Supporting Information

Z-scheme MoS$_2$/g-C$_3$N$_4$ heterojunction for efficient visible light photocatalytic CO$_2$

reduction

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In our experiment, CO were found to be the main reduction product and no other hydrocarbon product was detected. Furthermore, the oxidation product-O$_2$ and a small amount of competitive reduction product (H$_2$) were also detected. For the MSCN-10 sample, the average production rate of the products are calculated out and listed in Table 1 and the calculated molar ratios of electrons/holes according to the following equations (1 and 2) are 0.87 and 0.84 respectively, which is on the verge of 1:1. The deviation may be due to the adventitious oxygen in the suspension system or other undetected intermediates. Moreover, the high selective CO$_2$ reduction to CO in our experiment may be caused by the following reasons: active sites on the sample for CO$_2$ reduction reaction might be covered by the formed CO and intermediate products (·C), leaving insufficient elections contacted with CO$_2$ molecules to produce CH$_4$.\(^1\)

\[
\begin{align*}
2\text{H}_2\text{O} + 4\text{h}^+ & \rightarrow \text{O}_2 + 4\text{H}^+ \quad (1) \\
\text{CO}_2 + 2\text{H}^+ + 2\text{e}^- & \rightarrow \text{CO} + \text{H}_2\text{O} \quad (2)
\end{align*}
\]

<table>
<thead>
<tr>
<th>Sample</th>
<th>Reduction products</th>
<th>Oxidation products</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CO</td>
<td>O$_2$</td>
<td>e$^-$ : h$^+$</td>
</tr>
<tr>
<td></td>
<td>(μmol $\cdot$ g$^{-1}$ $\cdot$ h$^{-1}$)</td>
<td>(μmol $\cdot$ g$^{-1}$ $\cdot$ h$^{-1}$)</td>
<td></td>
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<tr>
<td>CN</td>
<td>2.85</td>
<td>1.65</td>
<td>0.87:1</td>
</tr>
<tr>
<td>MSCN-10</td>
<td>8.37</td>
<td>4.94</td>
<td>0.84:1</td>
</tr>
</tbody>
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Table 1 The generation rate of the reduction and oxidation products for CN and MSCN-10.
Fig. S1 XRD patterns of the freshly prepared and used MSCN-10 after three times cycling.

References