

## The Effect of Substrate Temperature on the Structural, Optical, and Electrical of Nano-Crystalline Tin Doped-Cadmium Telluride Thin Films for Photovoltaic Applications

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**Abstract :** It was found that the induce an isolated dopant close to the middle of the bandgap by occupying the Cd position in the CdTe lattice structure is an efficient factor in reducing the nonradiative recombination rate and increasing the solar efficiency. According to our laboratory results, this work has been carried out to obtain the effect of substrate temperature on the CdTe<sub>0.6</sub>Sn<sub>0.4</sub> prepared by thermal evaporation technique for photovoltaic application. Various substrate temperature (25°C, 100°C, 150°C, 200°C, 250°C and 300°C) was applied. Sn-doped CdTe thin films on a glass substrate at a different substrate temperature were made using CdTe and SnTe powders by the thermal evaporation technique. The structural properties of the prepared samples were determined using Raman, x-Ray Diffraction. Spectroscopic ellipsometry and spectrophotometric measurements were conducted to extract the optical constants as a function of substrate temperature. The structural properties of the grown films show hexagonal and cubic mixed structures and phase change has been reported. Scanning electron microscopy (SEM) revealed that a homogenous with a bigger grain size was obtained at 250°C substrate temperature. The conductivity measurements were recorded as a function of substrate temperatures. The open-circuit voltage was improved by controlling the substrate temperature due to the improvement of the fundamental material issues such as recombination and low carrier concentration. All the result was explained and discussed on the biases of the influences of the Sn dopant and the substrate temperature on the structural, optical and photovoltaic characteristics.

**Keywords :** CdTe, conductivity, photovoltaic, ellipsometry

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