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Synthesis of CdS nanoparticles by chemical route and their characterization

M.P. Deshpande, Nilesh N. Pandya, Bindiya Soni, M.N. Parmar and G.K.Solanki*
Department of Physics, Sardar Patel University, Vallabh Vidyanagar, 388 120.

Abstract

With a direct bulk band gap semiconductor of 2.42 eV at room temperature, CdS nanostructured material have been prepared using various physical methods as well as by chemical methods with a view to their commercial or potential application in LED's, solar cells or other optoelectronic devices. In the present study, the inverse micellar and chemical method are used to synthesize CdS nanoparticles. The stoichiometry of samples is confirmed by EDAX (Energy Dispersive Analysis of X-rays) and particle size of nanoparticles is estimated by TEM (Transmission Electron Microscopy) and XRD (X-ray Diffraction). The thermal analysis of CdS nanoparticles was carried out in temperature region of 40^0C to 600^0C in air and N_2 atmosphere to know about the stability of this material. The II – VI semiconductor nanoparticles are well known to exhibit a strong change of their optical absorption when their size is reduced down to a few nanometers which is visible from absorption spectrums taken on CdS nanoparticles dispersed in acetone in the UV-VIS region.

Keywords: II-VI group semiconductor, Nanomaterial, Inverse micellar, Optical absorption.

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• Abstract

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•Introduction

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Introduction

Nanobiotechnology brings exciting new possibilities in the area of medical biology. Nanomedicines has been defined as the process of diagnosing, treating and preventing disease and traumatic injury, relieving pain, and preserving and improving human health (4), using molecular tools and molecular knowledge of the human body. One can envision nanocarriers that can be targeted to a specific tissue or cells to simultaneously detect and diagnose diseases as well as to treat them through the delivery of the therapeutics on the targeted organ and tissues (2). In general, miniaturization of our medical tools will provide more accurate, more reliable, more cost-effective and faster approaches to enhance the quality of human life. The aim of Nanomedicine may be broadly defined as the comprehensive monitoring, control, construction, repair, defense and improvement of all human biological systems, working from the molecular level using engineered devices and nanostructures, ultimately to achieve medical benefit and fitness.

•Materials and methods

This consists of the main body of the submission.

Status of Nanomedicine

Several approaches towards nanomedicine being pursued today are already close enough to fruition that it is fair to say that their successful development is almost inevitable, and their subsequent incorporation into valuable medical diagnostics or clinical therapeutics is highly likely and this may occur very soon (31).

Introduction of Some important nanomedicines are like Nanopores based, Fullerenes based pharmaceuticals, Nanoparticles, Dendrimer based, Liposomes, Nanoshells and Nanorobotics for delivery of drugs to an appropriate site.

1. Nanopores

Nanopores are the surface perforated with holes and in through the pores while remaining hidden from the immune system.

Similarly, microcapsules containing pig islet cells could be implanted beneath the skin of some diabetes patients that can restore the body's glucose level. The flow of nanomaterials through the nanopores can also be externally regulated (7). The first artificial voltage gated molecular nanosieve was fabricated by Martin and colleagues (8) in 1995. Martin's membrane contains an array of cylindrical gold nanotubules with inside diameter as small as 1.6 nm (6). Current research is directed towards reliably fabricating pores with specific diameters and repeatable geometries at high precision (9).

2. Fullerenes based pharmaceuticals

Soluble derivatives of fullerenes such as C_{60} have shown

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Introduction

Since last decade, research in nanoparticles, nanophase and nanocomposites have attracted interest due to size dependant tunable electric, magnetic and optoelectronic properties [1-3]. Semiconductor nanocrystals showing quantum size effects has attracted the attention of a great number of experimental and theoretical groups as it can be used as an attractive alternative to organic molecules [4].

•Results and discussion

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precipitated settled at the bottom of the beaker after 6 h. This precipitates were collected, filtered, washed, a number of times in methanol and dried in a vacuum oven.

Result and Discussion

The composition of CdS nanoparticles determined using the spectra obtained by EDAX are shown in figure 1 for the 1st (a) and 2nd (b) method. The spectrums reveal that the synthesized nanoparticles are of cadmium sulphide and also free of any other impurities.

shown in figure 2 and figure 3 respectively. We have observed that X-ray diffractogram of 1st method has close resemblance with JCPDF-21-0829 [25] whereas of 2nd method with JCPDF-47-1179 [26]. This reflects that CdS synthesized by 1st method exhibits cubic system whereas synthesized by 2nd method exhibits orthorhombic system. The values of the lattice parameters determined for 1st method is a = 5.26 A° and for 2nd method are a = 14.27 A°, b = 14.29 A°, c = 14.29 A° having good resemblance with the reported values of lattice parameters of CdS [25-26]. Well known Scherrer's formula [27] is used for calculating the particle size which shows the maximum value of 32.56 nm for 1st method and 59.429nm for 2nd method i.e. uniform size of each particle is not obtained in each case. The broadening of diffracted peak as observed in 1st method may be due to smaller size of particle in comparison to 2nd method.

•Conclusion

This section should contain a short conclusion text.

Conclusion

The future of technology is in some ways easy to predict, computers will become faster, materials will become stronger, and medicine will be cure more diseases. Nanotechnology is a broad interdisciplinary area of research, development and industrial activity that has been growing rapidly worldwide for the past decade it works on the nanometer scale of molecules and atoms, will be a large part of future, enabling great improvements in all technologies.

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absorption edge at 380nm for both the cases compared to bulk counterpart which lies at 515nm and the particle size obtained optically comes about 3.63 nm which is lesser than obtained by XRD and TEM.

Acknowledgment

We are thankful to UGC for sanctioning the DRS-SAP (IIIrd Phase) to the Department which made it possible to carry out this work.

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