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### Polyol Mediated Synthesis of Cadmium Sulphide Nanoparticles

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Cadmium complex of tetramethylthiuram monosulphide was used as a single-source precursors for the generation of cadmium sulphide nanoparticles. Rod like particles were obtained. The nanoparticles obtained showed optical absorption spectra and their photoluminescence showed an emission maximum that was characteristically red shifted in relation to the band edge. The X-ray diffraction (XRD) pattern showed that the materials were hexagonal.

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*Keyword:* Nanoparticles, CdS, Polyol, Tetramethylthiuram Monosulphide.

#### 1. Introduction

Cadmium sulphides nanoparticles have attracted a growing interest during the recent years, driven by various areas of application. Particles which are 10-500 nm in size are of potential importance in many areas<sup>[1-10]</sup>. For these applications, highly crystalline particles are required. Many different methods of preparation, liquid-based as well as gas phase-based, are aiming at the fulfillment of these requirements<sup>[11-15]</sup>. But there is still a strong interest in the synthesis of monodisperse and crystalline nanoparticles.

One of the methods which is used for the preparation of nanoscale metal and oxide particles is the polyol method. Here, a metal precursor is heated in a high boiling alcohol (bp > 200 °C). Due to the high temperature during the synthesis, normally well crystallised materials are realized. The polyol medium efficiently complexes the surface of the particles. Consequently, the particle growth is limited and agglomeration of particles is prevented. All these aspects are applicable to sulphide materials also.

#### 2. Experimental

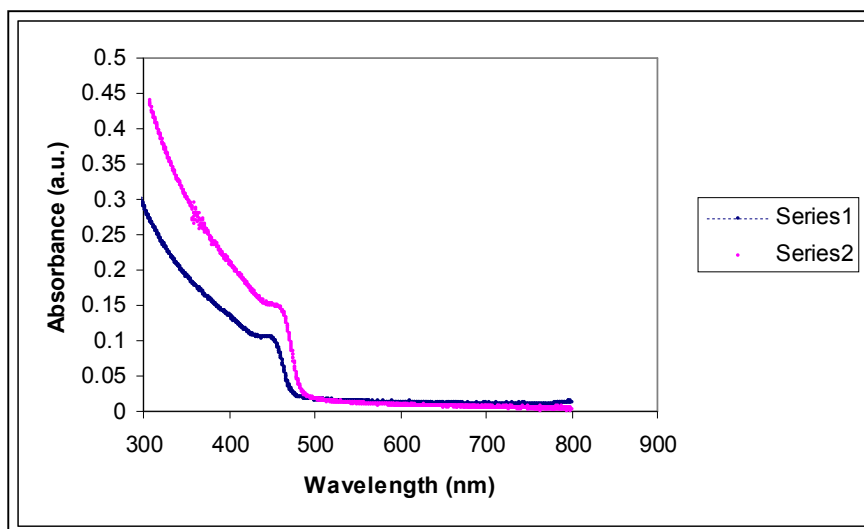
##### 2.1 Synthesis in Ethylene Glycol

Cadmium(II) complex of tetramethylthiuram monosulphide was added to ethylene glycol and the mixtures were heated to 180 °C. to yield colloiddally stable suspensions of cadmium sulphide. 1ml aliquots of samples were withdrawn after 5 minutes and 30 minutes respectively after reaching the annealing temperature.

##### 2.2 Optical Properties Using UV-Vis and Photoluminescence Spectra

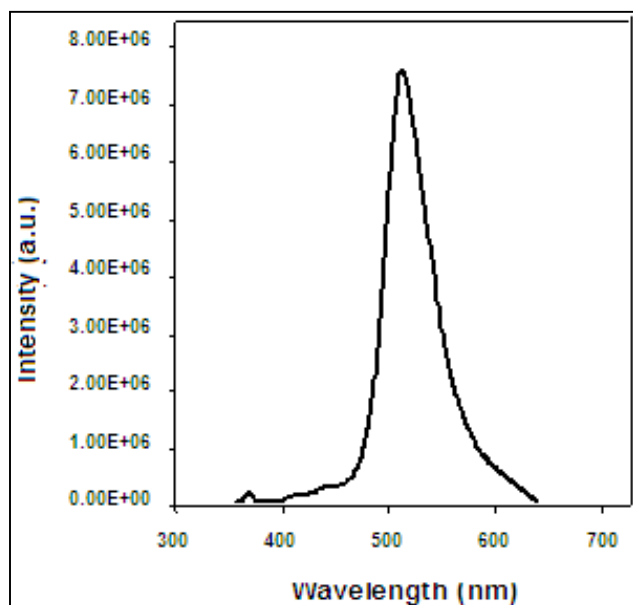
The UV-Vis spectra of CdS samples prepared by thermolysis of the precursor was recorded in transmission mode as solutions in toluene. For the bulk crystallites, we usually observe the interband absorption spectrum with a band edge around 515nm. Here we found that there is a blue shift of absorption edge as is expected for nanoparticles. There was not much difference between samples taken at 5 minutes and 30 minutes showing the versatility of the method in arresting the growth to give monodisperse particles. UV-Vis spectra of CdS samples taken

5 minutes after reaching annealing temperature of two representative complexes are given in Fig1.

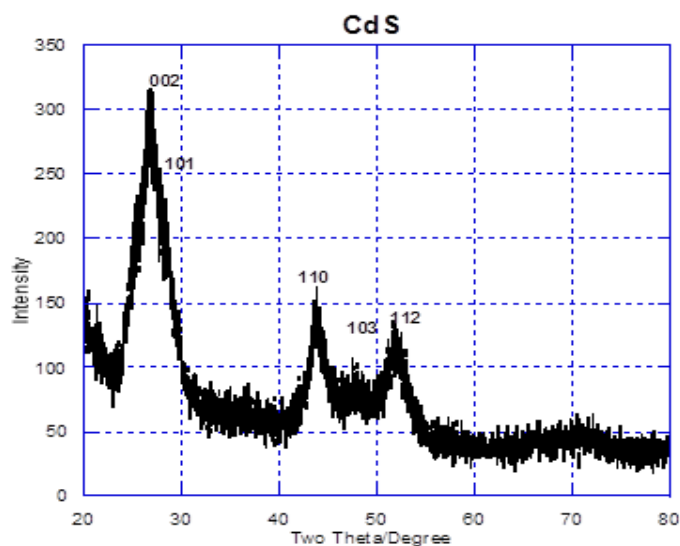


Series 1- t = 5 min  
Series 2- t = 30 min  
**Fig 1:** UV-Vis Spectra of CdS

The Photo Luminescence Spectra of CdS prepared is given in Figure 2. It has a maxima around 510 nm. This red shift in relation to the adsorption band edge is generally observed in II-VI semiconductor nanoparticles<sup>16-17</sup>. Bulk CdS has a broad emission with a maximum in the 500-700 nm region of the luminescence spectrum.



**Fig 2:** PL Spectra of CdS



**Fig 4:** shows one of the TEM images of CdS particles prepared. The particles had a narrow size distribution with mean particle size around 4.7 nm.

### 3. Conclusion

In the present work the synthesis of CdS nanocrystallites with a relatively narrow size distribution was achieved by the thermolysis of cadmium complex of tetramethylthiuram monosulphide. The average size of the crystallites were estimated by TEM measurements. X-ray diffraction studies revealed that the CdS nanocrystallites exist in the hexagonal phase.

Optical absorption measurements show that the band edge is blue shifted indicating the quantum confinement of the particles. The optical measurements of samples withdrawn from the reaction vessel at various time intervals after the injection of the precursors were used to monitor the growth of the particles with time which showed that growth is limited. It is concluded that cadmium acetate complexes of tetramethylthiuram monosulphide can act as a good nanoprecursor when using ethyleneglycol as high boiling solvent in the polyol method.

#### 4. Acknowledgement

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