ELABORATION AND CHARACTERIZATION OF ZnO THIN FILMS DEPOSITED BY DC SPUTTERING AT LOW PRESSURE AND LOW TEMPERATURE:APPLICATION TO PHOTOVOLTAIC AND GAS SENSOR

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Abstract : DC reactive sputtering was used to deposit Zinc oxide (ZnO) films onto corning glass and crystalline silicon substrates at both room temperature and 100°C with an argon/oxygen mixture at sputtering pressure varying from 10 to 70 Pa. The dependence of films properties including structure, microstructure as well as optical on deposition parameters (deposition temperature and sputtering pressure) are investigated. The ZnO thin films were characterized by X-ray diffraction (XRD), scanning electron microscopy (SEM), optical transmission, electrical conductivity measurements. All ZnO films exhibit an intensive (002) XRD peak, indicating that the films are highly texturized along the c-axis perpendicular to the substrate surface. It is found that the nature of the annealing atmosphere has a great influence on the ZnO film composition. Furthermore, thermal annealing at 300°C have the effects of narrowing the diffraction peak and shifting the (002) peaks to higher 2? angles, which indicates that grain growth has occurred. The transmission measurements have shown that all films exhibit high transmittance in the 400–2500 nm range. Post-deposition annealing influences the morphological, optical and electrical properties of ZnO films. A very large increase in electrical conductivity, up to nine orders of magnitude, was observed in as-grown ZnO films upon vacuum-annealing at 300°C for one hour, reaching as high as 10 $?^{-1}.cm^{-1}$.

Keywords : reactive sputtering, transparent conducting zinc oxide, optical properties, structural characterization, electrical conductivity.