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The outcome of replacing Sn completely by Ge in Kesterite Cu2ZnSnSe4 solar cells

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Abstract— In this work, the fabrication and properties of a Ge-based Kesterite Cu2ZnGeSe4 solar cell have been discussed. The substitution and the existence of the quaternary compound has been verified by physical methods. The device has a power conversion efficiency of 5.5% under AM1.5G illumination which is among the highest reported for pure Ge substitution. In depth electrical and optical analysis show that the Cu2ZnGeSe4 absorber has less bulk defects, less or no band tailing and no sub band gap emissions, which are all characteristic of Cu2ZnSnSe4 devices. These beneficial opto-electronic properties also result in a high open circuit voltage (Voc) of 744 mV which is amongst the highest reported for Kesterite materials.

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