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Effect of growth temperatures on the surface morphology, optical analysis, dielectric constants, electric susceptibility, Urbach and bandgap energy of sprayed NiO thin films

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Abstract

Thin films of nickel oxide (NiO) were deposited on glass substrates at a different temperature of growth using spray pyrolysis. Optical properties were examined using spectral measurement at a wavelength range of 300-2500 nm. Optical constants (n and k) were calculated from corrected transmittance and correct reflection. The data obtained show that the direct transition (E_g) decreased from 3.738 to 3.146 eV and the change in indirect transmission from 2.790 to 2.049 eV with increasing temperature. On the contrary, it was found that the Urbach energy (band tail width), the E_U has decreased from 0.184 to 0.104 eV. This behavior is believed to be associated with increased growth temperature. Optical conductivity, reflectivity, dielectric constants, volume and surface energy loss functions, electrical susceptibility and relaxation time were discussed as functions for growth temperatures. Of these results, NiO films were rated as an excellent material for optoelectronic applications and a potential candidate for solar cell applications due to their ability to improve.

Keywords: Optical Conductivity, Dielectric Constant, Nickel Oxide, Thin Films, Spray Pyrolysis

1-Introduction

Nickel oxide is an important magnetic semiconductor with a wide band gap 3.6 eV and cubic crystal structure [1,2]. The promising candidate for many applications such as electro catalysis [3], the positive electrode in batteries [4], the fuel cells [5], the electrochromic devices [6], the solar thermal absorber [7] the catalyst for the evaluation of oxygen [8] and photo electrolysis [9]. Surface atoms play an important role in controlling the electronic and optical properties of nanomaterial. Estimating the energy gap in semiconductors in nanostructures is somewhat difficult because the surface atoms in the valence and conductivity bands are not surprising, and the complexity of the

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