Structural Features of Sn_xS_y Thin Films

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Today Sn_xS_y could be considered as a perspective material for thin film solar cells (SC). This is presupposed by the fact that it fully meets demands to highly effective SC, possess bang gap E_g = 1.16 – 2.4 eV, has *p*- and *n*-type conductivity and includes no toxic or rare elements. Besides of that, the SnS, Sn_2S_3 and SnS_2 compounds with different band gaps and conductivity type could be formed within sulfur-tin system. This gives an opportunity to create heterojunctions SC based on the *n* - SnS_2/*p* – SnS.

The present work deals with the study of the structural properties of the Sn_xS_y thin films deposited by the closed-space vacuum co-evaporation (CSVCE) method. The effect of growth conditions on surface morphology and structural properties of Sn_xS_y films were studied. Surface morphology of obtained films was determined by the scanning electron microscope (SEM-102E). Structural investigations of the films were performed with the X-ray diffraction (XRD) method. The analysis of chemical composition of the layers was carried out by by energy dispersive X-ray (EDAX) spectroscopy. Influence of the substrate temperature on chemical composition of thin films and their structural properties was also investigated.

It was showed that obtained layers consist of platelet-shaped grains about 300 μm thickness. There was observed increasing in size of crystals from 0.7 μm to 4.2 μm with the increasing in the substrate temperature. Chemical composition of the layers depended on the substrate temperature and changed in the range from $\varphi = C_S/C_{Sn}$ = 1.03 to 1.41. Hereby their stoichiometry was becoming better when condensation conditions were close thermodynamic equilibrium. The most stoichiometric samples ($\varphi = C_{Sn}/C_S$ = 0.96) were deposited at 573 K.

At XRD patterns a range of peaks, which were identified as reflections from (103), (011), (111), (112) crystallographic planes and other orthorhombic phase were observed. Positions of this peaks coincides with the JCPDS data for Sn_2S_3. Parameters of the crystal lattice of the material were calculated *a* = 0.88741 – 0.89129 μm, *b* = 0.37525-0.37568 μm, *c* = 1.40209-1.40948 μm.