Supplementary Information (SI) for New Journal of Chemistry.
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# Supplementary Information

## γ-Graphyne modulated g-$C_3N_4$ nanostructures for boosted photocatalytic ammonia production

## List of Contents

**Chemicals and materials**

Most chemicals were purchased from Sinopharm Chemical Reagent Co. Ltd, including melamine (CP), benzene/hexahydrobenzene (CP), benzene (≥99.5 %, AR), absolute ethanol (AR), $HNO_3$ (68 wt.%, AR), anhydrous sodium sulfate (AR), methanol (≥99.5%, AR), ammonium chloride (≥99.5 %, CP), potassium sodium tartrate (≥99.5 %, AR) and Nesseler's reagent. Fluorine-doped tin oxide (FTO) conducting glasses were obtained from Foshan City Mei jing Glass Co. Ltd. Nafion (5 wt.%) and $CaC_2$ (≥80 %) were gained from Sigma-Aldrich (USA). $N_2$ (99.5 %) and Ar (99.5 %) were supplied from Shanghai Haoqi Gases Co., Ltd. They were used as received, without any further treatment.

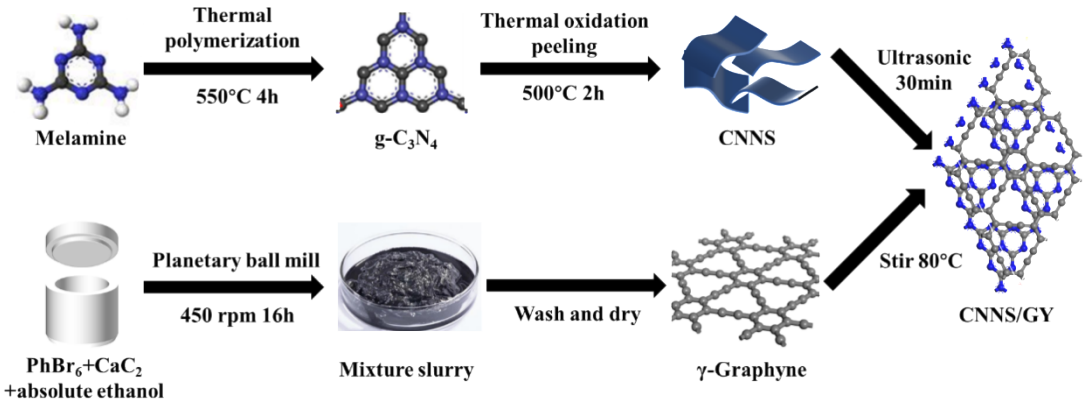


**Fig. S1** Schematic diagram of preparation process of CNNS/GY

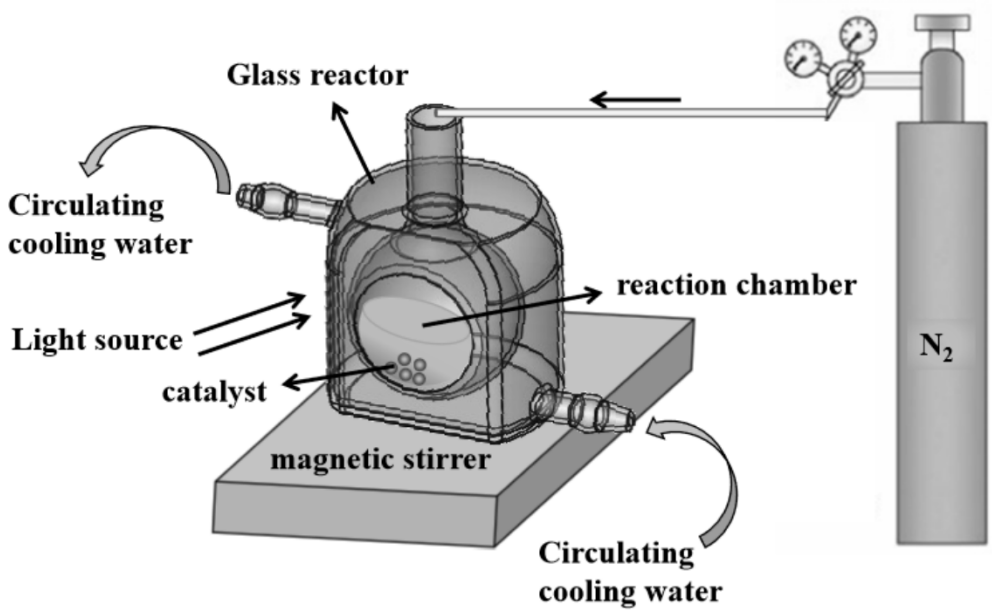


**Fig. S2** The schematic picture of the used reactor system.

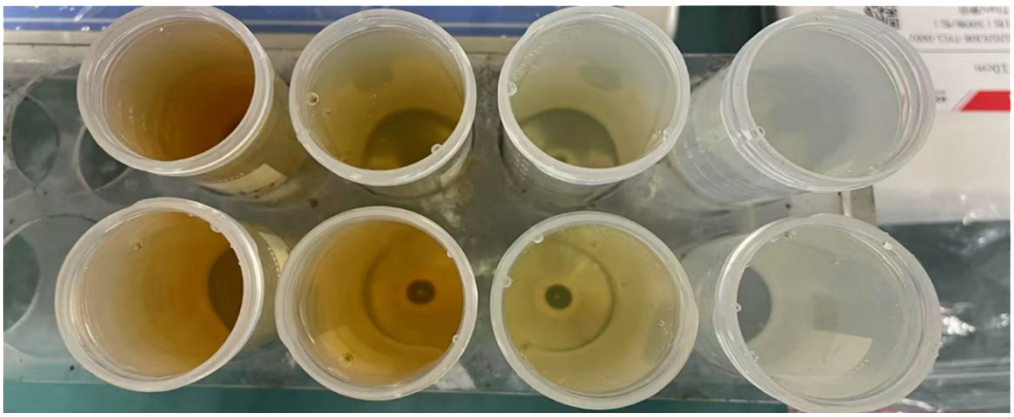

**Fig. S3** Colorimetric photos of the solution at different ammonia nitrogen concentrations.

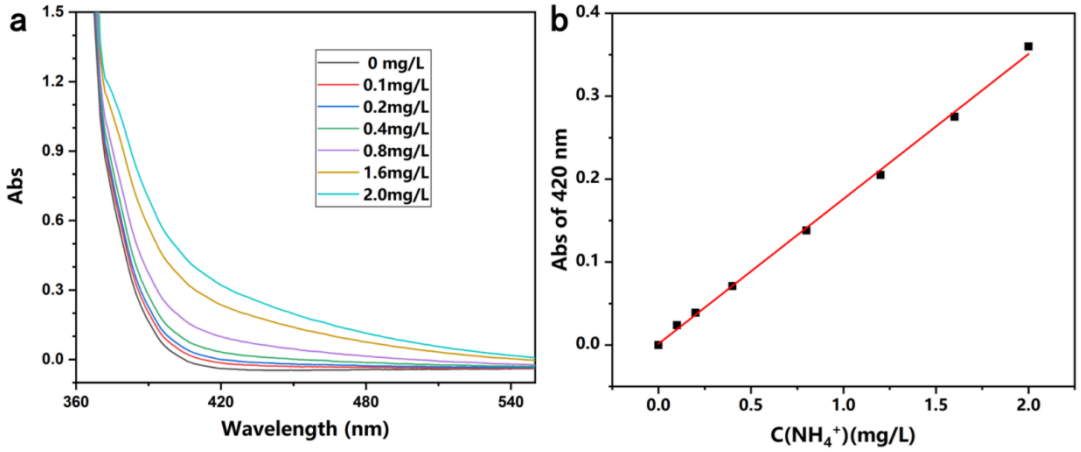


**Fig. S4** Determination of ammonia nitrogen standard curve. (a) Absorption spectra of $NH_4^+$ standard solutions, (b) Linear plot of the absorbance values at 420 nm versus $NH_4^+$ concentration.

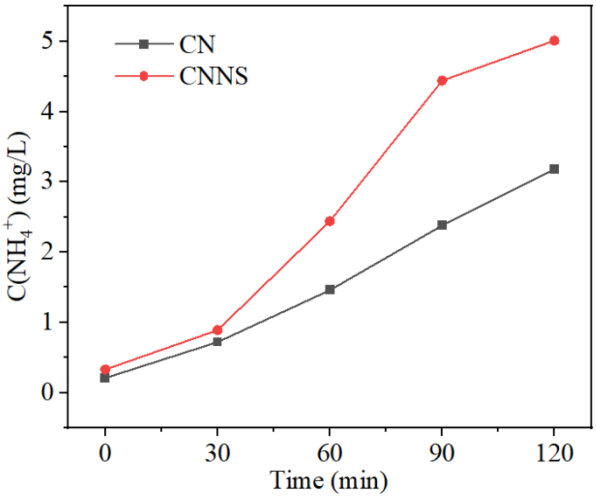


**Fig. S5** Time-dependent $NH_4^+$ concentrations generated by CN and CNNS.

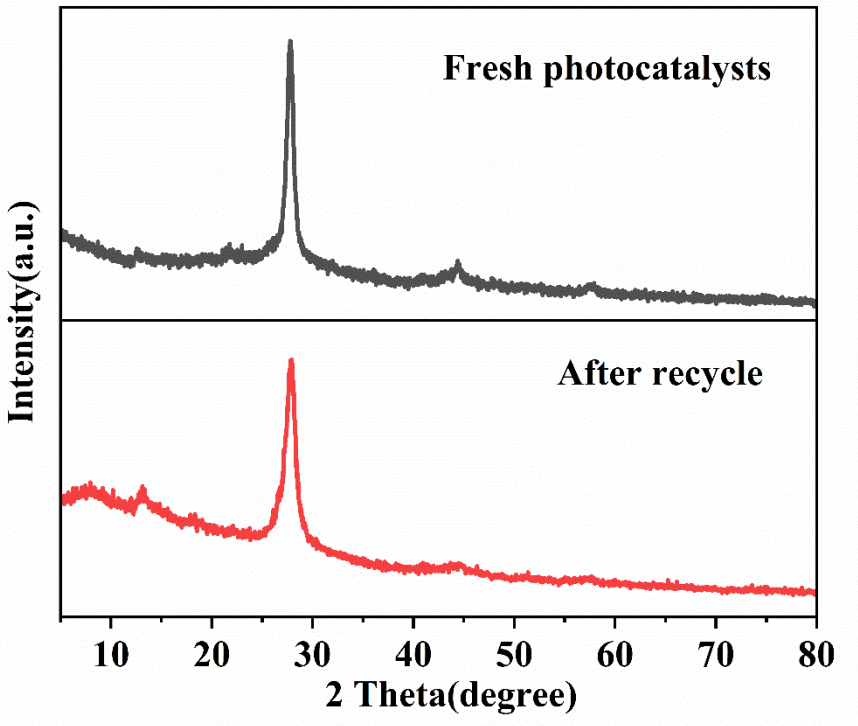


**Fig. S6** XRD patterns of CNNS/GY composites before and after three recycles.

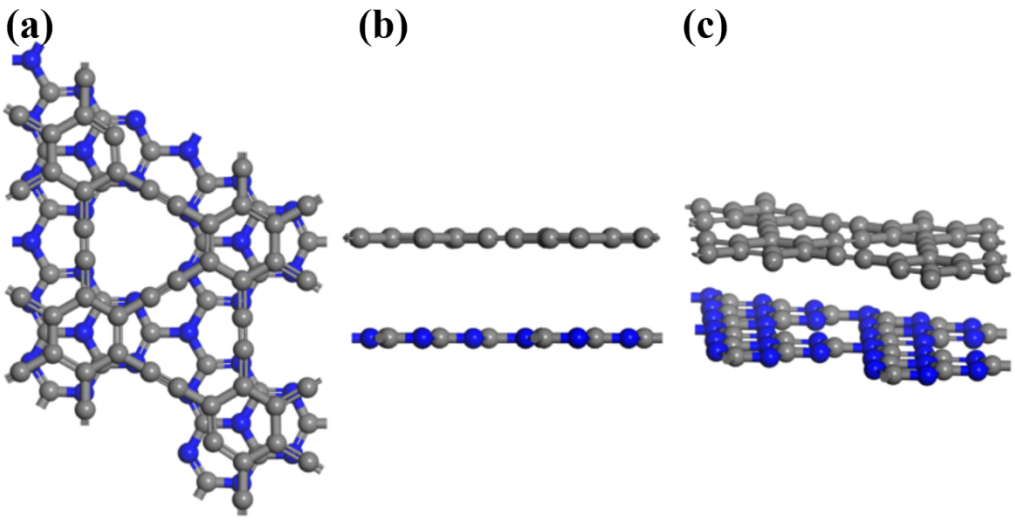


**Fig. S7** Theoretical models of the CNNS/GY electronic structure: (a) top view; (b) side view; (c) oblique view.

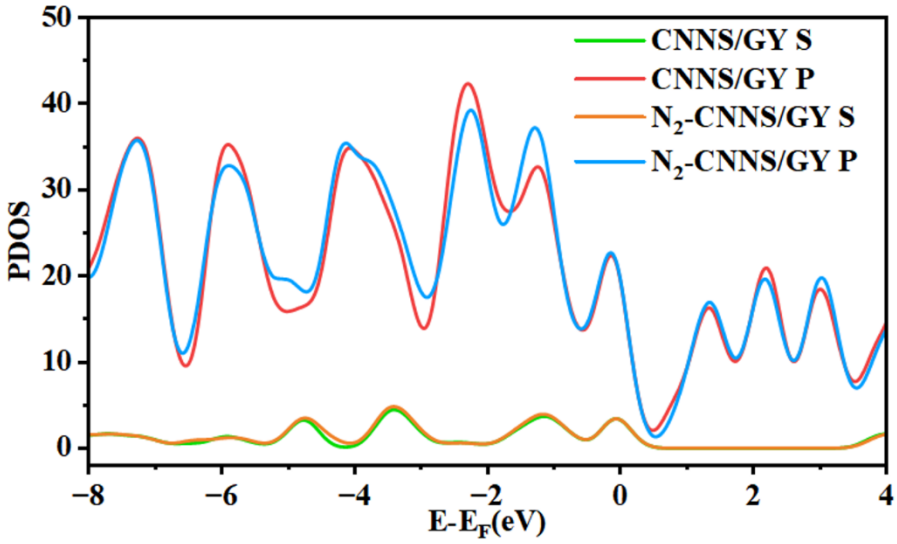


**Fig. S8** Partial density of states (PDOS) of the CNNS/GY heterostructure before and after $N_2$ adsorption.

**Table 1** Corresponding absorbance of ammonia nitrogen standard solution

| **Concentration (mg/L)** | **Actual Absorbance（Abs）** |
|---|---|
| 0 | 0 |
| 0.1 | 0.024 |
| 0.2 | 0.039 |
| 0.4 | 0.071 |
| 0.8 | 0.138 |
| 1.2 | 0.205 |
| 1.6 | 0.275 |
| 2.0 | 0.360 |