Supporting information

Microwave-assisted Synthesis of Monodispersed CdTe Nanocrystals

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Chemicals and stock solutions

CdO (99.99%), 1-octadecene (90%) (ODE), tributylphosphine (99.9%) (TBP), and Tellurium (99.999%) (Te) were purchased from Sigma-Aldrich, and tetradecylphosphonic acid (>97%) (TDPA) was purchased from PCI. All chemicals were used as received without further purification.

The stock solution of Cd-TDPA-ODE in various concentrations was prepared by dissolving CdO into TDPA and ODE at 300˚C under Ar flow. The molar ratio of cadmium to TDPA was kept at 1 to 2.2. The 1M stock solution of Te-TBP was prepared by dissolving 2.55g Te into 20mL TBP at 60˚C in Ar flow. For microwave-assisted synthesis, 1M Te-TBP stock solution was further diluted by ODE to 0.1M.

Synthesis of CdTe Nanocrystals

All syntheses were performed by using a commercial single-mode microwave synthesizer coupled with an automation system (CEM Discovery, CEM Inc. USA). The microwave power output was set at 300W under the fixed-power mode condition. The reaction temperatures were set at 180˚C, 240˚C, 260˚C and 280˚C. The total reaction time ranged from 1 to 90 minutes.

Synthesis of CdTe nanocrystals as shown in Figure 2(a), (b)

4 mL of 6mM Cd-TDPA-ODE and 0.48 mL of 0.1M Te-TBP-ODE were loaded into 10 mL vessel and mixed together inside a Ar-filled glovebox. After the vessel was protected by a crimp cap, it was then transferred into the microwave synthesizer. The temperature was quickly ramped to 180˚C at a rate of 35˚C/min, and maintained for 5, 15, 30, and 60 minutes, respectively, under 300W fixed-power mode microwave

irradiation. The reaction vessel was quickly cooled to below 60˚C by forced air flow after the reaction time was reached. CdTe nanocrystals were finally purified by precipitation and decantation.

Synthesis of CdTe nanocrystals as shown in Figure 2(c), (d)

4 mL of 6 mM Cd-TDPA-ODE and 0.48 mL of 0.1M Te-TBP-ODE were loaded into 10 mL vessel and mixed together inside a Ar-filled glovebox. After the vessel was protected by a crimp cap, it was then transferred into the microwave synthesizer. The temperature was quickly ramped to 240˚C at a rate of 35˚C/min, and the total reaction time at temerpature was 1, 5, 15, 30, 60 and 90 minutes, respectively, under 300W fixed-power mode microwave irradiation. The reaction vessel was quickly cooled to below 60˚C by forced air flow after the reaction. The CdTe nanocrystals were finally purified by precipitation and decantation.

Synthesis of CdTe nanocrystals as shown in Figure 2(e), (f)

4 mL of 12 mM Cd-TDPA-ODE and 0.96 mL of 0.1M Te-TBP-ODE were loaded into 10 mL vessel and mixed together inside a Ar-filled glovebox. After the vessel was protected by a crimp cap, it was then transferred into the microwave synthesizer. The temperature was qucikly ramped up to 240˚C at a rate of 35˚C/min, and the total reaction time was held for 1, 5, 15, 30, 60 and 90 minutes, respectively, under 300W fixed-power mode microwave irradiation. The reaction vessel was quickly cooled to temperature less than 60˚C by forced air flow after the reaction. The CdTe nanocrystals were finally purified by precipitation and decantation.

Purification Procedure

To a separation funnel with 5mL of CdTe nanocrystals solution, 8mL of chloroform/methanol (volume ratio 1:1) and 0.5mL octylamine were added. After the solution was shaked, it was then settled for 5minutes to get two layers. After discarded the bottom layer, the procedure was repeated by using 4mL chloroform/methanol without the addition of octylamine. Again, the bottom layer was discarded. After the remain CdTe nanocrystals solution was diluted by 10 mL hexane,

CdTe nanocrytals were precipitated by adding acetone and centrifugation at 7000 rpm for 10 minutes. This hexane/acetone washing step was repeated a second time making a sample of nanocrystals that are soluble in hexane, toulene, chlorofrom and other relatively nonpolar solvents.

Characterization

The linear absorption spectra were recorded by UV-Vis-NIR spectrophotometer (Varian Cary 400 or Cary 5000). The photoluminescent spectra were measured with FluoroLog spectrofluorometer (Horiba Jobin Yvon). All absorption and photoluminescence spectra were measured in 1cm cuvette with the CdTe nanocrystals dispersed in chloroform. The powder X-ray diffraction (XRD) was obtained on a Bruker D8 Discover with GADDS diffractometer operated at 40kV and 40mA, and Cu K_α radiation (λ = 1.5418Å) was used for all measurements. TEM and HRTEM images were recorded by using a JEOL-JEM 2010-F electron microscopy operated at 200kV.

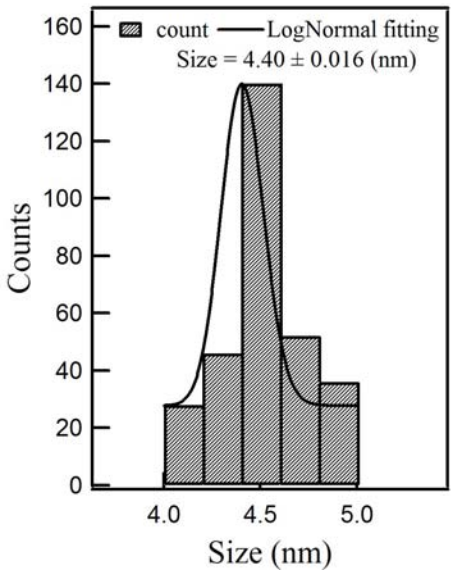

Figure S1. Histogram of size distribution and Log(normal) fitting (solid line) from more than 300 randomly selected nanocrystals as shown in **Fig. 1a**.

Reaction conditions and characterization for reproducibility study as shown in Fig 3

All twelve separate reactions were carried out in CEM Discovery single mode microwave reactor. The microwave power output was 300W in a fixed power mode. First, 5 mL of 0.012M Cd-TDPA-ODE stock solution and 1.2 mL of 0.1M Te-TBP-ODE stock solution were loaded into a 35mL vessel in the Ar-filled glove box. After the vessel was sealed by a snap cap and transferred into the microwave cavity, it was heated to 280˚C by 300W microwave irradiation in a rate of 35˚C/min. The reaction was held for 15 minutes, and then quickly cooled to a temperature < 60˚C by forced-air flow. The CdTe nanocrystals were finally purified by precipitation and decantation.

All absorption spectra as shown in **Figure 3** were recorded on a UV-Vis-NIR spectrophotometer (Varian Cary 5000). The CdTe nanocrystals were dispersed in chloroform in 1cm cuvette for all measurements.