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A Facile growth of spray based ZnO films and device performance investigation for Schottky diodes: determination of interface state density distribution

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Abstract

This paper reports on the study of *ZnO* films grown by chemical spray pyrolysis on glass and *Si* substrates at temperatures of 300, 350 and 400°C and on the performances of the corresponding *Au/n-ZnO* Schottky diodes. XRD measurements have shown that all films are in single phase and have a wurtzite crystal structure. Microstructural properties such as lattice constants ($a = b \neq c$), unit cell volume, texture, dislocation density, standard deviation have been determined. The crystal size and the microstrain have also been calculated by taking X-ray line broadening profile into account. Besides, the optical features have been investigated by UV-Vis measurements. The optical band gap was found dependent on the temperature of the substrate during film growth and decreased from 3.28 to 3.24 eV in case of films grown at 300 and 400 °C, respectively. Electrical characterizations of *Au/n-ZnO* Schottky barrier diodes have been investigated using the current-voltage (*I-V*) and the capacitance-voltage (*C-V*) measurements. Results show that the ideality factor firstly increased for the film grown at 350°C, then decreased for the film grown at 400°C. Also, barrier height decreased with the increase of substrate temperature. This behaviour has been attributed to the inhomogeneous nature of barrier height, to variation of interface states and to the formation of a new phase on ZnO surface.

Keywords: *ZnO Films; Spray pyrolysis; Electrical properties; Schottky diodes*