pH selective synthesis of ZnS nanocrystals and their growth and photoluminescence

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Abstract

ZnS nanocrystals with sizes of 3.0 $\pm$ 0.5 and 6.5 $\pm$ 0.5 nm have been prepared, that were selectively dependent upon the pH values (pH $\approx$ 7 and $\approx$ 1.7, respectively) of the synthetic aqueous solutions; where environmental friendly β-cyclodextrine was used as a stabilizer. Two different growth processes were observed depending on the pHs. For an aqueous solution with a pH of 7, the growth process was analogous to the thermodynamically controlled discontinuous growth, whereas, for an aqueous solution with a pH 1.7, the growth process was analogous to continuous growth followed by Ostwald ripening. The growth of the nanocrystals proceeds faster in pH 1.7 than in pH 7, where the interaction between stabilizer and core nanocrystals is stronger in pH 7 than in pH 1.7. The PL of the nanocrystals demonstrated that the band-edge emissions are dominant for both crystallites, where red shifts of 75 meV were observed for smaller nanocrystals as compared to the larger ones.