Contribution ID: **253** Type: **Poster Presentation**

A Comparative Study of Zn-doped Al₂O₃ versus Al-doped ZnO Thin Films on Glass for Optimizing Transparent Conducting Properties

Tuesday, 10 July 2012 17:30 (2 hours)

Abstract content
   (Max 300 words)

Aluminium-doped zinc oxide (ZnO:Al) and zinc-doped aluminium oxide (Al₂O₃:Zn) thin films were synthesized by spray pyrolysis process onto standard microscope glass. Optical measurements in the ultraviolet, visible, near- and far-infrared ranges were performed using UV-VIS-NIR and Fourier Transform Infrared (FT-IR) spectrophotometers. Structural characterization for determination of surface morphology and film thickness were done using scanning electron microscopy (SEM), transmission electron microscopy (TEM) and a Phenom Tabletop Microscope. Electrical properties were measured using a four-point resistance square probe. The transmittance, reflectance and thickness of the thin films as well as the sheet resistance were experimentally determined. The solar transmittance of 88 percent was achieved for Al-doped zinc oxide (ZnO) films and 71.94 per cent for Zn-doped aluminium oxide (Al₂O₃). The films have low reflectance in the order of 10% although peak reflectance of 25% was observed in the wavelength range 8-12μm. Wavelength-dependent refractive index of the coatings were then determined from reflectance and transmittance measurements using the Bruggeman and Maxwell-Garnett effective medium theories. In the VIS-NIR, the obtained refractive indices were 1.28 for ZnO, 1.97 for ZnO:Al and 2.0 for Al₂O₃:Zn. The film sheet resistance values of 0.75 Ω, 9.5 Ω and corresponding resistivity values of 9.59 x 10⁻⁴ Ωm and 2.43 x 10⁻⁴ Ωm were obtained for ZnO:Al, and 5.56 Ω and 12 Ω with corresponding resistivity values of 4.47 x 10⁻⁴ Ωm and 11.80 x 10⁻⁴ Ωm for Al₂O₃:Zn. Features of the film surface microstructure were analyzed and related to how they affect the general properties of the films. The spectral selectiveness of these oxide thin films and their applicability in producing efficient solar energy generators and energy saving have been evaluated and related to applications in solar energy applications.

Apply to be
 consider for a student
   award (Yes / No)?

Yes

Level for award
 (Hons, MSc,
   PhD)?

MSc

Main supervisor (name and email)
and his / her institution

Dr Kaumba Chinyama - kchinyama@ufh.ac.za

Would you like to
 submit a short paper
 for the Conference
 Proceedings (Yes / No)?

Yes

Primary authors: Dr CHINYAMA, Kaumba Godfrey (University of Fort Hare); Ms NJINGANA, Primrose Nosicelo (University of Fort Hare)

Co-authors: Prof. MEYER, Edson Leroy (University of Fort Hare); Mr TAZIWA, Raymond (University of Fort Hare)

Presenter: Ms NJINGANA, Primrose Nosicelo (University of Fort Hare)

Session Classification: Poster Session

Track Classification: Track A - Division for Condensed Matter Physics and Materials