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$_2$·6H$_2$O 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:

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

(S1)

where $\alpha$, $A$, $h$, $\nu$ 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 $I_d$ and $I_r$ 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.

<table>
<thead>
<tr>
<th>Sample</th>
<th>CoO mass fraction (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CoO-TS-1</td>
<td>0.5</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Sample</th>
<th>Specific surface area (m² g⁻¹)</th>
<th>Average pore width (nm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CoO-TS-1</td>
<td>436.90</td>
<td>4.07</td>
</tr>
<tr>
<td>TS-1</td>
<td>322.87</td>
<td>3.88</td>
</tr>
</tbody>
</table>
3. Supplementary Figures.

![Diagram](image)

**Fig. S1.** The schematic diagram for the synthetic process of CoO-TS-1 photocatalysts.

![SEM images of TS-1 and CoO-TS-1.](image)

**Fig. S2.** SEM images of (a) TS-1 and (b) CoO-TS-1.

![SEM images and XRD spectrum of CoO.](image)

**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) N₂ 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
