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CHEMICAL ROUTE SYNTHESIS AND SONICATION OF ZNO NANOPARTICLES

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Abstract

ZnO Nanoparticles can be prepared by different methods. Zinc oxide nanoparticles find extensive uses in variety of specialized applications. There are multiple synthesis techniques available for producing ZnO nanoparticles, which determine the dimensions and morphologies of the particles. Among various synthesis techniques, chemical route, especially direct precipitation method for preparing ZnO nanoparticles by employing zinc sulphate and potassium hydroxide as precursor finds extensive applicability in synthesizing ZnO nanoparticles. The prepared ZnO nanoparticles were characterized by uv-visible spectra and XRD.

1. Introduction

Nanomaterial's are developed to exhibit novel characteristics compared to the same material without Nano scale features, such as increased strength, chemical reactivity or conductivity. The shape of the nanoparticle is also equally important to control its different properties. Due to remarkable chemical and physical properties such as high chemical stability, high electrochemical coupling coefficient, broad range of radiation absorption and high photo stability, anti-corrosion, anti-bacteria, low electrons conductivity, excellent heat resistance, low toxicity, biocompatible and biodegradable nature makes zinc oxide as a multifunctional material and makes its adaptability in various technological areas, such as optoelectronics, cosmetology, medicine, and industry [1, 2] and in photo catalysis for water treatment [3] and many more. One of the uses of ZnO nanoparticles is in sunscreen because they reflect ultraviolet light, but are small enough to be transparent to visible light. [4] ZnO nanoparticles are also being investigated to kill harmful microorganisms in packaging, [5] and in UV-protective materials such as textiles. [6] Zinc oxide is key element for many industrial processes like paints, ceramics, rubber, soap, textiles, and floor coverings. There are multiple techniques available, such as sol-gel [7], direct and hydrothermal precipitation [8– 10], aerosol process [11], sonochemical [12], micro emulsions [13], mechanochemical process for producing ZnO

nanoparticles, which determine the dimensions and morphologies of the particles. But among this chemical route method is reliable and cost effective.

ZnO nanoparticles possess unique semiconducting, optical, and piezoelectric properties. Therefore, ZnO-based nanomaterial has been studied for a wide variety of applications such as nano-electronic/nano-optical devices, energy storage, cosmetic products, and Nano sensors.

2. Materials and Methods

ZnO nanoparticles were synthesized by chemical precipitation method using zinc sulphate and KOH as Precursors in the ratio of 1:2.In this work first we take KOH (0.4M) 2.24gm added in 100ml distil water stir it continuously for four hours using magnetic stirrer. Secondly we take ZnSO4 (0.2M) 3.229gm added in 100ml distil water stir it continuously for four hours using magnetic stirrer at room temperature. In this work the aqueous solution (0.2M) of zinc sulphate and the solution (0.4M) of KOH were prepared with deionized water respectively. The KOH solution was added slowly into zinc sulphate. The solution at room temperature under vigorous stirring results the formation of white suspension. The white product was centrifuged at 5000 rpm for 20 min.

The obtained precipitate wash with distilled water, filter and dried. The particles obtained kept in a muffle furnace for 3 hours at 450^{o}C. Particles disperse by using ultra sonication having frequency of 20 kHz for 10 minute and 4 second pulse. The Titanium horn is used in sonication process.

3. Result and Discussion

3.1 UV-visible Spectra

The synthesized ZnO nanoparticles characterized by using UV-visible spectroscopy. The graph of wavelength vs. absorption is shown below from the graph it is clear that the maximum absorption 0.325, 0.327, 1.742 in UV Vis spectroscopy thus attributes to the formation of ZnO nanoparticle.

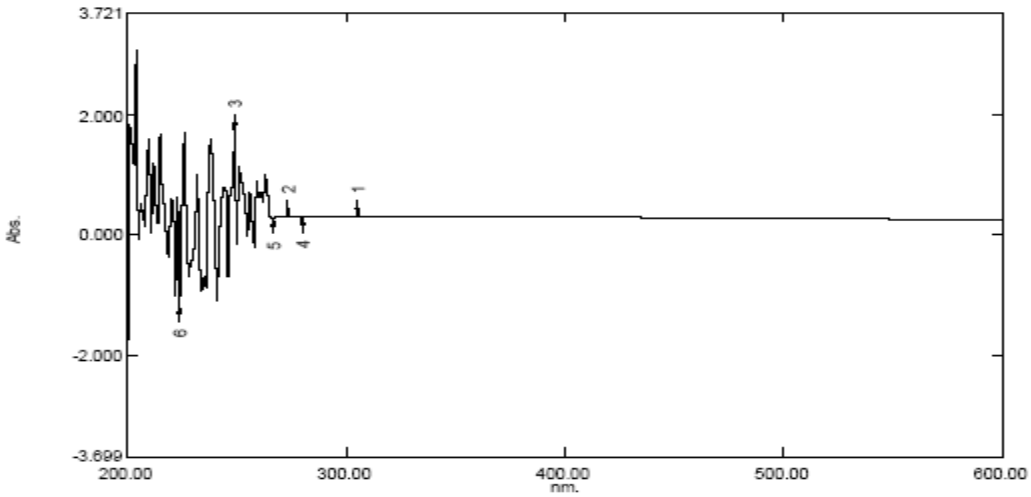

Fig. 1

3.2 XRD

X-ray diffraction pattern of synthesized ZnO particle is carried out for 2 theta value. The XRD pattern shown below in fig 2. The peaks for 2 theta values are obtained at 30 to 40 as shown in fig. The peaks obtained show the presence of ZnO nanoparticles.

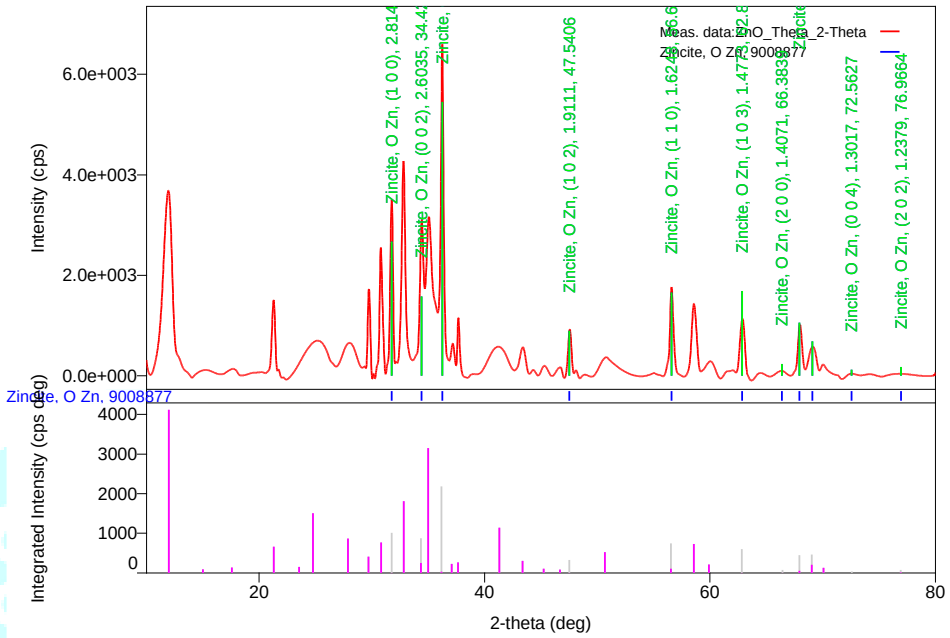

Fig. 2

3.3 Sonication

The process in which Ultrasonic wave are immerge in the liquid mixture of given sample for the separation of that sample and sample should be completely in Nano form. The frequencies (>20 KHz) are usually used, leading to the process also being known as ultra-sonication. The figure of sonication perform are as shown in fig. 3.

Take a small beaker of glass in which dissolve the given sample (ZnO nanoparticle) in sufficient amount of water. We apply the ultrasonic wave for 10 minutes (pulse time is 4 second) to the given solution afterward start sonication. After some time all particles of given sample are separate and color of solution is equally bright. After that by drying this mixture we get fine powder of given sample.

Fig. 3

4. Result & Discussion

For analytical study of the prepared sample, the amount of absorption within wave length of 200-300 nm was observed by uv-vis spectroscopy. It is known that an absorption band at about 0.325, 0.327, 1.742 due to surface Plasmon resonance in ZnO nanoparticles shows the UV-Vis spectra of ZnO nanoparticles recorded between 200-300nm. In this study the ZnO nanoparticles were successfully synthesized by direct precipitation method using zinc sulphate as zinc source and KOH as precipitating agent in aqueous solution.

In summary we have successfully designed a facile and fast synthesis route to produce ZnO nanoparticles and finally ZnO nanoparticles were characterized by UV-visible and XRD analysis.

5. Conclusion

The characterization of ZnO nanoparticles by using XRD techniques and UV-Vis spectroscopy shows that synthesized ZnO nanoparticles are good in morphology, high in purity and suitable.

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