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Research Article

SYNTHESIS OF ZnO NANOPARTICLES

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ABSTRACT
In this work we develop a simple technique to synthesize ZnO nanoparticles using zinc nitrate and KOH in aqueous solution. The precipitated compound was calcined and characterized by X-Ray Diffraction (XRD), Scanning Electron Microscope. Particle size distribution showed that the particles are in the range of 30±15 nm.

Keywords: *ZnO Nanoparticles, Precipitation, X-Ray Diffraction, Scanning Electron Microscope*

INTRODUCTION
Research in the field of synthesis methodology of nanomaterials is mainly oriented in controlling their shape, size and composition (Chandross and Miller, 1999). Each of these factors is a key factor in determining the properties of materials that lead to different technological applications. Zinc oxide, with its unique physical and chemical properties, such as high chemical stability, high electrochemical coupling coefficient, broad range of radiation absorption and high photostability, is a multifunctional material (Djalali *et al.*, 2004). ZnO nanoparticles were synthesized by different methods. It is confirmed that the various applications of ZnO nanoparticles depend upon the control of both physical and chemical properties such as size, size dispersity, shape, surface state, crystal structure, organization onto a support, and dispensability (Segets *et al.*, 2009). This has led to the development of a great variety of techniques for synthesizing the compound. Hong *et al.*, (2006) used a controlled precipitation method (Guo *et al.*, 1991). The process of precipitating zinc oxide was carried out using zinc acetate ($Zn(CH_3COO)_2 \cdot H_2O$) and ammonium carbonate $(NH_4)_2CO_3$.

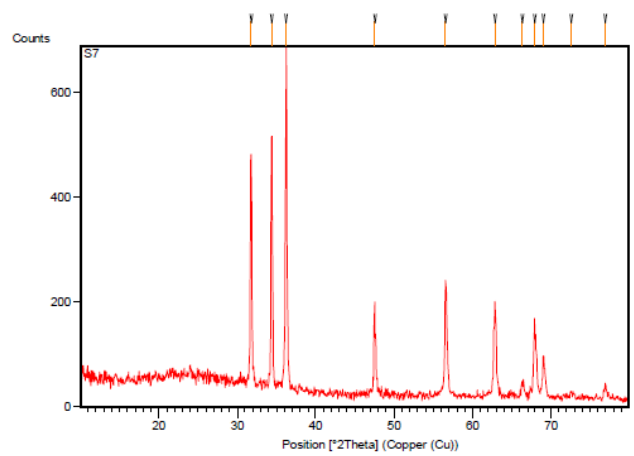

Figure 1: XRD graph of ZnO nanoparticles

A simple precipitation process for the synthesis of zinc oxide was carried out by Lanje *et al.*, (2013). The single step process with the large scale production without unwanted impurities is desirable for the cost-effective preparation of ZnO nanparticles. Lanje *et al.*, (2013) reported another process of controlled precipitation of zinc oxide (Wahab *et al.*, 2007). Nanometric zinc oxide was obtained by precipitation from aqueous solutions of NH_4HCO_3 and $ZnSO_4 \cdot 7H_2O$. Hong *et al.*, (2006 prepared ZnO powder by sol-gel method from zinc acetate dihydrate, oxalic acid, using ethanol as solvent. The technique of obtaining ZnO using microemulsion was also used by Yildirim and Durucan. Wang *et al.*, (2010) they attempted to modify the microemulsion method so as to obtain monodisperse zinc oxide (Benhebal *et al.*, 2013). Kang *et al.*, (2014) reported the continuous synthesis of zinc oxide nanoparticles in a microfluidic system for photovoltaic application. Kang *et al.*, **(**2014**)** their work was carried out to investigate the synthesis and characterization of ZnO nanoparticles using numerica simulations and experimental methods (Yildirim and Durucan, 2010).

This paper presents the synthesis of ZnO nanoparticles by simple method. In this work, we employed *zinc nitrate* as an initial reagent and KOH as a precipitating agent.

X-Ray Diffraction (XRD) Analysis

The powered sample was used by a Cu Kα - X Ray Diffractometer for confirming the presence of ZnO and analyzes the structure. The peaks appeared at 2θ value ranging from 31.73°, 34.38°, 36.22°, 47.50°, 56.56°, 62.81°, 66.34°, 67.91°, 69.03° , 72.6° and 76.90° values corresponds to pure ZnO.

Scanning Electron Microscope (SEM) Analysis

The SEM analysis was used to determine the structure of the reaction products that were formed. As is seen in Fig. 3, average size of nanoparticle synthesized is 30 nm. The distribution of ZnO nanoparticles is about 20 nm which indicates moderate distribution of the nanoparticles.

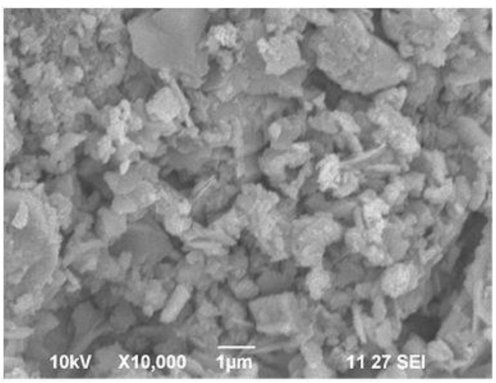

Figure 2: SEM images of Zinc Oxide Nanoparticles

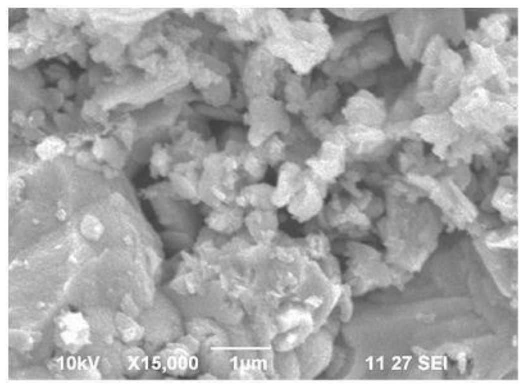

Figure 3: SEM images of Zinc Oxide Nanoparticles

Conclusion

In this paper we have reported the synthesis of ZnO nano powder by fast and efficient combustion method. Using XRD data crystallite size is calculated as 21 nm which are in good agreement. Particle Analyzer supported the XRD calculations of crystallite size. SEM picture showed that particles were arranged on one another. The biological production of metal nanoparticles is becoming a very important field in chemistry, biology, and materials science. Metal nanoparticles have been produced chemically; however, their biological production has only been investigated very recently. The synthesized nano crystallites of ZnO are in the range of 30-35 nm. The synthesis of ZnO nano particles is still in its infancy and more research needs to be focused on the mechanism of nanoparticle formation which may lead to fine tuning of the process ultimately leading to the synthesis of nanoparticles with a strict control over the size and shape parameters.

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