Fabrication and characterization of SnS_2 nanoparticles as buffer layer in $Cu(InGa)Se_2$ solar cell device

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Tin disulfide (SnS_2) is a new, non-toxic, earth abundant, and n-type semiconductor. In this work, SnS_2 nanoparticles were synthesized from the aqueous solution of the tin (IV) chloride pentahydrate and thioacetamide as tin and sulfur precursors. The prepared nanoparticles were dissolved in ethanol and then spin coated in soda-lime glass (SLG) and on SLG/Mo/CIGS absorber substrates. The deposited films and powders were characterized by the helping of various techniques. The X-ray photoelectron spectroscopy results showed the prepared nanoparticles has a stoichiometric composition of Sn and S. Further, Raman spectra showed a characteristic peak at 316 cm-1 and at 230 cm-1 related to the SnS_2 phase. The optical absorbance of SnS_2 films were measured using UV-Vis spectroscopy and the results showed that the films exhibited an average high transmittance about 85% and the band gap energy was calculated from absorbance and found around ~2.7 eV. Finally, the CIGS solar cell devices were fabricated using SnS_2 as a buffer layer and the device photovoltaics parameters were compared to reference CIGS device prepared with standard CdS buffer layer.