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Hydrothermally deposited Hydrogen doped Zinc Oxide nano-flowers structures for amorphous silicon thin film solar cells

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The surface morphology of front transparent conductive oxide (TCO) films is very important to achieve high current density in amorphous silicon (a-Si) thin film solar cells since it can scatter the light in a better way. In this study, we present the low cost hydrothermal deposited uniform zinc oxide (ZnO) nano-flower structure with various aspect ratios for a-Si thin film solar cells. The ZnO nano-flower structures with various aspect ratios were grown on the RF magnetron sputtered AZO films. The diameters and length of the ZnO nano-flowers was controlled by varying the annealing time. The length of ZnO nano-flowers were varied from 400 nm to 2 μm while diameter was kept higher than 200 nm to obtain different aspect ratios. The ZnO nano-flowers with higher surface area as compared to conventional ZnO nano structure are preferred for the better light scattering. The conductivity and crystallinity of ZnO nano-flowers can be enhanced by annealing in hydrogen atmosphere at 350 oC. The vertical aligned ZnO nano-flowers showed higher haze ratio as compared to the commercially available FTO films. We also observed that the scattering in the longer wavelength region was favored for the high aspect ratio of ZnO nano-flowers. Therefore, we proposed low cost and vertically aligned ZnO nano-flowers for the high performance of thin film solar cells.

Keywords: Light scattering, Zinc oxide nano-flowers, Hydrothermal process, Haze ratio, a-Si thin film solar cell.

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The xps study of the Cu-Zn nanofiber

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The copper-zinc(Cu-Zn) nanofiber was prepared by electrospinning method. The Cu/PVP (polyvinylpyrrolidone) and Zn/PVP precursor solutions were prepared by dissolution of copper sulfate and zinc acetate in methanol, respectively. The PVP was used to control the viscosity of the precursor solutions. The optimized ratio for the Cu/PVP and Zn/PVP nanofibers was determined separately. Then the suitable ratio of the precursor solutions was applied for fabrication of Cu/Zn/PVP nanofiber. For the electrospinning method, the precursor solutions were filled in a syringe. The distance between metallic needle on the syringe and collector was fixed at 16 cm and the voltage was applied on the tip was 13.0 kV. And the as-spun nanofiber was heated at 353K for removal of residual solvent. Then the heated nanofibers were calcined at 973K to decompose PVP. The obtained Cu, Zn, and Cu-Zn nanofibers were investigated with X-ray photoelectron spectroscopy (XPS) for the chemical properties, scanning electron microscopy (SEM) for the morphologies, and X-ray diffraction (XRD) to characterize the crystallinity and phase of nanofibers.

Keywords: XPS, Cu, Zn