

Microstructure Analysis and Multiple Photoluminescence in High Temperature Electronic Conducting InZrZnO Thin Films

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Abstract : Indium and Zirconium co doped zinc oxide (InZrZnO) thin films are prepared by chemical spray pyrolysis method on pre-heated quartz substrates. The films are subjected to vacuum annealing at 400°C for three hours in an appropriate air (10-5mbar) ambience after deposition. X-ray diffraction, Scanning electron microscopy, energy dispersive spectra and photoluminescence are used to characterize the films. Temperature dependent electrical measurements are conducted on the films and the films exhibit exceptional conductivity at higher temperatures. XRD analysis shows that all the films prepared in this work have hexagonal wurtzite structure. The average crystallite sizes of the films were calculated using Scherrer's formula, and uniform deformation model (UDM) of Williamson-Hall method is used to establish the micro-strain values. The dislocation density is determined from the Williamson and Smallman's formula. Intense, broad and strongly coupled multiple photoluminescence were observed from photoluminescence spectra. PL indicated relatively high concentration defective oxygen and Zn vacancies in the film composition. Strongly coupled ultraviolet near blue emissions authenticate that the dopants are capable of inducing modulated free excitonic (FX), donor acceptor pair (DAP) and longitudinal optical phonon emissions in thin films.

Keywords : PL, SEM, TCOs, thin films, XRD

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