International Journal of NanoScience and Nanotechnology.
ISSN 0974-3081 Volume 5, Number 1 (2014), pp. 55-57

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Study of CdS Nanoparticles and Nanocrystalline Thin Films for Synthesis

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Abstract:

Nanoparticles have a large number of surface atoms compare to the bulk, so the characteristics of nanoparticles are more important. Semiconductors nanoparticles are used as solar cell, display model and single electron transistors. So synthesis structure and application of CdS must be necessary in nanoparticles and nanocrystalline thin films. CdS nanoparticles and nanocrystalline thin films are successfully synthesized by chemical bath deposition at room temp.

Keyword: Synthesis, properties, applications, relation between diamond structure and CdS structure, FCC sub lattice, resistivity of CdS.

Introduction:

CdS thin films are used in the fabrication of Solar cells. This is also used in photovoltaic. A study of CdS is an important because of its applications in FET, LED, Photo catalysis and biological sensors [1]. The Applications of nanoparticles depend on their size and the size-controlled synthesis of nanoparticles has been much demanded for various nano applications. A unique synthesis method is given as below.

Synthesis Method:

Single source orgenometallic precursor prepared various sizes of the CdS nanocrystals. First we consider water at 60^{o}C. Now prepare a mixture of 36 mg Cadmium Chloride ($CdCl_2.2H_2O$) and 12 mg of thiourea [$(NH_2)_2CS$] in 30 ml ethanol. Then this mixture is dissolve into water under magnetic stirring. Say this precursor solution as A. Another solution B was prepared by dissolving 10 mg sodium hydroxide (NAOH) in 10 ml ethanol. Then made a mixture of solution of A and B.

The mixed solution was kept at 60^{o}C under magnetic stirring. We got a green yellow solution. The solution samples were centrifuged and washed with ethanol and then with acetone, and dried to obtain nano crystalline CdS powder [2].

Structure of Bulk CdS:

We know there are carbon atoms in diamond. If these carbon atoms are alternatively replaced with cadmium and sulphur atoms. The cadmium sulphide structure is obtained. In this type of structure, the total number of valance electrons is four times the number of atoms. For each atom, there are four equally distant atoms of opposite kind arranged at a regular tetrahedron. CdS structure is almost identical to the diamond structure except that the two interpenetrating FCC sub lattice are of different atoms and displaced from each other by one quarter of the body diagonal.

Properties:

- They are very attractive for the realization of thermally stable and frequency selective lasers and photo detectors [3].
- The dark resistivity of CdS thin film grown by CBD is so high in the order of 10^{8}-10^{10} Ω cm [4].
- In CdS nanocrystalline thin films the band gap increases with decrease of crystalline size [5].
- CdS has an average transmittance of 50% within the optical region and as high as 70%.

Applications:

- In bioorganic detectors of proteins or DNA, Cds is used [6].
- Photo detector, laser, high density magnetic information storage and many others in semiconductors industries [7].
- CdS is an important material used in optoelectronics, such as non linear optics, light emitting diodes and lasers [8].

Conclusions:

We get the initial basic introduction about CdS nanomaterials and thin films. We get information about existing chemical, biological routes by which CdS nanoparticles, nano crystals and thin films can be synthesized. Properties, structure of bulk CdS, application of CdS nanomaterials and thin films are also known. CdS can be doped with certain impurities so as to improve its luminescence effect.

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