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Electrical properties of n-ZnO/p-Si heterojunction photovoltaic devices

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ZnO semiconductor material has been widely utilized in various applications in semiconductor device technology owing to its unique electrical and optical features. It is a promising as solar cell material, because of its low cost, n-type conductivity and wide direct band gap. In this work ZnO/Si heterojunctions were fabricated by using pulsed laser deposition. Vacuum chamber was evacuated to a base pressure of approximately $2x10^{-6}$ Torr. ZnO thin films were grown on p-Si (100) substrate at oxygen partial pressure from 5mTorr to 40mTorr. Growth temperature of ZnO thin films was set to 773K. A pulsed (10 Hz) Nd:YAG laser operating at a wavelength of 266 nm was used to produce a plasma plume from an ablated a ZnO target, whose density of laser energy was $10J/cm^2$. Thickness of all the thin films of ZnO was about 300nm. The optical property was characterized by photoluminescence and crystallinity of ZnO was analyzed by X-ray diffraction. For fabrication ZnO/Si heterojunction diodes, indium metal and Al grid patterns were deposited on back and front side of the solar cells by using thermal evaporator, respectively. Finally, current-voltage characteristics of the ZnO/Si structure were studied by using Keithly 2600. Under Air Mass 1.5 Global solar simulator with an irradiation intensity of $100mW/cm^2$, the electrical properties of ZnO/Si heterojunction photovoltaic devices were analyzed.

Keywords: zinc oxide, pulsed laser deposition, photovoltaic

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Surface properties of Nb oxide thin films prepared by rf sputtering

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Niobium oxide thin films were synthesized by reactive rf magnetron sputtering. The target was metallic niobium with 2 inch in diameter and the substrate was n-type Si wafer. To control the surface properties of the films, Nb oxide thin films were obtained at various mixing ratios of argon and oxygen gases. Nb oxide thin films were analyzed with alpha step, scanning electron microscopy (SEM), X-ray diffraction (XRD), and X-ray photoelectron spectroscopy (XPS). The result of alpha step showed that the thickness of Nb oxide thin films were decreased with increasing the oxygen gas ratios. SEM images showed that the granular morphology was formed at 0% of oxygen gas ratio and then disappeared at 20 and 75% of oxygen gas ratio. The amorphous Nb oxide was observed by XRD at all films. The oxidation state of Nb and O were studied with high resolution Ni 2p and O 1s XPS spectra. And the change in the chemical environment of Nb oxide thin films was investigated by XPS with Ar+ sputtering.

Keywords: Niobium oxide thin films, rf sputtering