocoated with moisture to 1 day; 2 - no cover before the test; 3 - coated with nano moisture 2 days; 4 - no cover in 2 days; 5 - coated with nano moisture 3-14 days; 6 - no cover in 3 days.

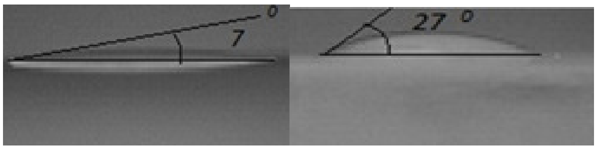

Fig.3. Left - the wetting angle on the substrate KBr (value of the wetting angle 7°); right - the wetting angle on the substrate KBr with coated nanotube (values of the wetting angle 27°).

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