# Abstract

Zinc Oxide (ZnO), a wide and direct band gap semiconductor with large exciton binding energy, is attractive for optoelectronic applications. ZnO exhibits near-UV emission, transparency, conductivity, and resistance to high temperature electronic degradation. ZnO nanostructures have unique advantages including high specific surface area, nontoxicity, chemical stability, and electrochemical activity.

Structural features and surface morphology of ZnO and Al doped ZnO films grown by rf magnetron sputtering have been studied by X-ray diffraction (XRD) and atomic force microscopy analyses. Al-doped films exhibit high optical transparency with blue shift of band gap and a reduction of resistivity with increasing Al concentration. The grain and grain boundary scattering contribution with doping concentration has been investigated with impedance spectroscopy.

ZnO films and ZnO nanoprisms have been grown by sol-gel and electrochemical methods. The films have been characterized by XRD, scanning electron microscopy (SEM), and transmission electron microscopy. Hexagonal-shaped ZnO nanoprisms can be obtained by varying the current density and potential. The mechanism of ultraviolet and green emission of ZnO nanostructures has been investigated using temperature dependent photoluminescence spectra.

ZnO nanorods have been deposited on Si substrates by vapor-solid (VS) method. XRD, SEM, TPL, and IS have been used to characterize the structural, optical and electrical transport properties of the grown nanostructures. A strong free excitonic emission with very weak defect emissions is observed at room temperature. A comparative study of the impedance characteristics has been studied in detail.

ZnO tripods have been grown on Si substrates by VS technique. The tripods show irreversible shape transformation to tetrapods at higher temperature and at prolonged growth time. Temperature dependent PL characteristics of ZnO tripods have been investigated. ZnO nanostructures have been used for glucose bio-sensors. A quantitative comparison of the responsivity of bio-sensor for ZnO nanorods and tripods is presented. The sensitivity of ZnO tripods is found to be higher than that of ZnO nanorods.



**Key Words: ZnO; Thin films; Nanostructures; Photoluminescence; Impedance spectroscopy; Bio-sensors**