Electrochemical Formation and Selenization of Ternary CuZnSn Alloys for Growing Cu₂ZnSnSe₄ Photoactive Thin Films

Mohamed Benaicha^{*}, Meriem Hamla, Sabrina Derbal

Energetic and Solid-State Electrochemistry Laboratory, Faculty of Technology, Ferhat Abbas-Setif1 University, Setif, 19000, Algeria.

^{*}E-mail: mdbenaicha@yahoo.fr

doi: 10.20964/2016.06.76

Received: 19 March 2016 / *Accepted:* 25 April 2016 / *Published:* 4 May 2016

A two-step electrochemical route for the synthesis of Cu₂ZnSnSe₄ (CZTSe) photoactive thin films is reported in this work. A ternary Cu-Zn-Sn (CZT) alloy was electrochemically deposited onto Indium doped Tin Oxide (ITO) substrates from citrate electrolyte followed by a thin layer of Se on the top. The CZT + Se deposits were annealed under vacuum and characterized by means of field emission scanning electron microscopy (FESEM), energy dispersive spectrometry (EDS), X-ray diffraction (XRD), Raman spectroscopy and UV-VIS spectroscopy respectively. The XRD measurements indicated that when annealed under vacuum at 350 °C, the manufactured CZT+ Se precursors contained the main diffraction peaks of CZTSe in addition to secondary phases such as Cu₆Sn₅ and Cu₅Zn₈ binaries. With increasing temperature up to 550 °C, the CZTSe deposits presented stannite structure with a band gap of 1.12 eV and contained traces of Cu₂SnSe₃ phase.

Keywords: Cu₂ZnSnSe₄; Solar cells; thin films; Selenization; Electrodeposition

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