

## Abstract

This thesis presents the development of transparent conducting zinc oxide coating on glass substrate by Metal Organic Chemical Vapor Deposition (MOCVD) technique. The gas mixture of Diethylzinc (DEZ) and water ( $H_2O$ ) carried by Argon (Ar) gas was used as reactant gas while Diborane ( $B_2H_6$ ) was employed as the n-type doping gas. We have investigated the effect of the  $B_2H_6$  flow rate and the deposition temperature on the structural, electrical, and optical properties of ZnO films. We found that the  $B_2H_6$  flow rate significantly affected resistivity and morphology of the ZnO films. With the increase of  $B_2H_6$  flow rate from 0 to 20 sccm, the resistivity, the pyramid grain size, the roughness, and the deposition rate of ZnO films decreased while the free carrier absorption increased. At the optimum condition, the total transmittance of ZnO film showed high absorption starting from the wavelength of 380 nm and extended up to 980 nm. The addition boron atoms decreased the surface roughness and hence lowly diffuse transmittance. For the effect of substrate temperature on ZnO films properties range of  $100^\circ C$  to  $200^\circ C$ , from the SEM investigation, the ZnO deposited at the temperature of  $100^\circ C$  shows the smooth surface, and the morphology shows sphere-like shape. The peak intensity of (002) plane is grown perpendicular to substrate. Increasing the substrate temperature to  $180^\circ C$ , the surface roughness of ZnO film is increased and the morphology shows the pyramid-like shape. The intensity of (100) peak strengthen is grown parallel to substrate. The deposition rate is increased with increasing in substrate temperature and has the highest at  $180^\circ C$ , further increase in substrate temperature leading to the decrease of the deposition rate. The resistivity of the ZnO film decreases with the increase of substrate temperature. The total transmittance in the wavelength region of 380-980 nm increases. The cell deposited on ZnO is characterized by a higher Short circuit current with  $I_{sc}$  value of  $18.9 \text{ mA/cm}^2$  against a value of  $17.1 \text{ mA/cm}^2$  on  $SnO_2$ . Surface roughness of these ZnO is related to light-scattering capacity increase the path of the light within the solar cell is importance to increase the current generation in thin film solar cell.