

## Post-growth treatment of $\text{Sn}_x\text{S}_y$ thin films

V.Kosyak<sup>1</sup>, A.Vozny<sup>1</sup>, P. Onufrijevs<sup>2</sup>, L.Grase<sup>2</sup>, J. Vecstaudža<sup>2</sup>, A. Opanasyuk<sup>1</sup>, A. Medvids<sup>2</sup> and G. Mezinskis<sup>2</sup>

<sup>a</sup>*Sumy State University, 2, Rymsky Korsakov Str., 40007 Sumy, Ukraine*

<sup>b</sup>*Riga Technical University, 3/7, Paula Valdena Str., LV-1048 Riga, Latvia*

In this study, the effect of post-growth thermal annealing and laser irradiation on phase composition, structural, optical and electrical properties of  $\text{SnS}_2$  obtained by the close-spaced sublimation on ITO substrates was studied. It was found, by using EDS, XRD and Raman methods that as-grown samples have single phase  $\text{SnS}_2$  structure and their chemical composition is close to stoichiometric. In order to determine annealing conditions for phase transition from  $\text{SnS}_2$  to  $\text{SnS}$  the samples were annealed in vacuum under different temperature and time. It was determined that annealing in the vacuum of  $\text{SnS}_2$  films at  $500\text{ }^\circ\text{C}$  for 90 min leads to the formation of single phase stoichiometric  $\text{SnS}$ . The laser annealing of the  $\text{SnS}_2$  thin films sample was performed by the Nd:YAG laser, with two intensities of radiation of 8.5 and 11.5  $\text{MW}/\text{cm}^2$ . It was established, that irradiation of the samples with 8.5  $\text{MW}/\text{cm}^2$  intensity leads to the coalescence of grains accompanied with smoothing of the surface. The EDS line scan of the samples cross section shows that chemical composition of the layer at the irradiated surface is close to  $\text{SnS}$ , while near the substrate the chemical composition remains the same as before irradiation. Formation of  $\text{SnS}$  phase was also confirmed by the XRD and Raman methods. The application of 11.5  $\text{MW}/\text{cm}^2$  laser radiation leads to the formation of  $\text{SnS}$  phase not only at the surface but in the whole volume of samples. The I-V characteristics of the ITO/ $\text{Sn}_x\text{S}_y$ /Al samples show ohmic behaviour in a case of non-irradiated and irradiated with high 11.5  $\text{MW}/\text{cm}^2$  intensity samples. While for the samples irradiated with 8.5  $\text{MW}/\text{cm}^2$  intensity the diode behaviour of I-V curve was observed. It could be considered as an evidence of formation of p- $\text{SnS}$ /n- $\text{SnS}_2$  heterojunction structure.

## **Бібліографічний опис:**

Post-growth treatment of  $\text{Sn}_x\text{S}_y$  thin films [Text] / V.Kosyak, A.Vozny, P. Onufrijevs, L.Gräse, J. Vecstaudža, A. Opanasyuk, A. Medvids, G. Mezinskis // Materials of European Materials Research (E-MRS) Society Spring Meeting, Lille, 2-6 May. - Lille, 2016. - P. 2.14.