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Band alignment by cobalt doping in nanostructured ZnO/CuO heterojunction solar cells

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We investigated the effect of cobalt doping on band offset between ZnO and CuO in nanostructured ZnO/CuO heterojunction solar cells. The band offsets between $Zn1-_xCo_xO$ (x=0, 0.05, 0.1, 0.15 and 0.20) and CuO nanostructures was calculated from X-ray Photoelectron Spectroscopy (XPS) measurements. We observed that the conduction band of Zn1-xCoxO moves closer to the vacuum level with the increasing value of cobalt doping (x), leading to a decrease in the conduction band offset between $Zn1-_xCo_xO$ and CuO and hence an enhancement of the open circuit voltage. Photovoltaic devices with 10% cobalt-doped ZnO exhibited the best power conversion efficiency of 1.87%. The performance of the fabricated solar cells is studied as a function of conduction band offsets with doping. Correspondingly, it was demonstrated that the insertion of a thin film of molybdenum oxide (MoO_3) between the CuO active layer and the gold contact inhibits the formation of a Schottky junction. By inserting a MoO_3 layer on the absorbing CuO layer, we enhanced the conversion efficiency of the 10% cobalt doped ZnO-CuO solar cell to 2.11. A detailed analysis of the influence of MoO_3 buffer layer thickness on the current-voltage (I-V) characteristics of devices will be presented.

Biography

Parameswar Hari is currently working as an Associate Professor at the University of Tulsa and also the Director of the Oklahoma Photovoltaic Research Institute at the University of Tulsa. He has completed his MS in Physics from Ohio University and PhD from the University of Utah. He is the author of over 80 publications in Condensed Matter Physics.

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