Influence of Copper Incorporation on the Structural and Optical Properties of ZnO Nanostructured Thin Films

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Abstract

The copper-doped ZnO thin films were grown on glass substrates using the sol–gel method and the spin coating technique. Cu dopants with ratios less than 10% (in molar ratio) were chosen because they are anticipated to have excellent optical and electrical properties and could be used in many research, environmental, industrial, and technological applications. XRD results indicate that a ZnO single phase with a hexagonal wurtzite structure is formed. The crystallinity of ZnO thin films is gradually deteriorated with increasing the Cu ratio. AFM images of the films indicate that the Cu-doped ZnO films seem to be consisted of nanofibers. The surface roughness of the films is increased with increasing Cu content. The optical band gap is red shifted from 3.3 eV to 3.255 eV with the increase of Cu content from x=0 to x =9.8%. The refractive index, extinction coefficient, and optical conductivity show a decrease with increasing Cu content. The correlation between the structural modifications and the resultant optical properties are reported. The results of the present system are compared with those of similar materials.

Keywords: Sol-gel; Zinc oxide; Thin films; Nanofibers; Direct band gap; Refractive Index; Optical conductivity.