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Comprehensive analysis of spin coated copper zinc tin sulfide thin film absorbers

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ABSTRACT

Copper zinc tin sulfide (Cu_2ZnSnS_4, CZTS) thin films have been widely studied recently due to the advantages of low-cost, high absorption coefficient ($\geq 10^4$ cm^{-1}), suitable band gap (~1.5 eV) and non-toxicity. This promising kesterite semiconductor structure can also be fabricated using spin coating methods that do not require vacuum and high technology. So far, a comprehensive parameter analysis about the growth of spin-coated CZTS absorbing layers has been lacking in the literature; therefore, here the effects of spin speed, solution molarity, amount of stabilizer, drying and subsequent annealing parameters on the films were investigated in terms of composition, grain size, surface morphology, crystallinity and film thickness. It has been found that the spin speed and molarity are effective on the film quality, but this effect is not sufficient. The quality of the prepared CZTS thin film is largely dependent on the heat treatment. Various drying, annealing temperatures and atmospheres were used and optimum heat treatment parameters obtained. As a result, spin coating and subsequent heat treatment parameters for the stoichiometric CZTS thin film absorber layer were determined.

Keywords: Cu_2ZnSnS_4, Thin films, Spin coating, Parameter analysis