Supporting Information

Efficient photocatalytic water splitting through titanium silicalite stabilized CoO nanodots

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1. Experimental section

1.1. Synthesis of CoO

For comparison, CoO was fabricated through a similar procedure to CoO-TS-1. Certain amount of $CoCl_2 \cdot 6H_2O$ was directly put into a porcelain boat and calcinated at 900 °C in a tube furnace under N_2 atmosphere for 4 h. The collected black powder was denoted as CoO.

1.2. Determination of the bandgap (E_g)

The bandgap of the catalyst was calculated according to the following equation:

$$\alpha = A(hv - E_g)^{n/2} / hv$$

(S1)

where α, A, h, v and E_g correspond to the absorption coefficient, proportionality constant, Planck's constant, frequency of the incident light and band energy, respectively (n in the index is equal to 1 for direct band gap, 4 for indirect band gap).[1]

1.3. Determination of the electron transfer number (n)

The electron transfer number was determined through a rotating disk-ring electrodes (RRDE) testing system (RRDE-3A, ALS Co. Ltd). The experiments were carried out in N_2 saturated ultrapure water with a scan rate of 10 mV·s^{-1} and a rotating speed of 1600 rpm. A CHI 920C electrochemical workstation (CH Instruments, Shanghai, China) was employed to record the data. The electron transfer number (n) can be calculated according to the following equation:

$$n = \frac{4I_d}{I_d + I_r/N}$$

(S2)

where Id and Ir represent the disk and ring current, respectively, and N is the

rotating disk-ring electrode (RRDE) collection efficiency determined to be 0.24.[2]

2. Supplementary tables.

Table S1. Inductively Coupled Plasma (ICP) result of CoO content in CoO-TS-1.

Sample	CoO mass fraction (%)
CoO-TS-1	0.5

Table S2. The Brunauer-Emmett-Teller (BET) specific surface area and average pore width of CoO-TS-1 and TS-1.

Sample	Specific surface area ($m^2\ g^{-1}$)	Average pore width (nm)
CoO-TS-1	436.90	4.07
TS-1	322.87	3.88

3. Supplementary Figures.
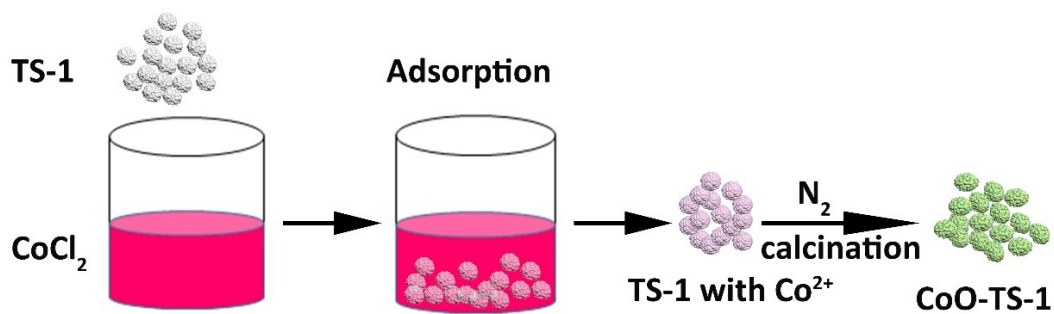
Fig. S1. The schematic diagram for the synthetic process of CoO-TS-1 photocatalysts.
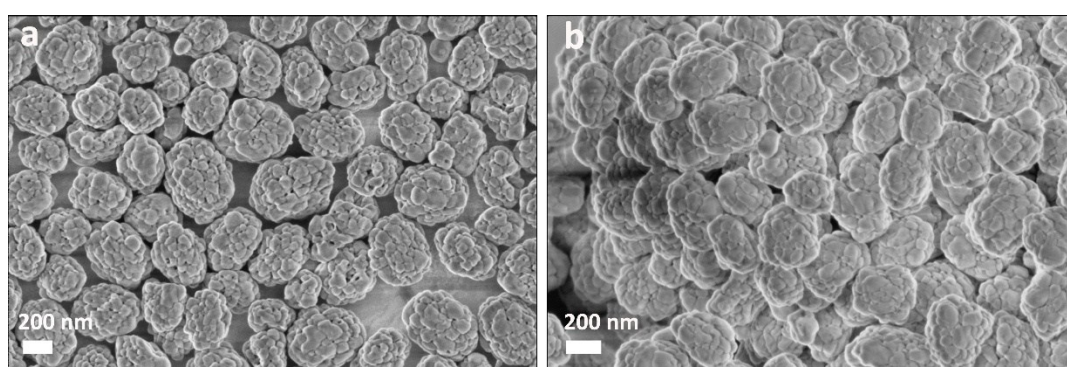
Fig. S2. SEM images of (a) TS-1 and (b) CoO-TS-1.
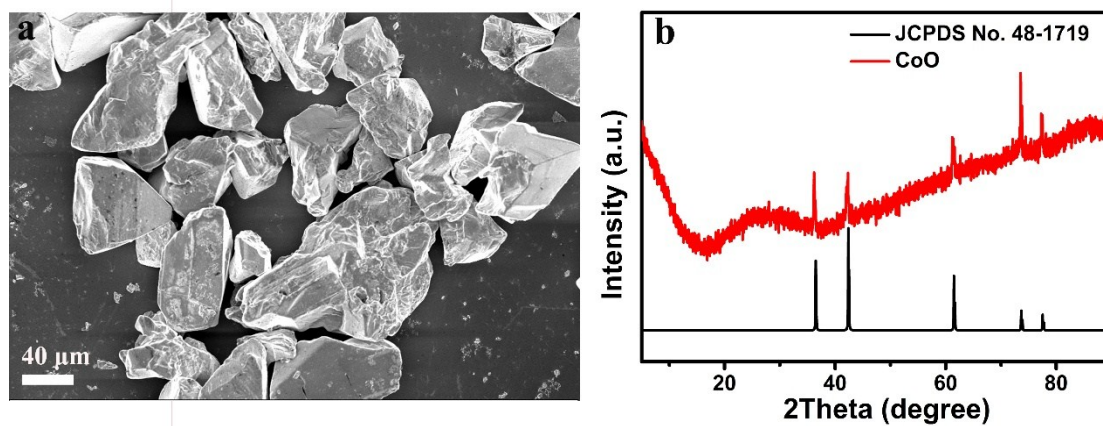
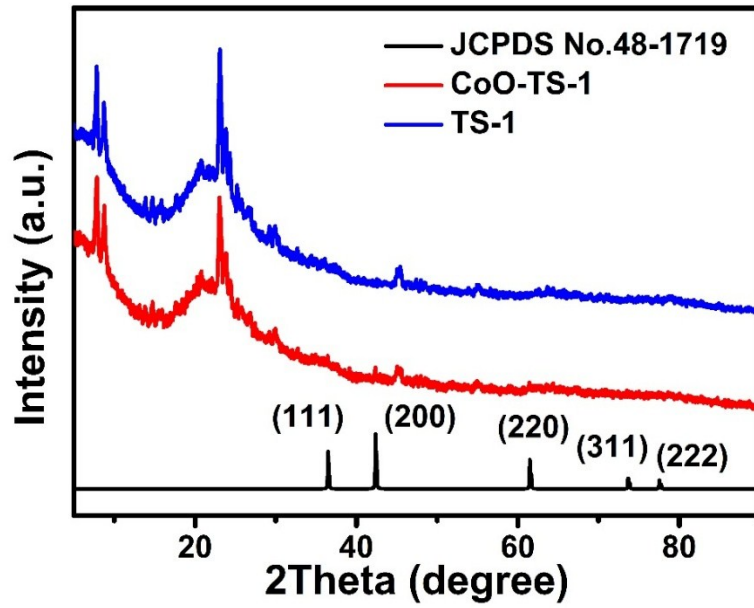**Fig. S3.** (a) SEM images and (b) XRD spectrum of CoO.

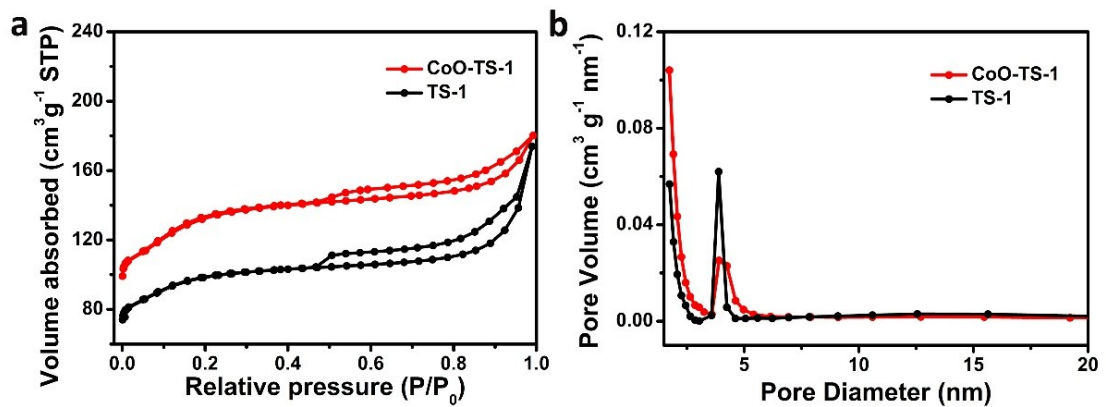**Fig. S4.** XRD spectra of TS-1 and CoO-TS-1.

Fig. S5. (a) N$_2$ adsorption–desorption isotherms for CoO-TS-1 and TS-1. (b) The pore-size distribution curves for CoO-TS-1 and TS-1.
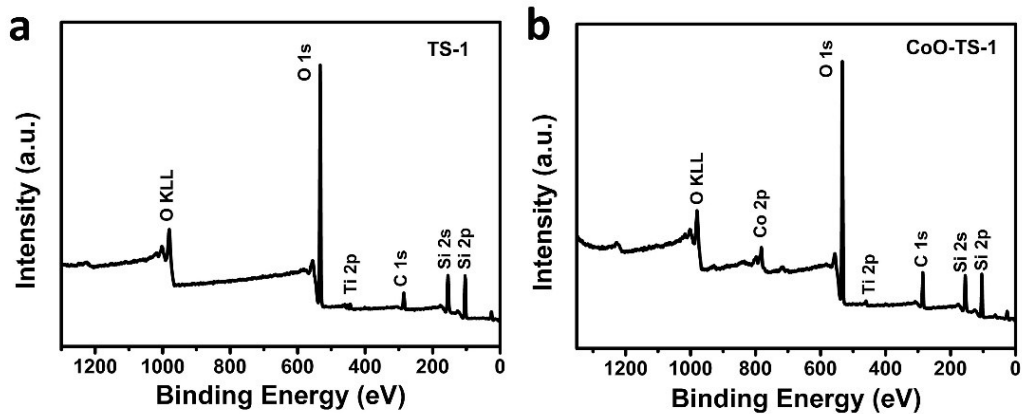
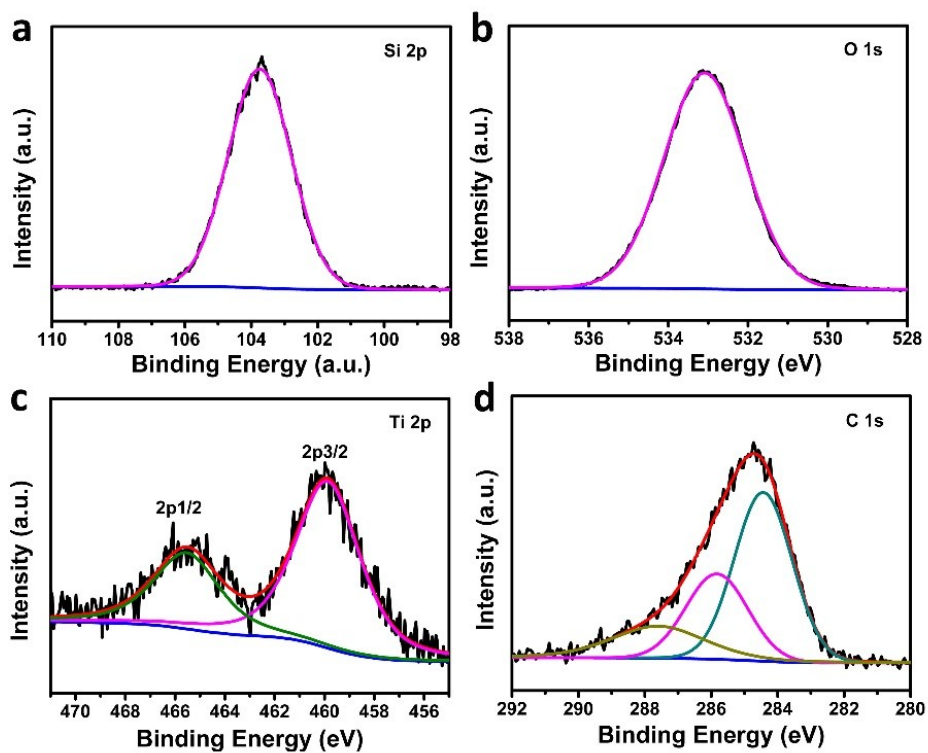**Fig. S6.** Full XPS survey spectra of (a) TS-1 and (b) CoO-TS-1.

Fig. S7. High-resolution XPS spectra of (a) Si 2p, (b) O 1s, (c) Ti 2p and (d) C 1s for TS-1.
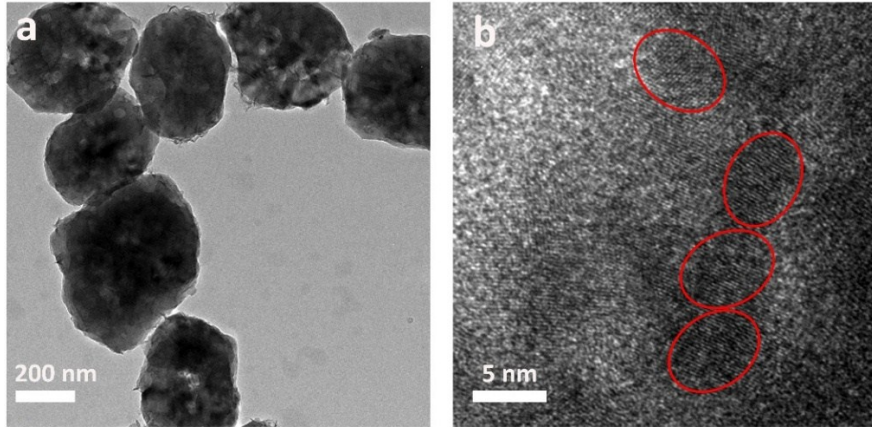
Fig. S8. (a) TEM and (b) HRTEM images of CoO-TS-1 after photocatalytic water splitting.
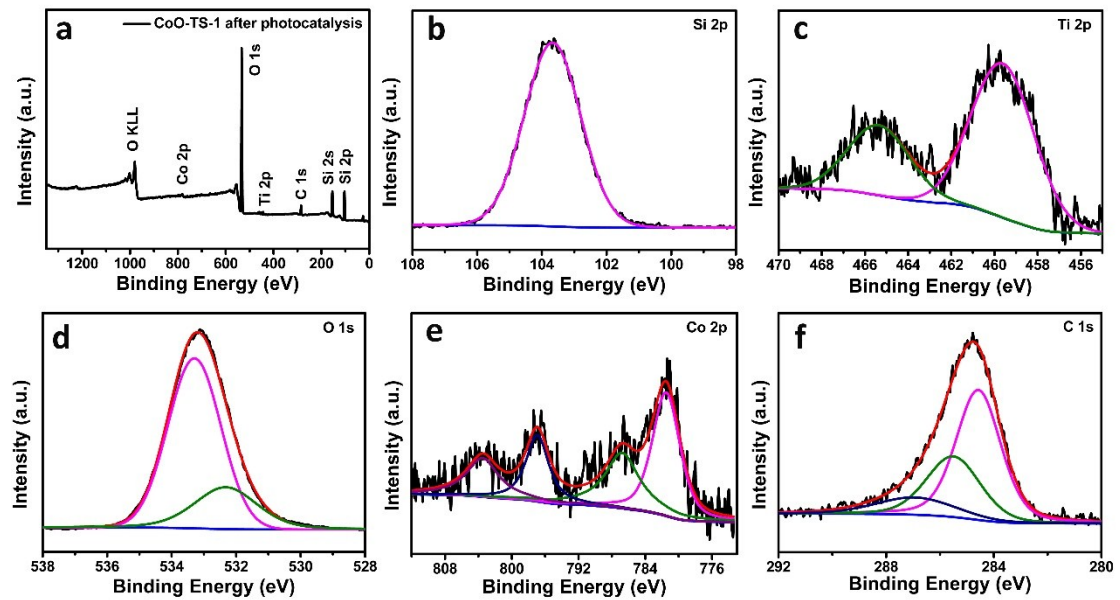

Fig. S9. (a) Full XPS survey spectrum and high-resolution XPS spectra of (b) Si 2p, (c) Ti 2p, (d) O 1s, (e) Co 2p and (f) C 1s for CoO-TS-1 after photocatalytic water splitting.
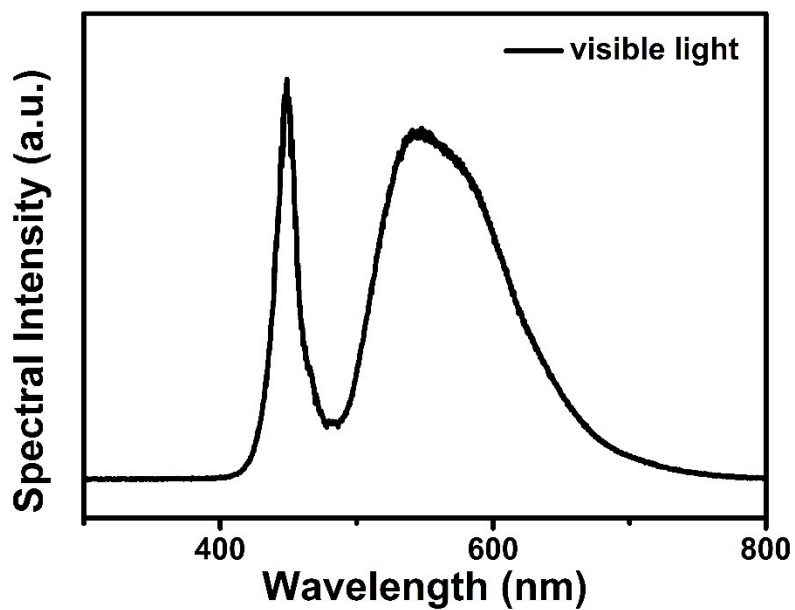
Fig. S10. Optical spectrum of the multi-channel photocatalytic reaction system.
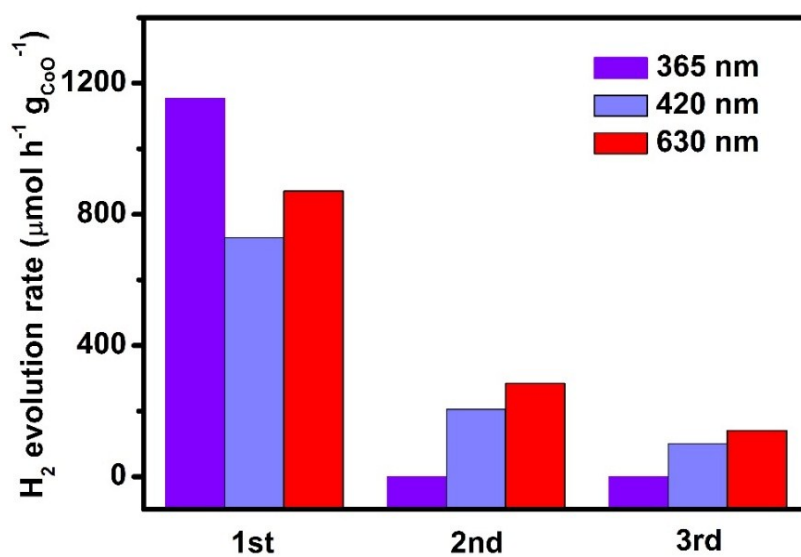

Fig. S11. Photostability of CoO-TS-1 towards water splitting with the specific incident light sources.
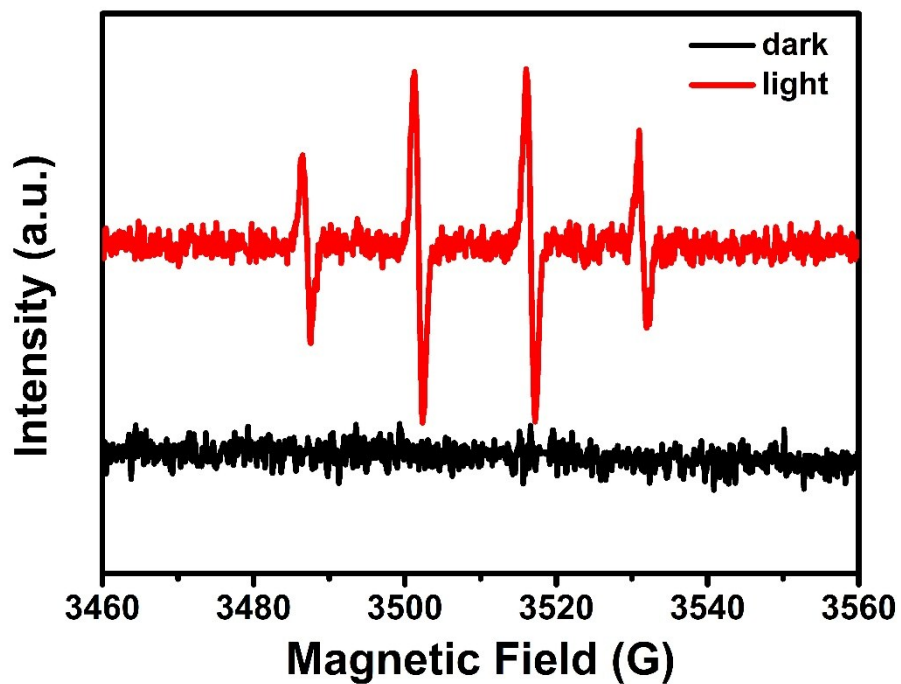
Fig. S12. EPR spectra for DMPO-˙OH of CoO-TS-1 under dark and light irradiation.

References

S1. Zhu, C. Liu, Y. Zhou, Y. Fu, S. Guo, H. Li, S. Zhao, H. Huang, Y. Liu and Z. Kang, *Appl. Catal. B Environ.*, 2017, **216**, 114–121.

S2   M. Zhu, M. Han, C. Zhu, L. Hu, H. Huang, Y. Liu and Z. Kang, *J. Colloid Interface Sci.*, 2018, **530**, 256–263.