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AZO as a transparent conductive oxide for inversion-layer silicon solar cells

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1. Introduction
   Zinc Oxide (ZnO) has been attracting much attention in research activities for applications in light emitting diodes, spintronic devices, solar cells, etc. [1]. Doping the ZnO changes its properties especially in increasing its electrical conductivity [2]. This work focuses on the development of Aluminium doped Zinc Oxide (AZO) which has property-integrity to allow a research-in-progress hybrid inversion layer silicon solar cell to give maximum efficiency. The effects of thermal post-annealing in controlled air (N and O mixtures) on the electrical, structural and optical properties of undoped and aluminium-doped (i.e., 0%, 2% and 5%) AZO thin films deposited on glass and silicon substrates by the sol-gel method are investigated.
2. Results
   AZO was prepared using the sol-gel method with 0%, 2% and 5% Al. Thin films were then deposited on glass as well as crystalline silicon (c-Si) immediately after preparation, after 1 day, after 2 days, and after 3 days, pre-heating at 200˚C between layers. After a number of days, they were post-annealed at 400˚C, 450˚C, 500˚C, 550˚C, 600˚C and 650˚C. Various characterization techniques including four-point probe, PL, UV-Vis, Raman spectroscopy, AFM, SEM and XRD measurements were conducted on the prepared samples. The energy bandgaps for 0%, 2% and 5% of Al in ZnO were determined as 3.48 eV, 3.37 eV and 2.95 eV respectively for samples deposited on microscope glass slides after 1 day ('Day 1', see Fig. 1) from the time of the sol-gel preparation. The determined Eg results for AZO depositions on Day 0, Day 2 and Day 3 after the preparation of the sol-gel are consistent with the trend of reducing bandgap as the concentration of Al increases from 0% through 2% to 5% in the AlxZn1-xO polycrystalline material configuration. XRD measurements indicate that (002) is the most preferred orientation of the material. Peaks for (010), (011) and (110) orientations were also observed in the XRD pattern. Fig. 2 shows the deconvolution of peaks for AZO on glass Raman spectra, re-sulting in significant attribution of measured peaks. The results are being analyzed to understand the structural characterization of the AZO. The measurements from the other techniques will also be discussed.

Are you currently a postgraduate student? (Yes/No)

Yes

At what level of studies are you currently? (Hons/MSc/PhD)

PhD

Please provide the name and email address of your supervisor.

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