Routes to Rapid Synthesis of $Cu(InGa)Se_2$ Solar Cell Absorbers

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Recent advances in the development of high efficiency (19.9 % AM1.5G, 100 mW/cm2) polycrystalline thin film Cu(InGa)Se2 (CIGS) solar cells are extremely promising. The route used to synthesize the CIGS absorber material is critical to achieving high cell efficiency as well as high processing throughput. Two widely employed techniques to fabricate high quality CIGS films are the elemental co-evaporation, and the deposition of metal precursor followed by subsequent selenization called two-step method. A sophisticated vacuum co-evaporation process, however, has not been successfully implemented in industrial large-area module production mainly due to high production cost and non-uniformity in large-scale deposition. The limitation in two-step method for successful commercialization includes the toxicity of H2Se gas or Se vapor currently used for selenization of metal precursor, and low selenization rate limiting throughput.
In this paper, alternative reaction routes will be proposed to rapidly synthesize CIGS absorber based on the systematic study of thermodynamic phase diagrams and reaction pathways of CIGS materials.