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EFFECT OF LIGAND'S NATURE ON CHEMICAL DEPOSITION BY SODIUM SULPHATE OF SODIUM THIN CdSe FILMS

A. V. Pozdin,¹ D. D. Smirnova¹, L. N. Maskaeva^{1,2}, V. F. Markov^{1,2}

¹*Ural Federal University named after the first President of Russia B. N. Yeltsin, 620002, Ekaterinburg, 19 Mira St.*

²*Ural Institute of State Fire Service of the Ministry of Emergency Situations of Russia. 620002, Ekaterinburg, 22 Mira St.*

E-mail: andrej.pozdin@yandex.ru

Abstract. Amongst the II–VI compound semiconductors, cadmium selenide (CdSe) is an important material with n-type semiconductor character. CdSe has the band gap (E_g) of 1.74 eV and high photosensitivity in the visible region of the spectrum. Due to these properties CdSe has potential application in optoelectronics and photovoltaics. Thin-film condition of CdSe is more preferable for modern technology, therefore, it's necessary to create the new techniques of CdSe films' synthesis and to improve the existing ones. Chemical bath deposition (CBD) method is considered to be available because of low cost, opportunity of CdSe deposition on flexible and solid substrates and simplicity of technique, e.g. low temperature and pressure of process. Recipes for CBD of CdSe films presented in the publications have no physico-chemical justification.

Consequently, the purposes of present work were to predict chemical deposition's conditions by analysis of ionic equilibriums in reaction mixture “ $\text{CdCl}_2 - \text{L} - \text{Na}_2\text{SeSO}_3$ ” (L – NH_4OH or $\text{Na}_3\text{C}_6\text{H}_5\text{O}_7$ or mixture of NH_4OH and $\text{Na}_3\text{C}_6\text{H}_5\text{O}_7$) and to choose chemical composition of reaction mixture in order to synthesize CdSe checking calculations experimentally.

Formation conditions of CdSe defining by basic system parameters, i.e. pH range, concentration of sodium selenosulfate, initial content of metal salt, chemical resistance of cadmium complex compounds, which depend on ligand's concentration and its nature were estimated by the method from [1]. Formation conditions are given in fig.

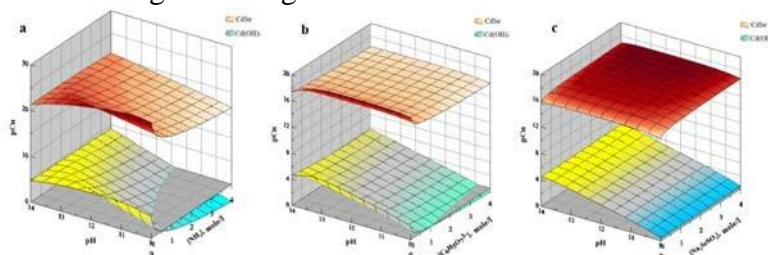


Figure. Concentration regions of the formation of CdSe и $\text{Cd}(\text{OH})_2$ in the “ $\text{CdCl}_2 - \text{L} - \text{Na}_2\text{SeSO}_3$ ” system from the concentrations of NH_4OH (a), $\text{Na}_3\text{C}_6\text{H}_5\text{O}_7$ (b) и Na_2SeSO_3 (c) taking into account the crystallization factor.

Thermodynamic estimation of composition and mode of deposition allows to simplify experimental search of appropriate mode of deposition CdSe and to determine optimal pH range and concentration fields of CdSe deposition in reaction mixture “ $\text{CdCl}_2 - \text{L} - \text{Na}_2\text{SeSO}_3$ ”. CdSe films with specular surface were grown by chemical bath deposition (CBD) from bath containing aqueous solutions of CdCl_2 ; NH_4OH or $\text{Na}_3\text{C}_6\text{H}_5\text{O}_7$ or their mixture; Na_2SeSO_3 at a temperature of 353 K within an hour. All films have good adhesion to the glass substrate; films' thickness ranges from 100 to 200 nm. The differences of elemental composition and morphology of synthesized films according to ligand background in the reaction bath were established.

References

1. Markov, V. F., Maskaeva, L. N., Ivanov, P. N. (2006). Chemical bath deposition of metal sulfide films: modeling and experiment. *Ural Branch of RAS*, p. 218.