

Sociedad Mexicana de Ciencia y Tecnología de Superficies y Materiales A.C.

VIII International Conference on Surfaces, Materials and Vacuum

September 21st – 25th, 2015 Puebla, Puebla

[SEM-331] Nanoelectrical characterization of ZnO:Al films prepared by spray pyrolysis

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In this work, zinc oxide films with different amounts of aluminum in the precursor solution (0, 0.5, 1, 2, 5 and 10 % [Al/Zn]) were prepared by ultrasonic spray pyrolysis onto glass substrates using zinc acetate as zinc precursor and 450 °C of substrate temperature. The films were characterized by X-ray diffraction, optical transmittance, scanning electron microscopy and current sensing atomic force microscopy. X-ray diffraction indicates a mixture between pure ZnO and some (Zn,Al)O phase with no evidence of crystalline Al₂O₃. The transmittance maximum and band gap increases with the [Al/Zn] ratio. The morphology was studied by SEM evolves from hexagonal flakes to hexagonal micro columns that first appear included between the flakes and thereafter dominate in the images. AFM indicate a grain size reduction from ZnO to ZnOAl up to 1% [Al/Zn] in the precursor solution as well as an increment in the conductivity, followed by a grain size increase as a reduction in the conductivity. CAFM indicates that conduction changes from grain bulk conduction to conduction through the grain boundaries when [Al/Zn] increases from 0.5-1% to 2-10%. Undoped ZnO shows uneven conduction paths, possibly related with the uneven distribution of vacancies. Financed by SIP20151074 and SIP2015599