Preparation and Characterization of Zinc Sulphide Nano Particles

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Abtract

Nano materials have created a high interest in recent years by virtue of their unusual mechanical, electrical, optical and magnetic properties. Zinc Sulphide nano particles were synthesized by reduction method using Zinc nitrate & Sodium Sulphide. The synthesized Zinc Sulphide nanoparticles were characterized by UV-Vis spectroscopy. UV-Visible spectrum shows the absorption beak at 280 nm.

Key Words: *Zinc Sulphide, Nanoparticles, Zinc Nitrate, Sodium Sulphide, UV-Visible spectroscopy*

Introduction

A nano particle is a microscopic particle with at least one dimension less than 100nm. Nano particle is of great scientific interest as they are effectively a bridge between bulk materials and atomic or molecular structures. Nano materials have a much greater surface area to volume ratio than their conventional forms, which can lead to greater chemical reactivity and affect their strength. Also at the nano scale, quantum effects can become much more important in determining the materials properties and characteristics, leading to novel optical, electrical and magnetic behaviors. Nano particles often have unexpected visible properties because they are small enough to confine their electrons and produce quantum effects. Suspensions of nano particles are possible because the interaction of the particle surface with the solvent is strong enough to overcome differences in density, which usually result in a material either sinking or floating in a liquid. Sintering can takesplace at lower temperatures, over shorter time scales than for large particles. This theoretically does not affect the density of the final products, though difficulties and the tendency of nano particles to agglomerate complicate matters**.** They are even being projected as future generation anti microbial agent. Zinc nano particles are important materials that have been studied extensively, such nano particles possess unique electrical, optical as well as biological properties and are thus applied in catalysis, imaging, drug delivery, nano device fabrication and in medicine. Synthesis of Zinc nano particles was extensively studied employing chemical and physical methods, but the development of reliable technology to produce nano particles is an important aspect of nano technology.

Nanomaterial - synthesis

Nano materials deal with very fine structures: a nanometer is a billionth of a meter. This indeed allows us to think in both the 'bottom up' or the 'top down' approaches (Fig. 1) to synthesize nano materials, i.e. either to assemble atoms together or to dis-assemble (break, or dissociate) bulk solids into finer pieces until they are

constituted of only a few atoms. This domain is a pure example of interdisciplinary work encompassing physics, chemistry, and engineering upto medicine.

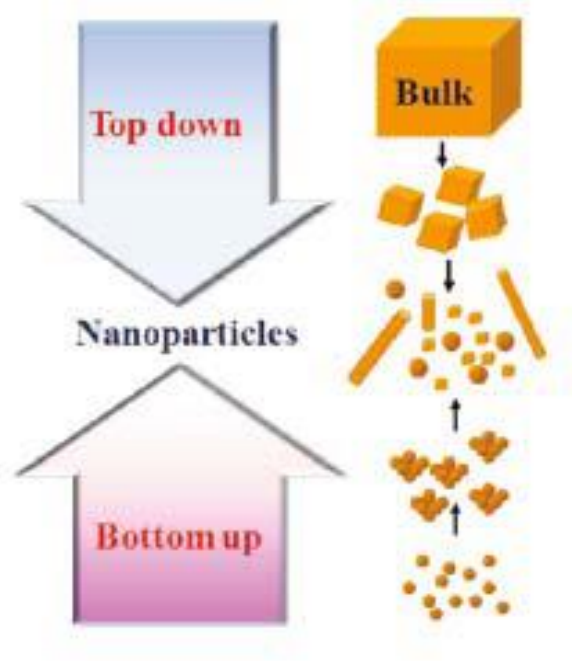


Fig. 1 Nanomaterial - synthesis and processing

Zinc Sulphide

Zinc Sulphide is an inorganic compound with the chemical formula of ZnS. This is the main form of Zinc found in nature where it mainly occurs as the nature sphalerite. Although this mineral is usually black because of various impurities, the pure material is white and it is widely used as a pigment.In its dense synthetic Zinc Sulphide can transparent, and it is used as a window for visible optics and infra red optics.Zinc Sulphide exits in two main dualism often a salient example of poly morphism.In each form the coordination geometry at Zn and S is tetrahedral. The more stable cubic form is known also as Zinc blende or sphalerite. The hexagonal form is also known as the mineral wurtzite although is also can be produced synthetically. The transition from the sphalerite form to the wurtzite form occurs at round at 1020 celsius.. A tetrahedral form is also known as very rare mineral called polhelmusite, with the formula (Zn,Hg) S.

Applications of Zinc sulphide nanoparticles

Luminiscent material

Zinc sulphide, with addition of few ppm of suitabkle activator, is used as phosphor in many applications, from cathode ray tubes through x-rays screams to glow in the dark products when silver is used as activator, the resulting colour is bright blue, with maximum at 450nm using manganese yields an orange red colour at around 590nm. Copper gives long time glow, and it has the dark familiar greenish glow in the dark. Copper doped Zinc Sulphide ("Zinc Sulphide plus copper) is used also in electro panels. It is also exhibits luminescent phosphorescent due to impurities on illumination with blue or ultra violet light.

Pigment

ZnS is common pigment, sometimes called sachtolith. When combined with Barium Sulphide, Zinc sulphide forms lithop one.

Catalyst

Fine ZnS powder is an efficient photocatalyst, which produces hydrogen gas from water upon illumination. Sulphur vacancies can be introduced in Zinc sulphide during its synthesis; this gradually turns the whiter yellowish ZnS into a brown powder; and boosts the photo catalytic activity through enhanced light absorption.

Scope

Zinc Sulphide is an inorganic compound with the chemical formula of ZnS. This is the main form of Zinc found in nature where it mainly occurs as the nature sphalerite. Thus ZnS has variety of applications in various fields. In our present work ZnS is prepared by reduction using $ZnNO_3$ and NaS.

Materials and methods

Chemicals Required

Zinc Nitrate, Sodium Sulphide, Glucose

Synthesis of Zinc Sulphide Nanoparticle

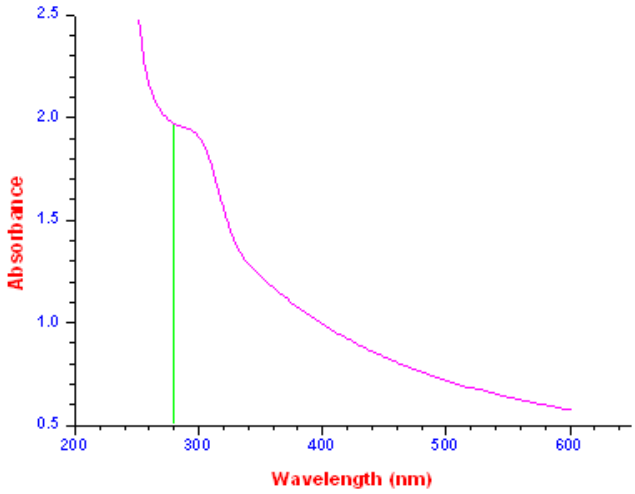
In a typical synthesis of ZnS NPs, 1M sodium sulphide was added drop wise in a beaker containing 1M of Zinc nitrate with constant stirring. The white colored solution was obtained. This was further stirred with magnetic stirrer for 15 hours.To this solution one mole of glucose solution was added. The solution was heated and incubated at 70^0c for more than 6 hours. The precipitate was obtained. This was centrifuged with 2000 rpm for 15 minutes and the product was dried at 30^0c for 4 hours.The obtained product was crushed into fine powder.

Result and Discussion

It is generally recognized that UV-Visible could be used to examine the size and shape controlled nanoparticle in aqueous suspensions.

UV-Visible Spectroscopy

UV Spectra of Zinc sulphide nanoparticles:



ZnS NPs UV λmax = 280nm

The ZnS nano particle were characterized by UV-Vis spectrophotometer. The absorption spectrum was observed in the range 280nm; this observation indicates that there is no aggregation in UV – Visible absorption spectrum. A comparison of the value of bulk ZnS was found to be 337 nm shows the band edge is blue shifted. The absorption spectrum of ZnS nanoparticles shift towards the (280 nm) lower wavelength side.

Conclusion

ZnS nanoparticles were synthesized from the reaction with Zinc nitrate and sodium sulphide in the presence of glucose medium. Synthesized ZnS nanoparticles were studied by UV-Vis spectroscopy. The study confirm the formation of ZnS nanoparticles.

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