Supporting Information

Efficient Visible-Light-Driven Photoreduction of CO₂ to CO over Porous Nitrogen-Deficient Carbon Nitride Nanotubes

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Fig. S1. Thermogravimetric analysis (TGA) of C₃N₄ under air atmosphere.

As the TGA curve collected under an air atmosphere showed that C_3N_4 started to decompose at 535 °C and completely lost at 750 °C, which may cause N vacancies during the oxidation process.^[1] Based on the TGA curve, porous C_3N_4 nanotubes with nitrogen vacancies can be prepared via etching process at 550 °C for desired time.



Fig. S2. Solid-state ¹³C MAS NMR spectra of BCN, NCN-1 and NCN-4, respectively

Samples	C/N
BCN	0.70
NCN-1	0.74
NCN-2	0.77
NCN-3	0.80
NCN-4	0.84

Table S1. C/N atomic ratios obtained from organic element analysis for BCN and NCN-T samples.



Fig. S3. (a) XPS survey spectra and (b) high-resolution O 1s XPS spectra of BCN and NCN-3.

Table S2. Peak area ratio of N-Hx/N group in the samples.

$S_{(C-NH)}/S_{(total)}$
0.151
0.098
0.083
0.073
0.068



Fig. S4. (a) SEM and (b) TEM images of BCN sample.



Fig. S5. Barrett–Joyner–Halenda method (BJH) pore size distribution curves of BCN and NCN-T samples.

Samples	BET surface areas (m ² /g)	Pore volume (cm ³ /g)	
BCN	23	0.11	
NCN-1	93	0.58	
NCN-2	147	0.61	
NCN-3	194	0.68	
NCN-4	207	0.76	

Table S3. Summary of BET surface areas and pore volumes of BCN and NCN-Tsamples.



Fig. S6. Tauc plots of transformed Kubelka-Munk function versus photon energy for BCN and NCN-T samples.



Fig. S7. Mott-Schottky plots of (a) BCN and (b-e) NCN-T samples collected at various frequencies of versus the saturated Ag/AgCl reference electrode (pH =7.0).



Fig. S8. VB-XPS spectra for BCN and NCN-T samples.



Fig. S9. Band structure alignments for BCN and NCN-T samples.



Fig. S10. GC-MS spectrum of pure ${}^{13}CO_2$ (m/z=45) and the photogenerated product ${}^{13}CO$ (m/z=29) from photoreduction of ${}^{13}CO_2$ by photocatalyst under visible light irradiation.



Fig. S11. Time courses of photocatalytic (a) H_2 and (b) O_2 evolution of BCN and NCN-T samples under visible light irradiation (λ >420 nm).



Fig. S12. Wavelength-dependent AQY (left axis) and UV-vis light absorption spectrum of NCN-3 (right axis).

Sample	τ_1 (ns)	Rel.%	τ_2 (ns)	Rel.%	τ (ns)
BCN	1.92	61.28	6.85	38.72	5.31
NCN-1	1.54	60.35	5.43	39.65	4.25
NCN-2	1.43	55.47	4.87	44.53	3.91
NCN-3	1.27	59.18	3.63	40.82	2.82
NCN-4	1.44	53.26	4.28	46.74	3.43

Table S4. Kinetic analysis of emission decay for BCN and NCN-T samples.

References

[1] P. Niu, G. Liu, H.-M. Cheng, J. Phys. Chem. C 2012, 116, 11013-11018.