

Sensitivity Studies for a Pin Homojunction a-Si:H Solar Cell

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Abstract : Amorphous-silicon alloys have great promise as low cost solar cell materials. They have excellent photo-conductivity and high optical absorption to sunlight. Now PIN a-Si:H based solar cells are widely used in power generation modules. However, to improve the performance of these cells further, a better fundamental understanding of the factors limiting cell performance in the homo junction PIN structure is necessary. In this paper we discuss the sensitivity of light J-V characteristics to various device and material parameters in PIN homo junction solar cells. This work is a numerical simulation of the output parameters of a PIN a-Si:H solar cell under AM1.5 spectrum. These parameters are the short circuit current (J_{sc}), the open circuit voltage (V_{oc}), the fill factor (FF), the conversion efficiency. The simulation was performed with SCAPS-1D software version 3.3 developed at ELIS in Belgium by Marc Burgelman et al. The obtained results are in agreement with experiment. In addition, the effect of the thickness, doping density, capture cross sections of the gap states and the band microscopic mobilities on the output parameters of the cell are also presented.

Keywords : amorphous silicon p-i-n junctions, thin film, solar cells, sensitivity

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