Supporting information for

**Enhanced visible light photocatalytic activity of CeO2@Zn0.5Cd0.5S by facile Ce(IV)/Ce(III) cycle**

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**Experimental**

***Synthesis of CeO2;*** CeO2sample was synthesized by a simple hydrothermal method. Typically, 1 g of Ce(NO3)3.6H2O was dissolved in 35 mL of double distilled water under stirring. Then, 5 mL of 2M NaOH solution was added drop wise into the solution under vigorous stirring and stirred for 30 min. Subsequently solution was transferred into a 50 mL Teflon cup stainless steel autoclave and processed at 180o C for 12h. After reaction for 8 h, the autoclave was cooled to room temperature naturally; the solid was washed with distilled water and ethanol several times, respectively; and collected *via* centrifugation. Finally, the solid was dried at 60ο C in an oven overnight.

### Fig. S1



**(f)**

***h+***

***e-***

O2/O2•- = -0.28 V

**0**

**-2**

**-1**

**1**

**2**

•OH /H2O = 2.38 V

**CB -0.29 V**

**CeO2 3.10 eV**

**VB 2.81 V**

Potential (V) *vs.* SHE

**Fig. S1** (a) XRD pattern; **(b)** SEM image; **(c)** UV-DRS spectrum; **(d)** Tauc plot;

**(e)** Mott–Schottky plot; **(f)** Energy band potentials of CeO2

**Figure S2**



**Figure S2** XPS survey spectra of the sample