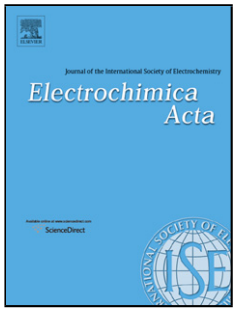

Title: Effect of cell configuration on the compositional homogeneity of electrodeposited Cu-Zn-Sn alloys and phase purity of the resulting Cu_2ZnSnS_4 absorber layers

Authors: Begum Unveroglu, Giovanni Zangari

PII: S0013-4686(17)31815-7
DOI: http://dx.doi.org/10.1016/j.electacta.2017.08.155
Reference: EA 30159

To appear in: *Electrochimica Acta*

Received date: 5-7-2017
Revised date: 16-8-2017
Accepted date: 27-8-2017

Please cite this article as: Begum Unveroglu, Giovanni Zangari, Effect of cell configuration on the compositional homogeneity of electrodeposited Cu-Zn-Sn alloys and phase purity of the resulting Cu2ZnSnS4 absorber layers, Electrochimica Actahttp://dx.doi.org/10.1016/j.electacta.2017.08.155

Effect of cell configuration on the compositional homogeneity of electrodeposited Cu-Zn-Sn alloys and phase purity of the resulting Cu_2ZnSnS_4 absorber layers

Begum Unveroglu and Giovanni Zangari

Department of Material Science and Engineering, University of Virginia, 395 McCormick Rd., Charlottesville, Virginia 22904, United States

Highlights

- Cu-Zn-Sn films of ~1cm^2 area with less than 0.7 at% deviation are obtained by electroplating in a horizontal configuration
- After annealing in sulfur atmosphere, phase purity and photoresponse of the CZTS layer is improved when starting with more homogenous precursors.
- Order of CZTS layers at the Cu-Zn sublattice is improved after annealing at 175 °C

Abstract

Cu_2ZnSnS_4 (CZTS) absorber layers were synthesized by electrodeposition of Cu-Zn-Sn (CZT) alloys using horizontally or vertically oriented electrodes, followed by sulfurization. A significant improvement in compositional homogeneity was observed for the horizontal vs. vertical deposition configuration, most probably due to the absence of buoyancy-induced convection and the improved uniformity of the current distribution in the former. The morphology of the two CZT films is similar, but the films grown from the horizontal, facing down electrode, show some pinholes related to the adhesion of hydrogen bubbles. The horizontally grown and sulfurized CZTS films show also a better homogeneity and improved phase purity, as demonstrated by EDS mapping and imaging. The disorder due to anti-site defects in as-sulfurized CZTS films is decreased by gentle annealing, which also results in improved crystallinity. Liquid junctions were utilized to measure film photoactivity, showing