Supporting Information

$g\text{-}C_3N_4$ modified by cobalt-nickel bimetallic phosphide for highly efficient photocatalytic removal of methylene blue

Jinpu Zhang[1,3], Xiaoyu Wang[3], Ruihan Du[3], Siyang Sun[3], Shuyi Yu[3], Chunli Kang[123*]

1. Key Laboratory of Groundwater Resources and Environment, Jilin University, Ministry of Education, Changchun, 130021, China

2. Jilin Provincial Key Laboratory of Water Resources and Water Environment, Jilin University, Changchun, 130021, China

3. College of New Energy and Environment, Jilin University, Changchun, 130021, China

* Corresponding author.

E-mail address: kangcl@jlu.edu.cn (C. Kang).

Contents

Fig.S1. SEM images of gCN and gCN/CoP

Fig.S2. UV-vis spectra of CoNiP

Fig.S3. XPS full scan spectra of gCN/CoNiP and Valence-band XPS spectra of gCN/CoNiP

Fig.S4. EIS and TPR of gCN, gCN/CoP and gCN/CoNiP

Fig.S5. The first-order reaction kinetics fitting for gCN, gCN/CoP, and gCN/CoNiP with varying Co/Ni ratios

Fig.S6. XRD patterns and XPS spectra of gCN/CoNiP catalysts after 5 cycles

Table.S1. The degradation kinetics equations and parameters for gCN/CoNiP with different Co/Ni ratios

Table S2. The photocatalytic activity of catalysts containing g-C_3N_4

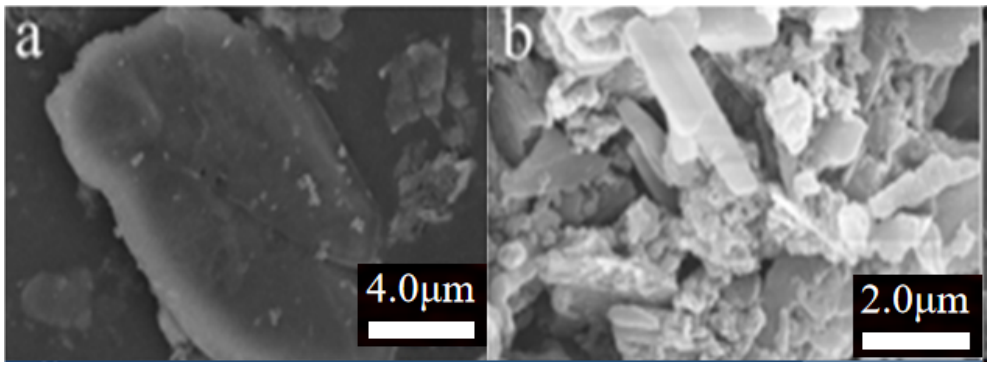

Fig.S1 SEM images of (a) gCN, (b) gCN/CoP

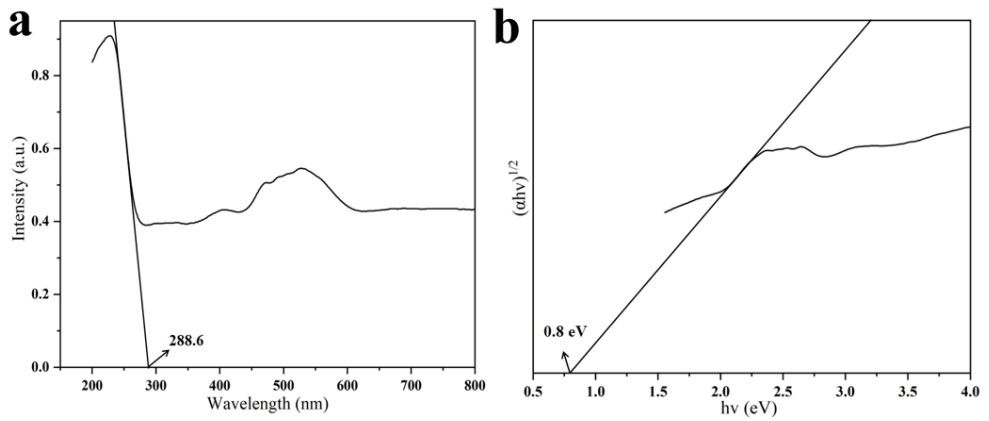

Fig.S2 (a) UV-vis spectra of CoNiP, (b) the $(\alpha h\nu)^{1/2}$ versus hν curves for CoNiP

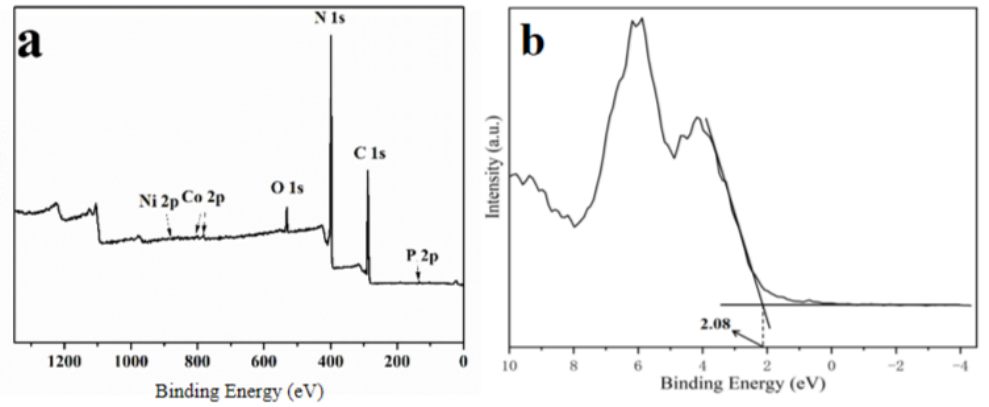

Fig.S3 (a)XPS full scan spectra of gCN/CoNiP, (b) Valence-band XPS spectra of gCN/CoNiP

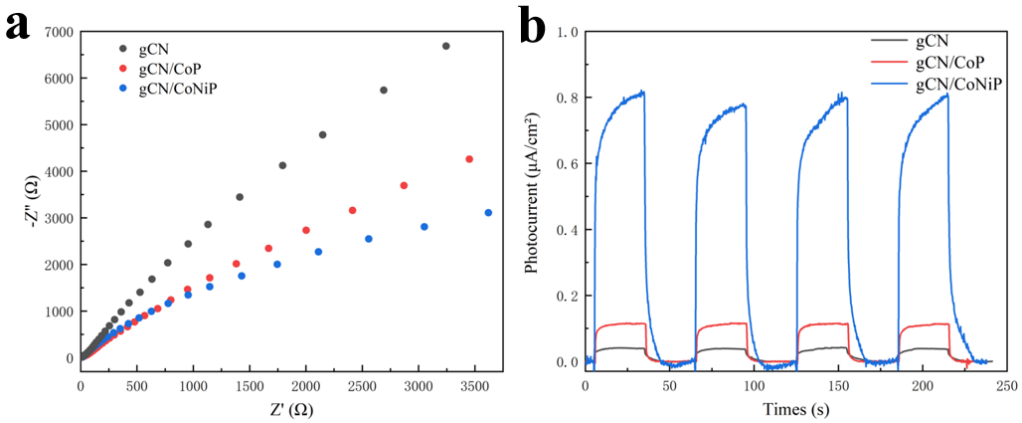

Fig.S4 (a) EIS (b) TPR of gCN, gCN/CoP and gCN/CoNiP

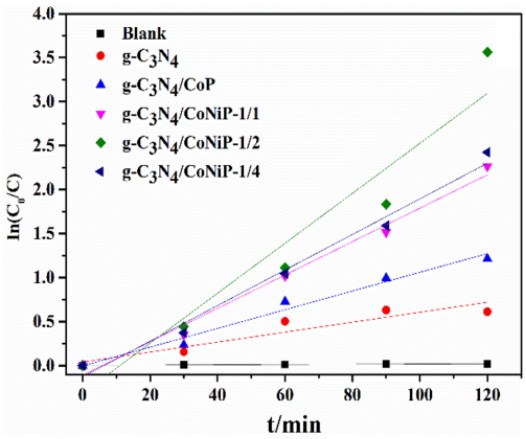

Fig.S5 The first-order reaction kinetics fitting for gCN, gCN/CoP, and gCN/CoNiP with varying Co/Ni ratios

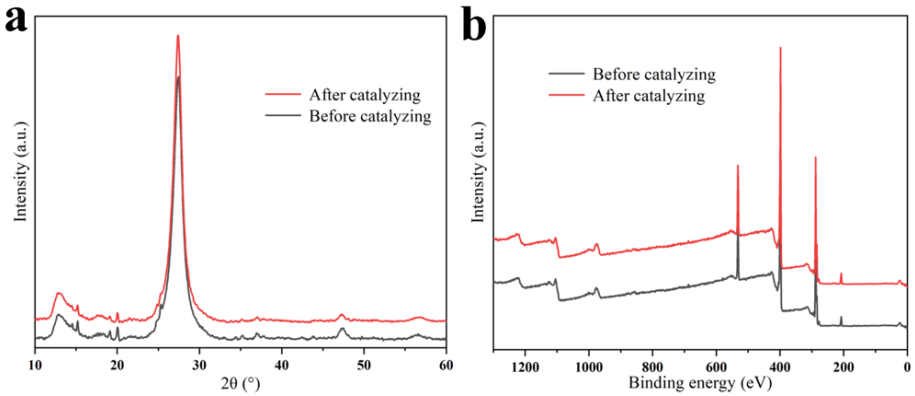

Fig.S6 (a) XRD patterns and (b) XPS spectra of gCN/CoNiP catalysts after 5 cycles

Table. S1. The degradation kinetics equations and parameters for gCN/CoNiP with different Co/Ni ratios

Photocatalyst	First-order kinetics equation	k/min^{-1}	R^2
g-C_3N_4	y=0.0064x-0.0057	0.0064	0.9721
g-C_3N_4/CoP	y=0.0106x-0.0033	0.0106	0.9903
g-C_3N_4/CoNiP-1/1	y=0.0190x-0.1091	0.0190	0.9837
g-C_3N_4/CoNiP-1/2	y=0.0284x-0.3131	0.0284	0.9962
g-C_3N_4/CoNiP-1/4	y=0.0202x-0.1267	0.0202	0.9925

Table S2. The photocatalytic activity of catalysts containing g-C_3N_4

Catalyst(g/L)	System	Pollutants(mg/L)	Removal efficiency(%)	Ref.
GaN-ZnO/g-C_3N_4(0.5)	75 W lamp with a filter cutting UV rays	MB(50)	98(300min)	[1]
$BaTiO_3$/g-C_3N_4(1.0)	sunlight(60,000–65,000 lux)	MB(10)	91(90min)	[2]
SnS_2/rGO/g-C_3N_4(0.05)	300 W visible lamp	MB(25)	86(70min)	[3]
$SnNb_2O_6$/g-C_3N_4(0.25)	500 W tungsten light lamp with a 420 nm cutoff filter	MB(10)	99(240min)	[4]
g-C_3N_4/BiOCl(0.1)	500 W xenon lamp	MB(10)	92(240min)	[5]
rod-like TiO_2/g-C_3N_4(1.0)	Ideaoptics iDH2000-BSC with the optical fiber spectrometer	MB(60)	97(240min)	[6]
C_3N_4/ZIF67(0.1)	300 W Xenon lamp irradiation with a 420 nm cutoff filter	MB(10)	90(70min)	[7]
Ag/g-C_3N_4(1.0)	visible lamp	MB(20)	94(180min)	[8]
g-C_3N_4/CoNiP(1.0)	450 W xenon lamp	MB(10)	98(120min)	This work

References

1 K. Nguyen Van, V. N. Nguyen Thi, T. P. Tran Thi, T. T. Truong, T. Lieu Le Thi, H. Tran Huu, V. T. Nguyen and V. Vo, *Chemical Physics Letters*, 2021, **763**, 138191.

2 S. Kappadan, S. Thomas and N. Kalarikkal, *Chemical Physics Letters*, 2021, **771**, 138513.

3 S. Chandra Shyagathur, A. H. Nagaraja Rao, P. K. Ravishankar, G. Nagaraju and J. Pattar, *Optical Materials*, 2024, **147**, 114688.

4 Z. Zhang, D. Jiang, D. Li, M. He and M. Chen, *Applied Catalysis B: Environmental*, 2016, **183**, 113–123.

5 S. Qi, X. Liu, R. Zhang, Y. Zhang and H. Xu, *Inorganic Chemistry Communications*, 2021, **133**, 108907.

6 M. Tian, J. Wang, R. Sun, D. Lu, N. Li, T. Liu, M. Yao, G. Zhang and L. Li, *Inorganic Chemistry Communications*, 2022, **141**, 109517.

7 P. Su, J. Zhang, K. Xiao, S. Zhao, R. Djellabi, X. Li, B. Yang and X. Zhao, *Chinese Journal of Catalysis*, 2020, **41**, 1894–1905.

8 K. Portillo-Cortez, U. Caudillo-Flores, P. Sánchez-López, E. Smolentseva, D. Dominguez and S. Fuentes-Moyado, *Nanomaterials*, 2024, 14.