Short Communication

Enhanced Ripening Behaviour of Cadmium Selenide Quantum Dots (CdSe QDs)

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In this research, cadmium selenide quantum dots (CdSe QDs) are synthesized successfully in the absence of trioctylphosphine (TOP) for 46 minutes and characterized by TEM and XRD analysis. The TEM image reveals that the CdSe QDs are spherical, compact with a dense structure. The ripening behaviour of CdSe QDs is monitored using the red-shift characteristic in the UV-visible absorption peaks, and their size variations are estimated by the quantum confinement theory. The coarsening effect of CdSe QDs can be observed clearly from LSW plots due to the increase in ripening time and ripening temperature. The ripening coefficient is obtained to be 6.84 \( (10^{-3}) \) nm\(^3\)/min. The Arrhenius plot provides the activation energy value of the ripened samples, which are very low compared to the sample prior ripening, and is attributed to the domination of volume diffusion through the liquid phase.

Keywords: Semiconductors; nanostructures; chemical synthesis; optical properties.

1. INTRODUCTION

Many studies have been carried out on III-V and II-VI semiconductor quantum dots (QDs) all over the world. For II-VI QDs, in particular, the CdSe QDs prepared by chemical methods are by far, the most popular [1-3]. Recently, a new method has been developed for the synthesis of CdSe QDs without the use of TOP solvent [4-6]. The method is inexpensive, safer and produces CdSe QDs of high quality. Furthermore, the process can be operated in open atmosphere [7]. It is noteworthy that non-TOP based routes produce colloidal CdSe QDs with high-quality zinc blend structures and have attracted a great deal of interest due to their size-tunable photoemission characteristics. The photoemission characteristics originated from the quantum confinement effect of both electron and hole in all three dimensions, leading to an increase in effective energy band gaps of nanocrystals [8-11]. In addition, CdSe QDs exhibit almost full-range visible light emission within a reasonable size