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ORIGINAL ARTICLE

Synthesis By Sol-gel Method And Characterization Of Zno Nanoparticles

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ABSTRACT

In the present work zinc oxide nanoparticles were synthesized using simple chemical method. The prepared nano zinc oxide was characterized d using XRD and UV- Visible spectroscopy. The optical band gap was calculated from UV-Visible absorption measurement. The particles size was estimated using XRD pattern.**Key words** :Thermotropic, liquid crystalline,randomcopolyesters,

INTRODUCTION

Semiconductor nanomaterial's have received been received great attentions. Among these various semiconductor oxide nanomaterial's zinc oxide is a versatile material because of its physic-chemical properties such as mechanical, electrical, optical, magnetic and chemical sensing properties. It has a wide band gap of 3.3 eV and it is used in various applications electronic devices, biomedical field, verity of sensors, etc[1]
Now a days, various routes have been used for the synthesis of ZnO nanomaterial's, such as sol-gel synthesis[2], hydrothermal/solvothermal methods [3,4] microemulsion method [5], precipitation[6], and physical vapor deposition [7]. Sol-gel method gives homogenous, high-purity, and high-quality nanopowders [8]. The morphology of the nanoparticles can be changed by changing the solvents.

In the present study, a simple and cost effective sol-gel method was used to prepare ZnO nanoparticles, using zinc acetate as a precursor, acetic acid the complexing agent and triton X-100 as a surfactant. The optical properties, particle size, and crystallinity, of the final ZnO nanoparticles were investigated.

2. EXPERIMENTAL

The ZnO nanoparticles were prepared by sol-gel method at room temperature. Zinc acetate (Zn(CH3COO)2.2H2O), and Triton X-100 were used as starting materials. 0.2 M zinc acetate solution was prepared by dissolving 1 g of zinc acetate in 25 mL of water. The solution was stirred at room temperature, and then the 5mLTriton X-100 was added to the solution and again stirred for 3 hour at room temperature. After the 1 hour slightly precipitation observed then ammonia solution was added for complete precipitation. Then the residue was filtered, washed with water and then dried at 353 K for an hour. The dried residue then calcined at 673 K in an electric oven.

The structure morphology of the prepared ZnO nanoparticle was characterized by Bruker D-8, powder X-ray diffraction (Cu Ka=1.5406 A). The UV-Vis absorption measurement was measured over the range of200-800 nm by a Bio-age UV-Vis spectrophotometer. FTIR spectra of the samples were recorded on BRUKER Alpha FT9-Infra-Red spectrometer.

3. RESULTS AND DISSECTION

3.1 UV-visible Absorption Studies

Figure 1(a) shows the UV-Vis spectra of ZnO nanoparticles. UV-Vis absorption of ZnO nanoparticles was measured and it is observed in the wavelength range of 250-400nm. Figure 1(b) Shows the plot ofA hA1/2 vs. photon energy hA of ZnO nanoparticles. The band gap energy value for ZnO samples was calculated from this plot. The wavelength of 380 nm corresponds to the bulk band-edge of 3.2 eV for ZnO. The absorbance at wavelength of 370 nm indicates a blue shift, which should be due to the quantum confinement effect from the small particles size of 10 nm as found in XRD analyses.

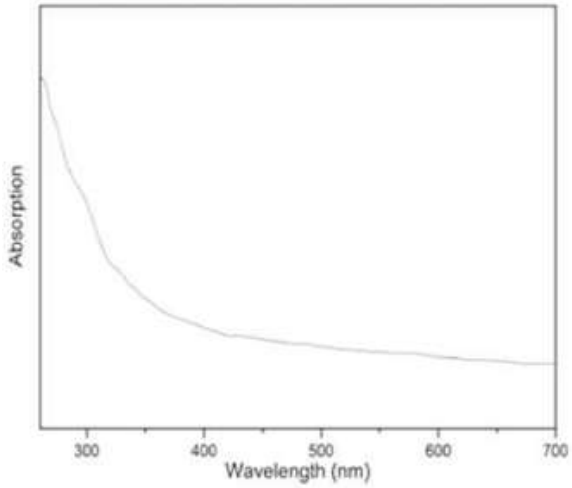

Figure (a)UV-Vis spectra of ZnO nanoparticles

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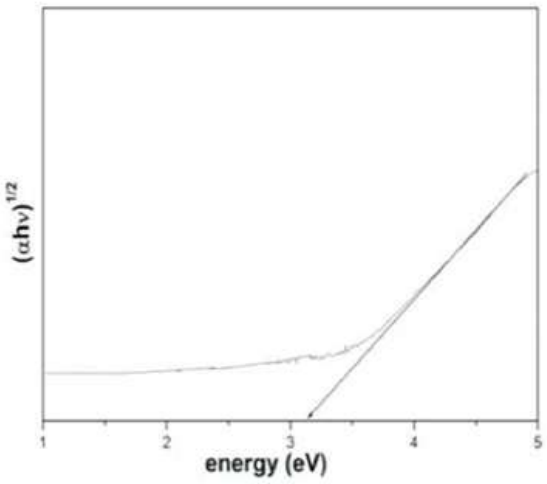

Figure 1 (b) **Band gap measurement**

\Figure 1 (b) Band gap measurement

3.2 XRD studies

The XRD pattern of ZnO nanoparticles calcined at 673 K is shown in Figure 3. The XRD pattern shows of ZnO. All XRD diffraction peaks of ZnO powders are shown in a good agreement with hexagonal structure of zincite phase reported in JCPDS File Card No.05-0664. No peaks of impurity are observed, indicating that the high purity ZnO was obtained. The particle size calculated using Debye-Scherrer formula D = 0.941 / (Pcos0), where X the X-ray wavelength, P the peak width ofhalf-maximum, and 0 is the Bragg diffraction angle. The average crystallite size D is 10 nm calculated using the Debye-Scherrer formula.

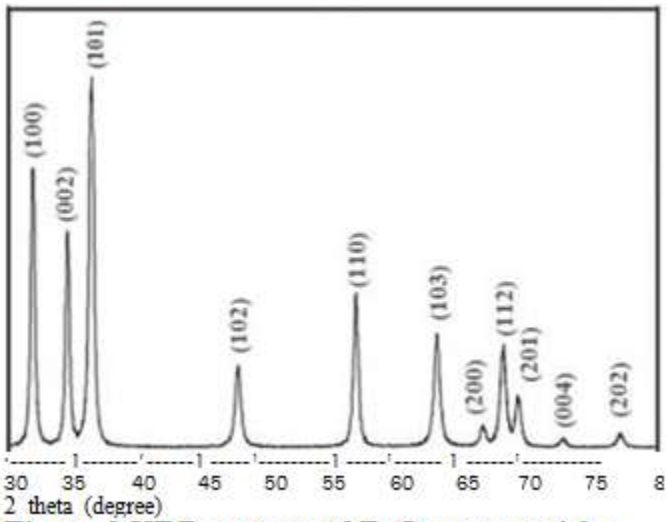

Figure 2 XRD pattern of ZnO nanoparticles

CONCLUSIONS

ZnO nanoparticles have been sussesfully synthesized by simple sol-gel method at room temperature. The prepared ZnO nanoparticles were characterized using XRD and UV-Vis absorption measurement. The average particle size was found to 10 nm for ZnO nanoparticles calcined at 673K. ZnO offers tremendous potential in future applications of electronic, optoelectronic, and magnetoelectronic devices. The prepared ZnO nanoparticles may possibly applicable for photocatalysis, gas sensing, biomediacal devices and sun screens applications.

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