

Supplementary Materials

Polymeric Carbon Nitride-CNTs-Ferric Oxide All-Solid Z-Scheme Heterojunction with Improved Photocatalytic Activity towards Organic Dye Removal

*Xinxin Yang¹, Rongcai Gong¹, Zhaoen Dong¹, Guiqing Liu¹, Yunyi Han¹, Yuwei Hou¹,
Meili Guan², Xuezhong Gong^{1*} and Jianguo Tang^{1*}*

¹Institute of Hybrid Materials, National Center of International Research for Hybrid Materials Technology, National Base of International Science & Technology Cooperation, College of Materials Science and Engineering, Qingdao University, Qingdao 266071, P. R. China

²College of Materials Science and Engineering, Qingdao University, Qingdao 266071, P. R. China

³College of Chemical and Biological Engineering, Shandong University of Science and Technology, Qingdao, Shandong, PR China

Corresponding email: xzgong@qdu.edu.cn; tang@qdu.edu.cn

Synthesis of binary composites (PCN/CNTs, PCN/ α -Fe₂O₃ and α -Fe₂O₃/CNTs)

The synthesis of binary composites was carried out in the same process and conditions as the ternary composites synthesis except for the difference of components. The weight content ratio of PCN, CNTs and α -Fe₂O₃ was controlled as follows: α -Fe₂O₃ / PCN =1:3, CNTs/PCN=1:10, and CNTs/ α -Fe₂O₃ =1:10. The binary composites are denoted as PCN/CNTs, PCN/ α -Fe₂O₃, and α Fe₂O₃/CNTs.

Table S1 The calculated reaction rate constants (min^{-1}) for PCN, Fe₂O₃, binary composite of PCN/CNTs, PCN/Fe₂O₃, and Fe₂O₃/CNTs, ternary PCN/CNTs/Fe₂O₃ hybrids with various CNTs/Fe₂O₃ mass ratios.

Samples	Kinetic rate constant ($-k, 10^{-3} \text{ min}^{-1}$)	
	MB	CV
PCN	13.3	12.0
Fe ₂ O ₃	3.73	3.24
CCF-5(CF-3)	17.9	36.7
CCF-10(CF-5)	15.9	39.9
CCF-5(CF-5)	19.1	42.4
CCF-10(CF-3)	25.3	56.1
PCN/CNTs	18.8	34.9
PCN/Fe ₂ O ₃	15.4	29.1
Fe ₂ O ₃ /CNTs	2.72	4.23

Table S2 Physical properties of PCN, Fe₂O₃ and CCF-10(CF-3)

Sample	S _{BET} (m ² /g)	Pore volume (cm ³ /g)	Average pore size (nm)
PCN	11.33	0.027	10.2
α -Fe ₂ O ₃	14.54	0.022	8.4
CCF-10(CF-3)	23.34	0.064	12.8

Table S3 Valence band, conduction band and band gap energies of PCN and α -Fe₂O₃ samples.

Sample	E _{VB} (eV)	E _{CB} (eV)	E _g (eV)
PCN	1.73	-1.49	3.22
α -Fe ₂ O ₃	2.31	0.28	2.03

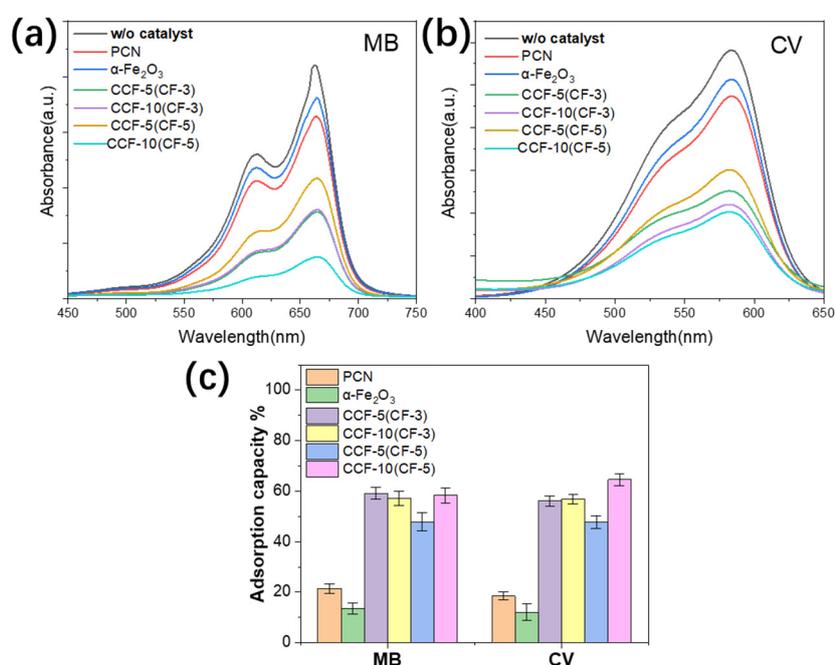


Figure S1. UV-Vis absorbance spectra of (a) MB and (b) CV after 30 min dark adsorption over the different samples. (c) Calculated adsorption capacities of MB and CV over the different samples.

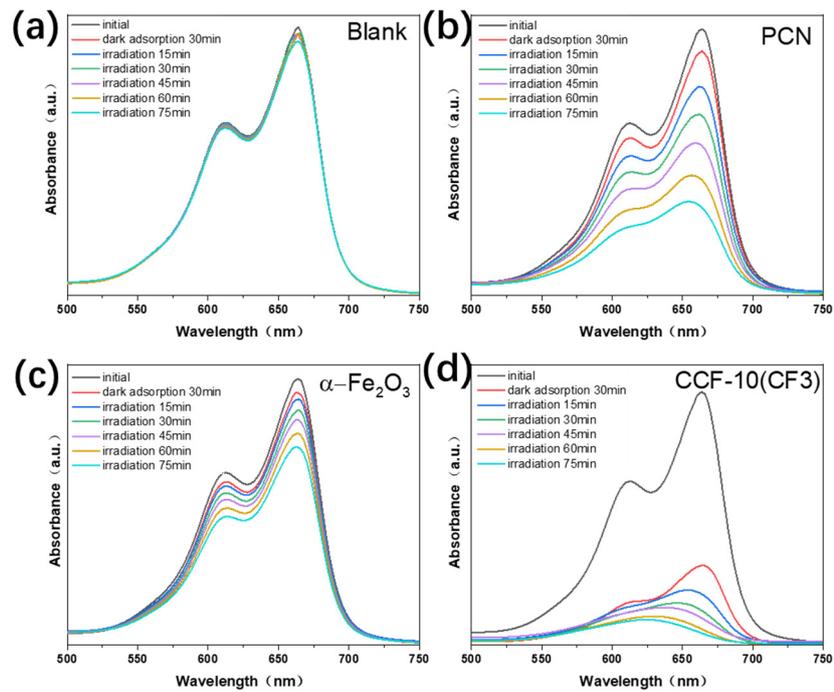


Figure S2 Time-dependence of the UV-Vis absorption spectra of MB in the presence of different samples under light irradiation: (a) Blank, (b) PCN, (c) $\alpha\text{-Fe}_2\text{O}_3$ and (d) CCF-10(CF3)

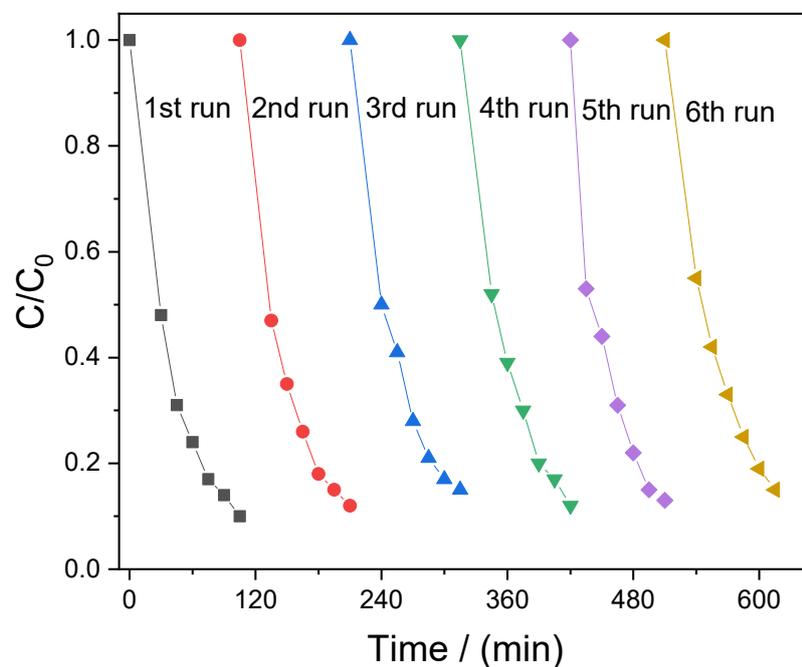


Figure S3 Recycling test and reusability of CCF-10(CF3) sample using the MB as target substrate.