

**DR-60. THE RESEARCH ON PHASE COMPOSITION
AND POROUS STRUCTURE
OF THE INDIUM SULPHIDE (III) NANOMATERIALS OBTAINED
VIA CHEMICAL BATH DEPOSITION**

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At present thin films of indium sulphide In_2S_3 are promising materials for solar energy. The aim of this work was to study the properties of In_2S_3 based layers and powders obtained by the chemical bath deposition method [1].

A set of the samples of indium sulphide (III) was synthesized using the solutions with various composition. The measurements of the specific surface area of In_2S_3 nanopowders were carried out by nitrogen thermal desorption method in the SORBIMS device [2]. The morphology of the surface layers was studied with the use of atomic force microscope (AFM) Ntegra Terma. To study the phase composition of the layers, Raman spectroscopy (LabRam HR800 spectrometer) was used.

As a result of chemical synthesis, thin layers were obtained with a thickness of 300 to 850 nm, depending on the conditions of deposition. Using the method of nitrogen desorption, the specific surface area per mass unit for each of the powders from the series of samples was determined. This information allowed us to estimate the average particle size, which ranges from 40 to 90 nm. The decrease in particle sizes is due to a change in the concentration of the metal salt in the initial solution. With an increase in the metal content in the initial solution, the roughness of the films also decreased, which was established when the samples were analyzed by the AFM method in a semi-contact mode.

In the study of the samples by Raman spectroscopy, blurred Raman spectra of the samples were recorded, which indicates a small crystallization of the structure of the films under study. However, the position of the reflections corresponds to the crystalline phase of In_2S_3 [3]. When conducting thermal annealing in the temperature range from 50 °C to 350 °C, new phases are not observed, the degree of crystallization of the structure is preserved, which indicates the thermal stability of the samples under study in this temperature range.

References

1. Гидрохимическое осаждение тонких пленок халкогенидов металлов : практикум / Л. Н. Маскаева [и др.]. Екатеринбург : Изд-во Урал. ун-та, 2017. 284 с.
2. The study of porous silicon powders by capillary condensation / A. O. Belorus [et al.] // J. Phys. Conf. Ser. IOP Publishing, 2015. Vol. 586, № 1. P. 012017.
3. Izadneshan H., Gremenok V. F. Influence of Annealing on the Optical Parameters of In_2S_3 Thin Films Produced by Thermal Evaporation // J. Appl. Spectrosc. Springer US, 2014. Vol. 81, № 2. P. 293.

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