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Effects of the copper content on the structural and electrical properties of $\text{Cu}_2\text{ZnSnSe}_4$ bulks used in thin-film solar cells

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We have investigated the concept of defect in $\text{Cu}_x\text{ZnSnSe}_4$ ($x= 1.6\text{--}2.0$) and $\text{Cu}_y(\text{Zn}_{0.9}\text{Sn}_{1.1})\text{Se}_4$ ($y= 1.6\text{--}2.0$) bulks prepared by liquid-phase sintering at 600 °C for 2 h with soluble sintering aids of Sb_2S_3 and Te. All $\text{Cu}_x\text{ZnSnSe}_4$ pellets exhibited p-type conductivity regardless of Cu contents but $\text{Cu}_y(\text{Zn}_{0.9}\text{Sn}_{1.1})\text{Se}_4$ pellets show p-type at $y=1.6$ and n-type at $y= 1.8\text{--}2.0$. SEM surface images showed the sintered CZTSe bulk exhibited a smooth, densely packed and homogeneous surface at the nearly stoichiometric composition. Increasing the copper excess also yields a rougher CZTSe morphology. The non-stoichiometric composition of CZTSe under various Cu contents caused the intrinsic defects, and the structural and electrical properties of the bulks can be explained based on the point defect properties. The deficiency of Cu content in CZTSe bulks easily leads to smaller unit cells.

Are you currently a postgraduate student? (Yes/No)

No

At what level of studies are you currently? (Hons/MSc/PhD)

PhD

Please provide the name and email address of your supervisor.

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