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LOW TEMPERATURE SYNTHESIS OF WURTZITE ZnS NANORODS

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ABSTRACT

Wurtzite ZnS Nanorods was prepared by hydrothermal process at lower temperature at 170°C. The formation of Wurtzite ZnS Nanorods was characterized by XRD, FE-SEM, and UV-Vis spectroscopy. The XRD patterns and FE-SEM image indicated that the average crystallite size of the synthesized WZ –ZnS nanorods (NRs) is around 30 nm where the average length of NRs is around 300 nm. Optical measurements show that the value of optical band gap of the NRs is higher than that of Bulk ZnS.

Keywords: Wurtzite ZnS, nanorods, II-VI semiconductor.

INTRODUCTION

Among various classes of nanoparticles, II-VI semiconducting materials have attracted great interest due to their wide band gap that facilities relatively higher operating voltages, frequencies and temperature than conventional semiconductor materials. In this context, ZnS is a direct wide band gap compound semiconductor and exhibit emerging optoelectronic properties in bulk and as well as nano-dimensional scale. It has a wide range of applications, e.g., optical coating, sensors, photo conductors, field effect transistors, piezoelectric energy generators and light emitting materials.

INTRODUCTION

It has been found that the optical properties are sensitive to shape, size, crystal structure and defects; so much effort has been made to control the size, morphology and crystallinity of the ZnS nanocrystals to control their properties. In particular, ZnS bulk is typically found to have zinc blend (ZB) or cubic closed packing crystal structure at room temperature.

At elevated temperatures (typically ~1020 ^{o}C) [1], bulk ZnS can undergo a phase transformation from the cubic ZB structure to a hexagonal crystal structure or hexagonal closed packing structure known as the wurtzite (WZ) structure, which is generally considered to be more desirable for its optical properties than the ZB structures[2]. Various methods such as chemical vapour deposition, vapour-liquid-solid method etc. have been used for preparation of ZnS which are usually cubic closed packed in structure. It is difficult to synthesize pure cubic WZ structure at low temperature by these methods. In this work, we synthesize WZ –ZnS nanorods (NRs) by hydrothermal process at much lower temperatureat170^{o}C.

The characterization of the as synthesized product was carried out by X-ray diffraction (XRD), FE-SEM and UV-vis absorption. XRD pattern ensure the formation of wurtzite structure of ZnS and the FE-SEM image shows that the diameter of the ZnS NRs is around 30 nm. Band gap energies were calculated from UV-vis absorption spectra. It indicates that the band gap energy is increased compared to that of bulk ZnS.