

DR-32. PREPARATION OF ZnS THIN FILMS BY THE CHEMICAL BATH DEPOSITION METHOD

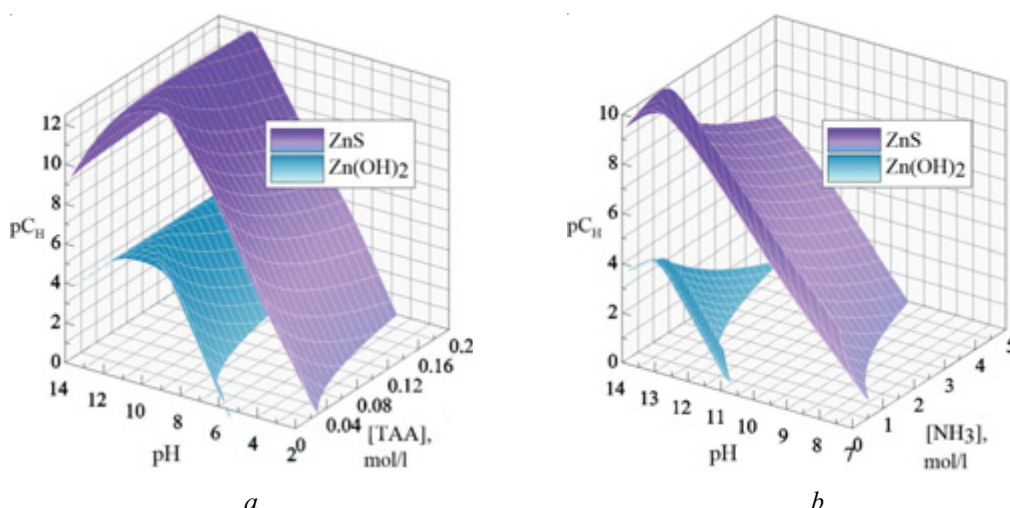
A. I. Zhdanova, A. D. Kutyavina, R. A. Gagarin, E. A. Klochko, L. N. Maskaeva

Ural Federal University of the first President of Russia B. N. Yeltsin,
Mira St., 19, Yekaterinburg, 620002, Russia

E-mail: anutan145@mail.ru

Zinc sulphide ZnS is II–VI n-type semiconducting material with a wide direct band gap of 3,65 eV. It has potential applications in optoelectronic devices such as light emitting diodes, electroluminescent devices and photovoltaic cells. As buffer layer, it is an important part of thin film solar cells. ZnS has a wider energy band gap than CdS, hence results in the transmission of more high-energy photons to the junction, and results in enhancement of blue response of the photovoltaic cells. Further more and most importantly, it replaces the toxic cadmium with sulphur. To fabricate ZnS thin films, several techniques (thermal evaporation, molecular beam epitaxy, metal-organic vapor phase epitaxy, chemical vapor deposition, spray pyrolysis. The aim of this research is to synthesize ZnS thin films at relatively low cost using simple methods and operating devices, while maintaining high film quality. Based on these considered factors, spin coating process was selected as the technique for the successful deposition of ZnS thin films, given its simplicity, cost-effectiveness and lower material losses. Moreover, it is a low temperature technique, simplest and the economical one – chemical bath deposition (CBD). However, a large amount of oxygen is detected in the ZnS film with using an alkaline medium in the deposition of thiourea. When thioacetamide, which is more reactive than thiourea and sodium thiosulfate, are used as a chalcogenide agent, it is possible to predict that the formation of zinc sulfide begins at a pH less than the pH of hydrate formation.

Therefore, in the present work, the analysis of ionic equilibria in two systems was carried out: « $pC_{II} - pH - [TAA]$ » and « $pC_{II} - pH - [NH_3]$ ». Concentration surfaces, which describe the boundary conditions for the formation of zinc sulfide, indicate that the solid phase ZnS can form in acidic $pH \approx 2-5$ (a) and in weakly alkaline regions, $pH \approx 7-10,5$ (b), which will allow obtaining thin film of zinc sulfide without oxygen.



Dependence of the boundary conditions of the formation of ZnS, $Zn(OH)_2$ from the medium and the concentration of thioacetamide (a) and ammonia (b)

The work was financially supported by program 211 of the Government of the Russian Federation (№ 02.A03.21.0006).