

EFFECT OF ANNEALING ON OPTICAL PROPERTIES OF NiO:ZnO THIN FILMS

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Abstract

Figure I.1 $(\text{ZnO})_{1-x}(\text{NiO})_x$ thin films were prepared onto glass substrates by spray ultrasonic technique from zinc acetate dihydrate and nickel chloride hexahydrate solutions dissolved in distilled water. Substrate temperature, solution concentration, Nozzle-substrate distance and spray time were kept constant during all deposition process at 300°C, 0.05 mol/l, 7 cm and 15 min, respectively, with different values of x (x varies from 0.00 to 0.15). The annealing of these films were under air for 1 hour, at different annealing temperatures (300 °C, 400 °C and 500 °C). The aim of our work is to study the influence of nickel concentration and the annealing on the optical and electrical properties of $(\text{ZnO})_{1-x}(\text{NiO})_x$ thin films.

The deposited films were transparent in the Vis-NIR region, well adherent to the substrates, they have a present surface roughness and two structural phases (ZnO and NiO) for $x > 0.00$. With the increase of the annealing temperature, it was found that the Urbach energy decreases and the two optical gap values obtained are increased from 3.17 eV to 3.26 eV for the zinc oxide and from 3.45 eV to 3.66 eV for nickel oxide. At $T_R = 500$ °C, it is observed that there is a high electrical conductivity ($1.5 \times 10^{-2} (\Omega \cdot \text{cm})^{-1}$) at $x = 0.15$.

Keywords : $(\text{ZnO})_{1-x}(\text{NiO})_x$ thin films, Spray ultrasonic, Annealing temperature, Optical properties, Electrical conductivity.