Electronic Supplementary Information (ESI) for:

A Novel Separation Technique for Aqueous Nanoparticles Based on a Two-phase Solvent System

Yuan Jiang, Shuhong Xu, Chunlei Wang, Haibao Shao, Zhuyuan Wang and Yiping Cui*

Advanced Photonics Center, School of Electronic Science and Engineering, Southeast University, Nanjing, 210096, PR China. E-mail: cyp@seu.edu.cn

Experimental

Materials

Thioglycolic acid (TGA), Te powder and dioctadecyldimethylammonium bromide (DODAB) were purchased from Aldrich. $CdCl_2$, $NaBH_4$, NaOH, chloroform and cetyl trimethylammonium bromide (CTAB) were commercially available products and used as received. NaHTe solution was prepared by using Te and $NaBH_4$ according to the reference methods.[1] Deionized water was used in all preparations.

Synthesis of TGA Capped CdTe NWs.

TGA capped CdTe NWs were prepared according to the reference methods.[2, 3] Namely, the mixture of $CdCl_2$ and TGA was adjusted to pH 9.1 by using 1.0mol/L NaOH solution, and then the mixture was aerated with N_2 for 30 min. After injection of freshly prepared NaHTe solution into the mixture, CdTe crude solution was obtained. The total concentration of Cd^{2+} in solution was 1.0×10^{-3} mol/L, and the initial molar ratio of $CdCl_2$/TGA/NaHTe was 2.0/5.0/1.0. The resulting crude solution was stirred in 80℃ water for 3h.

Synthesis of TGA Capped CdTe QDs.

CdTe QDs were prepared via similar process of aforementioned CdTe NWs except using Cd^{2+} concentration of 2.6×10^{-3}mol/L, $CdCl_2$/TGA/NaHTe molar ratio of 1.0/2.4/0.2, and heating temperature of 100℃. To obtain CdTe QDs with emissions from green to red, the crude solution was refluxed for 0.5h and 8h, and then cooled to room temperature in the open air. The sizes of green and red emitted QDs were respectively 2.9 and 5.0 nm as calculated according to the reference method.[4]

Separation of 1D NWs and 0D QDs.

A series of amount of DODAB was dissolved in chloroform solvent with concentration of 8g/L and 64g/L. The DODAB chloroform solvent and prepared aqueous NW solution were mixed in equal volumes. After storage for 4h, NWs and residual QDs were naturally separated in different phase.

Separation of different-sized QDs.

CTAB instead of DODAB was used in the case of separating different-sized aqueous QDs. After addition of green emitted CdTe QDs into equal volume of red emitted QD solution, 0.32g/L CTAB chloroform solvent was added in equal volumes with the mixed QD solution. After storage for 4h, green and red emitted QDs were naturally separated in different phase.

CTAB chloroform solvent (0.04, 0.08, 0.16, 0.32, 0.64, 1.28g/L) was added in equal volumes with red emitted QDs (PL peak 675nm with QD size of 5.0nm). Small-sized QDs fractions are extracted down to oil phase after storing for 4h.

Characterization.

UV–vis absorption spectra (UV) were recorded with a Shimadzu 3600 UV–vis near-infrared spectrophotometer. Fluorescence experiments and PL decay experiments were performed with an Edinburgh FLS 920 spectrofluorimeter. The excitation wavelength was 400 nm. Transmission electron microscopy (TEM) was recorded by a Tecnai F20 electron microscope with an acceleration voltage of 200 kV. Xray powder diffraction (XRD) investigation was carried out by using the D/max-2500/PC diffractometer with Cu Kα radiation (λ = 1.5418 A°). For XRD measurements, CdTe NCs powder was used. To obtain the powder, freshly prepared NCs were heated and then dried in vacuum.

Fig. S1 TEM images associated with histogram of (a) original green and red QD solution mixture, separated (b) green oil phase and (c) red water phase. The concentration of CTAB was 0.32g/L.

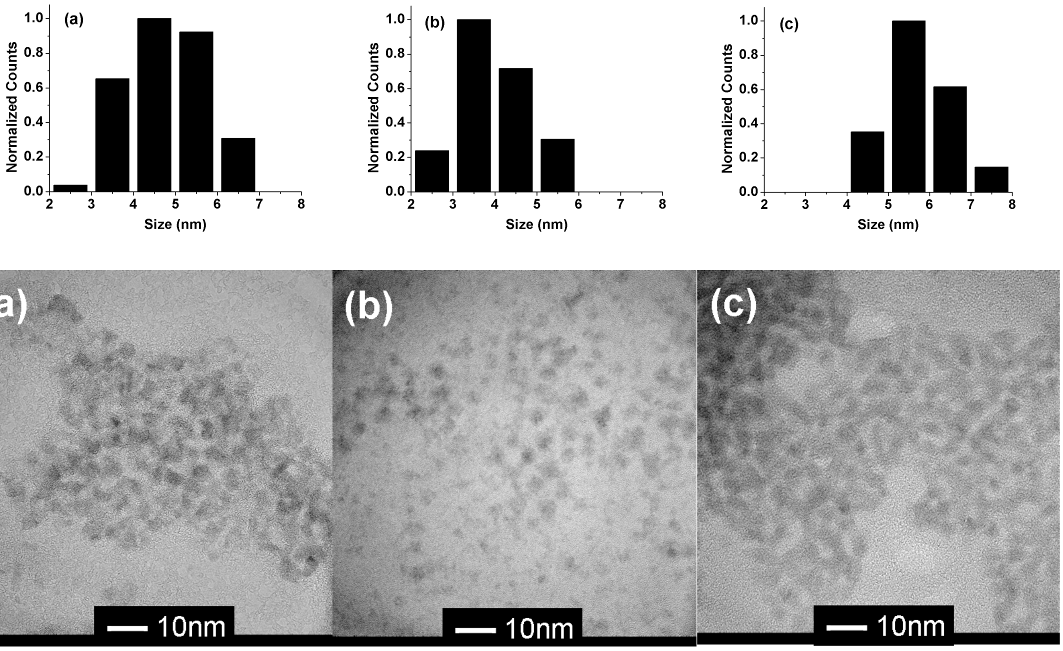
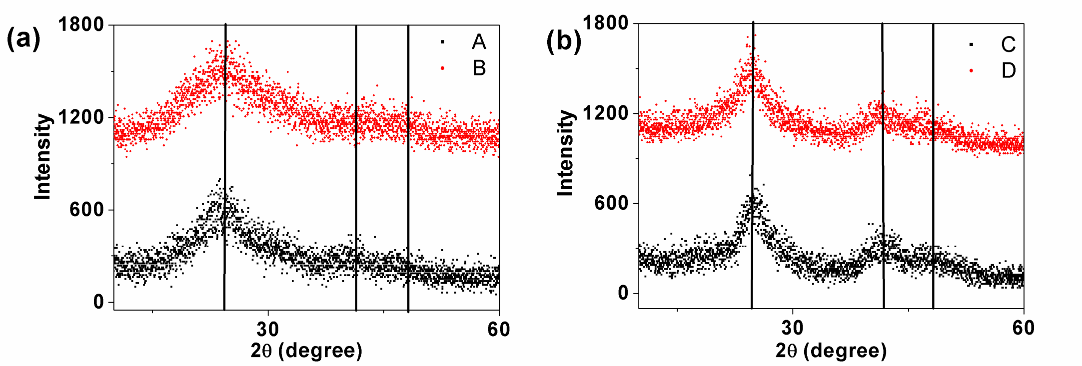


Fig. S2 XRD images of (A) original green QD solution, (B) separated green oil phase, (C) original red QD solution and (D) separated red water phase. The concentration of CTAB was 0.32g/L.



References.

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