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Structural, Optical and Electrical Properties of Gd Doped ZnO Thin Films Prepared by a Sol-Gel Method

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Abstract : ZnO thin films with various Gd doping concentration (0, 0.01, 0.03 and 0.05 mol/L) have been synthesized by sol–gel method on quartz substrates at annealing temperature of 600 ºC. X-ray analysis reveals that ZnO(Gd) films have hexagonal wurtzite structure. No peaks that correspond to Gd metal clusters or gadolinium acetylacetonate are detected in the patterns. The position of the main peak (101) shifts to higher angles after doping. The surface morphologies studied using a field emission scanning electron microscope (FESEM) showed that the grain size and the films thickness reduced gradually with the increment of Gd concentration. The roughness of ZnO film investigated by an atomic force microscopy (AFM) showed that the films are smooth and high dense grain. The roughness of doped films decreased from 6.05 to 4.84 rms with the increment of dopant concentration.The optical measurements using a UV-Vis-NIR spectroscopy showed that the Gd doped ZnO thin films have high transmittance (above 80%) in the visible range and the optical band gap increase with doping concentration from 3.13 to 3.39 eV. The doped films show low electrical resistivity 2.6 × 10-3Ω.cm.at high doping concentration.

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