International Journal of Nanotechnology and Applications
ISSN 0973-631X Volume 11, Number 2 (2017), pp. 117-120

http://www.ripublication.com

Optical Properties of Tin Selenide Nanoparticles Prepared by Aqueous Solution Method

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Abstract

Tin selenide (SnSe) is an important IV-VI semiconductors is one of the promising materials from its applications. Tin selenide (SnSe) powder has been prepared using chemical precipitation method in deionizer water. Tin Selenide nanoparticles have been analyzed by SEM. The optical properties of powder were studied by using spectrophotometer. The optical band gap was found to be indirect, which was equal to 1.5 ev.

Keywords: SnSe nanoparticles, Aqueous solution method, SEM, Optical properties.

INTRODUCTION

Tin selenide (SnSe) is one of the IV-VI semiconductors. It's having paying attention budding interest owing their significant unique properties. SnSe thin film has been used as light emitting diodes or laser diodes, memory switching devices, and infrared production and detention [1, 2]. SnSe nanoparticles were synthesized by numerous methods like solid – state reaction, solid state metathesis, Bridgman method, self – propagating high temperature synthesis, brush plating technique and aqueous solution method [3-7]. Along with there I use chemical precipitation method its very easy technique and there is no requirement for special machine and high temperature. It is a time-consuming process, which facilities a better orientation of the crystallites with an improved grain structure, Depending on the deposition situation. Present paper reports the preparation and morphological study of the tin selenide powder obtained by simple chemical route.

EXPERIMENTAL DETAILS:

In this mixture all chemicals use were of AR grade. (99.99% purity, Alpha essar).Tin chloride and selenium oxide used as precursors of sn^{+2} and se^{-2} ions in the reaction system. The $Sncl_2$ and Seo_2 solutions were mixed for 30 min using a magnetic stirrer by drop wise and as a result precipitations of SnSe were obtained in a solution. This precipitate was centrifuged at 3000rpm for 15 min. for separation of SnSe nanoparticles. Finally separated SnSe nanoparticles were washed by ethanol several times and kept at 100°c for 1 hour for obtaining dry powder of SnSe nanoparticles. Synthesized nanoparticles were carried out by Optical absorption spectroscopy measurements were carried out in the wave length range 200 nm to 2500 nm (Perkin Elmer Lambda-19).

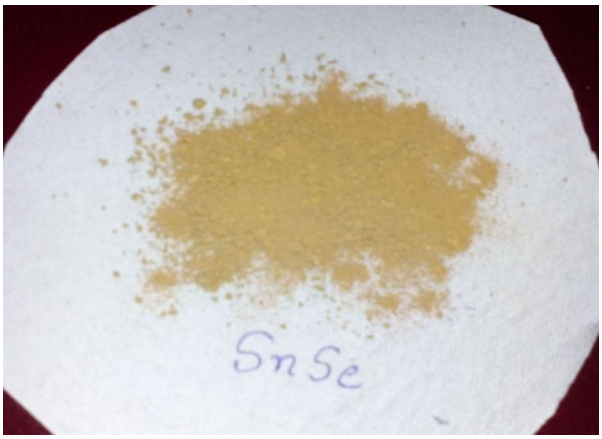

Fig.1 Photograph of synthesized SnSe nanoparticles.

RESULTS AND DISCUSSION

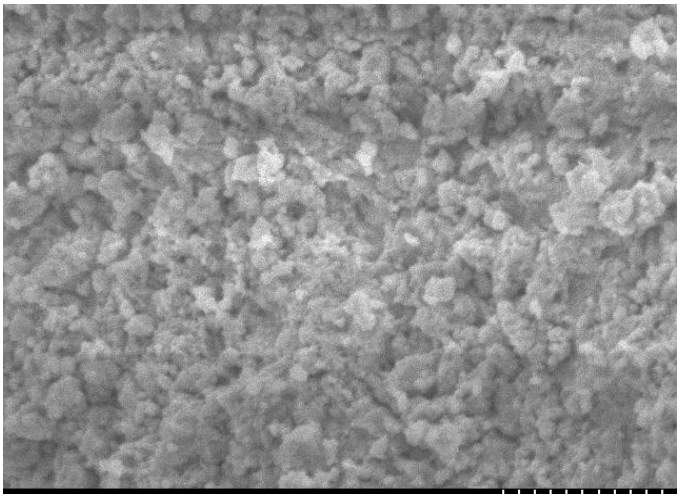

Fig. 2 SEM micrograph of SnSe powder

SEM:

Surface morphological and compositional analyses were accepted using a scanning electron microscope. Fig.2 show scanning electron micrograph of the synthesized SnSe powder. The SEM micrograph of powder contains particles with all most spherical shape. These consequences are in good conformity with others [8, 9]. This type of morphology has also been observed by others for Nanocrystalline Tin selenide. [7, 9]

UV-VIS:

Fig.3 shows the variation of the as prepared tin selenide nanoparticles. Optical absorption spectra of as synthesized nanoparticles were taken with the help of UV-VIS-NIR spectrophotometer in the wavelength range of 200 nm – 2500 nm. The nanoparticles have an extensive absorption range from the NIR to the UV, which means it is good for absorption of the rays. The band gap energy was expected from the Equation [12-14].

$$\text{Band Gap Energy } (E) = h^{*}C/\lambda$$

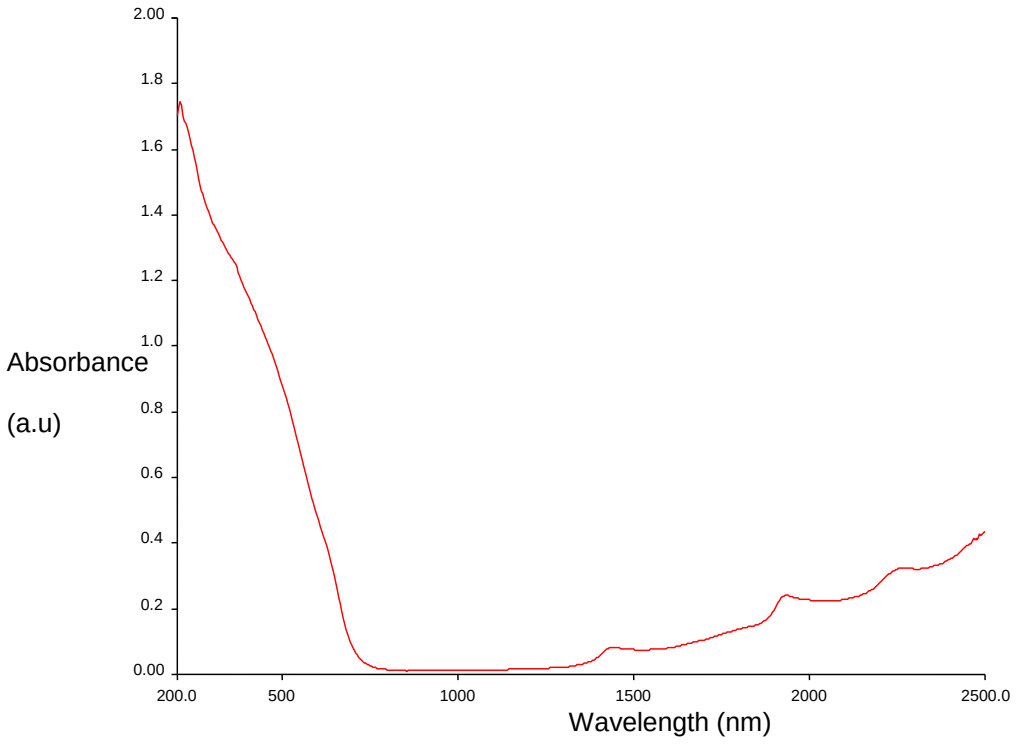

Fig. 3 Optical absorbance spectra SnSe powder

From the equation, the calculated value of band gap is E=1.489375 eV. Calculated value of band gap, which are good conformity with direct value of tin selenide band gap.

CONCLUSION

In this study, a simple chemical route for Tin selenide has been described. The technique is simple, cost-effective and requires less monitoring. The SEM micrograph of powder contains particles with all most spherical shape. In the optical study, the band gap was found to be indirect and about 1.50 eV.

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