

STRUCTURAL AND OPTICAL STUDIES OF ZNO NANO PARTICLES BY SOL - GEL METHOD

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ABSTRACT

The ZnOnano powders were synthesized using surfacing assisted complex sol — gel method. Zinc nitrate of 0.03 m was dissolved in 50 ml DE ionized water and was dripped into the citric acid and poly ethylene glycol. With the help of XRD analyses it conforms ZnO have poly crystalline nature. EDX analysis reveals there are no other impurities present in sample. FTIR spectrum was done and the formation of pure ZnOnano particles was visualized. The transparent solution is stirred continuously 4 hours at 353k.

Keywords :ZnO, XRD, EDX, FTIR, UV study

INTRODUCTION

Nano crystalline materials have attracted a wide attention due to their unique properties, and immense potential application in nano device fabrication. Zinc oxides of particle size in nanometer range has been paid more attention for their unique properties. They are widely used for solar power conversion, non-linear optics, catalysis, varistors, pigments, gas sensors, cosmetics, etc.[1-9]. Zinc oxide (ZnO) is an inexpensive, n-type semiconductor with a wide band gap having optical transparency in the visible range. It crystallizes in a hexagonal wüstite structure (z incite) with lattice parameters as $c = 5.205 \text{ \AA}$, $a = 3.249 \text{ \AA}$. The n-type semiconductor behavior is due to the ionization of excess zinc atoms in interstitial positions, and the oxygen vacancies [10]. Surface defects play an important role in the photo catalytic activities of metal oxides as they increase the number of the active sites [11,12]. The structure of ZnO are often described as variety of alternating planes composed of tetrahedral coordinated O^{2-} and Zn^{2+} stacked alternately along the c-axis, as shown in Figure 1. Various techniques for the preparation of ZnOnanopowders are applied: sol-gel method [13-16], co-precipitation method [15,17] etc. Among the various methods, the sol-gel approach appears to be one among the foremost promising methods to organize ZnO nanoparticles. Some of the foremost important advantages of the sol-gel method are: easiness of the synthesis, coldness of decomposition and control on the chemical composition. These advantages make the sol-gel technique a really attractive preparation method, especially within the case of photocatalytically active ZnO powders [15]. In this work, an easy sol gel method was wont to prepare ZnO nanoparticles. The study aims was to synthesize zinc oxide of low dimension, and investigation of morphological properties, and surfacing effect on the particle size. This method has novel features which are of considerable interest thanks to its low cost, easy preparation, and industrial viability.

Synthesis of ZnO nanoparticles by sol gel technique is reported by ZnSO₄·7H₂O precursor and calcined at 500°C. The structural and optical properties of ZnO have been studied by XRD, HR TEM, SEM, FTIR and UV-visible analyses.

MATERIALS AND METHODS

XRD

X-ray powder diffraction may be a rapid analytical technique similarly used for phase identification of a crystalline material and may provide information on unit dimensions. It also provides information about the crystalline nature, grain size, and the purity of sample.

EDX

This method is used to determine the chemical composition of unknown materials.

Fourier Transform Infrared Spectroscopy

IR spectrum is measured by scanning the sample with a continuous wavelength range.

UV's spectroscopy.

For this method optical property of sample and optical energy band gap can be measured.

Materials

Zinc nitrate of 0.03 M was dissolved in 50 ml DE — ionized water and was dripped into the citric acid and poly ethylene glycol of 0.003 M solution mixture. Initially pH of this solution was 2.2, 17 % ammonia solution was added to the solution, and pH was gradually increases to 2.5.

CONCLUSION

XRD studies confirms the poly crystalline nature. EDX analysis reveals there are no other impurities present in sample. FTIR spectrum was done and the formation of pure ZnOnano particles was visualized. The transparent solution is stirred continuously 4 hours at 353k.

LIST OF FIGURES

1. Structure of ZnO.

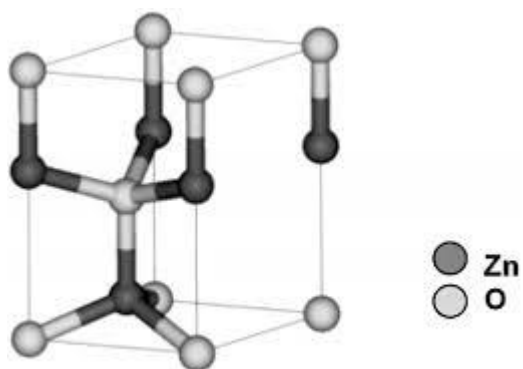


Figure 1. The wurtzite structure model of ZnO.

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