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CHARACTERIZATION OF INDIUM-DOPED ZNO FILMS DEPOSITED BY ROOM TEMPERATURE SHAVINGS REACTIVE MAGNETRON SPUTTERING (SRMS) FOR PHOTOVOLTAIC APPLICATIONS

The finding for new low-toxicity materials to be used in photovoltaic devices is of great importance to meet the energy demand without harming the environment. In recent years, CdTe/CdS solar cells have attracted much attention due to the remarkable increase in efficiency from 16% to 22% [1,2]. Recent studies show that the CdS film has a parasitic absorption, which does not contribute to the photocurrent of the cell and has its toxicity as a drawback. Therefore, it is proposed to search for new n-type materials that can be coupled to the heterostructure of cells with CdTe. In this work, suitable conditions for the deposition of IZO thin films were found by applying a new methodology called shavings-reactive-magnetron sputtering (SRMS) at room temperature. This procedure consists of placing metal chips on a base target, thus varying the concentration of the deposited films, and it is advantageous compared to other methods because it allows the deposition of ternary materials without the need to fabricate or use different targets. The structural, morphological, optical and chemical properties of the obtained IZO films were investigated. XRD and RAMAN results show that with increasing indium concentration the ZnO structure is lost and the ternary compound Zn₂In₂O₅ starts to form. In addition, XPS confirms that the IZO films are composed of the ternary compound Zn₂In₂O₅. The obtained IZO films have a uniform and smooth surface with roughness (~1-2 nm) and bandgap from 3.02 to 2.82 eV. Finally, the high transmittance obtained from the IZO films (99% of $\lambda = 450\text{-}530\text{ nm}$) shows that their application as a window layer in photovoltaic applications is possible.

Keywords

Thin film, sputtering reactive, window-layer, IZO, TCO

Reference

Gupta, A., Parikh, V. and Compaan, A.D. (2006) 'High efficiency ultra-thin sputtered CdTe solar cells', *Solar Energy Materials and Solar Cells*, 90(15), pp. 2263–2271. Available at: <https://doi.org/10.1016/j.solmat.2006.02.029>.

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