$Cd_xZn_{1-x}S$ and $Cd_xHg_{1-x}Se$ Thin Films Solid Solutions

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Deposition conditions

The chemical bath deposition (CBD) of solid solution thin films of $Cd_xZn_{1-x}S$ was conducted with the initial working solution, which was consisted of $ZnCl_2$, $CdCl_2$, complexing agent, $(NH_2)_2CS$ and pH-regulator. As complexing agent for zinc and cadmium was used – $Na_3C_6H_5O_7$; the pH-regulator – NH_4OH. The concentration of the $ZnCl_2$ in the working solution was equal to 0.08 M; $CdCl_2$ – 0.004 M; $Na_3C_6H_5O_7$ – 0.08 M; $(NH_2)_2CS$ – 0.25 M; NH_4OH – 0.10 M.

The CBD of solid solution thin films of $Cd_xHg_{1-x}Se$ was conducted with the initial working solution, which was consisted of $Hg(NO_3)_2$, cadmium nitrate ($Cd(NO_3)_2$), complexing agent, Na_2SeSO_3 and pH-regulator. As complexing agent for cadmium and mercury was used – $Na_2S_2O_3$); the pH-regulator – $Na_3C_6H_5O_7$. The concentration of the $Hg(NO_3)_2$ in the working solution was equal to 0.005 M; $Cd(NO_3)_2$ – 0.05 M; $Na_2S_2O_3$ – 1.0 M; Na_2SeSO_3 – 0.05 M; $Na_3C_6H_5O_7$ – 1.0 M.

Experimental

The phase composition of the $Cd_xZn_{1-x}S$ and $Cd_xHg_{1-x}Se$ films solid solutions was investigated by X-ray powder diffraction (diffractometer DRON-3.0, Cu$K\alpha^-$ radiation). Primary processing of the experimental diffraction data in order to identify the phases was made using the PowderCell program [1]. Optimum exposure for each of the samples was selected.

Absorption optical spectra of the $Cd_xZn_{1-x}S$ and $Cd_xHg_{1-x}Se$ films were obtained with a spectrophotometer XION 500 (Dr.Lange). A comparative signal was passed through glass substrates identical to the substrates, used for investigated films.

The investigation of surface morphology of the films samples was carried out using a raster electron microscope REM-106Y. Elemental analysis of films was carried out on an X-ray fluorescence (XRF) spectrometer ElvaX Light SDD (Elvatech).

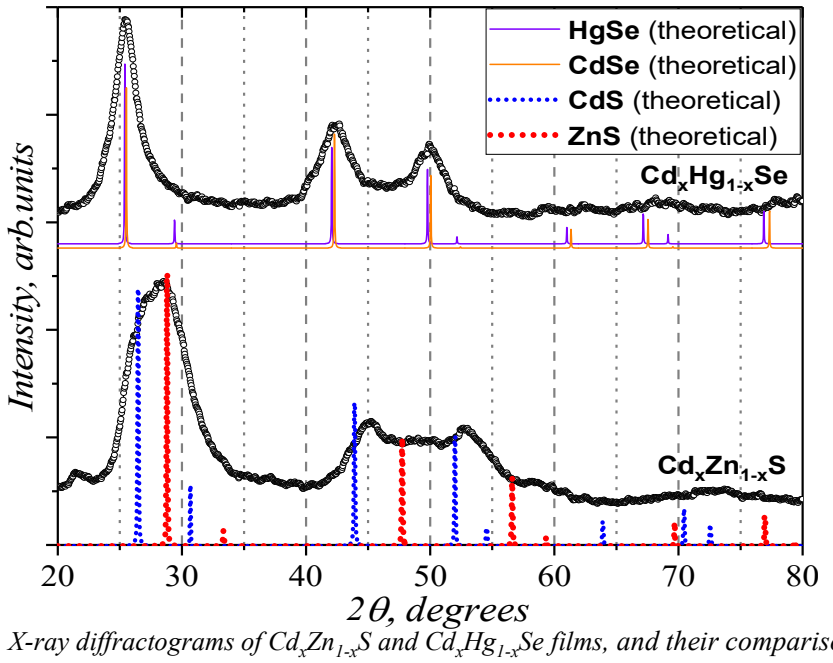

Fig 1. X-ray diffractograms of $Cd_xZn_{1-x}S$ and $Cd_xHg_{1-x}Se$ films, and their comparison with the lines of the theoretical diffraction patterns of ZnS, CdS, CdSe, and HgSe.

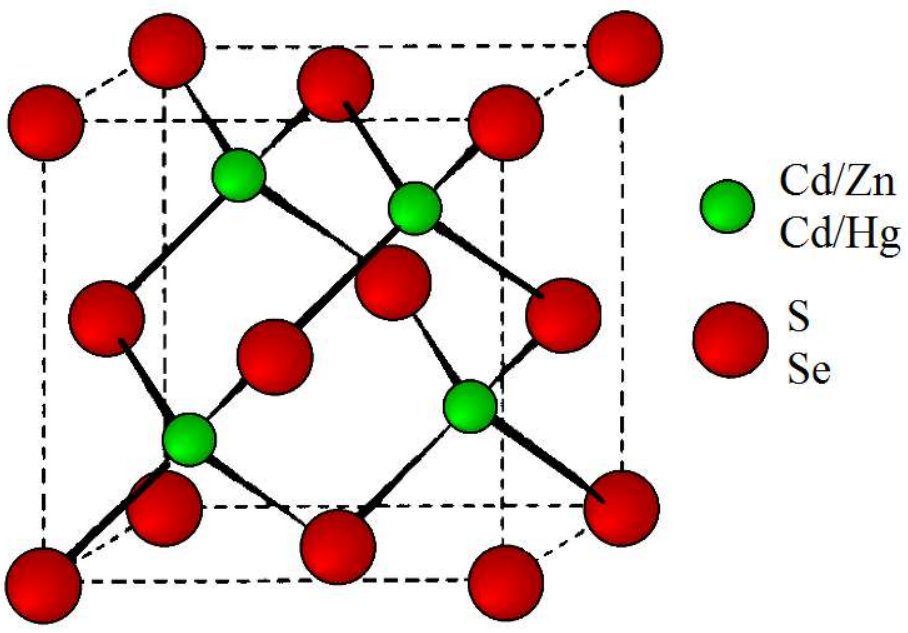

Fig 2. The unit cell of cubic sphalerite structure of $Cd_xZn_{1-x}S$ and $Cd_xHg_{1-x}Se$ films phases

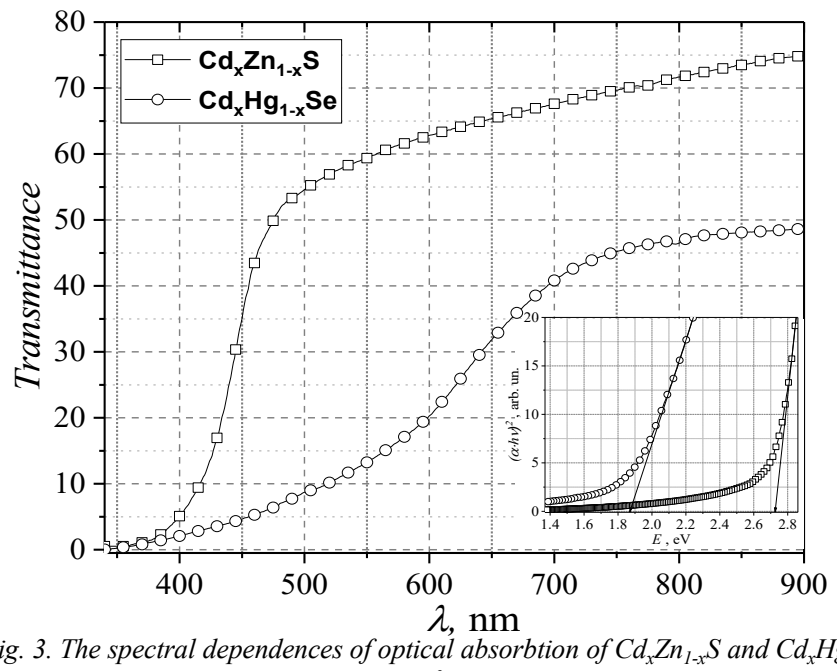

Fig. 3. The spectral dependences of optical absorbtion of $Cd_xZn_{1-x}S$ and $Cd_xHg_{1-x}Se$ films (inset – $(\alpha \cdot h\nu)^2$ vs. hν dependense)

Table 1. Results of microanalysis of thin films solid solutions

Film	Component	Weight %	Atomic %
$Cd_xZn_{1-x}S$	Cd	60.62	35.35
	Zn	15.20	15.24
	S	24.18	49.43
$Cd_xHg_{1-x}Se$	Cd	25.96	25.01
	Hg	31.95	17.25
	Se	42.09	57.74

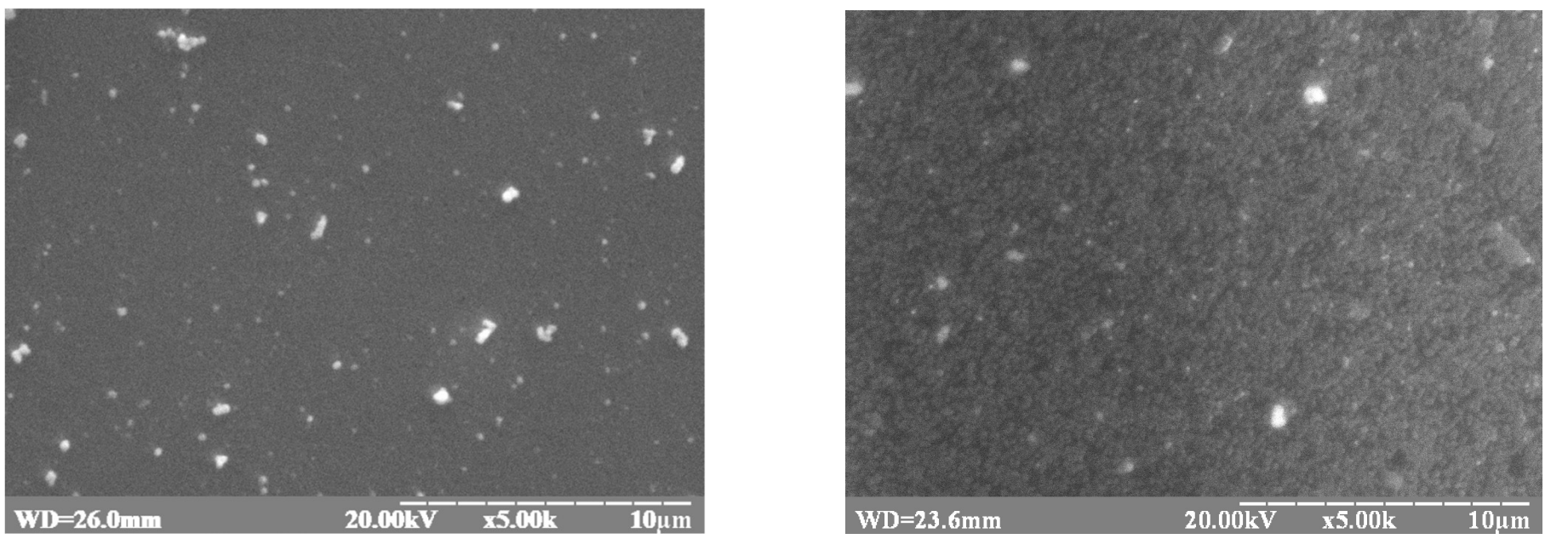

Fig.4 Surface morphology of $Cd_xZn_{1-x}S$ (left) and $Cd_xHg_{1-x}Se$ (right) films

References

[1] W. Kraus, G. Nolze PowderCell for Windows (version 2.4). – Berlin: Federal Institute for Materials Research and Testing, March 2000.