The obtained nanoparticles $AgInS_2$ in $AgNO_3–In_2S_3–C_2H_4(NH_2)_2$ systems

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Ternary $A^IB^{III}C_2^{VI}$ compounds are among the important functional materials of modern technology. Most of this class of compounds are widely used or are considered as promising materials with valuable semiconductor, photo-, ferro- and thermoelectric properties. This shows the relevance of research the preparation of nanoparticles of $AgInS_2$ in $AgNO_3–In_2S_3–C_2H_4(NH_2)_2$ systems.

The purpose of this work was to study of physical-chemical foundations of nanoparticles of $AgInS_2$ preparation in ethylenediamine environment.

To investigate the conditions for obtaining, structure and properties of the $AgInS_2$ compound differential thermal (DTA), X-ray diffraction (XRD) and microstructural (MSA) analysis methods were used.

As precursors for $AgInS_2$ compounds synthesis in the ethylenediamine medium silver nitrate ($AgNO_3$) and indium sulfide (In_2S_3) were used. At first In_2S_3 was obtained by the interaction of $InCl_3$ with $CH_3CS(NH_2)$. Then In_2S_3 with $AgNO_3$ in an environment of ethylenediamine at molar ratio 3: 2, respectively, were mixed for synthesis of $AgInS_2$ compound and it was transferred into an autoclave. The resulting precipitate was washed several times with distilled water and ethanol, then dried at 353 K in a vacuum oven for 2 hours. The results of microstructural analysis (HITACHI TM3000) have shown that the synthesized compound consists of nanoparticles. Depending on the concentrations of the components and the temperatures particle of different size and shape were obtained.

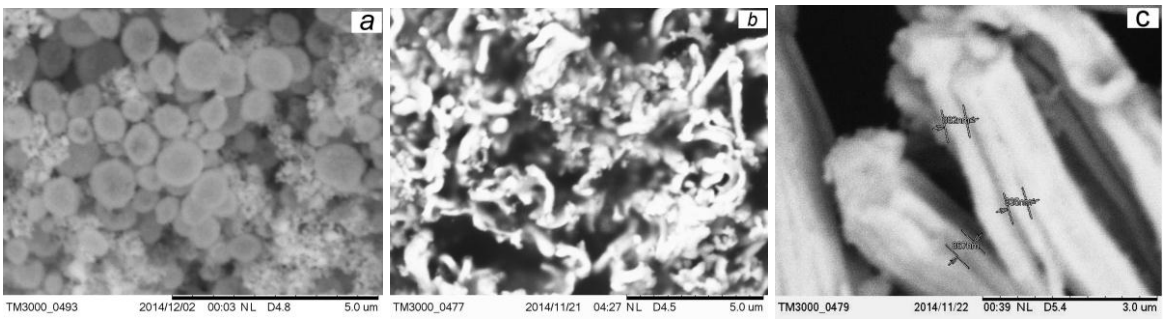

Fig. Micrographs of $AgInS_2$ nanoparticles obtained: *a* – 383 K, *b* – 410 K, *c* – 450 K

By the DTA and XRD methods the individuality of the resulting compound was proved. Crystallographic studies of the samples have been conducted with X-ray diffractometers 2D PHASER "Bruker" (CuK_α, 2θ, 20–80 deg.). According to XRD data it was revealed that at 383–450 K $AgInS_2$ is mainly in the amorphous state. The intensity of the diffraction lines of $AgInS_2$ after thermal treatment corresponds to the literature data [1, 2].

References

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