Electronic Supplementary Information

Experimental:

The preparation of CdTe@Co(OH)$_2$ composite nanoparticles was preformed using the following procedure. Firstly, highly luminescent CdTe was prepared by adding NaHTe into CdCl$_2$ solution containing mercaptopropionic acid (MPA) (pH 8-9). The typical molar ratio of Cd:Te:MPA was 2:1:4.8 in the our experiments. When the desired sizes of CdTe nanocrystals reached, Co(NO$_3$)$_2$ solution (0.01 M) was injected into the colloid solution (Cd, 1.25×10^{-3} M), and the molar ratio of Co: Cd was controlled within 1:1~1:10. The Co(NO$_3$)$_2$ solution was multi-injected for avoid the agglomeration of the particles caused by the suddenly increasing of ions strength. Typically, at the reflux time of 7 h, 8 ml 0.01 M Co(NO$_3$)$_2$ solution was injected into 250ml colloid solution (sample **S0** in Figure1) and further refluxed 1h (the sample **S1** in Fig 1 was taken from this stage), and then another 8 ml of 0.01 M Co(NO$_3$)$_2$ solution was injected and continued refluxing for 1h, the final sample **S2** in Fig 1 was obtained. The size of CdTe core was controlled by the reflux time of CdTe colloid solution. The Co(OH)$_2$ shell thickness were controlled by the adding amount of Co in solution, which determined the magnetism of nanoparticles too. The as prepared colloid samples were diluted for optical characterizations, and precipitated by 2-propanol for the XRD and magnetic characterisations.
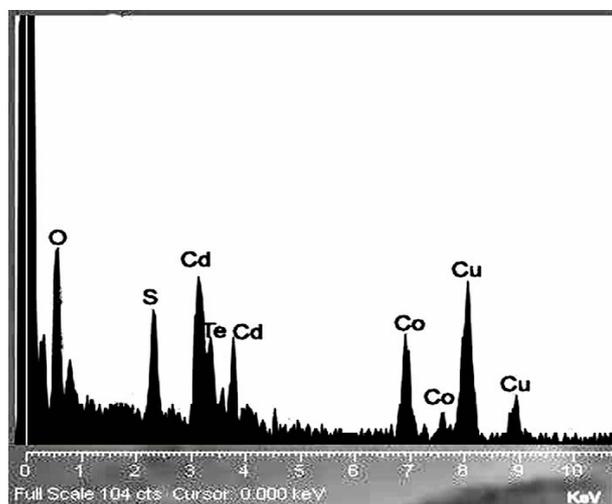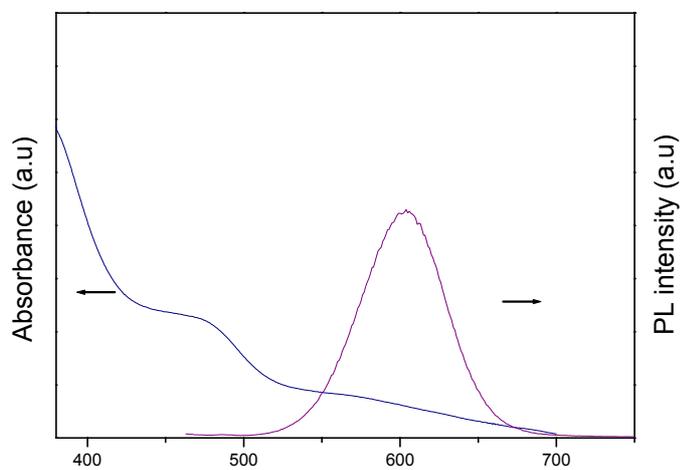
Figure S1. The EDX spectrum of sample S2

Figure S2. Absorption and photoluminescence spectra of the sample emerged in Figure 2, b. (the sample synthesized at the Co/Cd mole ratio 1 /1.25.)
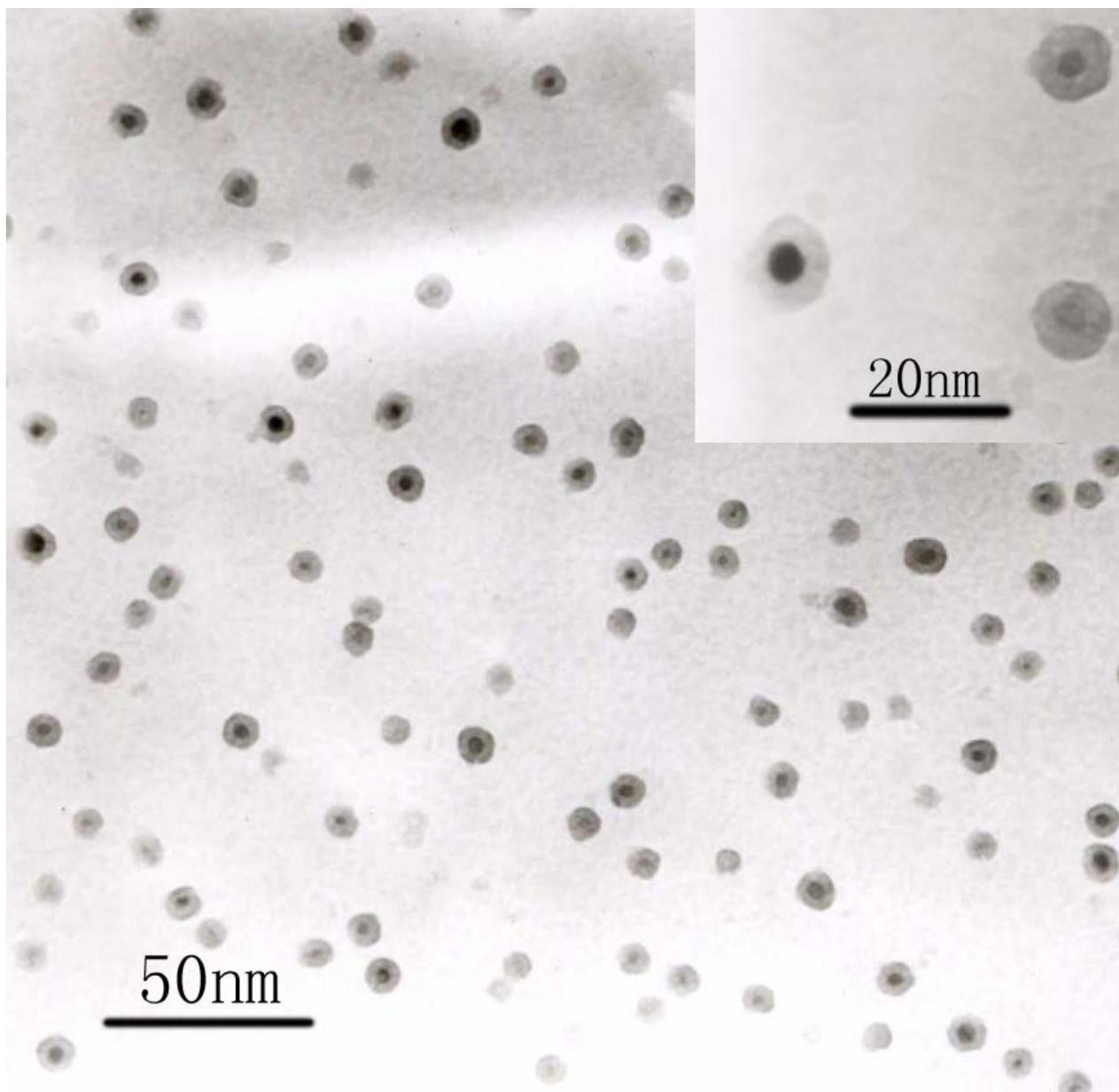
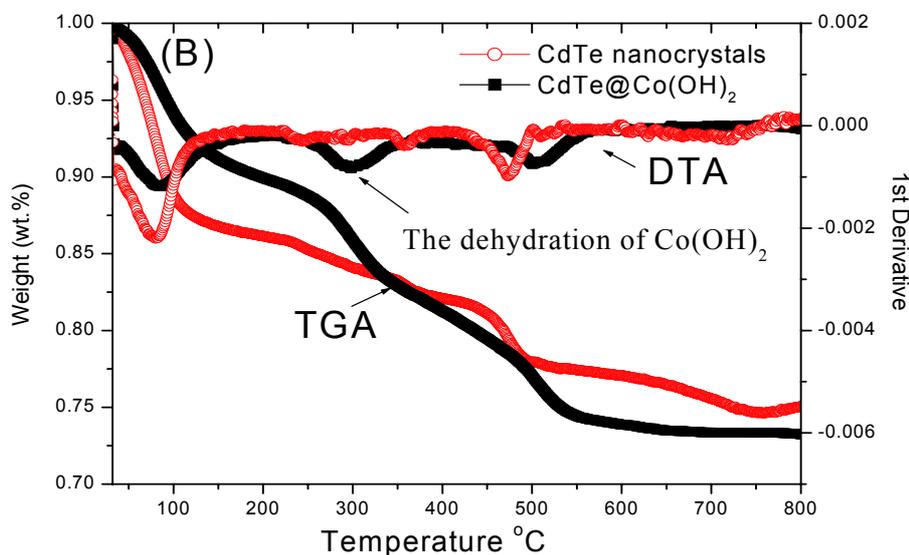**Figure S3:** The enlarged figure 2 (b).

Figure S4. DTA and TGA data of bare core CdTe nanocrystals and CdTe@Co(OH)$_2$ composite nanoparticles.

Notice: In both cases, the first weight-loss step below 150 ^{o}C was due to removal of various types of water. Different from the CdTe nanocrystals, the latter curve had a weight-loss peak at ambient from 206 ^{o}C to 301 ^{o}C, which was probably due to the loss of water produced by dehydration of the cobalt hydroxide. This data was nearly same as the TG data of cobalt hydroxide shown previously. [1-4]

(1)   Xu, R.; Zeng, H. C. *J. Phys. Chem. B* **2003**, *107*,12643.

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(3)   Zhu, Y. G; Li, H. L.; Yuri, K.; Aharon, G. *J. Mater. Chem.* **2002**, *12*, 729.

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     2000, *35*, 271.