Contribution ID: **35** Type: **Poster presentation**

Incorporation of Cu-Se to Cu-Ga-In precursors for the fabrication of $CuIn_{1-x}Ga_xSe_2$ thin film solar cells

Wednesday, May 20, 2015 2:00 PM (3h 30m)

Cu-In-Ga (CIG) metallic precursor thin films were fabricated by sequential depositions of Cu-Ga and In on Mo-coated soda lime glass (SLG) substrates. Due to low melting point of In and adhesion issues of the CIG metallic precursor, the substrate temperature was optimized for the depositions of In and Cu-Ga layers. It was found that the sequence of the depositions of Cu-Ga and In affected the formation of alloying precursors. In this study, $CuIn_{1-x}Ga_xSe_2$ (CIGS) thin films were obtained by the co-evaporation of Cu-Se during increasing the temperature of the CIG metallic precursors from 150℃ to 450℃, and followed by vacuum annealing at 450℃. The duration time of the Cu-Se flux and the annealing processes were among important varying parameters. The formation and the chalcopyrite phase of the CIGS layer were determined by FESEM and XRD, respectively. The CIGS thin film solar cells were also fabricated and tested for their I-V characteristics as well as quantum efficiency measurements (QE) to observe their spectral responses. The best efficiency of the CIGS solar cells obtained from the absorber fabricated by this method was 13.2%.

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Session Classification: Poster-1

Track Classification: Surface, Interface and Thin Film