

## ***Electronic Supplementary Information***

### **One-dimensional CdS nanowires-CeO<sub>2</sub> nanoparticles composites with boosted photocatalytic activity**

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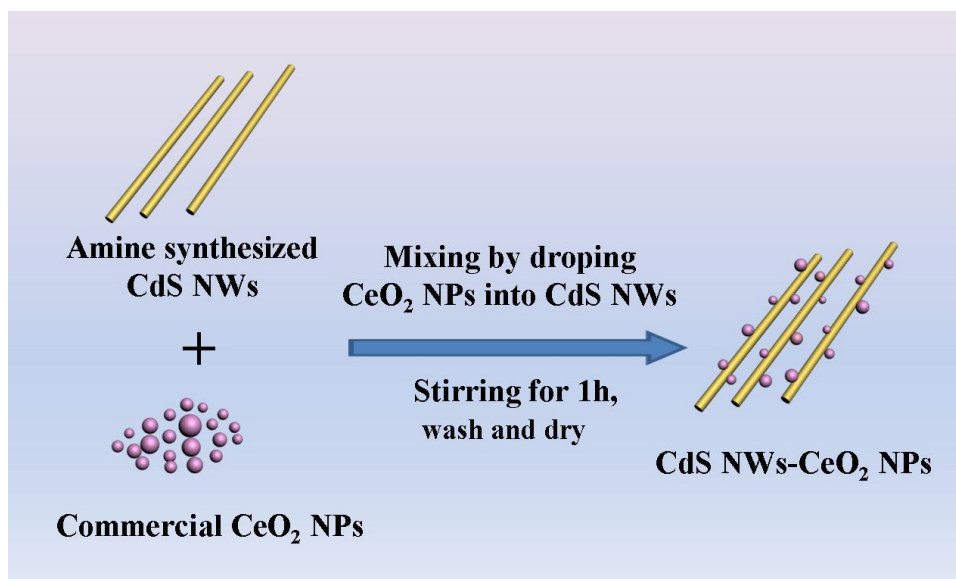
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### **Experimental Section**

#### ***Synthesis of CdS nanowires (CdS NWs).***

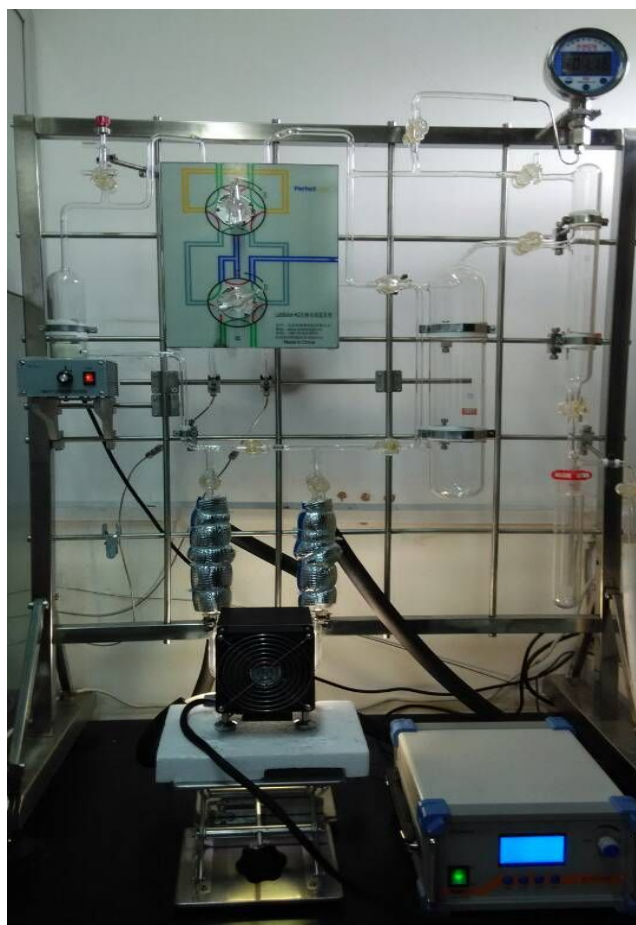
Uniform CdS NWs were prepared according to a method described earlier.<sup>S1-S2</sup> Briefly, 1.124 g of cadmium diethyldithiocarbamate (Cd(S<sub>2</sub>CNEt<sub>2</sub>)<sub>2</sub>), which was prepared by precipitation from a stoichiometric mixture of sodium diethyldithiocarbamate trihydrate and cadmium chloride in deionized water, was added to a Teflon-lined stainless steel autoclave with a capacity of 50 mL. After that, the autoclave was filled with 40 mL of ethylenediamine to about 80% of the total volume and maintained at 180 °C for 24 h. The resulting composites were separated by centrifugation and washed with absolute ethanol and deionized water to remove residue of organic solvents. After drying at 60 °C for 12 h, the CdS NWs were obtained.



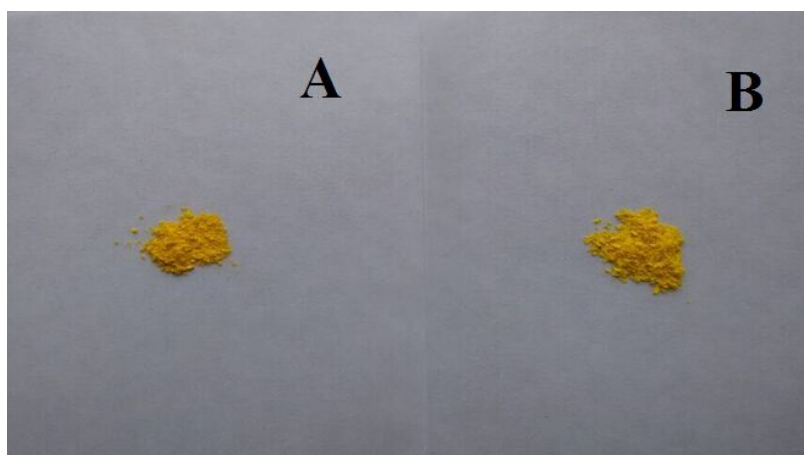
**Scheme S1.** The schematic illustration for synthesis of CdS NWs-CeO<sub>2</sub> NPs composites *via* a facile method at room temperature.



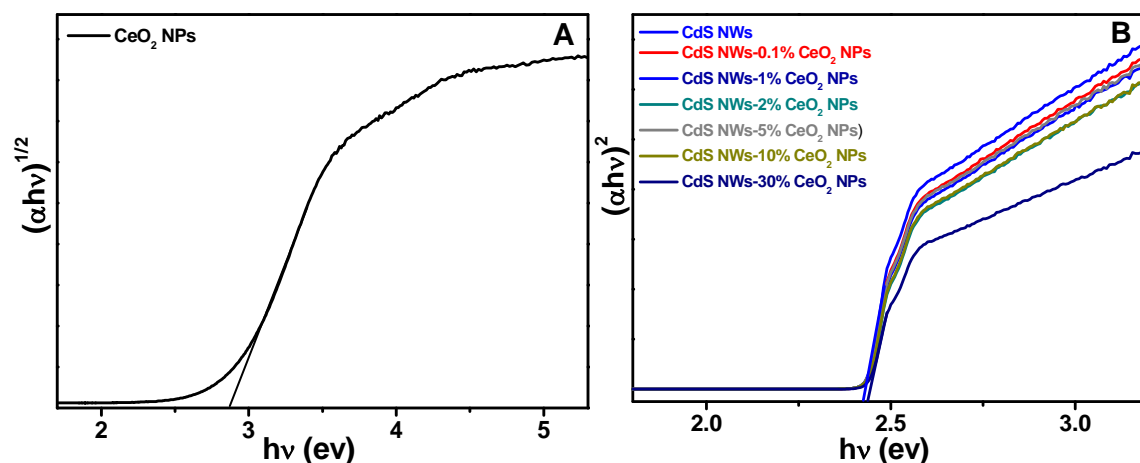
**Fig. S1** Photograph of the experimental setup for photocatalytic reduction of aromatic nitro compounds.



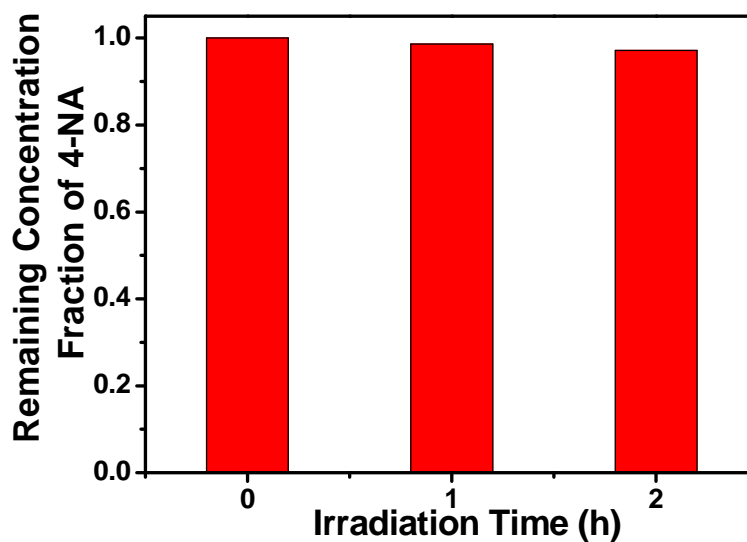
**Fig. S2** Photograph of the experimental setup for photocatalytic water-splitting to hydrogen.



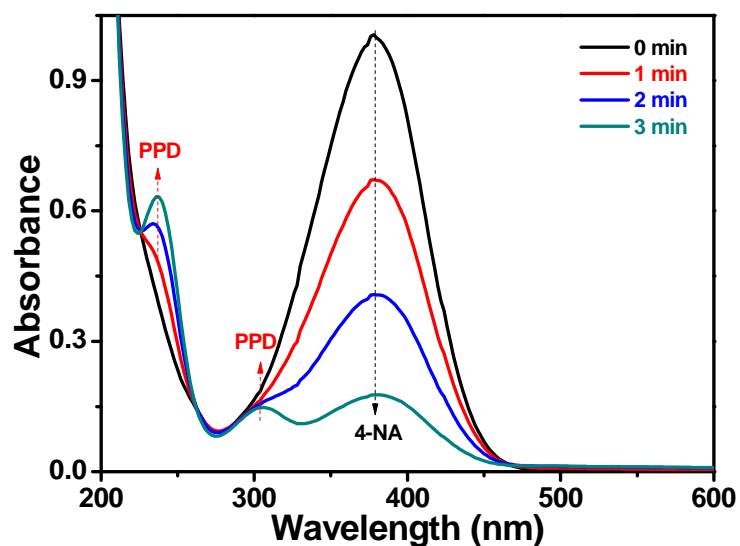
**Fig. S3** Photographs of the samples of CdS NWs (A) and CdS NWs-1% CeO<sub>2</sub> NPs composite (B).



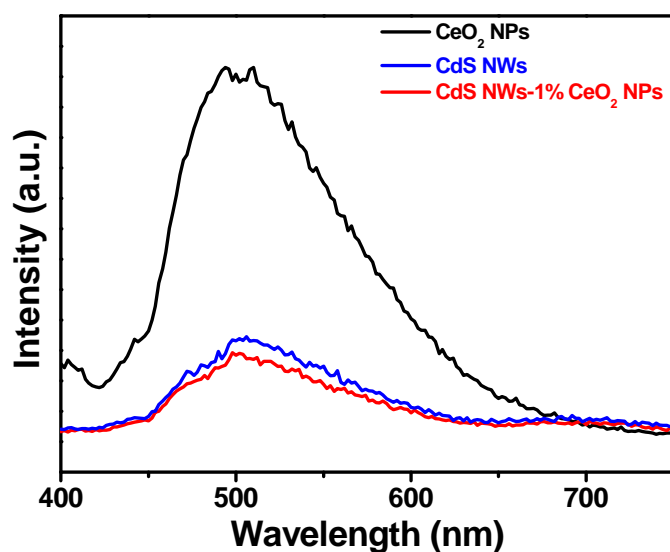
**Fig. S4** The plots of transformed Kubelka-Munk function versus the energy of light for  $\text{CeO}_2$  NPs (A), CdS NWs and CdS NWs- $\text{CeO}_2$  NPs composites (B).



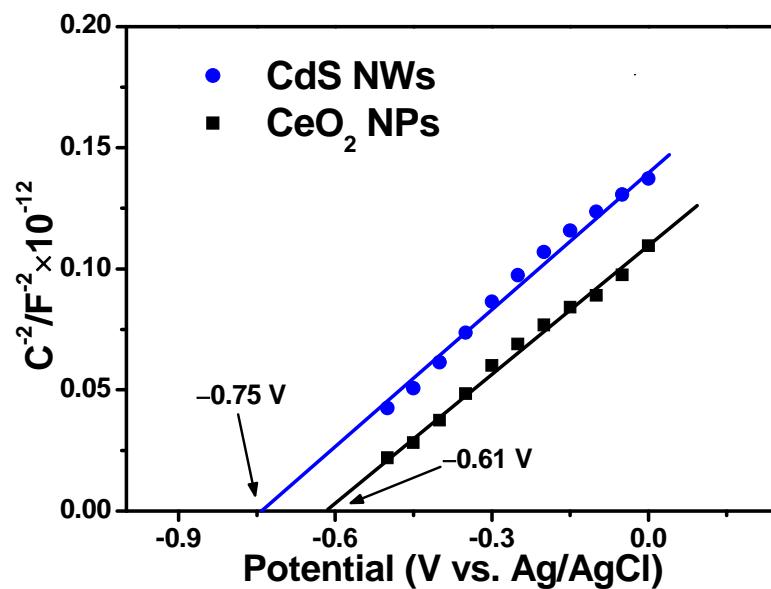
**Fig. S5** Bar plots showing the remaining concentration fraction of 4-nitroaniline (4-NA) after a certain time of visible light irradiation over  $\text{CeO}_2$  NPs.



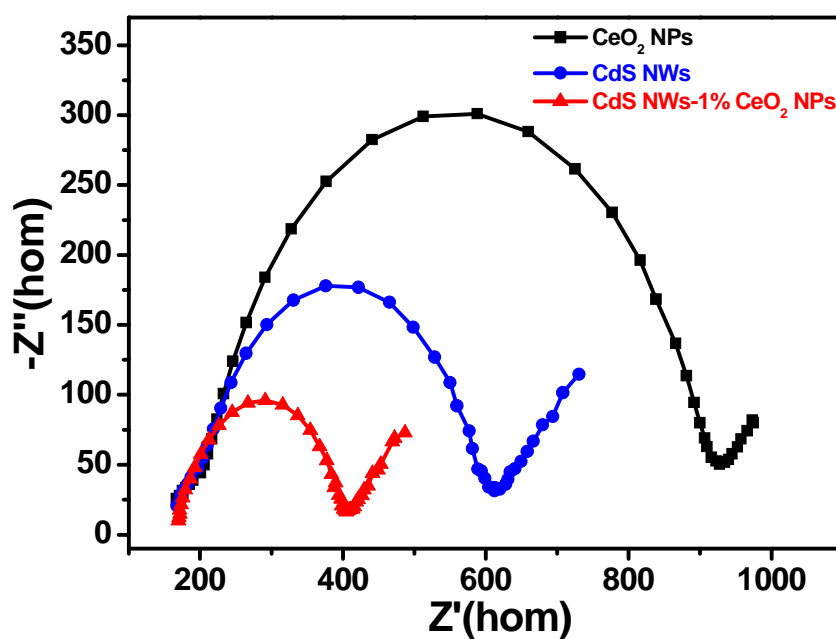
**Fig. S6** Time-dependent UV-vis spectral variation during the photocatalytic reduction of 4-nitroaniline (4-NA) to *p*-phenylenediamine (PPD) over CdS NWs-1%CeO<sub>2</sub> NPs composite under visible light irradiation ( $\lambda > 420$  nm) with the addition of ammonium formate as a quencher for photogenerated holes and N<sub>2</sub> purge at room temperature in the aqueous phase. The peak located at 380 nm is attributed to 4-NA and the peaks at 300 nm and 240 nm are ascribed to PPD.



**Fig. S7** Photoluminescence (PL) spectra of CeO<sub>2</sub> NPs, CdS NWs and CdS NWs-1%CeO<sub>2</sub> NPs composite with an excitation wavelength of 380 nm.



**Fig. S8** Mott-Schottky plots for CeO<sub>2</sub> NPs and CdS NWs in 0.2 M Na<sub>2</sub>SO<sub>4</sub> aqueous solution (pH = 6.8).



**Fig. S9** Nyquist impedance plots of CeO<sub>2</sub> NPs, CdS NWs and CdS NWs-1% CeO<sub>2</sub> NPs composite under visible light irradiation ( $\lambda > 420$  nm).

**Table S1.** Summary of the Brunauer-Emmett-Teller (BET) surface area and pore volume of CeO<sub>2</sub> NPs, CdS NWs and CdS NWs-1%CeO<sub>2</sub> NPs composite.

Samples	S <sub>BET</sub> (m <sup>2</sup> /g)	Total pore volume (cm <sup>3</sup> /g)
CeO <sub>2</sub> NPs	8.2	0.02
CdS NWs	28.9	0.15
CdS NWs-1% CeO <sub>2</sub> NPs	24.5	0.12

## References

1. J. Cao, J.-Z. Sun, H.-Y. Li, J. Hong and M. Wang, *J. Mater. Chem.*, 2004, **14**, 1203-1206.
2. L. Wang, H. W. Wei, Y. J. Fan, X. Gu and J. H. Zhan, *J. Phys. Chem. C*, 2009, **113**, 14119-14125.