Optimizing Sputtered Sb Layers for the Preparation of Sb_2Se_3 Absorbers by Rapid Thermal Process

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Antimony selenide (Sb_2Se_3) has recently attracted widespread attention as a solar absorber due to its outstanding optoelectronic characteristics and binary composition. It has high saturated vapor pressure below its melting point, which offers promising routes for vapor deposition methods. These characteristics have explored the Sb_2Se_3 for various other fields like thermoelectric, optoelectronic, photothermal, etc. Antimony (Sb) layers of different thicknesses (350 nm to 1400 nm) were deposited on Mo substrates using DC sputtering, followed by the deposition of a 1μm thick selenium (Se) layer on top of the Sb layers. Finally, the bilayers were annealed in a rapid thermal process (RTP) system to get Sb_2Se_3 absorbers. The XRD patterns revealed that all the diffraction peaks could be well indexed to the orthorhombic crystal structure of the pure Sb_2Se_3 phase. The SEM images of prepared films showed the large crystal grain morphology. The optical band gap energy values were found to be varied in the range of 1.1-1.4 eV. Therefore, this work has conclusively demonstrated that the prepared Sb_2Se_3 thin films were suitable for thin film solar cell application.