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Structural and Electrical Characterization of PbS Nanoparticles

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ABSTRACT

A simple Chemical Reduction method has been successfully deployed to synthesis PbS nanoparticles. The morphology of the nanostructures was studied using transmission electron microscopy (TEM).The nanopartiles are spherical in shape. Selected area electron diffraction (SAED) pattern reveals the good crystallinity nature of the nanoparticles. The nanofilm of PbS is deposited on glass slide using a spin coater. The Variation of Resistance with time of PbS thin flim in dark as well as under light shows exponential nature.

1. Introduction

Nanocrystalline PbS particles have attracted considerable interest in recent because of their favorable electronic and optical properties for optoelectronic applications [1,2]. PbS is a commercially important II–VI semiconductor having a narrow band gap (0.38 eV) rendering it a very attractive material for optical application in the IR region especially in nanocrystalline form. In this work, nanocrystalline PbS structures are formed via a chemical reduction method [3,4] in room temperature. The method is cost effective and free from experimental hazards [5].

2. Experimental

For the preparation of PbS nanoparticles stoichiometric amount of anhydrous $PbCl_2$ and Sulphur powders were used according to the molar ratios in the target compounds. THF and $NaBH_4$ used as Solvent and Reducing agent respectively. The soloution is stirred using a magnetic stirrer for three hours. The grown nanoparticles are filtered, washed and dried. The structural studies of the grown samples are done by TEM.The nanofilm of PbS is deposited on glass slide using a spin coater. Silver paint is used as ohmic contact. The photo and dark resistance of PbS thin flims are measured with time in dark as well as under light using Keithly electrometer.

3. Transmission electron microscopy study

Further studies on the structure of the PbS nanoparticles were done using transmission electron microscopy. Figure 1 shows the TEM image of the PbS nanoparticles. The diameters of the nanoparticles varies between 5-15 nm. The corresponding selected area

electron diffraction (SAED) pattern is also shown in figure 2, which reveals good crystalline nature of the nanoparticles.

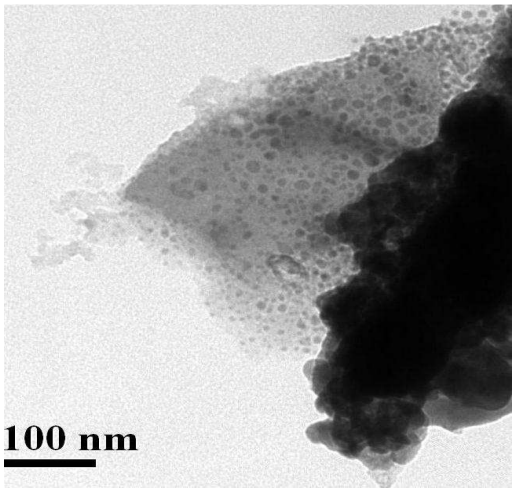

Figure 1:

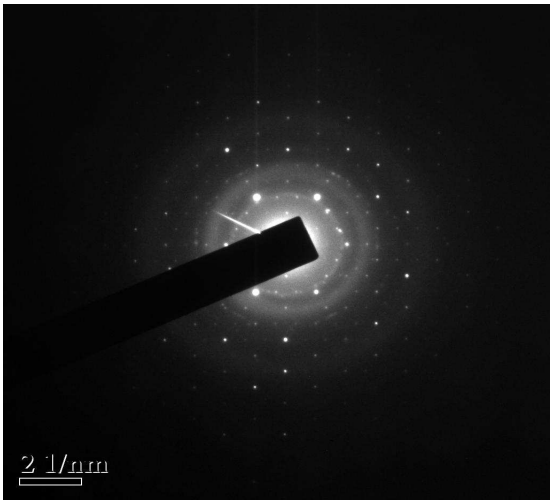

Figure 2:

4. Electrical characterization

The resistivity of the sample is measured in dark as well as under light using Keithly electrometer. The intensity of the light falling on the sample is 50 Lux. As light falls on the sample the resistance of the sample decreases. The figure 3 shows the decrease of resistance with incidence of light. As light is made off the resistance of the sample again

increases and this part also shown in the figure. The decrease and increase of light is exponential following linear recombination under weak illumination intensity.

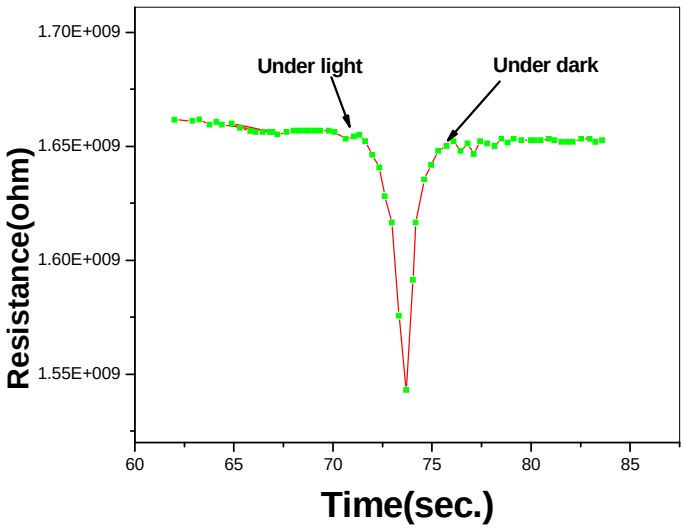

Figure 3:

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