

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

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Sahayaraj, S.; BRAMMERTZ, Guy; VERMANG, Bart; Schnabel, T.; Ahlswede, E.;
Huang, Z.; Ranjbar, S.; MEURIS, Marc; Vleugels, J. & POORTMANS, Jef (2017)
The outcome of replacing Sn completely by Ge in Kesterite Cu₂ZnSnSe₄ solar cells.
In: 2017 IEEE 44TH PHOTOVOLTAIC SPECIALIST CONFERENCE (PVSC),
IEEE,p. 3260-3264.

Handle: <http://hdl.handle.net/1942/28576>



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The outcome of replacing Sn completely by Ge in Kesterite $\text{Cu}_2\text{ZnSnSe}_4$ solar cells

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Abstract— In this work, the fabrication and properties of a Ge-based Kesterite $\text{Cu}_2\text{ZnGeSe}_4$ 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 $\text{Cu}_2\text{ZnGeSe}_4$ absorber has less bulk defects, less or no band tailing and no sub band gap emissions, which are all characteristic of $\text{Cu}_2\text{ZnSnSe}_4$ devices. These beneficial opto-electronic properties also result in a high open circuit voltage (V_{oc}) of 744 mV which is amongst the highest reported for Kesterite materials.

For the published version of record document, go to:

<http://dx.doi.org/10.1109/PVSC.2017.8366159>

