Critical review on sputter-deposited $\text{Cu}_2\text{ZnSnS}_4$ (CZTS) based thin film photovoltaic technology focusing on device architecture and absorber quality on the solar cells performance

Abstract

Thin film photovoltaic $\text{Cu}_2\text{ZnSnS}_4$ (copper zinc tin sulfide or CZTS) is one of the most promising sustainable solar cell absorber material. The CZTS absorber layer containing earth-abundant materials such as copper, zinc, tin and sulfur can be an alternative to existing materials for thin film solar cells. Recently, there has been an increased interest to step-up the efficiency and step-down the manufacturing cost of CZTS-based solar cells. This review critically addresses the advantages and challenges associated with sputter-deposited CZTS solar cells, since sputtering is an industry compatible and relatively low-cost vacuum deposition technique. Various approaches to fabricate CZTS thin films by sputtering are discussed. In addition, the single target quaternary CZTS sputtering technique has been discussed in detail. Current state-of-the art device architectures and methods to improve the quality of interfaces are discussed. This review is intended to highlight current trends and challenges in the field to realize the opportunity of CZTS thin film solar cells for large scale application.