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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 7,64.10-2Ω.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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