Reactively co-sputtered $ZnSnN_2$ thin films: a promising material/process for low cost/high efficiency sustainable tandem cells

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Considering that a tandem cell approach using a thin film technology in conjunction with the well-established Si technology is one of the promising ways to achieve high efficiency solar cells in a cost effective manner, we investigate earth-abundant high bandgap absorber materials based on Zn-IV-nitrides that moreover add sustainable and low environmental footprint facets to this approach. We started by studying the $ZnSnN_2$ material (and related spinnerets). Indeed, the choice of such materials is based on their band gap suitability (they exhibit the right range of bandgap value, i.e. between roughly 1.6 eV and 2eV). We used the sputtering approach for deposition since it can manage both large deposition parameter tuning and up-scalability possibilities.

We report our first results on room temperature reactively co-sputtered $ZnSnN_x$ thin films. Two metallic targets are used in a confocal configuration and deposition is made at room temperature. It is followed by a post-annealing under nitrogen or forming gas. We will discuss the effect of sputtering conditions (power, pressure, N_2 flow), annealing temperature and substrate nature on the microstructural, optical and electrical properties. As an example, the figure below shows the carrier mobility and concentration which are obtained under different deposition parameters of $ZnSnN_2$ films.