

## Supporting information for the manuscript

# Transforming CdS into an efficient visible light photocatalyst for selective oxidation of saturated primary C–H bonds under ambient conditions

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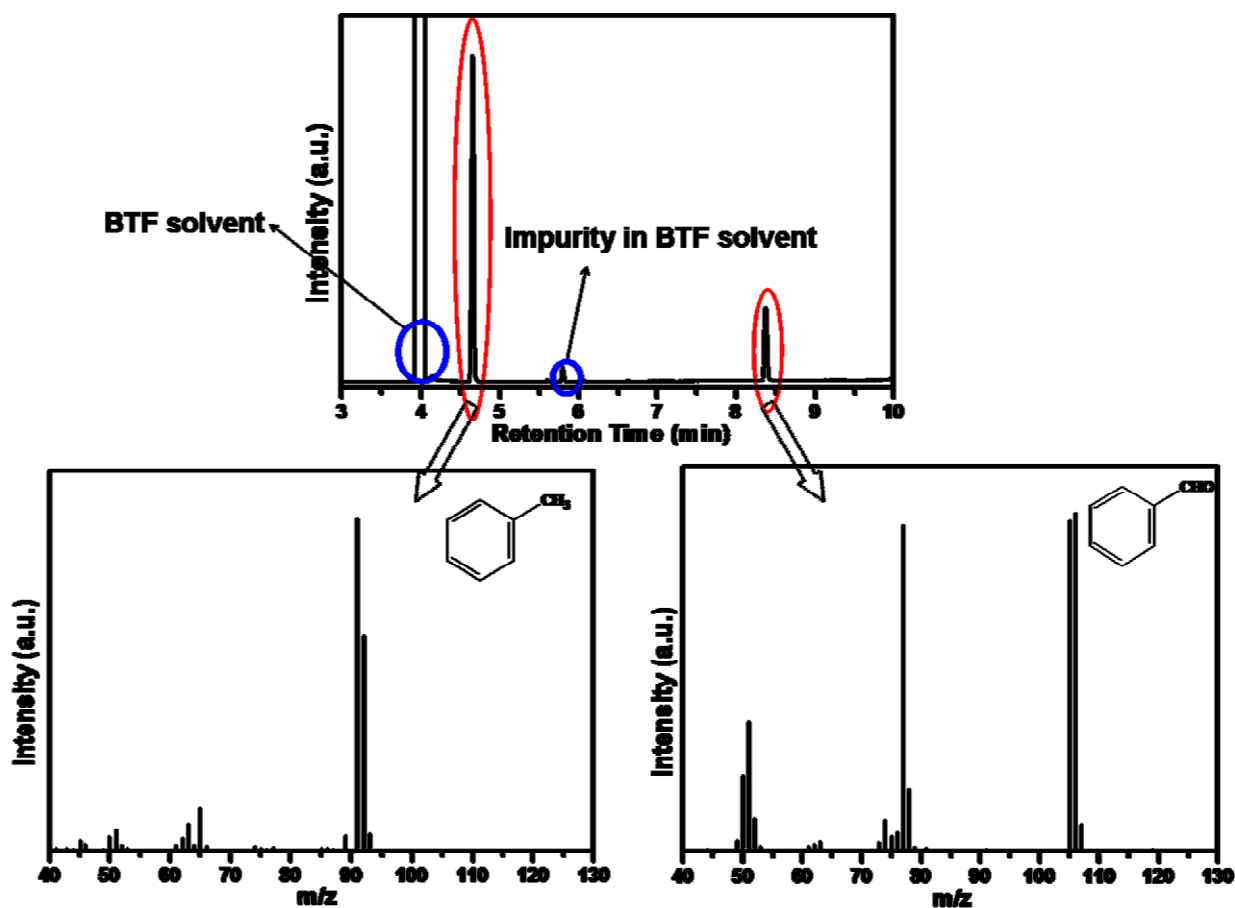
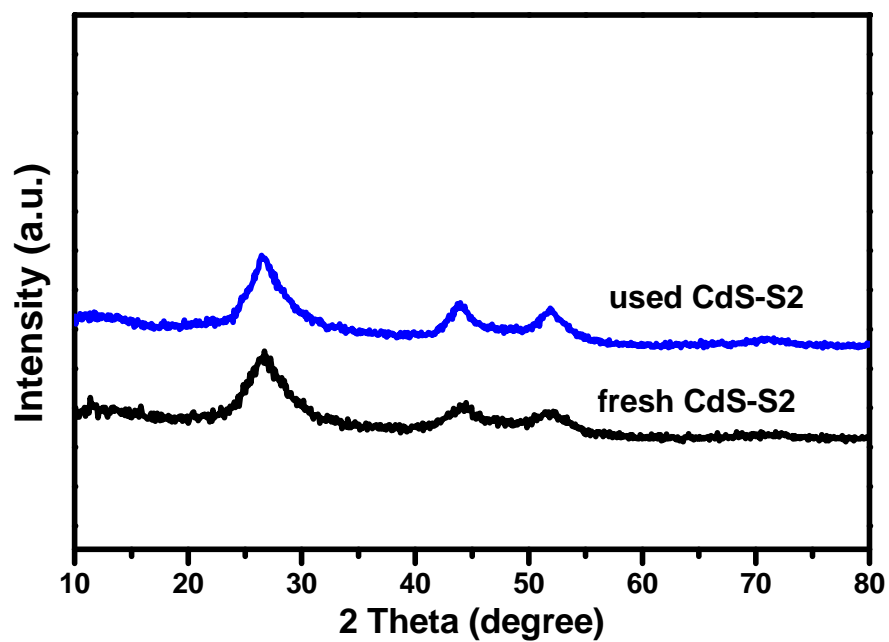
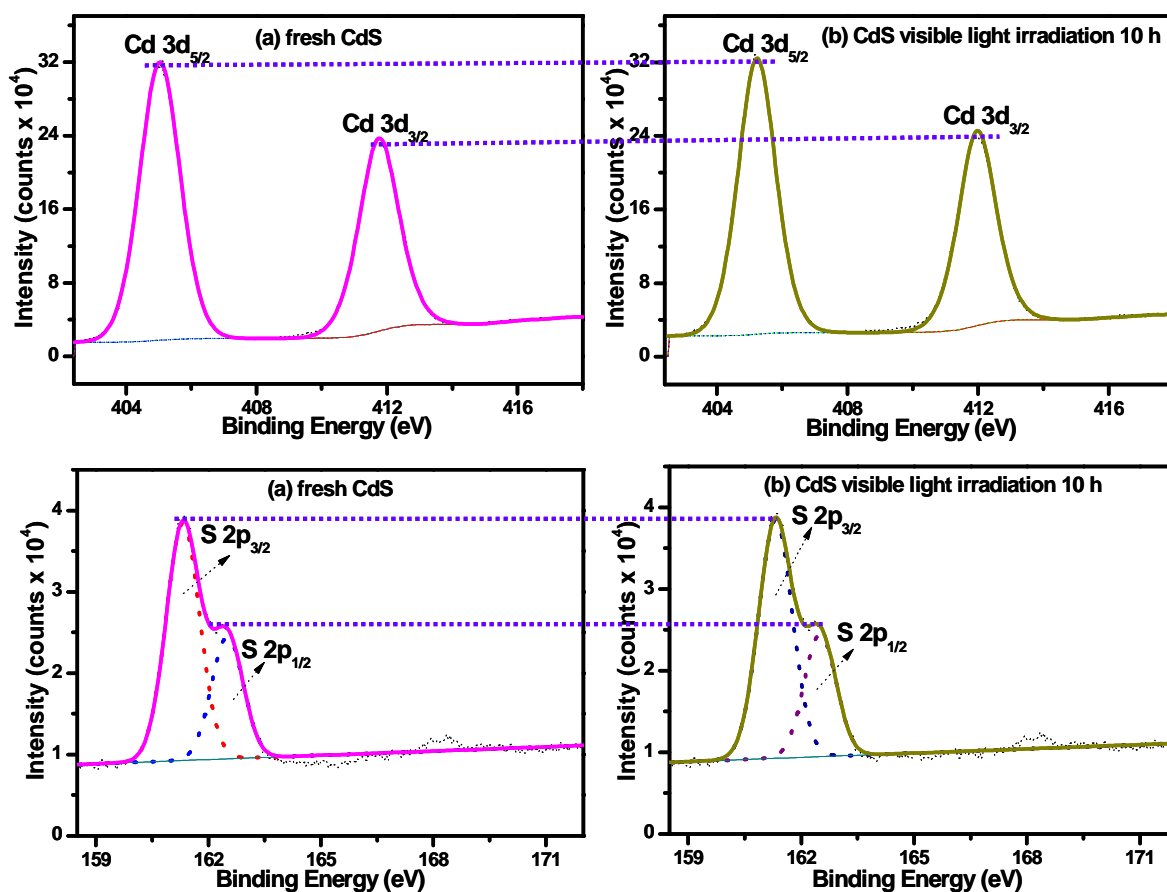


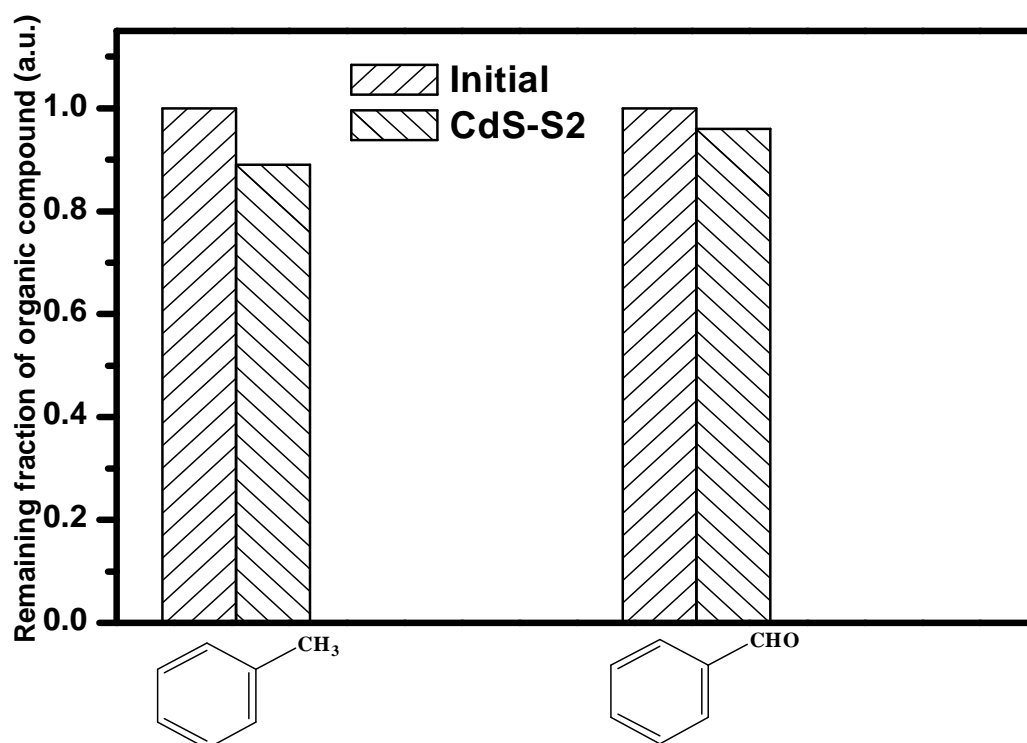
Fig. S1 The spectra of GC and GC-MS to identify toluene and benzaldehyde in the reaction system.



**Fig. S2** Contrast XRD patterns of the fresh CdS-S2 and used CdS-S2 after photocatalytic selective oxidation of toluene under visible light irradiation.



**Fig. S3** Contrast XPS spectra of fresh CdS-S2 and used CdS-S2 samples after visible light irradiation; the typical Cd 3d spectra with normalized intensity for fresh and used CdS-S2 samples (upper figure), and the typical S 2p spectra with normalized intensity for fresh and used CdS-S2 samples after visible light irradiation (lower figure).



**Fig. S4** Bar plot showing the remaining fraction of toluene and benzaldehyde after the adsorption-desorption equilibrium is reached in the dark over the as-prepared optimum CdS-S2 photocatalyst.

**Table S1** The detailed estimation of average crystallite size for commercial CdS and sphere CdS-1 with hexagonal phase.

2θ (deg)	hkl	D <sub>hkl</sub> (nm)	
		Sphere CdS-1	Commercial CdS
24.8	(100)	2.2	25.1
26.5	(002)	3.1	29.5
28.2	(101)	2.0	20.8
43.7	(110)	2.2	26.9
47.8	(103)	1.5	23.1
51.8	(112)	1.6	35.1

The average crystallite size for sphere CdS-1 is about **2.1 nm**=(2.2+3.1+2.0+2.2+1.5+1.6)/6; the average crystallite size for commercial CdS is about **26.7 nm**=(25.1+29.5+20.8+26.9+23.1+35.1)/6.