

A SOFT METHOD FOR THE PRODUCTION OF CdSe AND CdSe/ZnS QUANTUM DOTS

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Semiconductor nanocrystals, also known as quantum dots (QDs), are an emerging new class of powerful and versatile biomedical imaging probes. Their fluorescence is unique compared with that from traditional organic fluorophores. QDs exhibit high quantum yields, high photostability, large absorption coefficients, continuous absorption bands with narrow and symmetric emission for multicolor capability, and many biofunctionalisation strategies. Most of the preparation techniques use a tri-*n*-octylphosphine (TOPO) based system in which the reagents are injected into a high coordinating solvent at high temperature (200–400 °C) under nitrogen and moisture free atmosphere [1].

In this work, CdSe QDs were prepared by a simple microemulsion templating technique at low temperature (80 °C), under environmental conditions and using common inorganic precursors. Size control was obtained by small variations in reactant concentrations and pool size [2]. The chalcogenide source was a polyselenide solution in a polar aprotic organic solvent. Narrow (30-40nm fwhm) band gap photoluminescence with low defect level and high quantum yield (~10%) were obtained. Using the same strategy, core/shell CdSe/ZnS nanoparticles were obtained by growing a ZnS shell over preformed CdSe in AOT microemulsions, resulting in an increase of photoluminescence quantum yield. The particle size was evaluated using an empirical correlation [3]. Some preliminary applications in photocatalysis [4] and in biological imaging will be presented.

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[1] J. Hambrock, A. Birkner, R.A. Fischer, *J. Mater. Chem.*, **11**, 3197 (2001).

[2] T. Kinugasa, A. Kondo, S. Nishimura, Y. Miyauchi, Y. Nishii, K. Watanabe, H. Takeuchi, *Colloid Surf. A-Physicochem. Eng. Asp.*, **204**, 193 (2002).

[3] W. Yu, L. Qu, W. Guo, X. Peng, *Chem. Mat.*, **15**, 2854 (2003).

[4] A. M. Fontes Garcia, M.S.F. Fernandes, P.J.G. Coutinho, *Nanoscale Res. Lett.*, **6**, 426 (2011).