

Electrodeposition and Selenization of CuIn Alloys for the Synthesis of Photoactive $\text{Cu}_{2-x}\text{In}_x\text{Se}_2$ (Cigs) Thin Films

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Abstract : A new two stage electrochemical process as a safe, large area and low processing cost technique for the production of semi-conducting CuInSe_2 (CIS) thin films is studied. CuIn precursors were first potentiostatically electrodeposited onto molybdenum substrates from an acidic thiocyanate electrolyte. In a second stage, the prepared metallic CuIn layers were used as substrate in the selenium electrochemical deposition system and subjected to a thermal treatment in vacuum atmosphere, to eliminate binary phase formation by reaction of the Cu_{2-x}Se and In_xSe_y selenides, leading to the formation of CuInSe_2 thin film. Electrochemical selenization from aqueous electrolyte is introduced as an alternative to toxic and hazardous H_2Se or Se vapor phase selenization used in physical techniques. In this study, the influence of film deposition parameters such as bath composition, temperature and potential on film properties was studied. The electrochemical, morphological, structural and compositional properties of electrodeposited thin films were characterized using various techniques. Results of Cyclic and Stripping-Cyclic Voltammetry (CV, SCV), Scanning Electron Microscopy (SEM) and Energy Dispersive X-Ray microanalysis (EDX) investigations revealed good reproducibility and homogeneity of the film composition. Thereby optimal technological parameters for the electrochemical production of CuIn, Se as precursors for CuInSe_2 thin layers are determined.

Keywords : photovoltaic, CIGS, copper alloys, electrodeposition, thin films

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