

Supported Information

Mg-Fe layered double hydroxides/polyacrylonitrile nanofibers for solar-light induced peroxymonosulfate elimination of tetracycline hydrochloride

Hao Peng ^a, Beilei Ye ^b, Meiying Luo ^b, Xiaogang Zheng ^{b,*}

^a College of Chemistry and Chemical Engineering, Yangtze Normal University, Chongqing 408100, China

^b College of Chemistry and Chemical Engineering, Neijiang Normal University, Neijiang, Sichuan 641100, PR China.

S1. Characterization

CuS-Mg/S-BC samples were evaluated by X-ray diffraction (XRD, Bruker D8), field emission scanning electron microscopy (FE-SEM, Phenom Pharos), inductively coupled plasma optical emission spectrometer (ICP-OES, Optima 5300DV), X-ray photoelectron spectroscopy (XPS, Escalab 250XI), Fourier-transform infrared spectra (FT-IR, Bruker Alpha, Germany), Zeta potential (Brookhaven, NanoBrook Omni), UV-vis diffuse reflectance spectra (UV-vis DRS, Shimadzu UV-2600), photoluminescence (PL, FLSP 920, excitation at 380 nm), and electron spin resonance (ESR, Bruker A300, Germany). In addition, the photoelectrochemical properties were evaluated on a photoelectric instrument (CEL-PECX2000, Beijing CEL Tech. Co., Ltd., China) equipped with a Vertex. C. EIS electrochemistry workstation (Ivium Technologies B.V., Holland) and a Xe lamp ($\lambda > 420$ nm, 240 mW cm^{-2}). In the three-electrode system of $0.1 \text{ mol L}^{-1} \text{ Na}_2\text{SO}_4$ solution, the working electrode was indium tin oxide glass covered with the obtained photocatalyst film (0.5 cm^2), the counter electrode was Ag/AgCl electrolyte, and the reference electrode was calomel electrode. The working electrode was prepared as following: 20 mg bulks were dispersed into 1 mL DMF (N,N-dimethylformamide) and 20 μL Nafion@117 solution, then 50 μL solution was dropped onto indium tin oxide glass with an area of $0.5 \times 0.5 \text{ cm}^2$, and further the obtained electrode was dried at 363 K for 6 h.

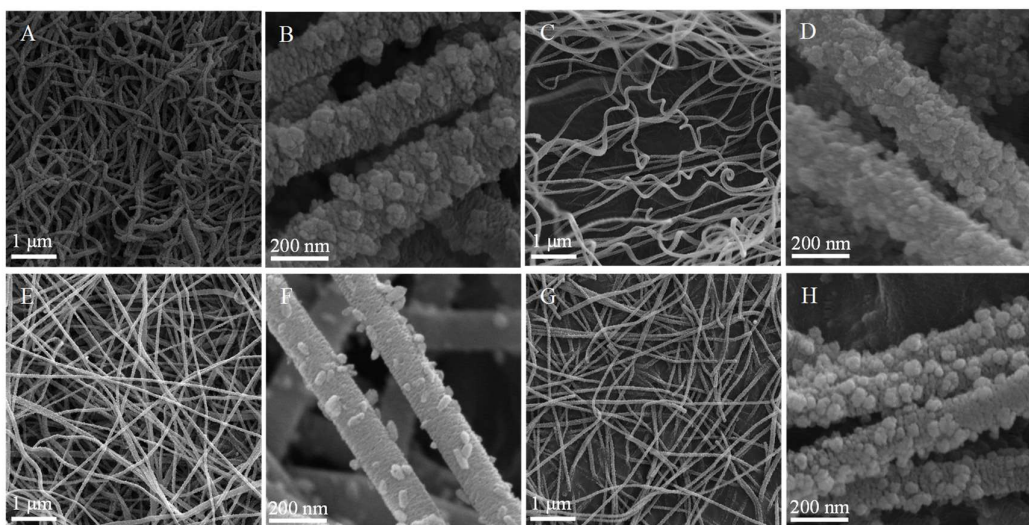


Figure S1. SEM images of MgFe/PAN (A and B), MgFe₂/PAN (C and D), MgFe₃/PAN (E and F), and Mg₂Fe/PAN (G and H).

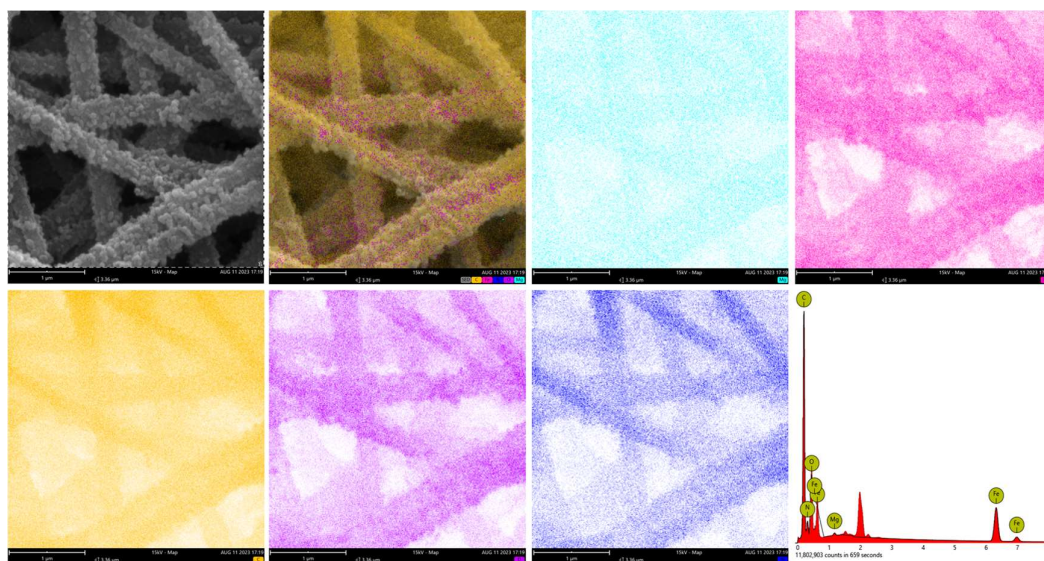


Figure S2. Elemental mapping images and EDX pattern of MgFe₂/PAN.

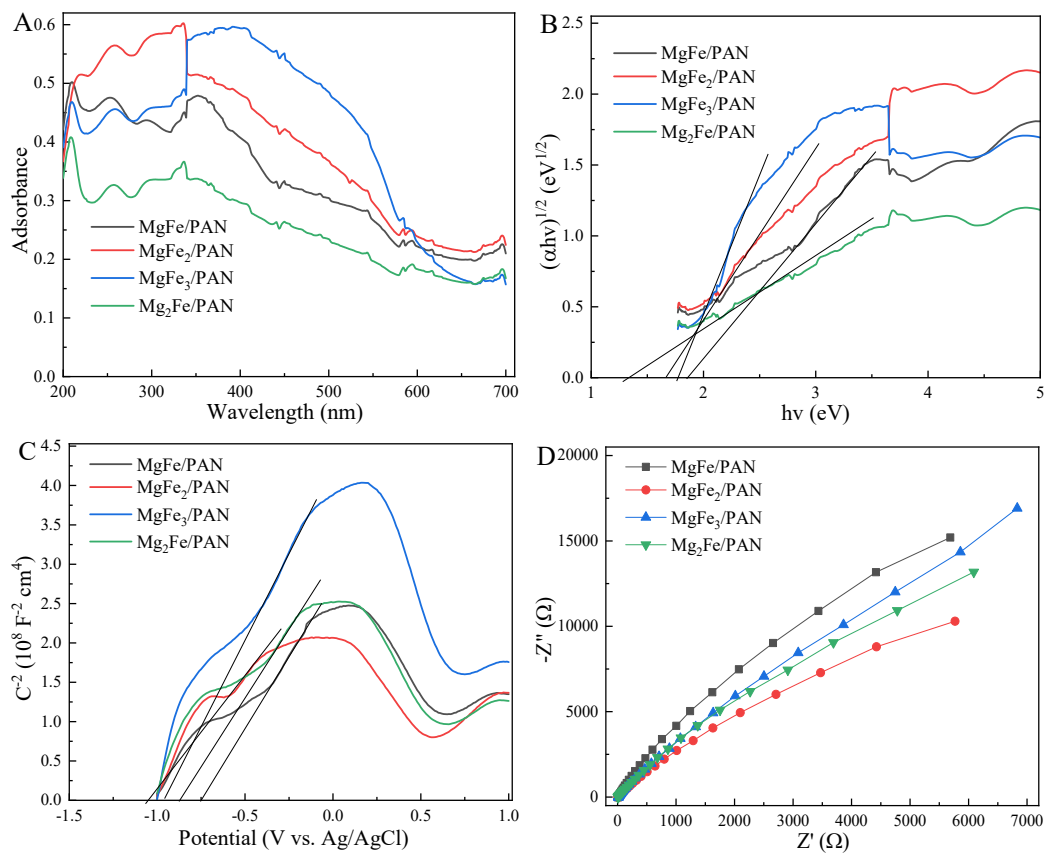


Figure S3. UV-vis DRS curves (A), plots of $(h\nu)$ versus $(\alpha h\nu)^{1/2}$, Mott-Schottky curves (C), and electrochemical impedance spectra (D) of MgFe/PAN with various Mg/Fe molar ratios.

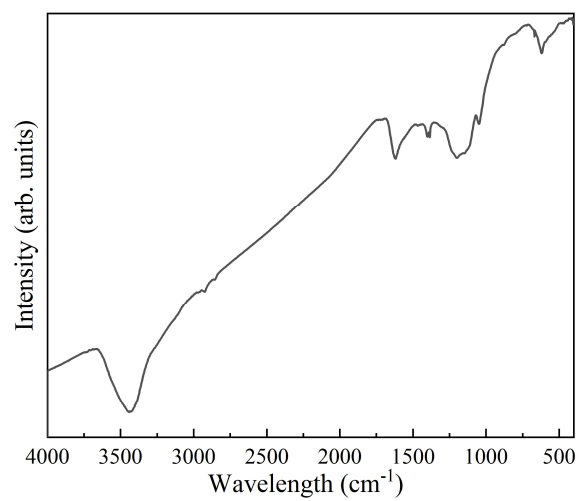


Figure S4. FT-IR spectra of PAN nanofibers.

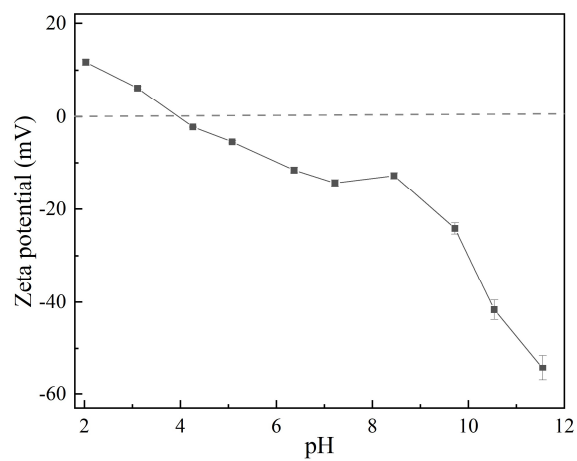


Figure S5. Zeta potential curve of MgFe₂/PAN.

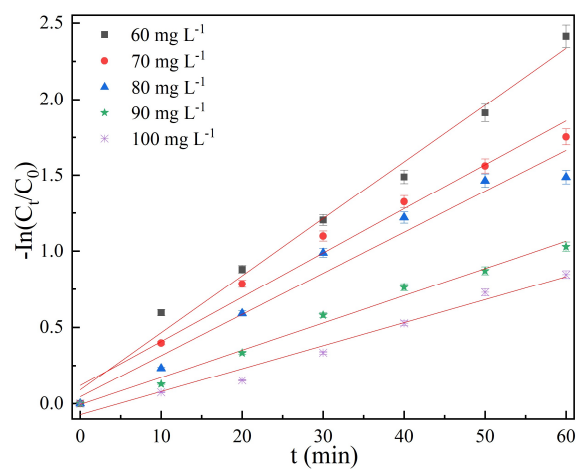


Figure S6. Effect of TCH concentration on the photo-PMS kinetics of MgFe₂/PAN for TCH removal.

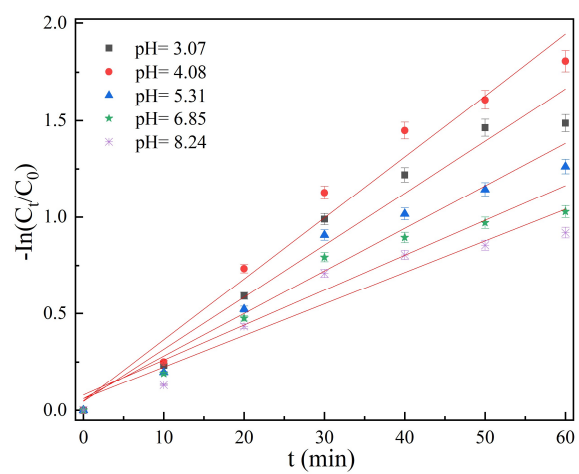


Figure S7. Effect of pH on the photo-PMS kinetics of MgFe₂/PAN for TCH removal.

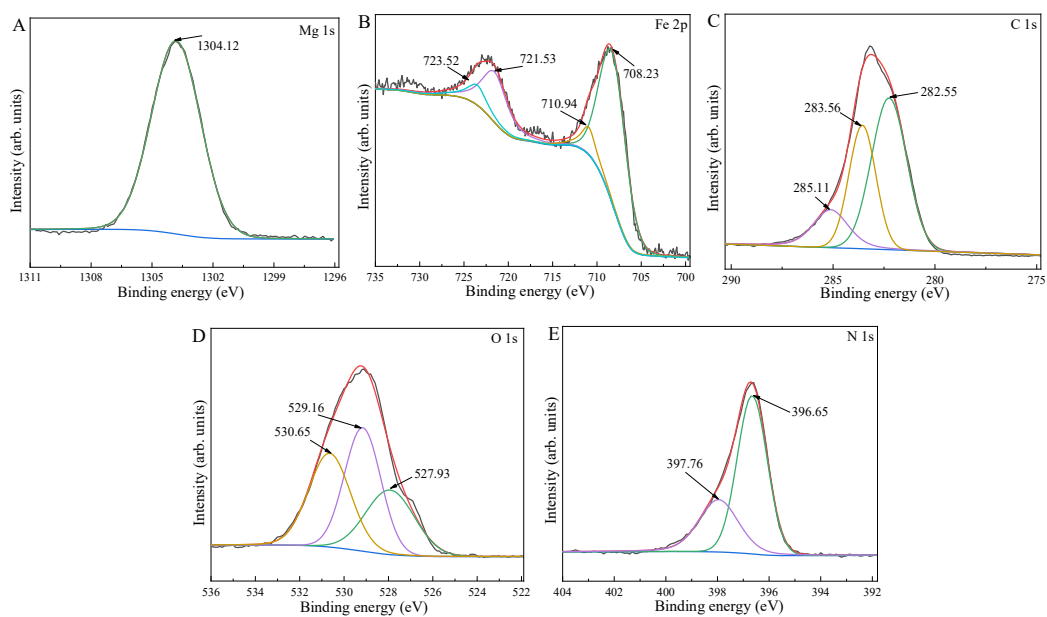


Figure S8. Mg 1s (A), Fe 2p (B), C 1s (C), O 1s (D), and N 1s (E) XPS spectra of used MgFe_2/PAN .

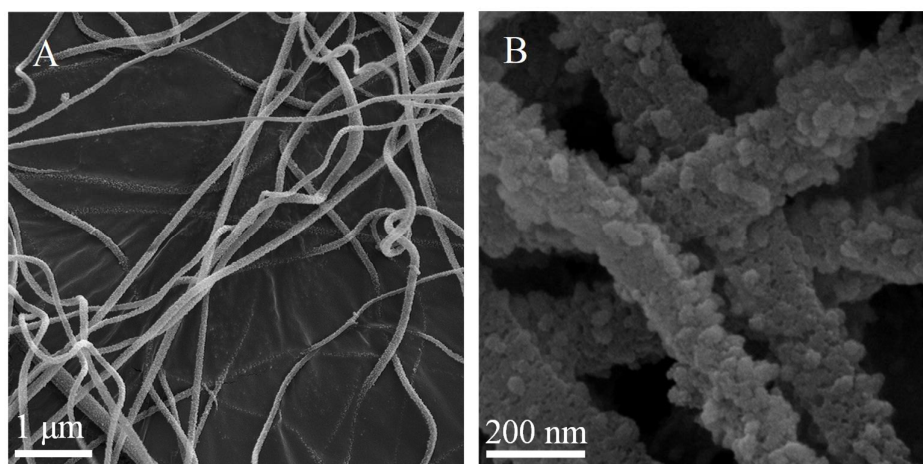


Figure S9. SEM images of used MgFe₂/PAN.

Table S1. Band gap energies and electronic properties of PAN and Mg-Fe/PAN composites.

Samples	Metal content		E_g (eV)	E_{FB} (V)	E_{CB} (eV) ^a	E_{VB} (eV) ^b
	Mg (%)	Fe (%)				
PAN nanofibers	/	/	3.84	-1.30	-1.10	2.74
Mg(OH) ₂ /PAN	0.56	/	2.83	-1.12	-0.92	1.91
Fe(OH) ₃ /PAN	/	1.20	1.75	-0.96	-0.76	0.99
MgFe/PAN	0.56	1.20	1.87	-0.75	-0.55	1.32
MgFe ₂ /PAN	0.53	1.35	1.67	-1.03	-0.83	0.84
MgFe ₃ /PAN	0.50	1.12	1.78	-0.96	-0.76	1.02
Mg ₂ Fe/PAN	0.61	1.22	1.34	-0.87	-0.67	0.67

^a $E_{CB} = E_{FB} + 0.197$ (0.197 is the standard electrode potential of Ag/AgCl electrode). ^b $E_{VB} = E_g + E_{CB}$.

Table S2. Degradation capacities of MgFe₂/PAN and reported materials for TCH elimination.

Photocatalyst	Light source	Catalyst content (g L ⁻¹)	TCH Conc. (mg L ⁻¹)	Time (min)	Degradation efficiency (%)	Ref.
g-C ₃ N ₄ /LDH0.3-OVs/Vis	Xe lamp	0.2	10	90	95.00	[51]
PCNFs@TiO ₂ -CuTCPP	Xe lamp, 300 W	0.25	40	240	89.90	[52]
MIL-88B(Fe)/ZnTi-LDH	Xe lamp, 300W	0.2	30	100	93.51	[53]
NiFe-LDH-V _{Ni} /PS	Vis	0.2	30	90	80.00	[50]
Ni ₂ P/NiCo-LDH	Xe lamp,	0.1	10	90	46.00	[54]

	350W					
NiCoMn-LDH	Xe lamp, 150W	0.3	20	120	96.00	[55]
CoAl-LDH/Ti ₃ C ₂	Xe lamp, 300 W	0.5	25	120	85.00	[56]
FeNi-LDH/Ti ₃ C ₂	Xe lamp, 300 W	0.2	20	120	94.70	[25]
Fe ₃ O ₄ /FeP	Xe lamp, 1000 W	0.4	50	210	88.00	[57]
ZIF-8/MnFe ₂ O ₄	Xe lamp, 300 W	0.3	20	120	90.20	[58]
MgFe ₂ /PAN	Xe lamp, 300 W	0.4	80	120	81.31	This work