

Facile synthesis of ZnS/CdS and CdS/ZnS core-shell nanoparticles using microwave irradiation and their optical properties

ABSTRACT

ZnS/CdS and CdS/ZnS core shell nanoparticles with tunable shell thickness were synthesized via a two steps route under microwave irradiation. In the first step core nanoparticles were prepared using polyol method, and in the second step capping process of shells were performed at moderate temperature by choosing ethanol as a solvent. The thickness of the shells was controlled by adjusting the concentration of core nanoparticles and shell precursors. The structural and chemical characterizations were performed using X-ray diffraction, energy dispersive X-ray spectroscopy and transmission electron microscopy which provide direct evidence for shell growth. The structures of ZnS/CdS and CdS/ZnS core shell nanoparticles were similar to the cubic and hexagonal core structures, respectively. The optical properties of obtained core shell nanoparticles were characterized using UV-Visible and photoluminescence spectroscopy. The absorption edge of ZnS/CdS core shells shows a red shift compared to ZnS (core) while for CdS/ZnS, the absorption edge shows a blue shift compare to CdS (core) owing to the size effect and the potential-well effect. The emission peaks of ZnS/CdS and CdS/ZnS core shell nanoparticles in the range of 400-650 nm are from sulfur, zinc and cadmium vacancy defects and created surface states at ZnS/CdS and CdS/ZnS interfaces.

Keyword: CdS; Core shell nanoparticles; Microwave; Optical properties; Shell thickness; ZnS