Supplementary Information

A Bifunctional Electroactive Ti_4O_7-based Membrane System for Highly Efficient Ammonia Decontamination

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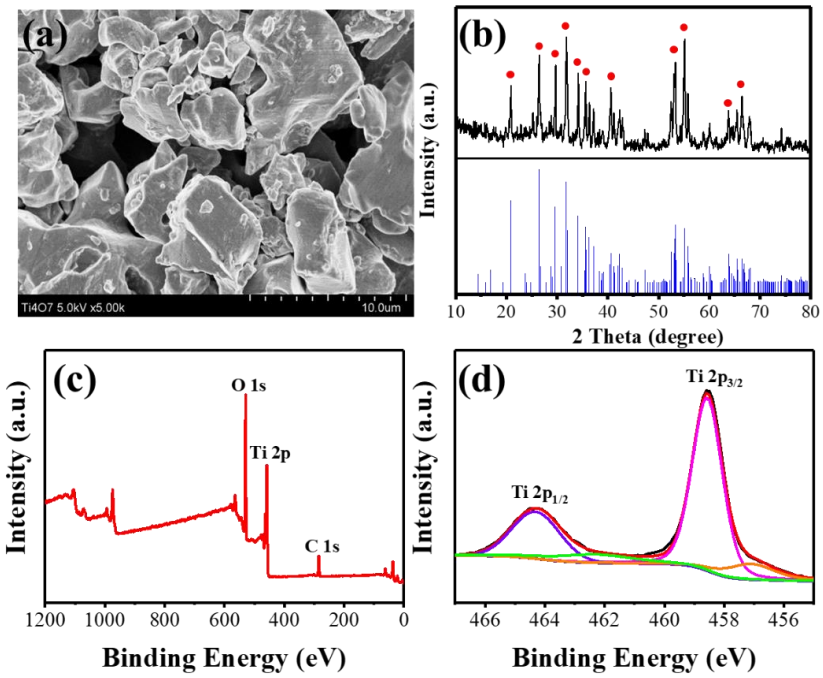

Figure S1. (a) FESEM characterization, (b) XRD pattern, and (c) XPS survey pattern of the Ti_4O_7 anode. XPS narrow scan of (d) Ti 2p on Ti_4O_7 electrode.

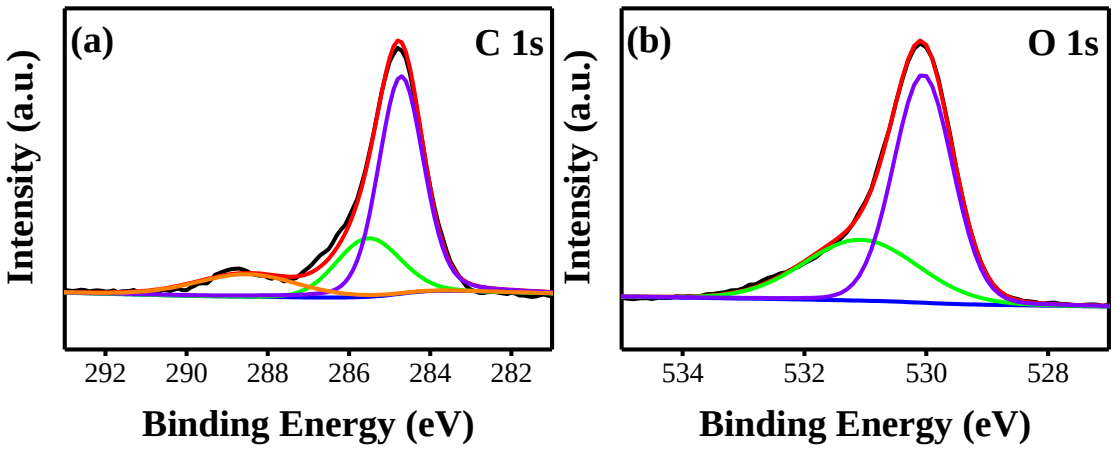

Figure S2. XPS spectra for the narrow scan of (a) C 1s, and (b) O 1s on Ti_4O_7 electrode.

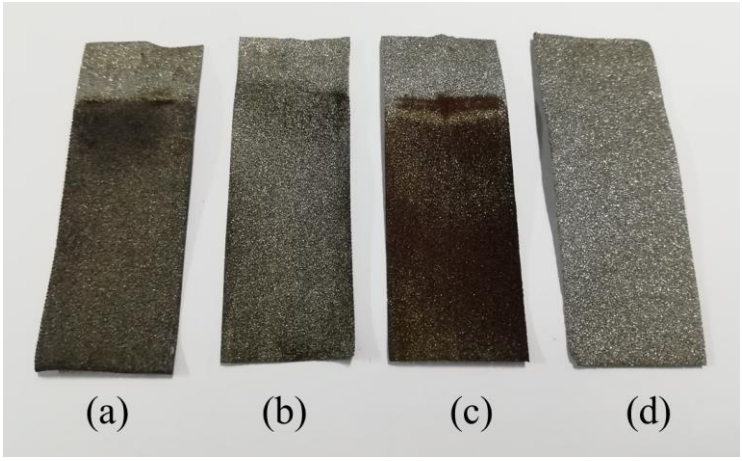

Figure S3. Digital pictures of (a) Pd-Cu/NF electrode, (b) Pd/NF electrode, (c) Cu/NF electrode and (d) pure Ni foam electrode.

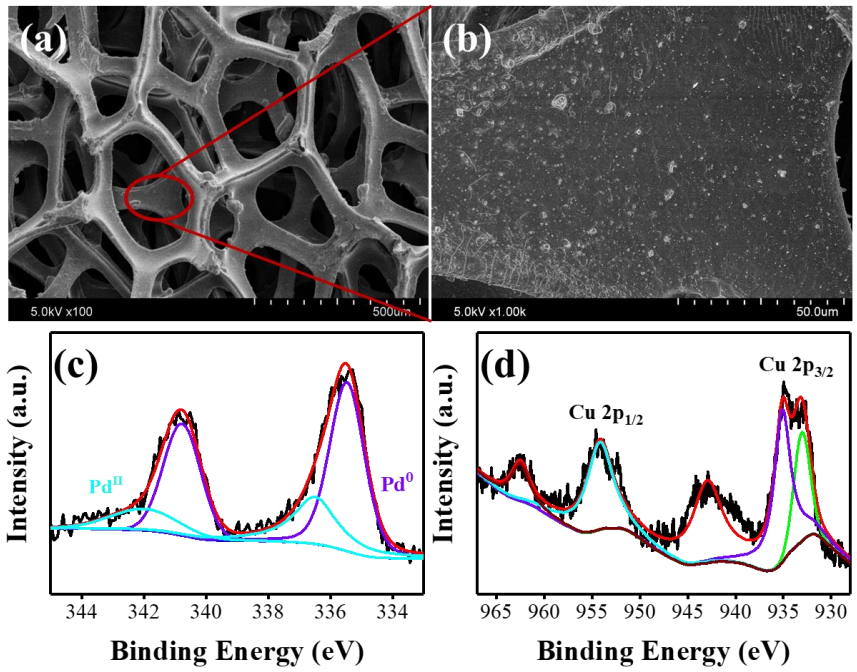

Figure S4. FESEM images (a, b) of the Pd/Cu-Ni foam electrode. XPS spectra for the narrow scan of (c) Pd, and (d) Cu of a fresh Pd−Cu/NF cathode.

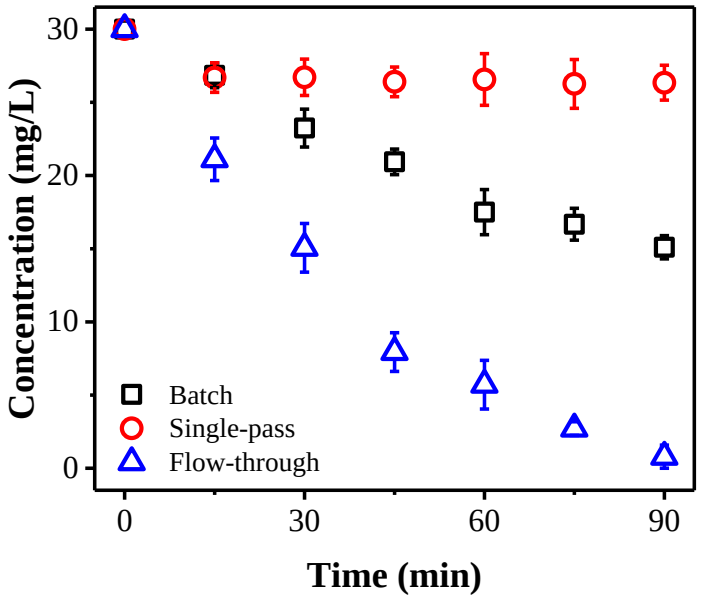

Figure S5. Comparison of ammonia conversion kinetics in batch, single-pass and flow-through systems. Reaction conditions: anode potential of 2.8 V vs. Ag/AgCl, [Cl^-] concentration of 0.14 M, and pH of 9.

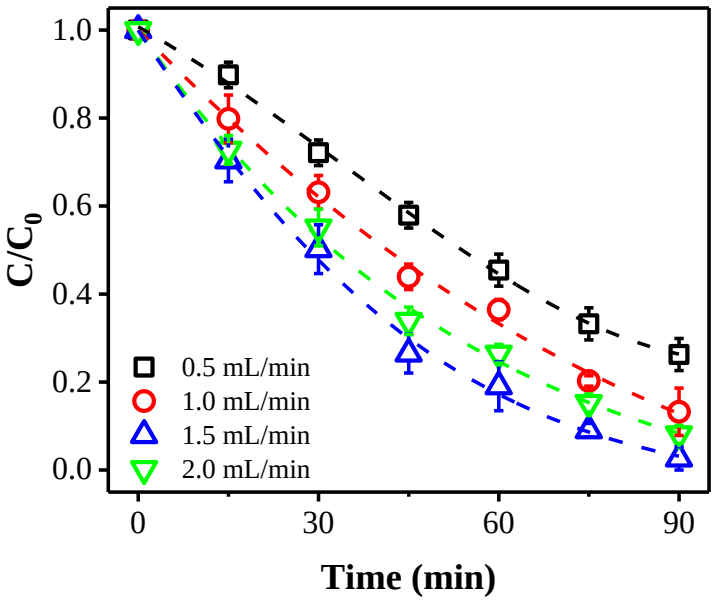

Figure S6. The effect of flow rate on ammonia conversion. Reaction conditions: anode potential of 2.8 V vs. Ag/AgCl, [Cl^-] concentration of 0.14 M, and pH of 9.

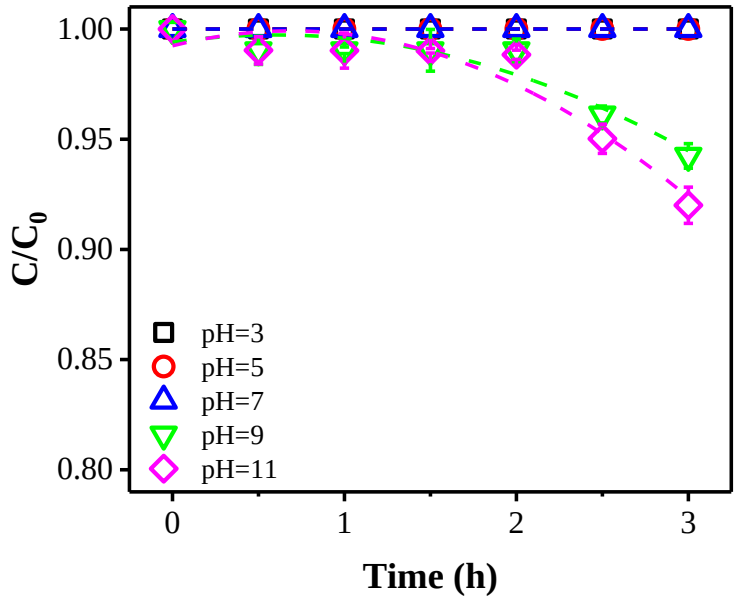

Figure S7. Conversion effect of ammonia with 0.14 M Na_2SO_4 background electrolyte at different anode potentials. Experimental conditions: [Cl^-] of 0.14 M, flow rate of 1.5 mL·min^{-1}, and pH of 9.

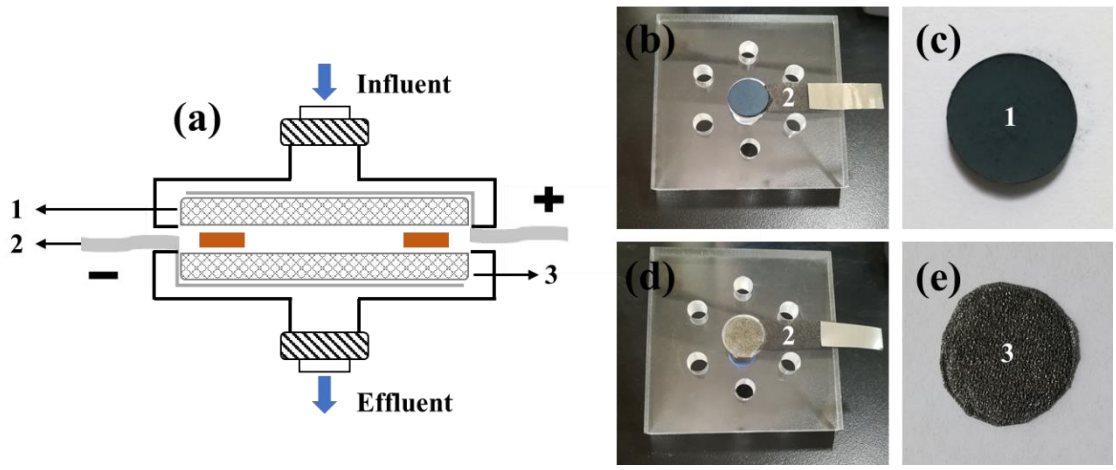

Figure S8. Schematic of the flow-through filtration setup. (a) Modified acrylic filter sleeve, including 1) a Ti_4O_7 anode, 2) a Ti plate current collector, and 3) a Pd-Cu/NF cathode. (b, d) Images of the modified filter sleeve. (c, e) Images of the anode and cathode.

Table S1. Comparison of the performance of different materials on ammonia conversion

Anode	Ammonia concentration	Experimental conditions	Removal efficiency	References
WO_3	20 mg L^{-1}	Cl^-/NH_4^+ = 20, pH = 4, 1.0 V vs. SCE	99.9% (1.5 h)	[1]
SnO_2-CNT	30 mg L^{-1}	2.5 V vs. Ag/AgCl, $[Cl^-]$ = 0.1 M, pH = 7 flow rate = 4 mL min^{-1}	> 99.9% (1.5 h)	[2]
Ti/Pt	150 mg L^{-1}	NaCl = 0.8% (w/v) pH = 9 I = 0.075 A cm^{-2}	82% (1 h)	[3]
Ti/RuO_2-TiO_2	1060-1380 mg L^{-1}	I = 116 mA cm^{-2} flow rate = 2000 L h^{-1}	49% (3 h)	[4]
Ti_4O_7	30 mg L^{-1}	2.8 V vs. Ag/AgCl, $[Cl^-]$ = 0.14 M, pH = 9 flow rate = 1.5 mL min^{-1}	97.4% (1.5 h)	/

References

[1] Ji Y.Z.; Bai J.; Li J.H.; Luo T.; Qiao L.; Zeng Q.Y.; Zhou B.X. Highly selective transformation of ammonia nitrogen to N_2 based on a novel solar-driven photoelectrocatalytic-chlorine radical reactions system. Water Res. **2017**, 125, 512-519.

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