Structural, microstructural, and optical properties of ZnO thin films prepared by spray pyrolysis

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ABSTRACT

The thin films of zinc oxide were deposited by the ultrasonic spray technique on glass substrates. Our interest consists in the study of structural and microstructural properties. The X-ray diffraction analysis of the samples shows that the thin films crystallize in the hexagonal structure of the Wurtzite type. With a preferential orientation along the c-axis perpendicular to the substrate surface. The average size of the crystallites of the order of 49 nm. The microstructures/nanostructures of thin films are characterized by the presence of nano pedals. The chemical composition of the films was analyzed by EDS which revealed the formation of the ZnO phase. The synthesized layers showed a transmittance value of 90%. The optical band gap and the refractive index values are in good accordance with available studies in the literature.

I. Introduction

Metal oxides are widely present in the environment, they have interesting properties, and they are used separately in very diverse areas such as pharmaceutical, electronic, cosmetic, and medical industries, etc. ... Among these oxides is zinc oxide[1].In recent years, zinc oxide (ZnO) has become an interesting research topic because it has many applications in everyday objects, and it has demonstrated the best properties.

ZnO is a semiconductor with a large optical gap of 3.37eV, high exciter energy of 60meV, and transmittance of 0.9 in the visible, ZnO crystallizes in the wurtzite structure under normal conditions. Due to its particular optoelectronic properties, it has been used to evaluate new theoretical or computational approaches as well as in many technological applications, such as transparent electronics, field emitters, gas sensors or solar cells [2,3]. Various techniques have been used for their elaboration in thin layers, among which we can mention chemical vapor deposition (CVD)[4], physical vapor deposition (PVD), laser ablation[5,6], pneumatic sputtering, and cathodic sputtering[7,8]. These methods allow to make good quality deposits