

Device Characteristics of CZTSSe Thin-Film Solar Cells with 8 % conversion efficiency

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Cu₂ZnSnS₄ (CZTS)-based thin film solar cells are promising candidates for high efficiency and cost effective thin film solar cells since most elements are highly abundant in the earth crust and the fundamental optoelectronic properties are suitable for photovoltaic applications.[1-2] CZTS-based thin films have been studied by many groups over the past years by using different fabrication approaches, sputtering, thermal co-evaporation, a solution process, photochemical deposition and the sol-gel method. There have been several reports on CZTS thin films fabricated with sulfurization of the precursor layer. This fabrication method is very similar to that of CIGS thin films. The processes of CZTS based solar cells can be divided into two categories: vacuum and solution process. In particular, for higher efficiency, two step-process, in which metallic or compound precursors are formed first and then subjected to post-sulfurization, has been adopted.[3-5]

In this work, we demonstrate a simple route to fabricate CZTS and CZTSSe films by using RF/DC sputtering for stacking orders of metal precursor. We reported on CZTS and CZTSSe films grown by sputtering using Cu, SnS, and ZnS targets and subsequent sulfurization using a two-zone furnace and sealed quartz furnace. We found the optimal metal precursor order and optimized the composition of the sulfurized CZTS by manipulating the stack order. We also fabricated CZTS and CZTSSe solar cell units and investigated their electrical characteristics.

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References

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