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Synthesising Highly Luminescent CdTe Quantum Dots Using Cannula Hot Injection Method

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Abstract : Recently, colloidal quantum dots (CQDs) have drawn increasing attention due to their unique size tunability, which makes them potential candidates for numerous applications including photovoltaic, LEDs, and imaging. However, the main challenge to exploit CQDs properly is that there has not been an effective method to produce them with highly crystalline form and narrow size dispersion. Hot injection method is one of the widely used techniques to produce high-quality nanoparticles. In this method, the key parameter is to reduce the time for injection of the precursors into each other, which yields fast and constant nucleation rate and hence to highly monodisperse QDs. In conventional hot injection method, the injection of precursors is carried out using standard lab syringes with long needles. However, this technique is relatively slow and thus will result in poor optical properties in QDs. In this work, highly luminescent CdTe QDs were synthesised by transferring hot precursors into each other using cannula method. Unlike regular syringe technique, with the help of high pressure difference between two precursors' flasks and wide cross-section of cannula, the hot cannulation process is too short which yields narrow size distribution and high quantum yield of CdTe QDs. Here QDs with full width half maximum (FWHM) of 28 nm was achieved. In addition, the photoluminescence quantum yield of our samples was measured to be about 21 ± 0.9 which is at least twice the previous record values for CdTe QDs wherein syringe was used to transfer precursors.

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