Publications

Available Online

J. Sci. Res. **13** (1), 9-20 (2021)

JOURNAL OF SCIENTIFIC RESEARCH

www.banglajol.info/index.php/JSR

Effect of Deposition Time on Structural and Optoelectronic Properties of Flower-Like Nanostructured PbS Thin Films

N. H. Sheeba[1*], A. Namitha[2], K. M. Ramsiya[2], T. M. Ashitha[3], R. Suhail[3]

[1]Department of Physics, M. E. S. Asmabi College, P. Vemballur, Kodungallur, 680671, India

[2]Department of Physics, S. N. College, Nattika, Thriprayar, 680566, India

[3]Department of Physics, M. E. S. Marampally College, Aluva, 683547, India

Received 25 May 2020, accepted in final revised form 28 September 2020

Abstract

Polycrystalline nanostructured PbS thin films are deposited onto soda-lime glass substrates by the method of chemical bath deposition (CBD) at different duration of deposition time. The structure and surface morphology of the films are characterized by X-ray diffraction (XRD) and field effect scanning electron microscopy (FE-SEM). XRD pattern exhibits polycrystalline structure with preferential orientation along (200) direction, parameters such as crystallite size, lattice constant, lattice-strain and dislocation density are calculated. The FE-SEM images show appearance of flower like structure on formation of PbS films which is indicative of suitability in gas sensing applications. Studies on optical properties carried out by UV-Vis spectroscopy measurements show bandgap in the range 1.65eV – 1.41eV. The photoluminescence spectra of the films exhibit two peaks centered at around 613 nm and 738 nm after excitation at 450 nm. Electrical studies from Hall measurements indicate the carrier concentration and mobility of the PbS samples corroborate the variations in the conductivity.

Keywords: Thin films; Chemical synthesis; Crystal growth; Surface morphology; Hall effect.

doi: http://dx.doi.org/10.3329/jsr.v13i1.47240 J. Sci. Res. **13** (1), 9-20 (2021)

1. Introduction

Lead sulphide (PbS) belongs to binary IV-VI semiconductor material with direct narrow optical energy band gap which can be tuned between 0.41 eV to 3eV at 300 K [1]. The flexibility to vary the band gap in PbS makes it a better candidate in solar cell applications [2]. Further, it is one of the oldest and most common detection materials in various infrared detectors. It functions as a photon detector, responding directly to the photons of radiation, as opposed to thermal detectors [3,4]. The large Bohr radius of 18 nm of the material leads to the observation of quantum confinement effects, a desirable property in

* *Corresponding author*: sheebames.naser@gmail.com