Growing mechanism and change of phase of synthesized CdSe nanoparticles

J. Sarmiento A.[1], E. Rosendo[1], A. I. Oliva[2] and W. De la Cruz[3]

[1]CIDS-ICUAP, Benemérita Universidad Autónoma de Puebla, Apartado Postal 1651 Puebla, Pue., 72570, México.

[2] Centro de Investigación y de Estudios Avanzados del IPN, Unidad Mérida, Departamento de Física Aplicada, A.P. 73-Cordemex, CP 97310, Mérida Yucatán México.

[3] Centro de Nanociencia y Nanotecnología, Universidad Autónoma de México, Km. 107 Carretera Tijuana-Ensenada CP 22860 Ensenada, B.C., México.

Abstract

Nanostructured cadmium selenide (CdSe) thin films were deposited by evaporation of a CdSe colloidal solution. The colloidal solution containing Cd and Se ions was prepared at room temperature. The solution was stirred during 30 min and cleaned with HCl and distilled water. The glass substrates were introduced into the colloidal solution and heated at 75°C during 2 h in air environment, the by-products were evaporated and a film on the substrate surface was obtained. The as-deposited films were further annealed in ambient air at 100°C, 200°C, and 300°C. Deposited films were characterized by x-ray diffraction (XRD), x-ray photoelectron spectroscopy (XPS) and high-resolution transmission electron microscopy (HRTEM). As-deposited nanoparticles with surface of CdSe and core of Se (CdSe@Se) with mean particle diameter of ~4.5 nm were observed by HRTEM, after the annealing process, this diameter increased until ~14 nm. XRD results support this results and show a phase combination of cubic and hexagonal CdSe crystalline structures XPS allows showing that crystals are mainly composed of Cd and Se. Based on the experimental results a model of growth for the CdSe@Se structures is proposed and the percent of each crystalline structure with the annealing process is calculated.

Keywords: Nanostructured cadmium selenide, Annealing process, Crystal structure, mechanism of growth, HRTEM, XRD.