Walnut-like CdS *micro*-particles/single-walled carbon nanotube hybrids: one-step hydrothermal route to synthesis and their properties

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Supporting Information

Preparation of CdS MPs/carbon microsphere and CdS MPs/SiO_2 microsphere: Carbon microsphere was prepared via the polycondensation reaction of glucose according to our previous work.[1-2] SiO_2 microspheres were synthesized by hydrolysis of TEOS with aqueous ammonia, according to the reported method by Stőber et al.[3]100 mg of as-prepared carbon and SiO_2 microsphere was added into 45 ml of 10 mM $CdCl_2$ aqueous solution and sonicated for 15 min, respectively. Then follow the same procedures as the preparation of CdS MPs/SWCNT hybrids.

Characterization: Fourier Transform Infrared Spectroscopy (FTIR) was carried out using Thermal Fisher, Nicolet IS10 Spectrometer.

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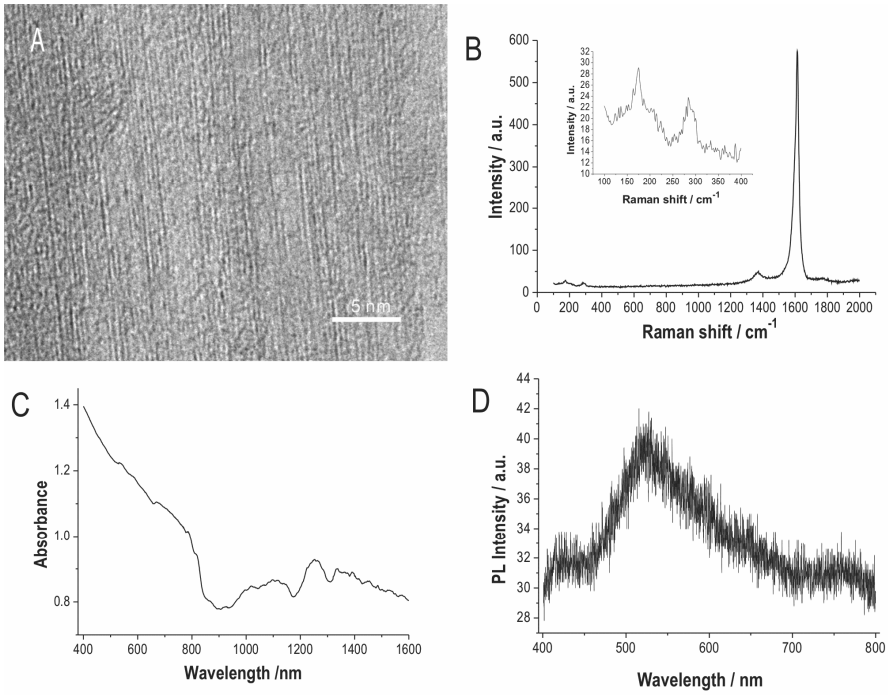

Fig. S1 A) HRTEM image of the SWCNTs. SWCNT bundles can be clearly seen. B) Raman spectra of the treated SWCNTs. The inset exhibits the RBM region in the Raman spectrum. The diameter of the SWCNTs is in the range from 0.8 to 1.5 nm calculated by the RBM peaks. The intensity of G peak is much higher than that of G peak, indicating that there might be little graphite carbon in the sample. C) NIR (Near-Infrared) absorption spectrum of SWCNTs shows there are metallic species and semiconducting species in the SWCNTs sample. D) Photoluminescence of SWCNTs. The broaden peak might be attributed to the bundle form of the SWCNTs.

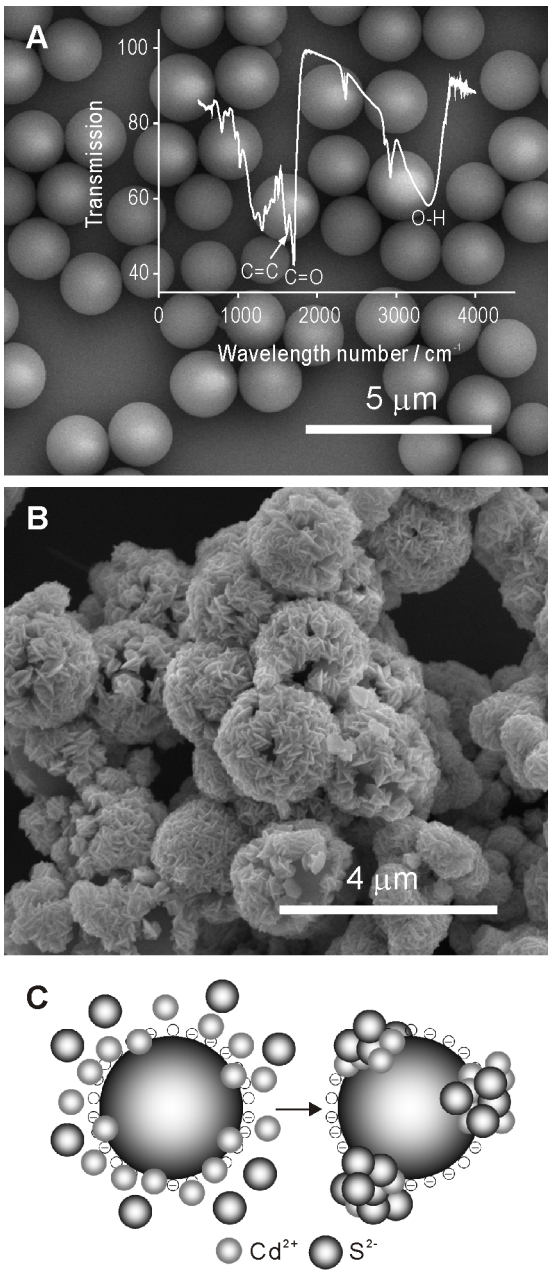

Fig. S2 A) Carbon microspheres; B) CdS MPs/carbon microsphere hybrids. The MPs shows walnut-like shape and are clearly attached to the carbon microspheres surface. The inset is the FTIR spectrum of pure canbon microspheres. C) Schematic illustration of the coordination between the CdS MPs and carboxylated carbon microsphere.

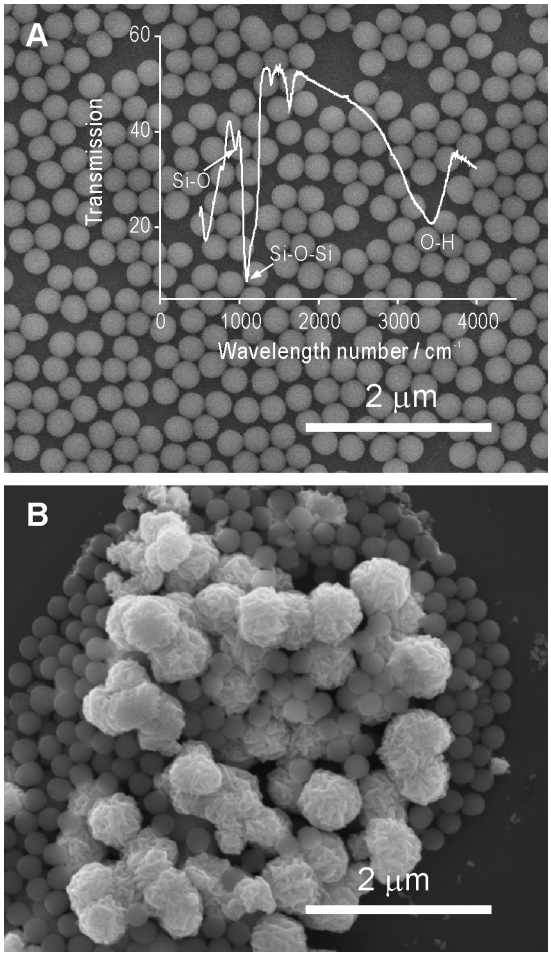

Fig. S3 A) SiO_2 microspheres. The diameter is about 250 nm. The introduction of hydroxyl groups is to improve the wettability of SiO_2 microspheres. The inset is the FTIR spectrum of pure SiO_2 microspheres. B) CdS MPs obtained after 12 h in the presence of SiO_2 microspheres. The diameter is about 350-400 nm. The MPs show a walnut-like morphology which is similar to that in the absence of SWCNTs and are clearly not attached to SiO_2 surface.

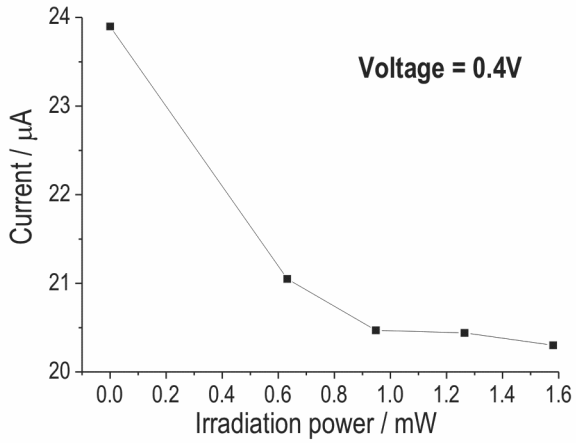

Fig. S4 The dependency of I-V characteristic on the irradiation power. The voltage between the two electrodes is 0.4 V, and the wavelength of the light is 470 nm.

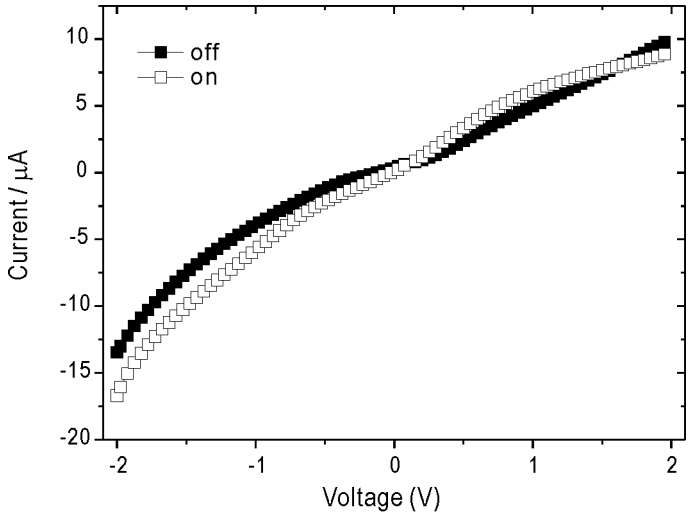

Fig. S5 Typical I-V characteristic of the mixture of CdS MPs and SWCNT with and without illumination.

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