Preparation of an ultrathin 2D/2D rGO/g-C$_3$N$_4$ nanocomposite with enhanced visible-light-driven photocatalytic performance

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Fig. S1 shows the schematic diagram of the photoreactor for CO$_2$ photoreduction. The pressure of the photoreactor can be well controlled by the intake-pipe, exhaust-pipe and pressure gage.

![Fig. S1 Schematic diagram of the photoreactor.](image)

Fig. S2 displays the UV-Vis spectrum of the 400 nm cutoff filter. It can be observed that there is no UV light in the spectrum.

![Fig. S2 UV-Vis spectrum of the 400 nm cutoff filter.](image)

Fig. S3 shows the N$_2$ adsorption-desorption isotherms of the g-C$_3$N$_4$ bulks, ultrathin g-C$_3$N$_4$ nanosheets, and 3rGO/g-C$_3$N$_4$ nanocomposite. It is obvious that the adsorption-desorption isotherms of different samples follows the sequence: ultrathin g-C$_3$N$_4$ nanosheets > 3rGO/g-C$_3$N$_4$ > g-C$_3$N$_4$ bulks, which is consistent with the surface area data.

![Fig. S3 Nitrogen adsorption-desorption isotherms of g-C$_3$N$_4$ bulks, ultrathin g-C$_3$N$_4$ nanosheets, and 3rGO/g-C$_3$N$_4$.](image)

Fig. S4 displays the absorbance spectra of MO solution during photocatalytic reaction using pure g-C$_3$N$_4$ nanosheets and 3rGO/g-C$_3$N$_4$ nanocomposite as photocatalysts. The arrows demonstrate the decline of MO absorbance peak intensity.
over time. It is obvious that the absorbance peak intensity of MO solution at 464nm over 3rGO/g-C$_3$N$_4$ nanocomposite decreases more quickly than that of pure g-C$_3$N$_4$, indicating the higher photocatalytic activity of 3rGO/g-C$_3$N$_4$.

**Fig. S4** The absorbance spectra of MO solution during photocatalytic reaction using ultrathin g-C$_3$N$_4$ (a) and 3rGO/g-C$_3$N$_4$ (b) as photocatalysts.