Short Communication

Effect of Sulfurization Temperature on the Preparation of $\text{Cu}_2\text{ZnSnS}_4$ Thin Films for Solar Cells via a Nanoink Coating Method

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High-temperature sulfurization is an effective method for preparing $\text{Cu}_2\text{ZnSnS}_4$ thin-film solar cells with reduced volume resistivity and defect density and a high energy conversion efficiency.

In this paper, a metal oxide precursor (CZTO) prepared by nanoink coating was sulfurized at different temperatures to study the change in the morphology and optimized phase of $\text{Cu}_2\text{ZnSnS}_4$ (CZTS) thin films. XRD-ray diffraction, Raman spectroscopy, SEM and absorption spectra confirmed that the CZTS film annealed at 580°C and had high crystallinity and a uniform particle size, and the absorption coefficient was greater than $10^4/\text{cm}$. Furthermore, a solar cell was fabricated to measure the conversion efficiency of a photoelectric device with the structure Mo/CZTS/CdS/i-ZnO/ITO/Ag. Finally, the $\text{Cu}_2\text{ZnSnS}_4$ solar cell possessed a band gap of 1.48 eV and exhibited a conversion efficiency of 2.08%, with an open-circuit voltage (Voc) of 583 mV, a short-circuit density (Jsc) of 7.32 mA/cm² and a fill factor (FF) of 48.86%.

Keywords: sulfurization temperature, $\text{Cu}_2\text{ZnSnS}_4$ thin film, crystallinity, conversion efficiency, solar cell

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