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ELECTRICAL CHARACTERIZATION OF NANOSTRUCTURED SOLAR CELLS PREPARED BY CHEMICAL SPRAY PYROLYSIS

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Nanostructured $ZnO/In_2S_3/CuInS_2$ superstrate configuration solar cell with all component layers deposited by low cost chemical spray pyrolysis (CSP) method show a conversion efficiency of 4.2% [1]. In this study, the electrical characteristics of nanostructured cell based on a nanocolumnar ZnO window layer are compared with that of flat thin film reference cell. We measured I-V in dark and under different illumination intensities, and C-V and C-f in dark, all in the range 100-360 K, and QE at room temperature. The output at AM1.5 of the flat reference cell is: Voc=497mV, Jsc=6.4mA/cm^2, FF=62%, Eff=2%. The use of a nanostructured instead of a flat window layer results in a gain of Jsc (12.2mA/cm^2) and efficiency (3%) at the expense of slightly reduced Voc (430mV) and FF (58%). Interestingly, the nanostructured cells perform worse than the flat reference at low illumination intensity, as also indicated by illumination dependent shunt conductance. The $CuInS_2$ bandgaps deduced from QE are 1.5 eV and 1.3 eV, the extrapolation of $V_{OC}(T)$ to 0 K yields a barrier of 0.93 eV and 0.75 eV, and the activation energy of the dark saturation current is 0.74 eV and 0.69 eV, for the flat reference and the structured cell, respectively. Analysis of C-V and C-f is in progress and will be discussed.

References

1. M. Krunks, E. Kärber, A. Katerski, K. Otto, I. Oja Acik, T. Dedova, A. Mere, Solar Energy Materials & Solar Cells 94 (2010) 1191–119

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