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Supporting Information

Tunable luminescence in full color region based on CdSe/Eu_xSe_y Hybrid Nanocrystals

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Experimental section

Materials

1-octadecene (90%) and oleic acid (90%) were purchased from Aldrich. Selenium powder (99.5%) was purchased from Alfa Aesar. Cadmium acetate dehydrate [$Cd(OAc)_2\cdot(H_2O)_2$], toluene, methanol and acetone were used in all processes. All the chemicals were used as purchased without purification. Europium trichloride hexahydrate [$EuCl_3\cdot(H_2O)_6$] was prepared from europium oxide [Eu_2O_3] treated with hydrochloric acid (36.5 wt%).

Synthesis of the green emission CdSe QDs.

The CdSe QDs was synthesized according to previous reported by Peng and co-workers[23] with a slight improvement. The solution containing $Cd(OAc)_2\cdot(H_2O)_2$ (100 μmol, oleic acid (0.8 mL) and octadecene (4.2 mL) was degassed at room temperature and was heated up to 120 °C under dynamic vacuum for 1 h with stirring. Then was switched to nitrogen and heated to 300 °C, and stabilized at this temperature for 10 min. A stock solution of selenium power (3.9 mg, 50 μmol) dispersed in octadecene (2 mL) was then quickly injected, causing a sudden drop in temperature to ca. 275 °C. The mixture reached up to 300 °C and the growth reaction was continued at this temperature for 10 min. The temperature of the solution was suddenly dropped under 100 °C in water bath. The result nanocrystals were precipitated by addition of excess acetone rinsed with methanol and then was dispersed in 10 ml toluene. The sample was labeled as **CdSe**.

Synthesis of the yellow emission CdSe/Eu_xSe_y hybrid NCs by method 1.

The solution a of $EuCl_3\cdot(H_2O)_6$ (20 μmol), oleic acid (0.25 mL) and octadecene (2.0 mL) and solution b containing $Cd(OAc)_2\cdot(H_2O)_2$ (80 μmol), oleic acid (0.55 mL) and octadecene (2.2 mL) was degassed at room temperature and was heated up to 120 °C under dynamic vacuum for 1 h with stirring, respectively. The solution a and b was mixed at room temperature and then was degassed at room temperature and heated up to 120 °C under dynamic vacuum for 1 h with stirring. The resulting clear homogeneous mixture was switched to nitrogen, heated to 300 °C, and stabilized at

this temperature over 10 min. Then a stock solution of selenium power (3.9 mg, 50 μmol) was quickly injected as well as **CdSe**. The temperature of the solution was suddenly dropped under 100 °C in water bath. The CdSe/Eu_xSe_y hybrid nanocrystals were precipitated as same as prepared **CdSe** and then were dispersed in 10 ml toluene. This method was called method **1.** The sample was named as **1-20.** Using the same method, the sample with purple emission (Eu 40 μmol and Cd 60 μmol, named **1-40**) and dark blue emission (Eu 80 μmol and Cd 20 μmol, named **1-80)** were prepared.

Synthesis of the red emission CdSe/Eu_xSe_y hybrid NCs by method 2.

The mixture of $EuCl_3{\cdot}(H_2O)_6$ (20 μmol), $Cd(OAc)_2{\cdot}(H_2O)_2$ (80 μmol), oleic acid (0.8 mL) and octadecene (4.2 mL) was in one 50 ml flask and degassed at room temperature and was heated up to 120 °C under dynamic vacuum for 1 h with stirring, together. The resulting cloudy homogeneous mixture was then switched to nitrogen, heated to 300 °C, and stabilized at this temperature over 10 min. Then a stock solution of selenium power (3.9 mg, 50 μmol) was quickly injected as the prepared process of **CdSe**. The temperature of the solution was suddenly dropped under 100 °C in water bath. The CdSe/Eu_xSe_y hybrid nanocrystals were precipitated as same as **CdSe** and then were dispersed in 10 ml toluene. This method was method **2.** The sample was named as **2-20.** Using the same method, the sample with orange-red emission (Eu 5 μmol and Cd 95 μmol, named **2-5**) and pure blue emission (40 μmol and Cd 60 μmol, named **2-40**) were prepared.

Characterization Methods.

UV-Vis absorption spectra were obtained by using a Shimadzu 3100 UV-Vis-near-IR spectrophotometer. Photoluminescence (PL) experiments were performed with the help of a Shimadzu RF-5301 PC spectrofluorimeter and tested in toluene solution. The relative PL quantum yields of all samples were estimated using Rohodamine 6G as reference. All optical measurements were performed at room temperature under ambient conditions. Structural and compositional characterizations were performed by Transmission electron micrographs (TEM), energy-dispersive X-ray (EDX), and powder X-ray powder diffraction (XRD) at room temperature. TEM was recorded by a JEOL-2010 electron microscope operating at 200 kV.

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HRTEM and EDX were characterized by TECNAI F20 transmission electron microscope (TEM) operating at 200 kV. For TEM characterization the purified sample stored in toluene was deposited on a carbon-coated copper grid. XRD was carried out using a Siemens D5005 diffract meter using Cu Kα (1.5418Å) radiation. The XRD samples were prepared by depositing the purified nanocrystals on quartz plates.

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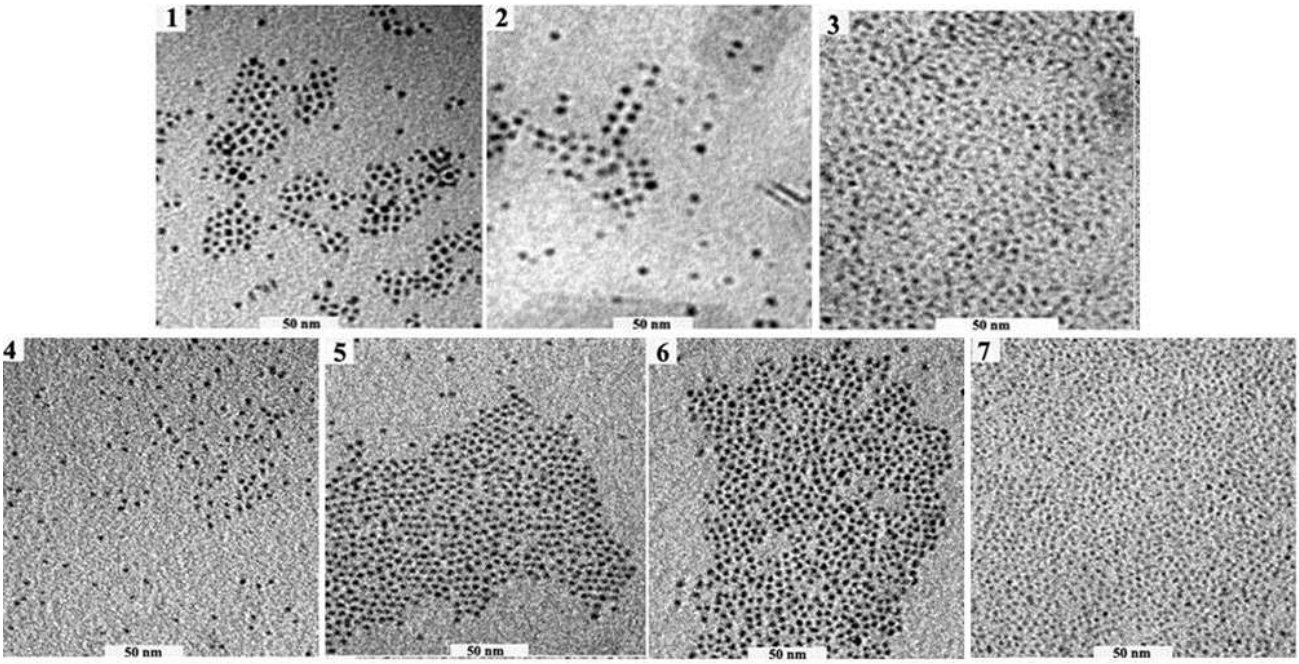

Figure S1 A large view of TEM images of fig 3.:1,**2-40**; 2,**1-80**; 3,**CdSe**; 4,**1-20**; 5,**1-40**; 6,**2-5**; 7, **2-20**.

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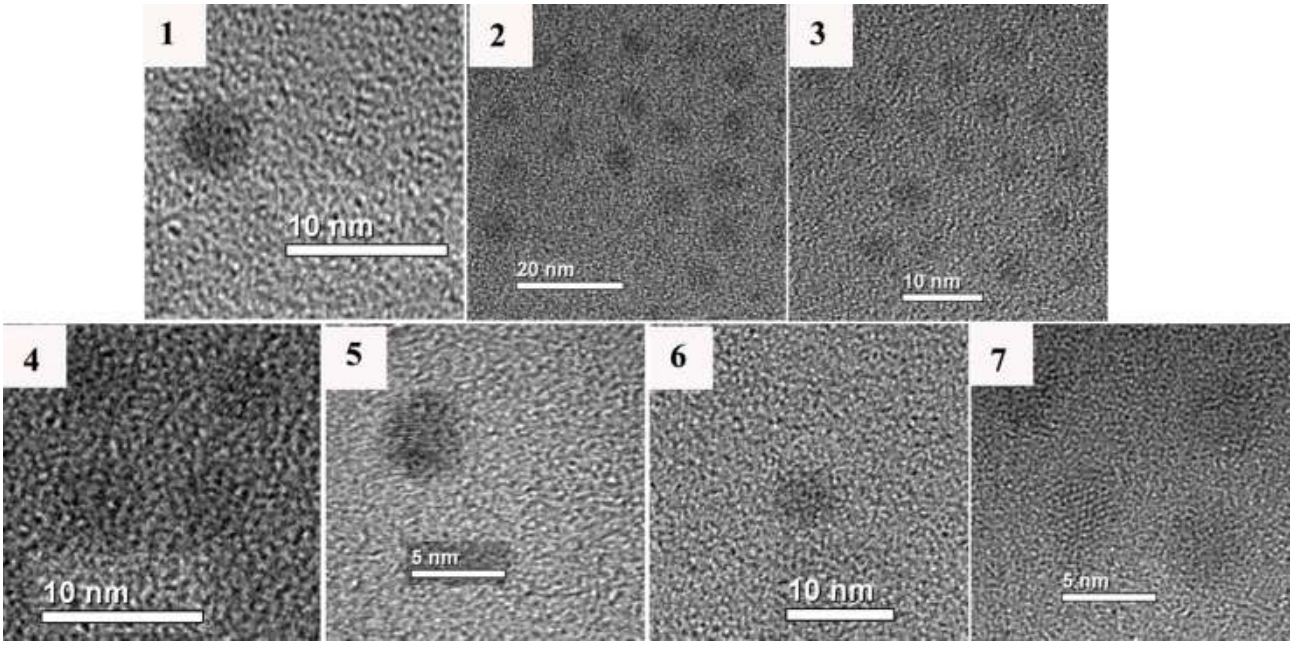

Figure S2 HRTEM images of the synthesized CdSe/Eu_xSe_y hybrid nanocrystals.:1,**2-40**; 2,**1-80**; 3,**CdSe**; 4,**1-20**; 5,**1-40**; 6,**2-5**; 7, **2-20**.

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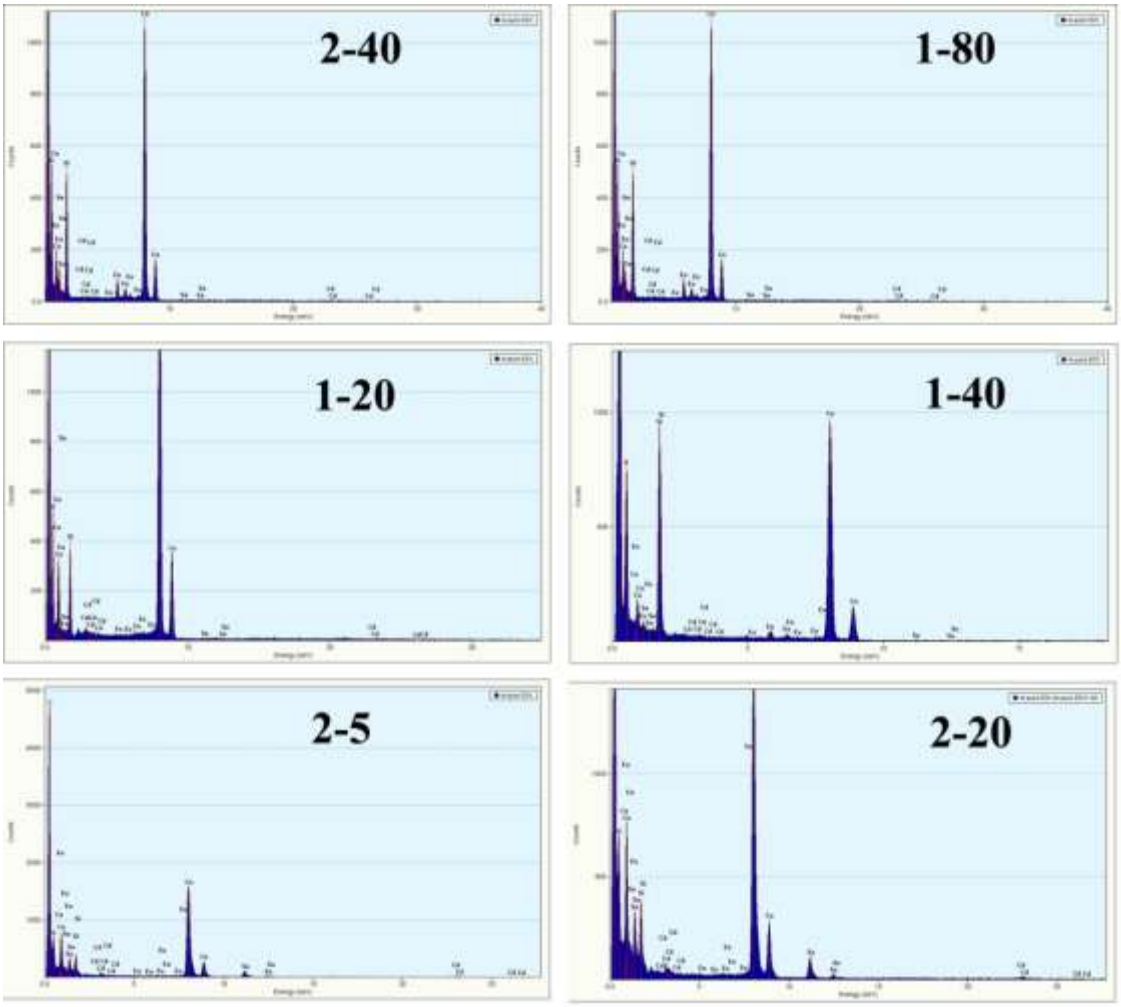

Figure S3 The energy-dispersive X-ray (EDX) images of as-prepared CdSe/Eu_xSe_y hybrid nanocrystals