The supporting information for

Defective g-C_3N_4 prepared by the $NaBH_4$ reduction for high-performance H_2 production

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KEYWORDS. Defects, graphitic carbon nitride, chemical reduction, charge separation, H_2 production

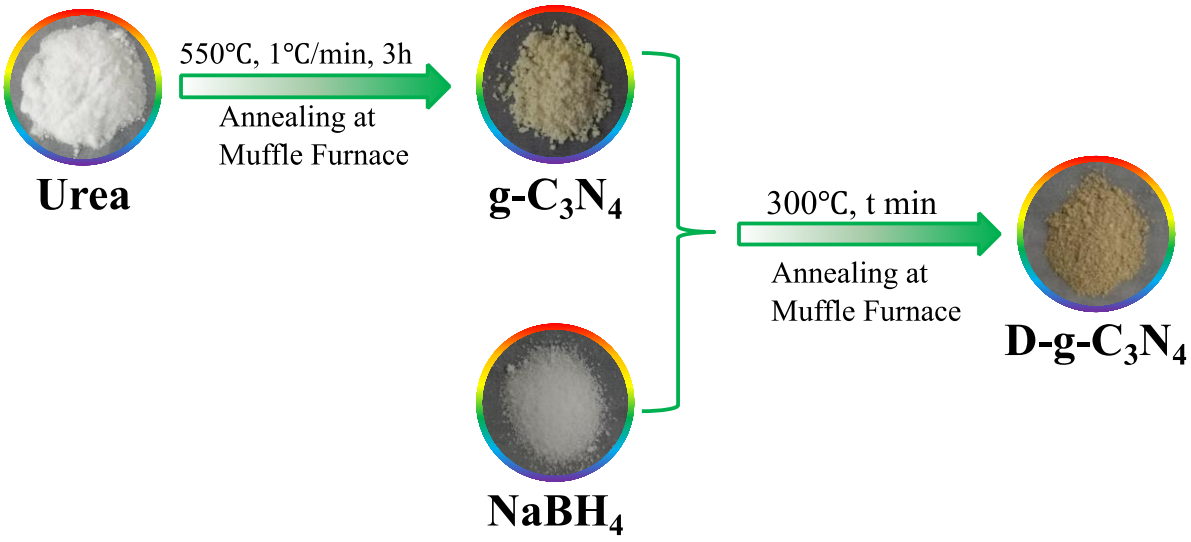


Figure S1. The schematic synthesis route of DCN samples.

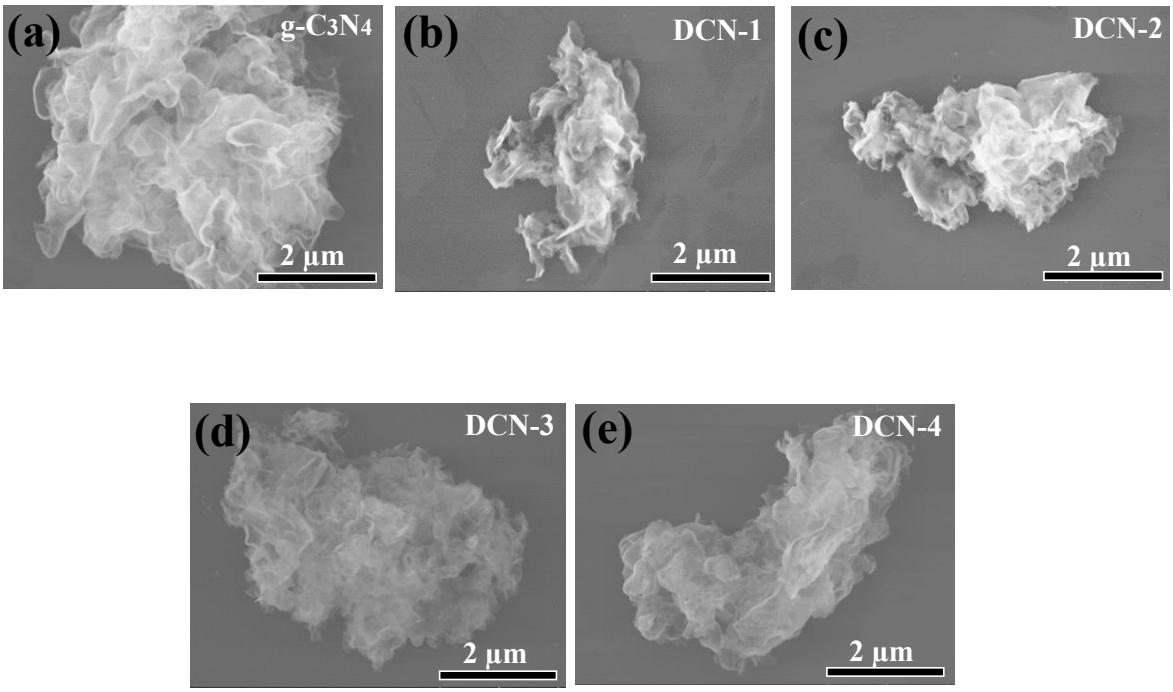


Figure S2 The SEM images of g-C_3N_4 (a), DCN-1 (b), DCV-2 (c), DCN-3 (d), and DCN-4 (e).

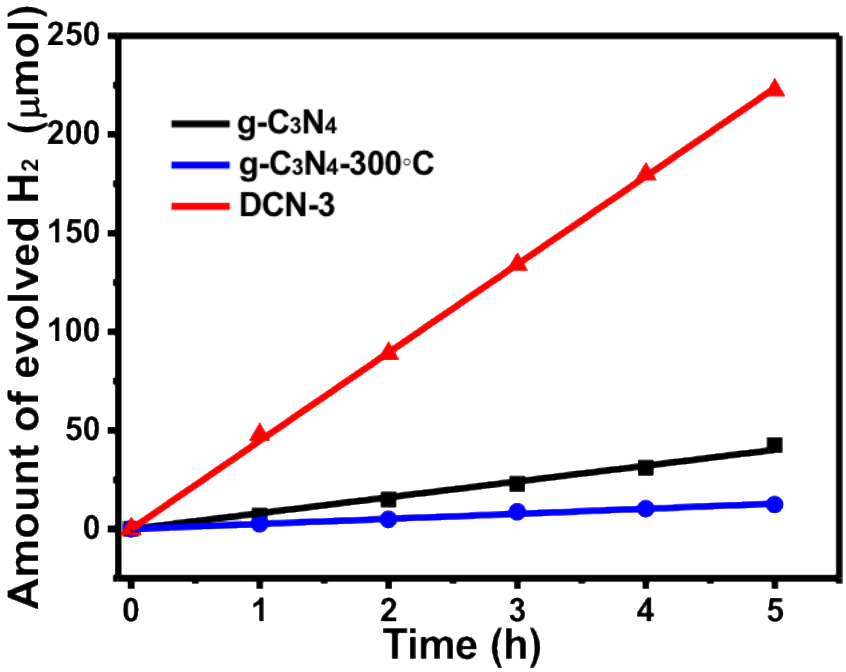
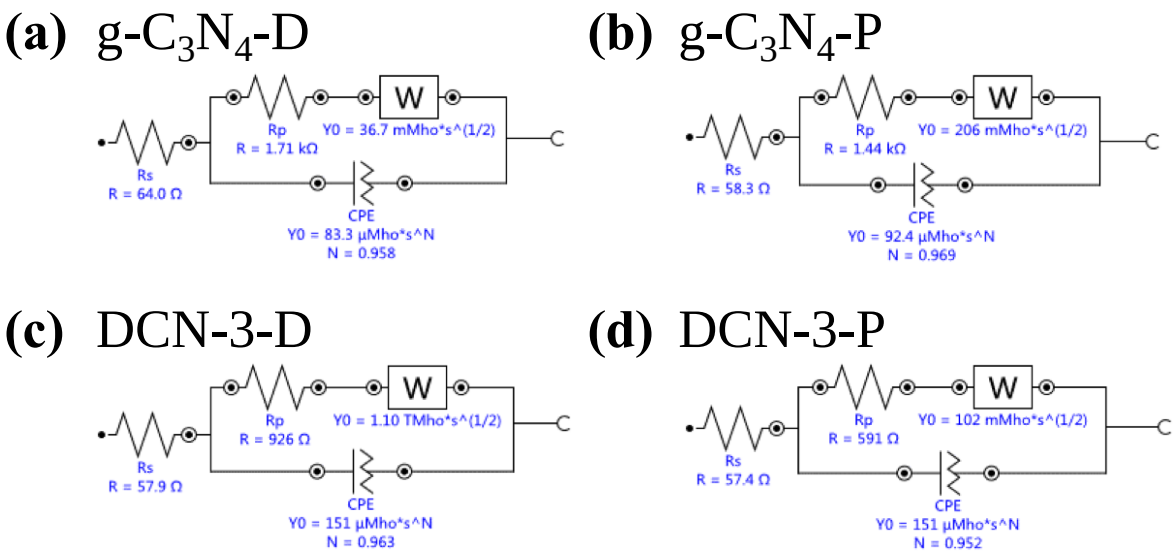


Figure S3. The amount of evolution H_2 of pure g-C_3N_4, DCN-3 and the pure g-C_3N_4 treated at 300°C for 30min without $NaBH_4$.



Catalyst/sample	Rs/ W	Rp/ W	CPE/ ∝Mho
g-C_3N_4- dark	64.0	1710	83.3
g-C_3N_4- light	58.3	1440	92.4
DCN-3- dark	57.9	926	151
DCN-3- light	57.4	591	151

Figure S4. Electrochemical impedance spectroscopy (EIS) of the equivalent circuit of g-C_3N_4 without/with light irradiation (a, b) and DCN-3 without/with light irradiation (c, d).

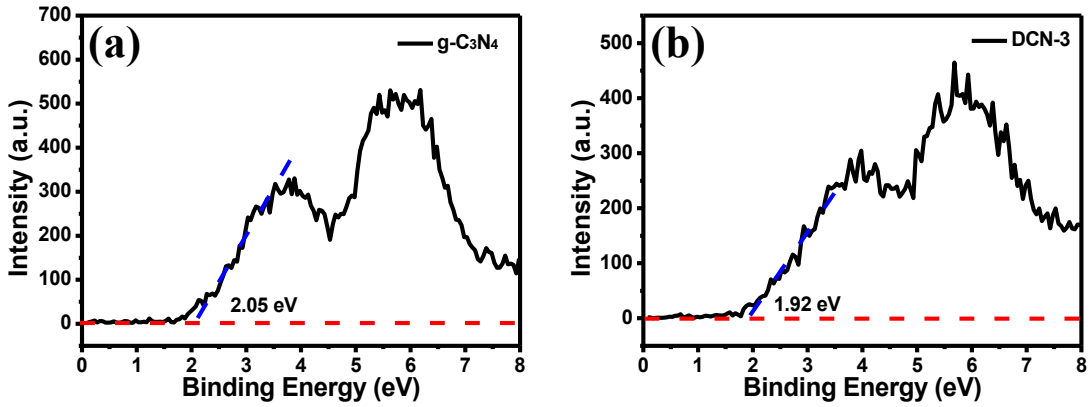


Figure S5. The valence band (VB) XPS of g-C_3N_4 (a) and DCN-3 (b).

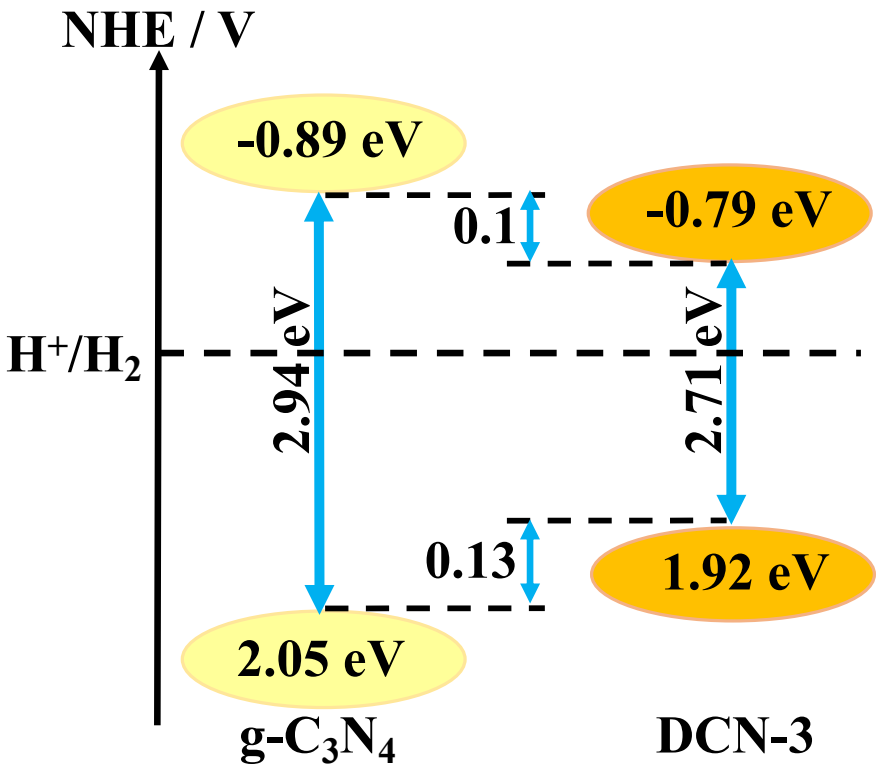
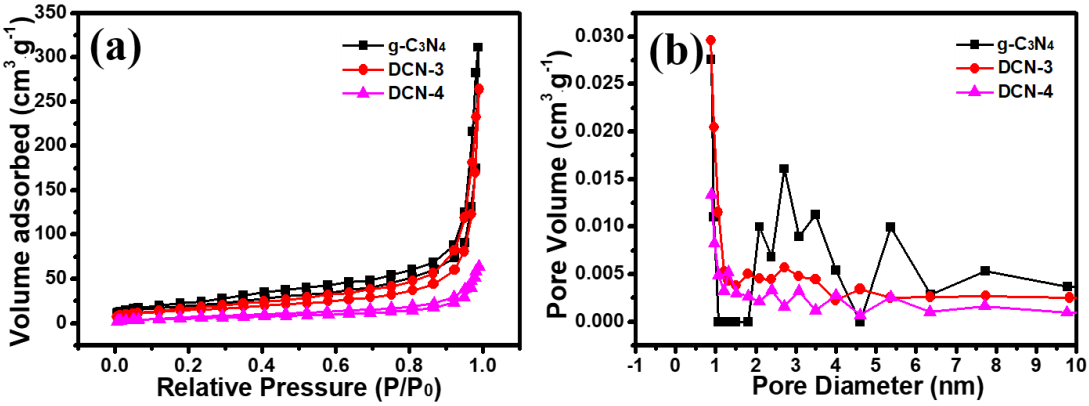


Figure S6. The band structure alignments of g-C_3N_4 and DCN-3 based on the VB XPS and UV-vis spectra.



Samples	SBET ($m^2 \cdot g^{-1}$)	Pore Volume ($cm^3 \cdot g^{-1}$)	Average Pore Size (nm)
g-C_3N_4	71.4	0.484	2.697
DCN-3	53.7	0.415	3.039
DCN-4	20.6	0.103	1.908

Figure S7. N_2 adsorption-desorption isotherms (a) and Barret-Joyner-Halenda (BJH) pore size distribution plots (b) of g-C_3N_4, DCN-3 and DCN-4.

Table S1 Photocatalytic H_2 Production over the photocatalysts under various reaction conditions.

Catalyst	Reaction medium	Scavenger	Light Source	H_2 Production rate	References
Defective g-C_3N_4	90 mL H_2O, 1.0wt%Pt	10% TEOA	300 W Xenon arc lamp, λ >420nm	2223.8 $\mu molh^{-1}g^{-1}$	This article
carbon/g-C_3N_4	80 mL H_2O, 1.0wt%Pt	15% TEOA	350 W Xenon arc lamp, λ ≥420nm	212.8 $\mu molh^{-1}g^{-1}$	1
pm-g-C_3N_4	243 mL H_2O 3.0wt%Pt	10% TEOA	300 W Xenon arc lamp, λ >420nm	417 $\mu molh^{-1}g^{-1}$	2
Graphene/g-C_3N_4	80 mL H_2O, 1.5wt%Pt	25% methanol	350 W Xenon arc lamp, λ > 400nm	451 $\mu molh^{-1}g^{-1}$	3
g-C_3N_4 /$Ca_2Nb_2TaO_{10}$	180 mL H_2O, 1.0wt%Pt	10% TEOA	300 W Xenon arc lamp, λ >400nm	870.8 $\mu molh^{-1}g^{-1}$	4
Dopamine Modified g-C_3N_4	72 mL H_2O, 3.0wt%Pt	8 mL TEOA	300 W Xenon arc lamp, λ >420nm	1380 $\mu molh^{-1}g^{-1}$	5
g-C_3N_4-M1U2	50 mL H_2O, 3.0wt%Pt	20% TEOA	100 W Xenon arc lamp, λ ≥ 400 nm	3.1 $mmolh^{-1}g^{-1}$	6
g-C_3N_4/WO_3	80 mL H_2O, 1.0wt%Pt	10% TEOA	300 W Xenon arc lamp, solar irradiation	3.12 $mmolh^{-1}g^{-1}$	7
oxygen-doped g-C_3N_4	90 mL H_2O, 3.0wt%Pt	10 mL TEOA	300 W Xenon arc lamp, λ >400nm	3780 μmolh-1g-1	8

REFERENCES

1. Xu, Q.; Cheng, B.; Yu, J.; Liu, G., Making Co-condensed Amorphous Carbon/g-C_3N_4 Composites with Improved Visible-Light Photocatalytic H_2-production Performance using Pt as Cocatalyst. *Carbon* **2017,** 118, 241-249, DOI 10.1016/j.carbon.2017.03.052.
2. Zhong, Y.; Wang, Z.; Feng, J.; Yan, S.; Zhang, H.; Li, Z.; Zou, Z., Improvement in Photocatalytic H_2 Evolution over g-C3N4 Prepared from Protonated Melamine. *Applied Surface Science* **2014,** 295, 253-259, DOI 10.1016/j.apsusc.2014.01.008.
3. Xiang, Q.; Yu, J.; Jaroniec, M., Preparation and Enhanced Visible-Light Photocatalytic H_2-Production Activity of Graphene/C3N4 Composites. *The Journal of Physical Chemistry C* **2011,** 115, 7355-7363, DOI 10.1021/jp200953k.
4. Thaweesak, S.; Lyu, M.; Peerakiatkhajohn, P.; Butburee, T.; Luo, B.; Chen, H.; Wang, L., Two-dimensional g-C_3N_4/$Ca_2Nb_2TaO_{10}$ Nanosheet Composites for Efficient Visible Light Photocatalytic Hydrogen Evolution. *Applied Catalysis B: Environmental* **2017,** 202, 184-190, DOI 10.1016/j.apcatb.2016.09.022.
5. Xia, P.; Liu, M.; Cheng, B.; Yu, J.; Zhang, L., Dopamine Modified g-C_3N_4 and Its Enhanced Visible-Light Photocatalytic H_2-Production Activity. *ACS Sustainable Chemistry & Engineering* **2018,** 6, 8945-8953, DOI 10.1021/acssuschemeng.8b01300.
6. Ruan, D.; Kim, S.; Fujitsuka, M.; Majima, T., Defects Rich g-C_3N_4 with Mesoporous Structure for Efficient Photocatalytic H_2 Production under Visible Light Irradiation. *Applied Catalysis B: Environmental* **2018,** 238, 638-646, DOI 10.1016/j.apcatb.2018.07.028.
7. Yu, W.; Chen, J.; Shang, T.; Chen, L.; Gu, L.; Peng, T., Direct Z-scheme g-C_3N_4/WO_3 Photocatalyst with Atomically Defined Junction for H_2 Production. *Applied Catalysis B: Environmental* **2017,** 219, 693-704, DOI 10.1016/j.apcatb.2017.08.018.
8. She, X.; Liu, L.; Ji, H.; Mo, Z.; Li, Y.; Huang, L.; Du, D.; Xu, H.; Li, H., Template-free Synthesis of 2D Porous Ultrathin Nonmetal-doped g-C3N4 Nanosheets with Highly Efficient Photocatalytic H_2 Evolution from Water under Visible Light. *Applied Catalysis B: Environmental* **2016,** 187, 144-153, DOI 10.1016/j.apcatb.2015.12.046.