Journal of Materials Science & Technology

Volume 28, Issue 4, April 2012, Pages 329-335

Effect of Al Doping on Structural, Electrical, Optical and Photoluminescence Properties of Nano-Structural ZnO Thin Films

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https://doi.org/10.1016/S1005-0302(12)60064-4

The nano-structural Al-doped ZnO thin films of different morphologies deposited on glass substrate were successfully fabricated at substrate temperature of 350 Â°C by an inexpensive spray pyrolysis method. The structural, electrical, optical and photoluminescence properties were investigated. X-ray diffraction study revealed the crystalline wurtzite (hexagonal) structure of the films with nano-grains. Scanning electron microscopy (SEM) micrographs indicated the formation of a large variety of nano-structures during film growth. The spectral absorption of the films occurred at the absorption edge of â^¼410 nm. In the present study, the optical band gap energy 3.28 eV of ZnO decreased gradually to 3.05 eV for 4 mol% of Al doping. The deep level activation energy decreased and carrier concentrations increased substantially with increasing doping. Exciting with the energy 3.543 eV (Î»=350 nm), a narrow and a broad

characteristic photoluminescence peaks that correspond to the near band edge (NBE) and deep level emissions (DLE), respectively emerged.

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Key Words

Thin film; Nano-structure; ZnO; Surface morphology; Photoluminescence

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