

ELECTROCHEMICAL SYNTHESIS OF In_2Se_3 THIN FILMS FROM CITRATE BATH. STRUCTURAL, OPTICAL AND MORPHOLOGICAL INVESTIGATIONS

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Received April 26, 2020; revised August 10, 2020; accepted August 31, 2020

In this work, indium selenide In_2Se_3 thin films were synthesized by electrodeposition in potentiostatic mode from aqueous solution containing InCl_3 and SeO_2 in acid medium (pH 4.2) with sodium citrate as complexing agent at ambient temperature with heat treatment of electrodeposited films at different temperatures. Voltammetry method was used to investigate the electrochemical behavior of the electrodeposition bath. The structural characterization of elaborate films was performed by X-rays diffraction (XRD) and RAMAN spectroscopy, the morphological one was carried out by Scanning Electron Microscopy (SEM) and atomic force microscopy (AFM), the UV-Visible Spectrophotometry was used to investigate their optical proprieties, whereas the Mott–Schottky measurement was used also to study their semiconducting properties. The results showed that the annealed deposit at 350, 450°C and the as-deposited films take the rhombohedral β -crystal-line phase hR5 of In_2Se_3 , as-deposited and annealed In_2Se_3 are photoactive thin films with band-gap energies 1.33, 1.55 eV respectively and belong to n-type semiconductors with number of charge carriers in order of $10^{21}/\text{cm}^3$. The obtained deposits have nanometric grain size and less roughness surface.

Keywords: electrodeposition, In_2Se_3 , thin film, citrate bath, semiconductor, energy gap

DOI: 10.31857/S0424857022030069

CONCLUSIONS

Electrodeposition of indium selenide thin films have been studied in thin paper, obtained films were synthesized from an aqueous solution containing InCl_3 and SeO_2 in acid medium (pH 4.2) at ambient temperature using sodium citrate as complexing agent which serve to approximate the deposition potentials, synthesis process was followed by vacuum annealing of elaborated films. It was concluded that electrodeposited In_2Se_3 annealed at 350, 450°C and untreated, have the rhombohedral β -phase crystalline structure hR5. As-deposited and annealed In_2Se_3 are photoactive thin films with band-gap energies 1.33, 1.55 eV respectively and belong to n-type semiconductors with number

of charge carriers in the order of $10^{21}/\text{cm}^3$ and composed mainly of In_2Se_3 nano-grains with low roughness surface.

The recorded results would help us understand the process and the good conditions for electrodeposition of In_2Se_3 thin films with nano-grains, good adhesion and smooth surface and open up prospects for research on the same axis.

This is an excerpt of the article “Electrochemical Synthesis of In_2Se_3 Thin Films from Citrate Bath. Structural, Optical and Morphological Investigations.” Full text of the paper is published in Russian J. Electrochemistry, 2021, vol. 57, p. 462.