

High Efficiency Achievement by a New Heterojunction N-Zno:Al/P-Si Solar Cell

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Abstract : This paper presents a new structure of solar cell based on p-type microcrystalline silicon as an absorber and n-type aluminum doped zinc oxide (ZnO:Al) transparent conductive oxide as an optical window. The ZnO:Al layer deposited by rf-magnetron sputtering at room temperature yields a low resistivity about $7,64.10^{-2}\Omega.cm$ and more than 85% mean optical transmittance in the VIS-NIR range, with an optical band gap of 3.3 eV. These excellent optical properties of this layer in combination with an optimal contact at the front surface result in a superior light trapping yielding to efficiencies about 20%. In order to improve efficiency, we have used a p+- μc -Si thin layer highly doped as a back surface field which minimizes significantly the impact of rear surface recombination velocity on voltage and current leading to a high efficiency of 24%. Optoelectronic parameters were determined using the current density-voltage (J-V) curve by means of a numerical simulation with Analysis of Microelectronic and Photonic Structures (AMPS-1D) device simulator.

Keywords : optical window, thin film, solar cell, efficiency

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