11th International Conference
on Advanced Materials

ICAM2009

Rio de Janeiro Brazil
September 20 - 25

An X-ray diffraction study of the growth kinetics and structure of nanocrystalline ZnO particles synthesized by a newly modified proteic sol-gel process

N. S. Ferreira[(1)*], D. A. A. Santos[(1)], J. A. C. Paiva[(2)] and M. A. Macêdo[(1)]

(1) Departamento de Física, Universidade Federal de Sergipe, São Cristóvão-SE, Brazil, e-mail: nilsondsf@gmail.com.
(2) Departamento de Física, Universidade Federal do Ceará, Fortaleza-CE, Brazil.
* Corresponding author.

Abstract – In the recent years Zinc Oxide (ZnO) has long been used in its powered form in paints, rubber processing and creams to prevent sunburn or diaper rash. The polycrystalline forms have been used for more high-tech uses such as phosphors, piezoelectric transducers, varistors, and transparent conducting films. The synthesis of ZnO nanopowder has been carried out via proteic sol gel process. The results obtaining from XRD showed that the nanoparticles are multiples crystals and the mean particle size is around 10 nm.

In the recent years, zinc oxide (ZnO) has long been used in its powered form in paints and creams to prevent sunburn. The polycrystalline forms have been used for more high-tech uses such as phosphors, piezoelectric transducers, and varistors [1]. In this work, the synthesis of ZnO nanopowder was carried out via proteic sol gel process. The proteic sol-gel process provides a promising and simples way for production of nanopartilces because does not need complicated equipments and expensive raw materials [2]. However, this method differs from traditional sol-gel process for uses salts as the starting material and processed coconut water (ACP®) as a chelating agent instead of expensive alkoxides. To prepare the precursor, 14.87 g of $Zn(NO_2)_2.6H_2O$ (molecular weight: 297.48 g/mol) was added to 100 ml of distilled water. This solution was divided in five parts of 20 ml, for each solution it was added 10; 50; 100; 200 and 400 % in mass of coconut water as a function of the zinc nitrate mass. These solutions were dried at 100 °C overnight. After solvent evaporation, a solid precursor gel was formed. The conversion of the gel into the powder was prepared with different calcination temperature varying from 400 to 600 °C during 1 h. The powders crystalline phases and structural parameters were investigated by X-ray diffraction and Rietveld refinement, respectively. These values indicated a hexagonal crystal system with Wurtzite structure of ZnO as shown in Fig. 1. The influences of the different temperatures on the particles sizes show an exponential tendency. The smaller particles size (~ 10 nm) was obtained at calcination temperature of 600 °C and ACP® concentration of 200 %.

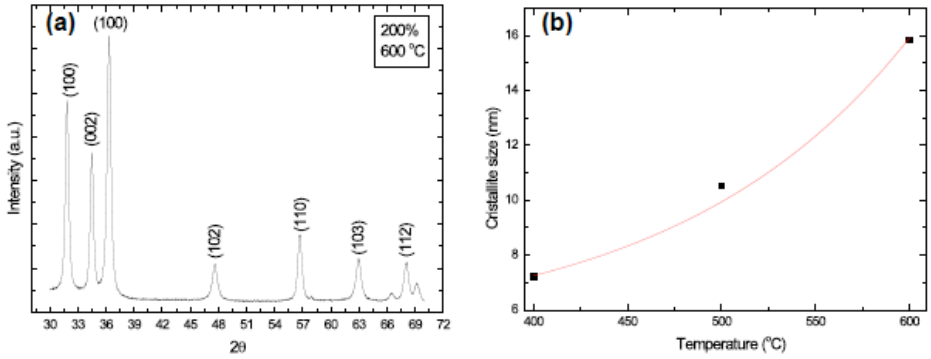

Figure 1: (a) XRD of ZnO nanopwder; (b) cristallyte size as a function of the temperature.

References

[1] D.A.A. Santos; A.D.P. Rocha; M.A. Macêdo Powder. Diffr. 2002, 23, S36.
[2] N.O. Dantas; M.A.C. dos Santos; F.C. Cunhas; M.A. Macêdo Phy. B. Cond. Mat. 2007, 398, 291.