CONCERTED STRUCTURAL CHARACTERIZATION OF LOW ASPECT RATIO CdSe NANORODS

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During the last decade, semiconductor nanoparticles have been intensively studied due to their potential applications in a vast variety of disciplines. Their unique tunable properties make them great candidates for fields like biological labeling [1], solar cells [2], and telecommunications [3].

A diverse range of synthetic routes of nanocrystals has been established [4-5]. In the last few years particular interest has been given to non-spherical nanoparticles such as rods, cubes, tetrapods, and wires [6-8].

We have developed a strategy for controlling the shape of colloidal CdSe nanocrystals using a dual precursor system and multiple injection method [9]. We have shown that nanorods can be grown in this fashion while maintaining their aspect ratio. Thus, quantum size effects as a function of size, at a fixed aspect ratio can be systematically studied. This evolution was monitored by measuring the UV-vis absorption spectra of CdSe particles isolated from the reaction after each injection of the second precursor system, labeled A, B, C, and D. A progressive red-shift in the band gap was observed with growth time, Fig. 1a.

The transmission electron microscopy (TEM) images, Fig. 1b, show the growth of nanorods with a mean aspect ratio of 1.5. The average length of the rod grows from 8.9 nm (A), to 13 nm (B), to ~14 nm (C and D). The XRD patterns of the sample shown in Fig. 2, can be indexed to hexagonal wurtzite CdSe with strong (110), (103), and (112) reflections. Further analysis of the XRD pattern using the Fundamental Parameter Approach (FPA) for standard peak profiles decomposition with the TOPAS software [10-11], we have been able to confirm the mean aspect ratio of the nanorods. High resolution-scanning transmission electron microscopy studies, Fig. 3, and analysis of the PXRD data reveal that these nanorods grow along the wurtzite *c*-axis and have a hexagonal cross-section. Thus, we present a detailed schematic illustration of the structure of the nanorods, Fig. 4.

Thus, this detailed model will be furthered discussed among our current progress on the synthesis and characterization of PbS nanorods.

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Figures:

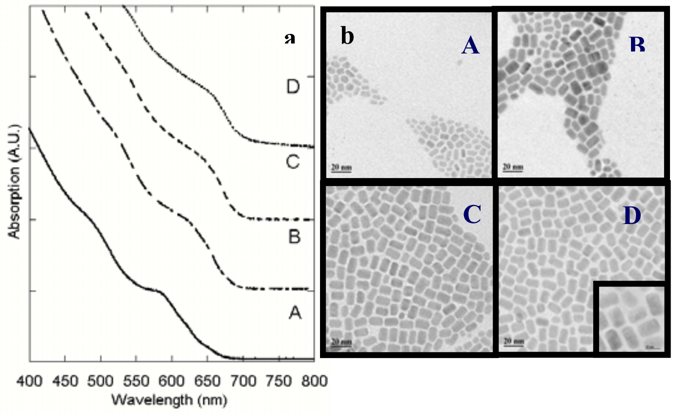

Fig. 1 (a) Absorption spectra and (b) TEM images of the CdSe nanorods after each injected of the second precursor.

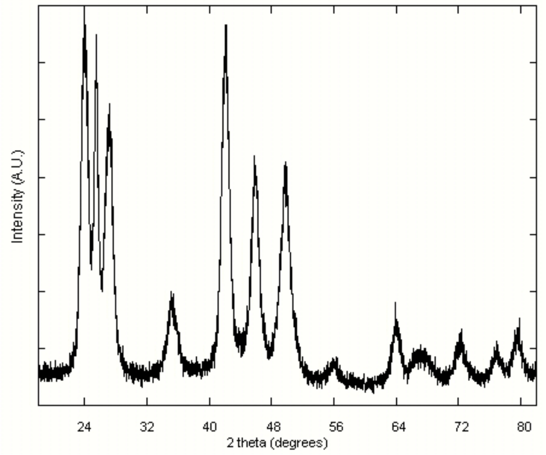

Fig. 2 PXRD data for the CdSe nanorods.

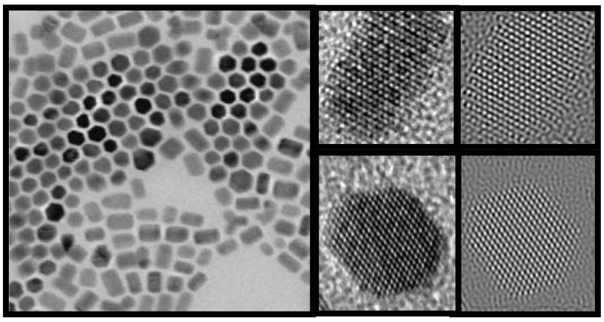

Fig. 3 HR-TEM images for the CdSe nanorods.

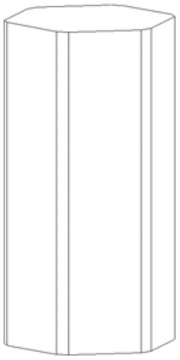

Fig. 4 A schematic illustration of the structure of CdSe nanorods.