Supporting Information

for

In situ Hydrothermal Etching Fabrication of CaTiO$_3$ on TiO$_2$ Nanosheets for Heterojunction Effect to Enhance CO$_2$ Adsorption and Photocatalytic Reduction

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Fig. S1  The possible structure of CaTiO$_3$/TiO$_2$ composite.

Fig. S2  (a) XRD spectra of mechanical mixture with 1:2, 1:1 and 2:1 ratio of CaTiO$_3$ (H) to TiO$_2$. (b) Plot of area ratios of the 2θ at 33.06° for CaTiO$_3$ (H) (112) to the 2θ at 25.28° for TiO$_2$ (101) (A$_{\text{CaTiO}_3\text{(H)}}$/A$_{\text{TiO}_2}$) versus weight ratios of CaTiO$_3$ (H) to TiO$_2$ (W$_{\text{CaTiO}_3\text{(H)}}$/W$_{\text{TiO}_2}$).

Table S1. The CaTiO$_3$ (H) content of the CaTiO$_3$/TiO$_2$ samples.

<table>
<thead>
<tr>
<th></th>
<th>CaTiO$_3$/TiO$_2$-0.4g</th>
<th>CaTiO$_3$/TiO$_2$-0.3g</th>
<th>CaTiO$_3$/TiO$_2$-0.2g</th>
<th>CaTiO$_3$/TiO$_2$-0.1g</th>
</tr>
</thead>
<tbody>
<tr>
<td>A$_{\text{CaTiO}<em>3\text{(H)}}$/A$</em>{\text{TiO}_2}$</td>
<td>0.098</td>
<td>0.153</td>
<td>0.276</td>
<td>0.762</td>
</tr>
<tr>
<td>W$_{\text{CaTiO}<em>3\text{(H)}}$/W$</em>{\text{TiO}_2}$</td>
<td>8.6 %</td>
<td>13.4 %</td>
<td>24.2 %</td>
<td>66.7 %</td>
</tr>
</tbody>
</table>

The weight fraction of CaTiO$_3$ (H), W$_{\text{CaTiO}_3\text{(H)}}$, can be estimated by semiquantitative analysis of the phase.
composition of the samples by XRD spectroscopy (shown in Fig. S1). And the weight fraction of CaTiO$_3$ (H) of the CaTiO$_3$/TiO$_2$ samples could be worked out from the XRD peak intensities using the following formula:

\[
\frac{W_{\text{CaTiO}_3(H)}}{W_{\text{TiO}_2}} = 0.87619 \times \frac{A_{\text{CaTiO}_3(H)}}{A_{\text{TiO}_2}}
\]

Where $A_{\text{CaTiO}_3(H)}$ and $A_{\text{TiO}_2}$ represent the X-ray integrated intensities of CaTiO$_3$ (H) (112) and TiO$_2$ (101) diffraction peaks, respectively. To estimate the weight fraction of the CaTiO$_3$ (H) in the samples by XRD spectroscopy, pure CaTiO$_3$ (H) and TiO$_2$ were mixed mechanically at the given weight ratios and ground carefully to mix sufficiently. Fig. S1a displays the XRD spectra of the mechanical mixture with 1:2, 1:1 and 2:1 ratio of CaTiO$_3$ (H) to TiO$_2$. The relationship between the area ratios of the $2\theta$ at 33.06° for CaTiO$_3$ (H) (112) to the $2\theta$ at 25.28° for TiO$_2$ (101) ($A_{\text{CaTiO}_3(H)}/A_{\text{TiO}_2}$) and the weight ratios of CaTiO$_3$ (H) to TiO$_2$ ($W_{\text{CaTiO}_3(H)}/W_{\text{TiO}_2}$) is plotted in Fig. S1b. It could be seen that a linear relationship between the band area ratios and the weight ratios of CaTiO$_3$ (H) to TiO$_2$ in the mixture is obtained. The anatase content in these samples (shown in details in Table S1) was ca. 13.4 % by calculation.
Fig. S3 The N\(_2\) adsorption-desorption isotherms of TiO\(_2\) (a), 8.6\%CaTiO\(_3\)/TiO\(_2\) (b), 13.4\%CaTiO\(_3\)/TiO\(_2\) (c), 24.2\%CaTiO\(_3\)/TiO\(_2\) (d), 66.7\%CaTiO\(_3\)/TiO\(_2\) (e) and CaTiO\(_3\) (H) (f) samples.

Fig. S4 The statistics of the side length of TiO\(_2\).
**Fig. S5** The products of 13.4%CaTiO$_3$/TiO$_2$ sample on the photocatalytic CO$_2$ reduction.

**Fig. S6** The XRD spectra of TiO$_2$ and CaTiO$_3$ (M).
Fig. S7 The XRD spectra of 13.4%CaTiO$_3$/TiO$_2$ before and after reaction.

Fig. S8 The isotopic experiments of 13.4%CaTiO$_3$/TiO$_2$. 
Fig. S9 The function of time of 13.4%CaTiO$_3$/TiO$_2$ irradiated by UV-visible light.

Fig. S10 CPDs of TiO$_2$ (a) and CaTiO$_3$ (H) (b) surface at scan measurement over 1.21 mm$^2$ area.