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Synthesis of ZnO based thin film by sol gel dip coating method

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ZnO thin films show a wide gamut of potential applications, mainly due to their optical and semiconducting properties. In present work, synthesis of undoped ZnO thin film and Aluminium doped ZnO (AZO) thin films on glass substrate by sol gel dip coating was done. Undoped and Aluminium doped Zinc oxide (AZO) thin films were prepared through sol gel dip coating technique with various doping concentrations from 0 to 1 at.% and sol ageing time from 24 and 48 hours. As ageing of solution also has an effect on thin film properties [1]. The thin films were characterized using X-ray Diffractometer (XRD), Scanning Electron Microscope (SEM), UV-VIS spectrophotometer and current voltage (I-V) measurement system. From the XRD analysis, increasing of doping concentration affected structural properties of the thin film. SEM shows a homogenous thin films in nanoscale while the UV-VIS spectra reveals all films exhibit high transmission (>80 %) in UV-Visible region. Change in electrical properties with dopant concentrations and ageing time is observed as shown by I-V measurement results.

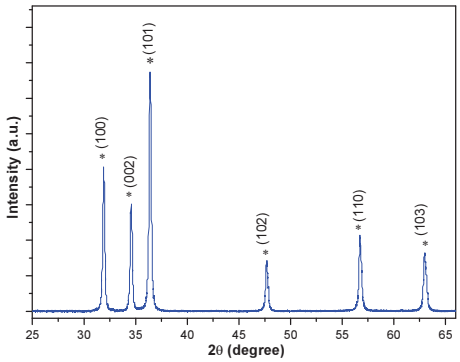

Figure 1: The XRD pattern of ZnO dried gel powder annealed at 400 °C for 1 h

The XRD pattern of the dried gel powder annealed at 400 °C for 1 h is shown in Figure 1. The calculated d-values are in good agreement with those taken from the Joint Committee of Powder Diffraction Standards (JCPDS 36-1451) card file data for ZnO powder [2]. That is, the as-prepared material has crystallized in a hexagonal wurtzite ZnO.

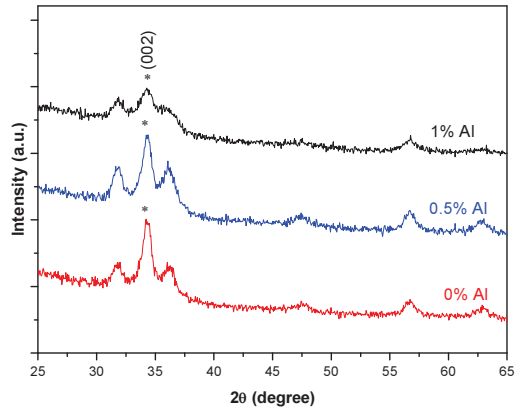

Figure 2: The XRD pattern of undoped and Al doped ZnO thin films

Figure 2 shows the XRD pattern of undoped and aluminium doped ZnO thin films. The XRD pattern shows all films exhibited polycrystalline that belongs to the ZnO hexagonal wurtzite type (JCPDS #36-1451). Compared to powder diffraction data, the XRD pattern of thin films show that films are preferential oriented along c-axis due to enhanced intensities of peak corresponding to (002) plane. However, the intensities of (002) peaks decreased with increasing dopant concentration which means that lower crystal quality is achieved at higher doping concentration.

References

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