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Controllable Synthesis and Characterization of CdS Quantum Dots by a Microemulsion-mediated Hydrothermal Method

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Abstract

CdS QDs were successfully synthesized through a chemical reaction between cadmium acetate dehydrate and thioacetamide by using a microemulsion-mediated hydrothermal method. The properties of as-prepared CdS QDs can be controlled by using Emulsifier OP and CTAB surfactant, which produce a universal cubic phase and an unusual hexagonal phase, respectively. As a comparison, CdS QDs prepared by CTAB exhibit a better crystallinity and dispersibility. A possible mechanism involving the critical role of surfactant in the formation of crystal structure has also been explored in this paper. It is also found that the crystal size gradually increase with the increase of temperature, and the observation of red shift in the absorption and emission peaks gives a clear evidence of quantum confinement effect. All the desired properties of CdS QDs synthesized in this study imply the possibility of the preparation of high quality QDs under the appropriate reaction conditions.

Key words: CdS; Nanocrystalline materials; Crystal structure; Morphology; Luminescence

Introduction

Nanocrystalline semiconductors have attracted considerable attention because of their novel optical-electronic properties and their promising applications in biological imaging, solar energy, photodetectors, and so on [1]. As an important semiconductor compound of II–IV binary compound semiconductor, cadmium sulfide (CdS) quantum dots (QDs) exhibit unique size-tunable optical and

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