

Structural and Optical Properties of Spin Coated $Zn_{1-x}Cr_xO$ Nanostructures

Superlattices and Microstructures, volume 60, 2013, pp.108–119.

A. M. El Sayed^{a*}, S. Taha^a, G. Said^a, Ahmed A. Al-Ghamdi^b, F. Yakuphanoglu^{b,c}

^aDepartment of Physics, Faculty of Science, Fayoum University, Fayoum, Egypt.

^bDepartment of Physics, Faculty of Sciences, King Abdulaziz University, Jeddah, Saudi Arabia

^cDepartment of Physics, Faculty of Science, Firat University, Elazig, Turkey.

Abstract : $Zn_{1-x}Cr_xO$ thin films were grown on glass substrates by the sol–gel spin-coating technique. XRD results indicate that a ZnO single phase with a hexagonal wurtzite structure is formed. The films exhibit a preferential orientation along (002) direction in comparing with the other directions. AFM images of the films indicate that the Cr-doped ZnO films are consisted of a wrinkled network structure. The surface roughness of the films is increased with increasing Cr content. The optical band gap of $Zn_{1-x}Cr_xO$ thin films is decreased from 3.3 eV to 3.2 eV with the increase of Cr dopant ratio from $x=0$ to $x=9.8\%$ (in molar ratio) . The observed red shift in optical band gap is due to $s-d$ and $p-d$ exchange interactions. Urbach energy, E_U , values are changed inversely with optical band gaps of the films. The refractive index and optical conductivity of the films were changed with Cr content. The obtained results suggest that the structural and optical properties of ZnO films can be controlled by Cr doping.

Keywords: Zinc oxide; Cr-doped thin films; Wrinkled network structure; Optical conductivity.