Supporting Information for

In-Situ g-C$_3$N$_4$ Self-Sacrificial Synthesis of g-C$_3$N$_4$/LaCO$_3$OH Heterostructure with Booming Interfacial Charge Transfer and Separation for Photocatalytic NO Removal

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Figure Captions

**Figure S1.** Visible-light photocatalytic activities of CN-LCOH-1.5, CN-LCOH, and CN-LCOH-2.5 for NO removal in air.

**Scheme S1.** Schematic flow diagram of the photocatalytic test system.

**Figure S2.** Survey XPS spectra (a) and high-resolution XPS spectra of La 3d (b), C 1s (c), and N 1s (d) of the as-prepared samples.

**Figure S3.** Energy band structure of CN and LCOH.

**Figure S4.** The CO$_3^{2-}$ detection experiment.

**Figure S5.** Visible-light photocatalytic activities of CN and CN after hydrothermal treatment for NO removal in air.

**Figure S6.** The monitoring of the fraction of $\Delta$NO$_2$ (a) and NO$_2$ selectivity of LCOH, CN-LCOH, Mechanical mixture, and CN samples, respectively.

**Figure S7.** FT-IR spectra of CN-LCOH before and after five photocatalytic repeated reactions.

**Figure S8.** Schematic crystal structure of (a) g-C$_3$N$_4$ ($a = 7.153$ Å, $b = 7.153$ Å, $c = 7.153$ Å), and (b) LaCO$_3$OH ($a = 12.675$ Å, $b = 12.675$ Å, $c = 10.081$ Å); The crystal models of CN-LCOH (c) before and (d) after geometry optimization.

**Figure S9.** XRD patterns of (a) g-C$_3$N$_4$/Bi$_2$O$_2$CO$_3$ and g-C$_3$N$_4$ and (b) g-C$_3$N$_4$/SrCO$_3$ and g-C$_3$N$_4$.

**Figure S10.** Schematic crystal structure of (a) Bi$_2$O$_2$CO$_3$ ($a = 3.865$ Å, $b = 3.862$ Å, $c = 13.675$ Å), and (b) SrCO$_3$ ($a = 5.14$ Å, $b = 8.44$ Å, $c = 6.11$ Å).

**Figure S11.** Visible-light photocatalytic activities of g-C$_3$N$_4$/Bi$_2$O$_2$CO$_3$ and g-C$_3$N$_4$/SrCO$_3$ for NO removal in air.

Table Caption

Table S1. N element contents, weight ratio LCOH %, weight ratio CN %, molar and weight ratio of LaCO$_3$OH to the g-C$_3$N$_4$ in CN-LCOH-1.5, CN-LCOH, CN-LCOH-2.5, CN-LCOH-1, and CN-LCOH-2.
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<th>Samples</th>
<th>N wt %</th>
<th>Weight ratio LCOH %</th>
<th>Weight ratio CN %</th>
<th>Molar ratio LCOH/CN %</th>
<th>Weight ratio LCOH/CN %</th>
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</table>

![Graphs](image.png)
Figure S2. Survey XPS spectra (a) and high-resolution XPS spectra of La 3d (b), C 1s (c), and N 1s (d) of the as-prepared samples.

Figure S3. Energy band structure of CN and LCOH.

The generation of $\text{CO}_3^{2-}$ from the decomposition of g-C$_3$N$_4$ was proved by an experiment as follows:

Repeated the part 2 in experimental section without adding La(NO$_3$)$_3$·6H$_2$O at 160 °C for 12h. After cooling down to room temperature naturally, the up-layer clear solutions were added dropwise into 20 mL 0.24 M BaCl$_2$ solution (label 1) and the transparent solution became turbid (Fig. S3a-c). For comparison, deionized water was used instead of the up-layer clear solution and remained other conditions unchanged (label 2). Subsequently, after adding 0.02 M HCl, the turbid solution (label 1) became transparent again and formed amounts of bubbles (Fig. S3d-f), which further illustrated the fact that the $\text{CO}_3^{2-}$ do exist in the solution and was generated from the decomposition of g-C$_3$N$_4$. 

s5
**Figure S4.** The CO$_3^{2-}$ detection experiment.

**Figure S5.** Visible-light photocatalytic activities of CN and CN after hydrothermal treatment for NO removal in air.
**Figure S6.** The monitoring of the fraction of $\Delta\text{NO}_2$ (a) and NO$_2$ selectivity of LCOH, CN-LCOH, Mechanical mixture, and CN samples, respectively.

The NO$_2$ selectivity was calculated according to the following equation $^1$:

$$\text{NO}_2 \text{ selectivity (\%)} = \frac{C_{\text{NO}_2}}{(C_0 - C)} \times 100$$

where $C_{\text{NO}_2}$ represents the production of NO$_2$, ppb, $C_0$ is the initial concentration of NO, ppb, and $C$ is the final concentration of NO, ppb.

**Figure S7.** FT-IR spectra of CN-LCOH before and after five photocatalytic repeated reactions.
Figure S8. Schematic crystal structure of (a) g-C$_3$N$_4$ ($a = 7.153$ Å, $b = 7.153$ Å, $c = 7.153$ Å), and (b) LaCO$_3$OH ($a = 12.675$ Å, $b = 12.675$ Å, $c = 10.081$ Å); The crystal models of CN-LCOH (c) before and (d) after geometry optimization.

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