Supplementary information for

Effects of *N,N,N',N'*-tetramethylethylenediamine on the properties of CdTe Quantum Dots

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Results and discussion

Optimization of the volume ratio of CdTe to TEMED.

The fluorescence emission spectra recorded under different volume ratios of CdTe to TEMED is shown in Figure S1. In this experiment, it is carried out in the range between 0 and 1:15. At beginning, PL intensity of CdTe nanorods increases gradually

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as the ratio of CdTe to TEMED gets lower. The strongest PL intensity of CdTe nanorods is obtained at the ratio of 1:8. When the ratio is lower than 1:8, a decrease of PL intensity will occur. It is supposed that too low ratio of CdTe to TEMED may result in an excess of TEMED molecules, which will bring about some extra traps, the center of nonradiative recombination, leading to a decrease of PL intensity. It is found that the nonradiative recombination could not be formed unless enough TEMED molecules exist.[1] Therefore, 1:8 of CdTe to TEMED is chosen for further experiments.

Optimization of Temperature.

When volume ratio of CdTe to TEMED is fixed on 1:8, reaction temperature affects the results of PL intensity of CdTe nanorods. The optimal temperature selected for the assay is from 35 ℃ to 75 ℃. It is known that at higher temperature, the kinetic energy of molecules increases, which results in a fiercer collision between molecules and would make the intermolecular reaction more effective and efficient. As is shown in Figure S2, when the temperature is lower than 65 ℃, PL intensity is enhanced gradually; however, when the temperature is higher than 65 ℃, PL intensity would decrease. This could be attributed to that too high temperature makes the intermolecular collision so violet that the molecules do not have adequate time to react with each other efficiently. Meanwhile, overhigh temperature would destroy the stability of the newly formed molecules and break the dynamic equilibrium of CdTe and TEMED. From the results it could be learned that the optimal temperature is 65 ℃.

Optimization of Heating Time.

Heating time is also studied in the assay when volume ratio of CdTe to TEMED is fixed on 1:8, and reaction temperature on 65 ℃. The heating time is changed from 0 to 50 min (Figure S3). PL intensity increases by degrees when heating time changes from 0 to 30 min, whereas a decrease of PL intensity could be observed as it is longer than 30 min. The mechanism is mainly due to Qstwald ripening and defocusing principle.[2] Therefore, according to a serial assay, the optimal heating time is 30 min.

Effects of Heating Temperature on the Shape of Nanocrystals

Figure S4 shows TEM images of the nanocrystals under different heating temperatures, with the volume ratio of TEMED to CdTe fixed at 8:1 and heating time at 30 min. It demonstrates that at ambient temperature, the nanocrystals remain spherical dots (Figure S4A); when the temperature is 45 °C, apart from many spherical dots, low-dimensional nanorods can be observed (Figure S4B); as the temperature increases to 65 °C, arrow-shaped nanorods with the average length of 40 nm are obtained (Figure S4C); however, when the temperature reaches to 75 °C, it is observed that CdTe nanosheets with irregular structures come into being (Figure S4D).

Effects of Heating Time on the Shape of Nanocrystals

As the volume ratio of TEMED to CdTe fixed at 8:1 and heating temperature at 65 °C, the influence of heating time on the nanocrystals shape has been studied. As can be seen in Figure S5, the nanocrystals are with the spherical shape without any heating (Figure S5A); Figure S5B shows TEM image of the nanocrystals with the heating time at 30 min, as can be seen that high-qualified arrow-shaped nanorods are formed; With the heating time increasing to 45 min, besides observing some nanorods, there are many fairly small 2D nanosheets (Figure S5C).

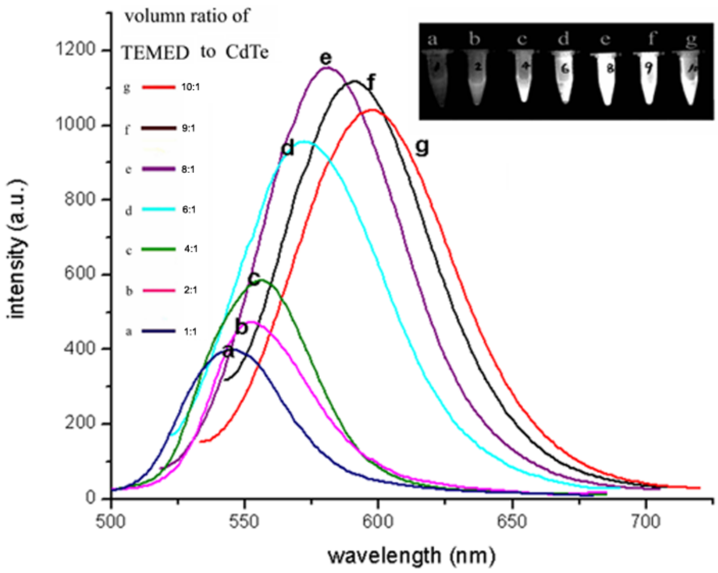

Figure S1. PL spectra (excited at 280 nm) of CdTe nanorods with different volume ratios of CdTe to TEMED. Concentration of CdTe QDs is 100 μM, reaction temperature is 65 °C, and heating time is 30 min. (Insert: image of CdTe nanorods illuminated by UV bioimaging system)

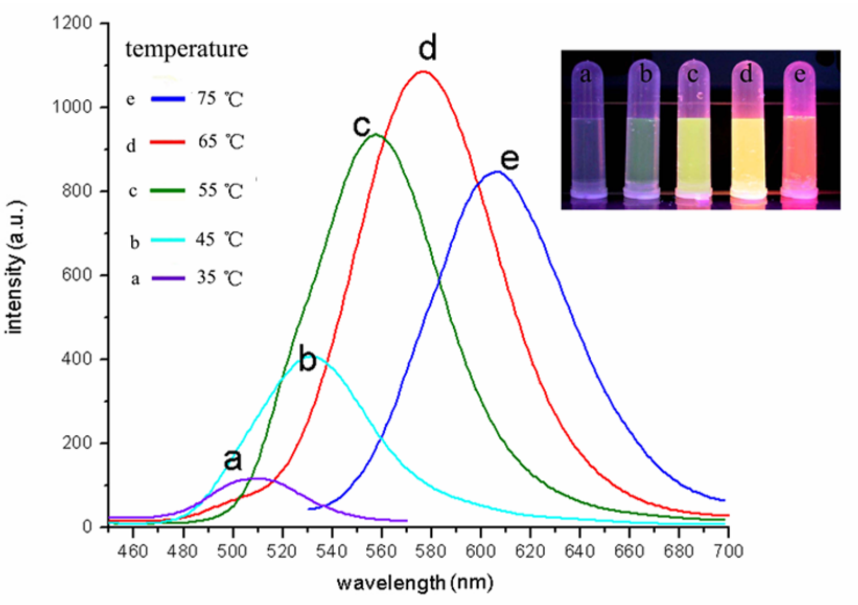

Figure S2. PL spectra (excited at 280 nm) of CdTe nanorods at different temperatures. Concentration of CdTe QDs is 100 μM, volume ratio of CdTe to TEMED is 1:8, and heating time is 30 min. (Insert: image of CdTe nanorods illuminated by UV bioimaging system)

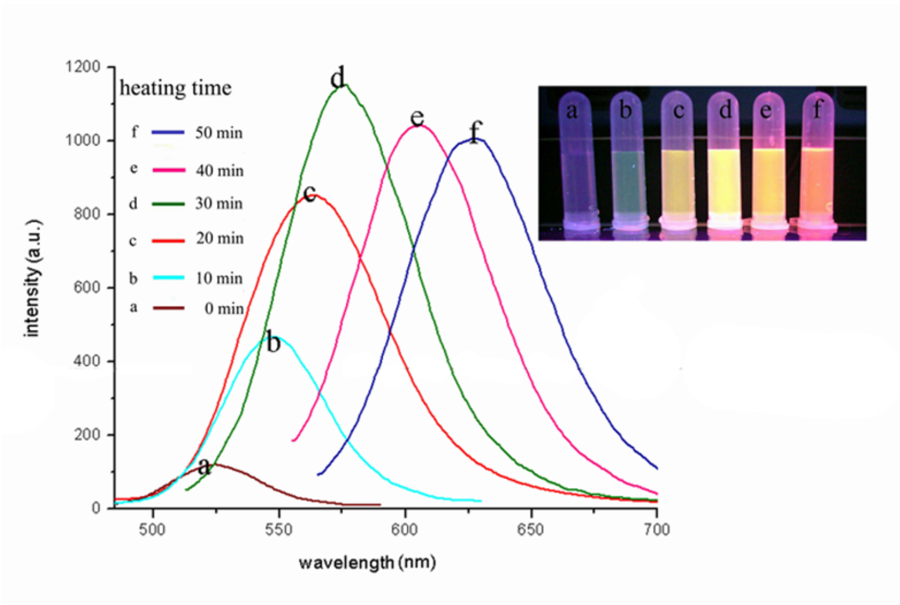

Figure S3. PL spectra (excited at 280 nm) of CdTe nanorods at different heating times. Concentration of CdTe QDs is 100 μM, volume ratio of CdTe to TEMED is 1:8, and temperature is 65 °C. (Insert: image of CdTe nanorods illuminated by UV bioimaging system)

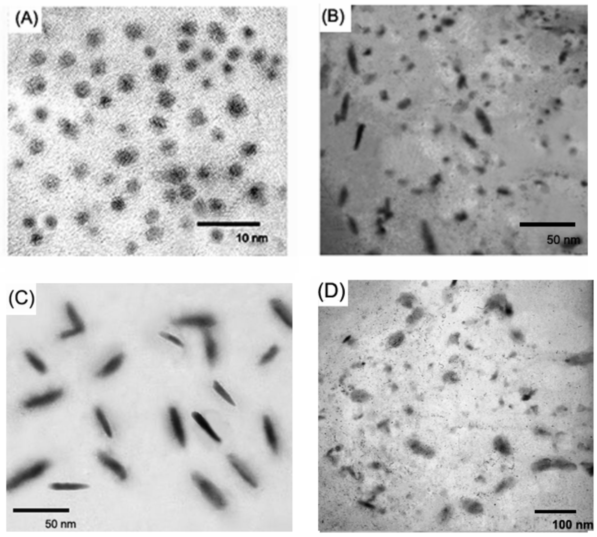

Figure S4. TEM images of CdTe-TEMED nanocrystals with different heating temperatures, from A to D: (A) room temperature; (B) 45 °C (C) 65 °C; (D) 75 °C. The volume ratio of TEMED to CdTe is 8:1, and the heating time is 30 min.

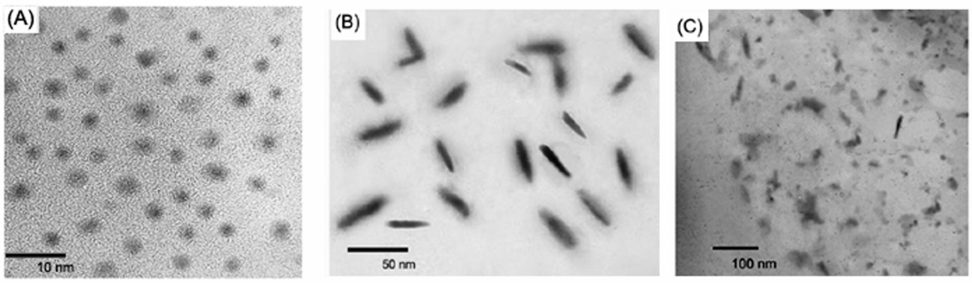

Figure S5. TEM images of CdTe-TEMED nanocrystals with different heating times, from A to C: (A) 0 min; (B) 30 min; (C) 45 min. The volume ratio of TEMED to CdTe is 8:1, and the heating temperature is 65 °C.

Reference

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2 X. Peng, J. Wickham, A. P. Alivisatos, *J. Am. Chem. Soc.* 1998, 120, 5343-5344.