Supporting Information

600 nm-irradiation-induced Efficient Photocatalytic CO₂ Reduction by Ultrathin Layered Double Hydroxide Nanosheets

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Experimental

Materials: Mg(NO$_3$)$_2$·6H$_2$O, Co(NO$_3$)$_2$·6H$_2$O, Ni(NO$_3$)$_2$·6H$_2$O, Zn(NO$_3$)$_2$·6H$_2$O, Al(NO$_3$)$_3$·9H$_2$O, CoCl$_2$·6H$_2$O, AlCl$_3$·6H$_2$O, NaOH, [Ru(bpy)$_3$]Cl$_2$·6H$_2$O (bpy = 2’2’-bipyridine), triethanolamine (TEOA) and acetonitrile (MeCN) were purchased from Sigma-Aldrich Co. and were used without any further purification. Deionized water was used in all experiments.

Synthesis of ultrathin MAl-LDH (M = Mg, Co, Ni, Zn; denoted as u-MAl-LDH):
The u-MAl-LDH photocatalysts were synthesized using a traditional titration method$^1$ with a slight modification. For the synthesis of u-MgAl-LDH, two solutions were prepared.

Solution A contained Mg(NO$_3$)$_2$·6H$_2$O (0.1718 g, 0.67 mmol) and Al(NO$_3$)$_3$·9H$_2$O (0.1238 g, 0.33 mmol) in 20 mL of decarbonated water.

Solution B contained NaOH (1.000 g, 25 mmol) in 100 mL of decarbonate water.

Solution A and Solution B were added dropwise into a 20 mL of decarbonated water under magnetic stirring at 80 °C, and the resulting reaction mixture maintained at a pH value of ca. 9. After 15 min, the product was collected by centrifugation, washed with decarbonated water (3 × 20 mL), and kept in the wet state for subsequent use.

Similarly, u-CoAl-LDH, u-NiAl-LDH, u-ZnAl-LDH were also prepared by replacing the Mg(NO$_3$)$_2$·6H$_2$O with the corresponding Co(NO$_3$)$_2$·6H$_2$O, Ni(NO$_3$)$_2$·6H$_2$O, Zn(NO$_3$)$_2$·6H$_2$O, respectively). Note that for the synthesis of u-ZnAl-LDH, the pH of the reaction mixture was kept at ~7.

Synthesis of NO$_3^-$ intercalated bulk Co$_2$Al-LDH (denoted as b-CoAl-LDH): The b-
CoAl-LDH was prepared by the hydrothermal method. Typically, CoCl$_2$·6H$_2$O (1.9034 g, 8 mmol), AlCl$_3$·6H$_2$O (0.9657 g, 4 mmol) and urea (1.6814 g, 28 mmol) were dissolved in 1L of deionized water. Then, the solution was heated to reflux and kept stirring for 2 d. The resulting product, CO$_3^{2-}$-intercalated Co$_2$Al-LDH (denoted as b-CoAl-CO$_3$-LDH), was collected by filtration, washed with deionized water, and dried at 60°C.

The NO$_3^-$-intercalated CoAl-LDH was subsequently synthesized from b-CoAl-CO$_3$-LDH according to the method described by Iyi et al. In a three-neck flask, 0.5 g of b-CoAl-CO$_3$-LDH was treated with 500 mL of an aqueous solution containing NaNO$_3$ (79.49 g, 0.75 mol) and 65% HNO$_3$ (0.0025 mol, 165 μL). The dispersion was stirred continuously for 24 h at room temperature under a nitrogen flow to allow exchange of the interlayer carbonate ions in b-CoAl-CO$_3$-LDH with nitrate ions. After 24 h, the b-CoAl-NO$_3$-LDH product was collected by filtration, washed repeatedly with water, and finally vacuum dried.
Figure S1. (A-C) The calculated total density of states (TDOS) and partial density of states (PDOS) plots for u-MgAl-LDH; u-ZnAl-LDH and u-NiAl-LDH (the bandgap values are indicated); (D) Models showing the most stable adsorption configurations of CO$_2$ and H$_2$O on u-CoAl-LDH.

Figure S2. UV-vis absorbance spectrum of u-CoAl-LDH.
Figure S3. (A) XRD patterns for the various u-MAI-LDH photocatalysts. (B) FT-IR spectra for the various u-MAI-LDH photocatalysts.

X-ray powder diffraction (XRD) patterns for the various u-MAI-LDH photocatalysts are displayed in Figure S3A. All samples showed characteristic (00l) diffraction peaks associated with LDHs. The (003) diffraction peak at 10.91° seen for all the samples corresponds to a layer spacing ~8.11 Å. The FT-IR spectra (Figure S3B) for the various u-MAI-LDH photocatalysts show a broad band at 3430 cm\(^{-1}\), associated with O-H stretching vibrations (of OH groups in the Brucite-like LDH sheets and interlayer water molecules). The small peak at 1633 cm\(^{-1}\) is assigned to a bending vibration of interlayer water. The strong band at 1380 cm\(^{-1}\) signifies the vibrations of NO\(_3^-\) (\(\nu_3\) mode of the nitrate ion). The feature at 450 cm\(^{-1}\) is an Al-O vibration.
Figure S4 TEM images of (A) u-MgAl-LDH; (B) u-ZnAl-LDH and (C) u-NiAl-LDH.

Figure S5. EPR spectrum of the u-CoAl-LDH powder.
Figure S6. (A) XRD patterns of b-CoAl-CO$_3$-LDH and b-CoAl-LDH; SEM images of (B) b-CoAl-CO$_3$-LDH and (C) b-CoAl-LDH.

Figure S7. (A) Derivative-normalized Co K-edge X-ray absorption near-edge structure (XANES) for u-CoAl-LDH and b-CoAl-LDH. (B) magnitude of weighted FT of Co K-edge extended X-ray absorption fine-structure (EXAFS) and EXAFS curve-fitting results for u-CoAl-LDH, b-CoAl-LDH and b-CoAl-CO$_3$-LDH.
Table S1. Local structure parameters around Co in b-CoAl-LDH and u-CoAl-LDH estimated by EXAFS analysis

<table>
<thead>
<tr>
<th>Sample</th>
<th>Shell</th>
<th>N&lt;sup&gt;a&lt;/sup&gt;</th>
<th>R[Å]&lt;sup&gt;b&lt;/sup&gt;</th>
<th>ΔE₀(eV)&lt;sup&gt;c&lt;/sup&gt;</th>
<th>R-factor</th>
<th>σ&lt;sup&gt;2&lt;/sup&gt;(10&lt;sup&gt;-3&lt;/sup&gt; Å&lt;sup&gt;2&lt;/sup&gt;)&lt;sup&gt;d&lt;/sup&gt;</th>
</tr>
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<tbody>
<tr>
<td>b-CoAl-CO₃-LDH</td>
<td>Co-O</td>
<td>6.0</td>
<td>2.08</td>
<td>-0.39</td>
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<td>6.9</td>
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<td></td>
<td>Co-Co</td>
<td>3.0</td>
<td>3.12</td>
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<td>Co-Al</td>
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<td>Co-O</td>
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<td>-1.79</td>
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<td>Co-Co</td>
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<td>0.0083</td>
<td>8.0</td>
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<td></td>
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<td>u-CoAl-LDH</td>
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<td>2.08</td>
<td>-1.26</td>
<td></td>
<td>7.0</td>
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<tr>
<td></td>
<td>Co-Co</td>
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<td>3.11</td>
<td>-0.068</td>
<td>0.0046</td>
<td>9.7</td>
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<td>Co-Al</td>
<td>1.4</td>
<td>3.15</td>
<td>0.081</td>
<td></td>
<td>6.9</td>
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</table>

<sup>a</sup>N = coordination number; <sup>b</sup>R = distance between absorber and backscatter atoms; <sup>c</sup>ΔE₀: the inner potential correction. <sup>d</sup>σ<sup>2</sup> = Debye-Waller factor; S₀², 1.0, was obtained from the experimental EXAFS fit of b-CoAl-CO₃-LDH reference.

Figure S8 Schematic illustration of the layered structure of CoAl-LDH.
Calculation of the Oxygen and Metal Vacancies in u-CoAl-LDH

Figure S8 shows a schematic illustration of layered structure of CoAl-LDH (without interlayer anions). The empirical molecular formula of CoAl-LDH is Co₆Al₃H₁₈O₁₈. The surface area of this cell is 0.9 nm × 0.9 nm × sin 60° = 0.701 nm². Thus, the volume of the LDH can be calculated as the product of surface area of the cell (in nm²) and the thickness (nm). Here, thicknesses were measured by AFM, and determined to be ~ 3.7 nm. The volume is thus 0.701 nm² × 3.7 nm = 2.594 nm³. The corresponding oxygen number in the CoAl-monolayer model is 18, and the total number of the metal atoms (Co and Al) is 9.

The EXAFS results for u-CoAl-LDH determine that the Co coordination number of the first Co-O shell is 5.0, compared with the ideal LDH (b-CoAl-CO₃-LDH) with coordination number of 6.0. The oxygen vacancy defect concentration in the Co-O shell for u-CoAl-LDH is thus (6-5.0)/6 = 0.1667 = 16.67%. Therefore, in the whole model, the defect intensity of oxygen vacancy can be inferred as follows:

Oxygen vacancies density (nm⁻³) in u-CoAl-LDH = defect concentration × the total oxygen number in the model per nm³ in the model = 0.1667*18/(2.594 nm³) = 1.16 nm⁻³.

The above equation can be also extend to calculate the metal vacancies density (in nm⁻³) in u-CoAl-LDH. By EXAFS, the metal vacancy defect concentration was (6.00-4.4)/6 = 0.227 = 22.7%.

Thus for u-CoAl-LDH, the metal vacancy density (in nm⁻³) was defect concentration × the total metal atoms per nm³ in the model = 0.227 × 9/(2.594 nm³) = 0.93 nm⁻³.
Figure S9. The irradiance spectrum of the Xe light source with 400 nm cutoff filter used in the photocatalytic experiments (400-800 nm).
Figure S10. The production rates of CO and H\textsubscript{2} during photocatalytic tests on u-CoAl-LDH and b-CoAl-LDH under irradiation above 400 nm (\(\lambda > 400\) nm) with 10 mg catalyst.

In order to evaluate the advantages of using ultrathin LDH materials in the photocatalytic reduction of CO\textsubscript{2}, a performance comparison was made between u-CoAl-LDH (10 mg) and b-CoAl-LDH (10 mg) under visible light (400 \(\leq \lambda \leq 800\) nm). The u-CoAl-LDH photocatalyst had a CO production rate of 2.52 mmol g\textsuperscript{-1} h\textsuperscript{-1} under the applied testing conditions and a high selectivity to CO (60.93%). The b-CoAl-LDH photocatalyst afforded a lower rate to CO production (1.67 mmol g\textsuperscript{-1} h\textsuperscript{-1}), and a lower CO selectivity of 47.71%. Results suggested that the defects contained within the LDH nanosheets were highly beneficial for enhancing CO\textsubscript{2} conversion and tuning the selectivity to CO.\textsuperscript{5}
**Figure S11.** $^1$H-NMR spectra of the reaction system following CO$_2$ photoreduction tests under visible light ($400 \leq \lambda \leq 800$ nm). The catalyst was 10 mg of u-CoAl-LDH; $^1$H-NMR spectra for TEOA, Ru(bpy)$_3$Cl$_2$·H$_2$O and CH$_3$CN are also provided for comparison.

**Figure S12.** The production rates of CO and H$_2$ on u-CoAl-LDH (10 mg) over 6 successive photocatalytic tests.

In order to investigate the stability of u-CoAl-LDH as a photocatalyst for CO$_2$ reduction, a series of successive photocatalytic tests were performed. At the end of each test, the catalyst was recovered from the reaction medium, washed with water, and then reused for photocatalytic CO$_2$ reduction. As shown in Figure S12, no significant deactivation or change in selectivity was observed over six successive sets of test, confirming that u-CoAl-LDH possessed excellent stability.
Figure S13. A) XRD patterns of u-CoAl-LDH samples before and after photocatalytic CO\textsubscript{2} reduction tests. B) TEM images of the u-CoAl-LDH after the photocatalytic CO\textsubscript{2} reduction test.

XRD was used to characterize u-CoAl-LDH before and after photocatalytic CO\textsubscript{2} reduction tests (Figure S13). No noticeable differences were seen in the XRD patterns before and after the tests, indicating that the LDH structure of u-CoAl-LDH was stable during the CO\textsubscript{2} reduction tests. TEM analysis confirmed that u-CoAl-LDH retained its ultrathin morphology and was stable against aggregation during the tests (Figure S13B). These results further indicated that u-CoAl-LDH was a very stable photocatalyst for CO\textsubscript{2} reduction.
Figure S14. The production rates of CO and H₂ in CO₂PR under visible light (400-800 nm) using different amounts of u-CoAl-LDH.
Table S2. The performance comparison of photocatalytic CO\(_2\) reduction over various photocatalysts.

<table>
<thead>
<tr>
<th></th>
<th>Catalyst</th>
<th>Photosensitizer</th>
<th>Sacrificial agent</th>
<th>Solvent</th>
<th>Light source</th>
<th>CO(_2) Conversion (mmol·g(^{-1})·h(^{-1}))</th>
<th>Major product selectivity</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CoAl-LDH nanosheets</td>
<td>-</td>
<td>-</td>
<td>H(_2)O</td>
<td>500 W Xe</td>
<td>(4.67\times10^{-3})</td>
<td>CH(_4): 77%</td>
<td>(J. \text{ Mater. Chem. A, } 2018, 6, 8366)</td>
</tr>
<tr>
<td>2</td>
<td>Co-ZIF-9</td>
<td>[Ru(bpy)(_3)]Cl(_2)·6H(_2)O</td>
<td>TEOA</td>
<td>MeCN-H(_2)O (4:1 v/v)</td>
<td>Xe lamp ((\lambda \geq 420 \text{ nm}))</td>
<td>(0.08) (mmol·h(^{-1}))</td>
<td>CO: 58%</td>
<td>(\text{Angew. Chem. Int. Ed., } 2014, 53, 1034)</td>
</tr>
<tr>
<td>3</td>
<td>Co/C</td>
<td>[Ru(bpy)(_3)]Cl(_2)·6H(_2)O</td>
<td>TEOA</td>
<td>MeCN-H(_2)O (3:1 v/v)</td>
<td>300 W Xe lamp ((\lambda &gt; 450 \text{ nm}))</td>
<td>0.45</td>
<td>CO: 64.2%</td>
<td>(\text{Small, } 2018, 14, 1800762)</td>
</tr>
<tr>
<td>4</td>
<td>carbon-nitride</td>
<td>Co(bpy)(_3^{2+})</td>
<td>TEOA</td>
<td>MeCN-H(_2)O (4:1v/v)</td>
<td>300 W Xe ((\lambda &gt; 420 \text{ nm}))</td>
<td>0.47</td>
<td>CO: 81.83%</td>
<td>(\text{Appl. Catal. B-Environ, } 2015, 179, 1)</td>
</tr>
<tr>
<td>5</td>
<td>Pt/C-In(_2)O(_3)</td>
<td>--</td>
<td>Pt</td>
<td>TEOA-H(_2)O (1:9 v/v)</td>
<td>300 W Xe</td>
<td>0.77</td>
<td>CO: 63.3%</td>
<td>(\text{J. Am. Chem. Soc., } 2017, 139, 4123)</td>
</tr>
<tr>
<td>6</td>
<td>In(_2)S(_3)-CdIn(_2)S(_4)</td>
<td>Co(bpy)(_3^{2+})</td>
<td>TEOA</td>
<td>MeCN-H(_2)O (3:2 v/v)</td>
<td>300 W Xe ((\lambda &gt; 400 \text{ nm}))</td>
<td>0.825</td>
<td>CO: 70.2%</td>
<td>(\text{J. Am. Chem. Soc., } 2017, 139, 17305)</td>
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<tr>
<td>7</td>
<td>MOF-Ni</td>
<td>[Ru(bpy)(_3)]Cl(_2)·6H(_2)O</td>
<td>TIPA</td>
<td>MeCN-H(_2)O (13:1 v/v)</td>
<td>300 W Xe ((\lambda &gt; 420 \text{ nm}))</td>
<td>0.37</td>
<td>CO: 97.7%</td>
<td>(\text{ACS Catal., } 2019, 9, 1726)</td>
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<td>8</td>
<td>RuRu′/Ag/C(_3)N(_4)</td>
<td>--</td>
<td>Ag(5.0 wt %)</td>
<td>DMA-TEOA (4:1 v/v)</td>
<td>300 W Xe ((\lambda &gt; 400 \text{ nm}))</td>
<td>2.12</td>
<td>HCOOH: &gt;99%</td>
<td>(\text{J. Am. Chem. Soc., } 2016, 138, 5159)</td>
</tr>
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</table>

Major product selectivity:
- CH\(_4\): 77\%
- CO: 7\%
- H\(_2\): 16\%
- CO: 58\%
- H\(_2\): 42\%
- CO: 64.2\%
- H\(_2\): 35.8\%
- CO: 81.83\%
- H\(_2\): 18.17\%
- CO: 63.3\%
- CH\(_4\): 14.0\%
- H\(_2\): 22.7\%
- CO: 70.2\%
- H\(_2\): 29.8\%
- CO: 97.7\%
- H\(_2\): 2.3\%
- CO: 47.4\%
- H\(_2\): 52.6\%
- CO: 22.6\%
- H\(_2\): 77.4\%
<table>
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<tr>
<th></th>
<th>Catalyst</th>
<th>Precursor</th>
<th>Solvent</th>
<th>Light Source</th>
<th>Lambda (nm)</th>
<th>CO (%)</th>
<th>H₂ (%)</th>
<th>Ref.</th>
</tr>
</thead>
</table>
| 9 | MAF-X271-OH    | [Ru(bpy)₃]Cl₂·6H₂O | MeCN-H₂O     | LED(λ > 420 nm) | 2.59        | CO: 98.3%| H₂: 1.7% | *J. Am. Chem. Soc.*, 2018, 140, 38  
| 10| Co₃O₄-400     | [Ru(bpy)₃]Cl₂·6H₂O | MeCN-H₂O     | 300 W Xe lamp (λ > 420 nm) | 2.00(3h) | CO: 77.1% | H₂: 22.9% | *Adv. Mater.*, 2016, 28, 6485  
| 12| BIF-101       | [Ru(bpy)₃]Cl₂·6H₂O | MeCN-H₂O     | 300 W Xe lamp (λ > 420 nm) | 5.83       | CO: 84.1% | H₂: 15.9% | *J. Mater. Chem. A*, 2019, 7, 17272  
| 13| Ni MOLs       | [Ru(bpy)₃]Cl₂·6H₂O | MeCN-H₂O     | 300 W Xe lamp (λ > 420 nm) | 12.50      | CO: 97.8% | H₂: 2.2%  | *Angew. Chem. Int. Ed.*, 2018, 130, 17053  
| 14| CoSn(OH)₃     | [Ru(bpy)₃]Cl₂·6H₂O | MeCN-H₂O     | 300 W Xe lamp (λ > 420 nm) | 18.70      | CO: 86.18%| H₂: 13.82%| *Appl. Catal. B-Environ.*, 2018, 224, 1009  
| 15| NiCo₂O₄       | [Ru(bpy)₃]Cl₂·6H₂O | MeCN-H₂O     | 300 W Xe lamp (λ > 420 nm) | 21.82      | CO: 84%   | H₂: 16%   | *Phys. Chem. Chem. Phys.*, 2015, 17, 16040  
| 16| ZnCo₂O₄       | [Ru(bpy)₃]Cl₂·6H₂O | MeCN-H₂O     | Xe lamp (λ > 400 nm)       | 25.38      | CO: 74.3%| H₂: 25.7%| *Chem. Commun.*, 2015, 51, 1517  
| 17| NC@NiCo₂O₄    | [Ru(bpy)₃]Cl₂·6H₂O | MeCN-H₂O     | 300 W Xe lamp (λ > 420 nm) | 26.20      | CO: 88.6%| H₂: 11.4%| *Energy Environ. Sci.*, 2018, 11, 306  
| 18| Ni(TPA/TEG)    | [Ru(bpy)₃]Cl₂·6H₂O | MeCN-H₂O     | 300 W Xe lamp (λ > 420 nm) | 26.62      | CO: 100% |         | *Sci. Adv.*, 2017, 3, e1700921  
| 19| MnCo₂O₄       | [Ru(bpy)₃]Cl₂·6H₂O | MeCN-H₂O     | 300 W Xe lamp (λ > 420 nm) | 28.51      | CO: 77.14%| H₂: 22.86%| *ACS Appl. Mater. Interfaces*, 2015, 7, 4327  
| 20| Ni₃(HITP)₂     | [Ru(bpy)₃]Cl₂·6H₂O | MeCN-H₂O     | LED (λ > 420 nm)          | 34.50      | CO: 97%   | H₂: 3%   | *Appl. Catal. B-Environ.*, 2018, 238, 339  
| 21| LaCoO₃         | [Ru(bpy)₃]Cl₂·6H₂O | MeCN-H₂O     | 300 W Xe lamp (λ > 420 nm) | 44.20      | CO: 76%   | H₂: 24%  | *Chem. Commun.*, 2018, 54, 2272  

*Note: LED (λ > 420 nm) indicates light-emitting diode with a wavelength greater than 420 nm.*
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<tr>
<td>22</td>
<td>Co-ZIF-9</td>
<td>Bipyridine, CdS</td>
<td>TEOA</td>
<td>MeCN-H₂O (3:2 v/v)</td>
<td>300 W Xe lamp (λ &gt; 450 nm)</td>
<td>50.40</td>
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<td>23</td>
<td>ZIF-67</td>
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<td>300 W Xe lamp (λ &gt; 420 nm)</td>
<td>374.00</td>
<td>0.1 mg</td>
<td>CO: 74.2% H₂: 25.8%</td>
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<td>u-CoAl-LDH</td>
<td>[Ru(bpy)₃]Cl₂·6H₂O</td>
<td>TEOA</td>
<td>MeCN-H₂O (3:1 v/v)</td>
<td>300 W Xe lamp (λ &gt; 400 nm)</td>
<td>218.13</td>
<td>0.05 mg</td>
<td>CO: 52.56% H₂: 47.44%</td>
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</tr>
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<td>25</td>
<td>u-CoAl-LDH</td>
<td>[Ru(bpy)₃]Cl₂·6H₂O</td>
<td>TEOA</td>
<td>MeCN-H₂O (3:1 v/v)</td>
<td>300 W Xe lamp (λ = 600 nm)</td>
<td>43.73</td>
<td>0.05 mg</td>
<td>CO: 55.84% H₂: 44.16%</td>
<td>This work</td>
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Table S3. The optical density of the different monochromatic light sources used in the photocatalytic CO₂ reduction tests and the corresponding CO yield and AQY values for CO production using the u-CoAl-LDH photocatalyst (0.05 mg).

<table>
<thead>
<tr>
<th>Wavelength (nm)</th>
<th>Optical density (mW/cm²)</th>
<th>CO yield ×10⁻³ (mmol/h)</th>
<th>AQY CO (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>405</td>
<td>77</td>
<td>8.98</td>
<td>2.44</td>
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<tr>
<td>470</td>
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<td>0.22</td>
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<td>650</td>
<td>113</td>
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</tbody>
</table>

Figure S15. Digital photograph showing the various u-MAl-LDH photocatalysts.
Figure S16. Tauc plots for the various u-MAI-LDH photocatalysts. Band gaps determined from the plots are indicated for each u-MAI-LDH photocatalyst.
Figure S17. N\textsubscript{2}-sorption isotherms for the various u-MAI-LDH photocatalysts.

Table S4. BET specific surface areas for the various u-MAI-LDH photocatalysts

<table>
<thead>
<tr>
<th>Catalyst</th>
<th>u-MgAl-LDH</th>
<th>u-ZnAl-LDH</th>
<th>u-NiAl-LDH</th>
<th>u-CoAl-LDH</th>
</tr>
</thead>
<tbody>
<tr>
<td>BET(m\textsuperscript{2}/g)</td>
<td>194.98</td>
<td>69.40</td>
<td>233.69</td>
<td>46.44</td>
</tr>
</tbody>
</table>

N\textsubscript{2} adsorption-desorption were collected for the different u-MAI-LDH samples by N\textsubscript{2} physisorption at 77 K (Figure S17). All samples gave a type IV isotherm with a H3 adsorption-desorption hysteresis loop, indicating that the LDHs possessed mesopores. BET surface areas determined from the adsorption isotherms were summarized in Table S4. Interestingly, u-CoAl-LDH possessed the lowest BET surface area (46.44 m\textsuperscript{2}/g), indicating that specific surface area was not a key factor influencing the activity of the u-MAI-LDH photocatalysts for CO\textsubscript{2} reduction (since u-CoAl-LDH was the most active photocatalyst)
Scheme S1. Probable reaction pathways involved in photocatalytic CO\(_2\) reduction over u-CoAl-LDH.
References


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