

Supporting Information for

Constructing a superhydrophobic free-standing cathode for high-efficient H₂O₂ production over a wide pH range

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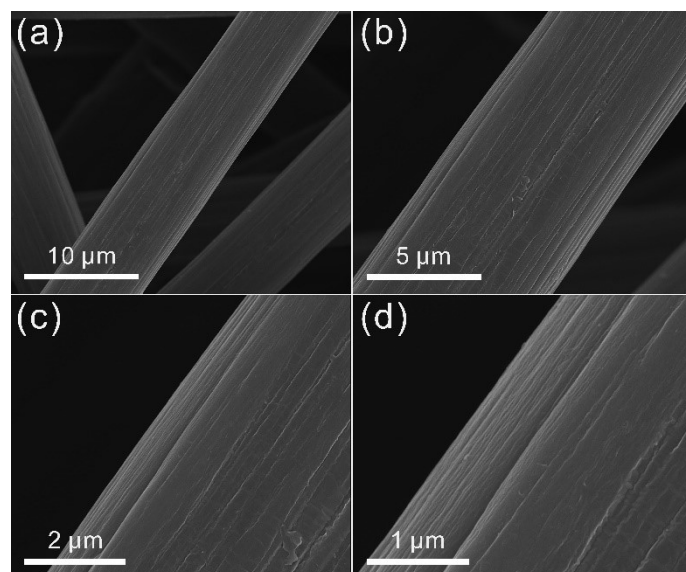


Fig. S1 (a–d) SEM images of CFP.

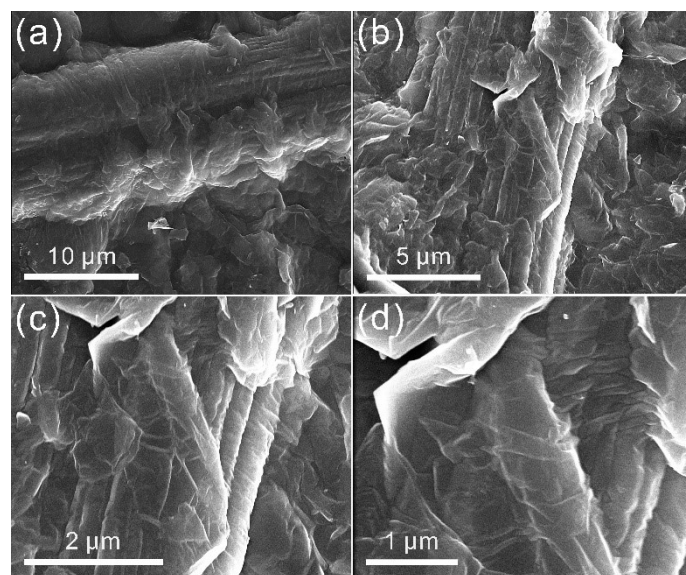


Fig. S2 (a–d) SEM images of Co-NC/CFP.

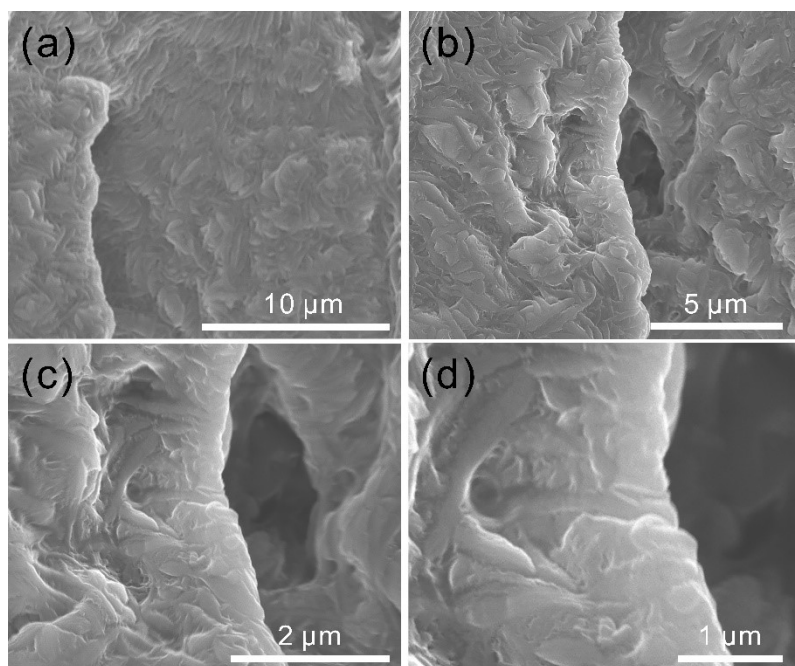


Fig. S3 (a–d) SEM images of Co-NC/CFP-PTFE.

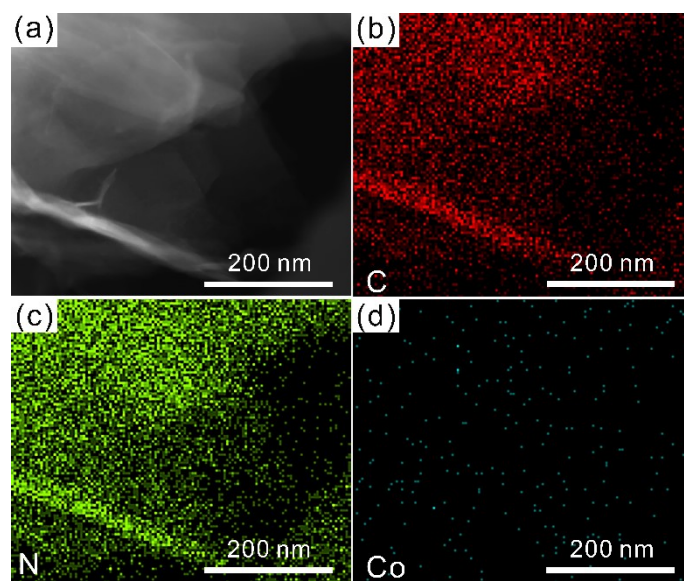


Fig. S4 (a) TEM images and (b–d) mapping images of Co-NC/CFP.

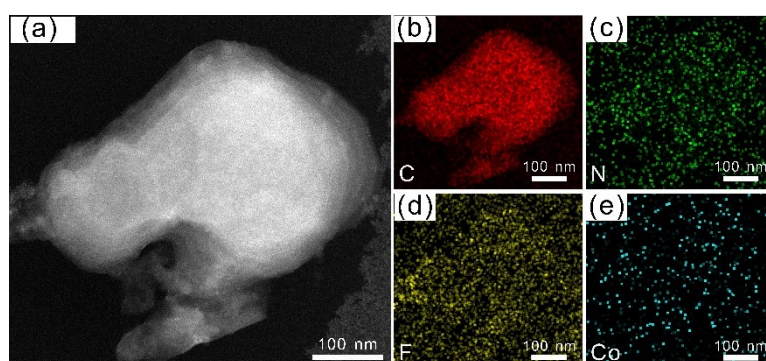


Fig. S5 (a) TEM images and (b–e) mapping images of Co-NC/CFP-PTFE.

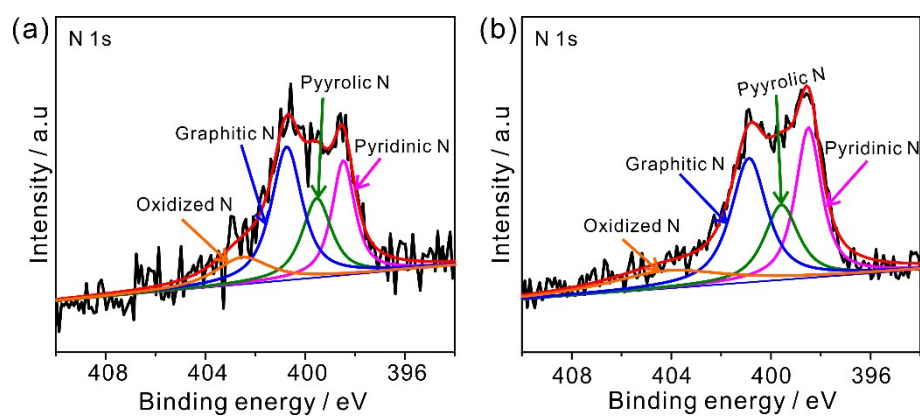


Fig. S6 N 1s spectra of (a) Co-NC/CFP and (b) Co-NC/CFP-PTFE.

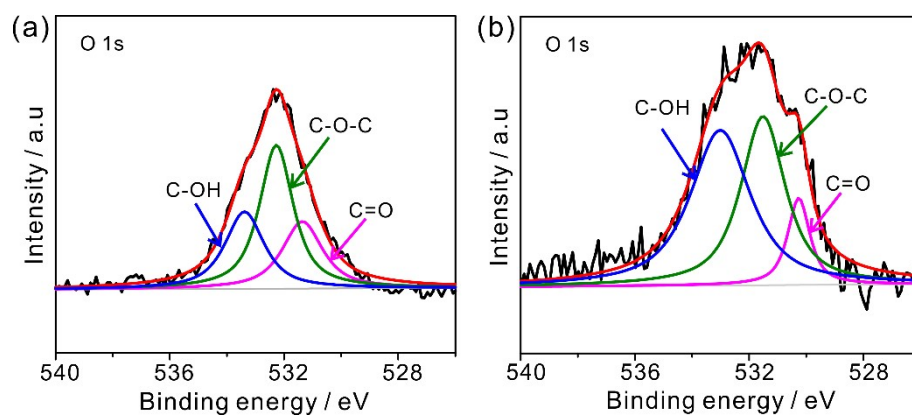


Fig. S7 O 1s spectra of (a) Co-NC/CFP and (b) Co-NC/CFP-PTFE.

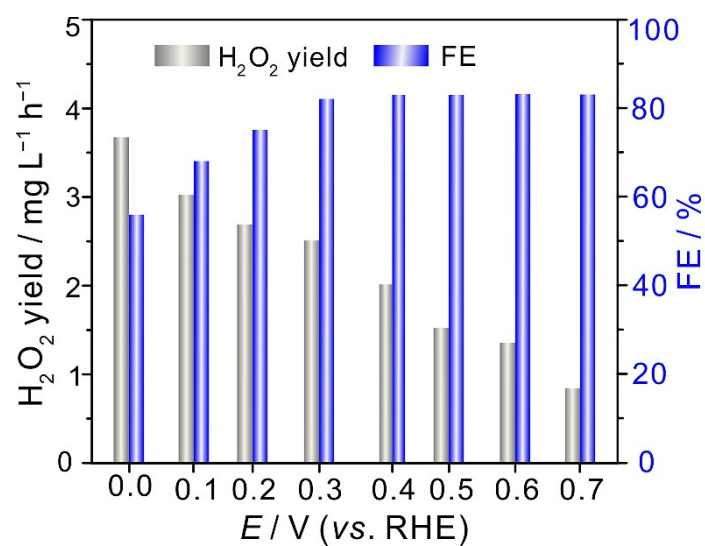


Fig. S8 H_2O_2 production rate of CFP in 0.05 M H_2SO_4 .

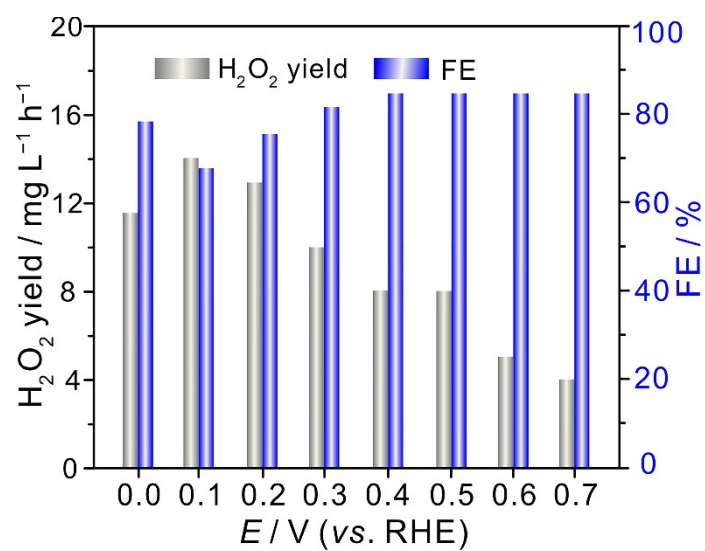


Fig. S9 H_2O_2 production rate of CFP in 0.1 M PBS.

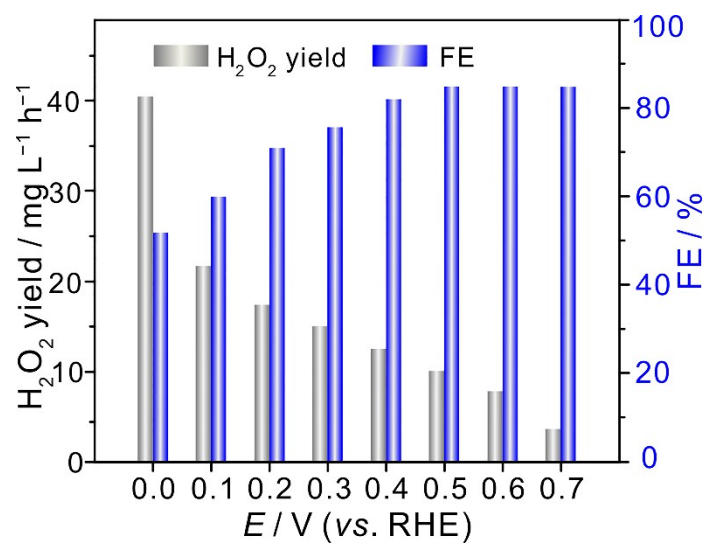


Fig. S10 H_2O_2 production rate of CFP in 0.1 M KOH.

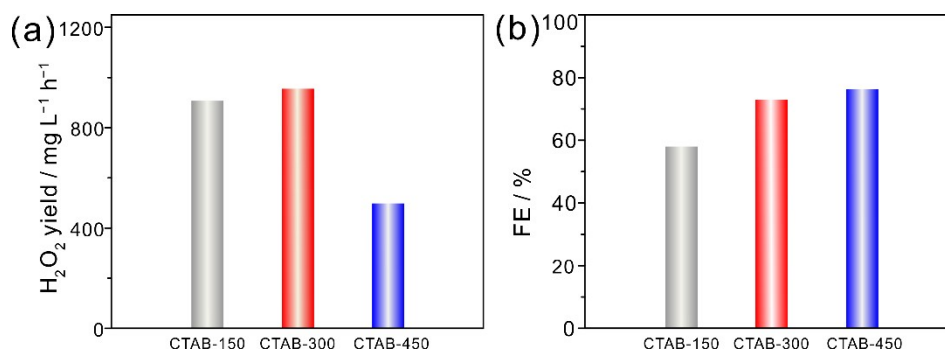


Fig. S11 H_2O_2 production rate and the corresponding FE of various CTAB-assisted Co-NC/CFP cathodes in 0.1 M PBS.

Table S1 H_2O_2 production rate comparison of Co-NC/CFP-PTFE with state of art catalysts from previous literature.

Catalyst	Electrolyte	E (vs. RHE)	H_2O_2 production rate	Ref.
Co-NC/CFP-PTFE	0.1 M PBS	0.1 V	1105	This work
$\text{Co}_1\text{-NG(O)}$	0.1 M KOH	0.65 V	242	<i>Nat. Mater.</i> , 2020, 19 , 436–442.
Co-POC-O	0.1 M KOH	0.4 V	813	<i>Adv. Mater.</i> , 2019, 31 , 1808173–1808180.
Fe-C-O	0.1 M PBS	0.35 V	460	<i>Nat. Commun.</i> , 2019, 10 , 3997–4007.
CoNOC	0.1 M HClO_4	0.1 V	345	<i>J. Am. Chem. Soc.</i> , 2021, 143 , 7819–7827.
CoSA/CC	0.5 M H_2SO_4	0.1 V	460	<i>Carbon Energy</i> , 2020, 2 , 276–282.
$\text{CoSe}_2\text{@NCNTs/CP}$	0.1 M HClO_4	0.1 V	172	<i>Nano Res.</i> , 2022, 15 , 304–309.
o- $\text{CoSe}_2\text{/CFP}$	0.05 M H_2SO_4	0.5 V	92	<i>Energy Environ. Sci.</i> , 2020, 13 , 4189–4203.
CCNS	0.05 M H_2SO_4	0.25 V	84	<i>ACS Catal.</i> , 2021, 11 , 12643–12650.

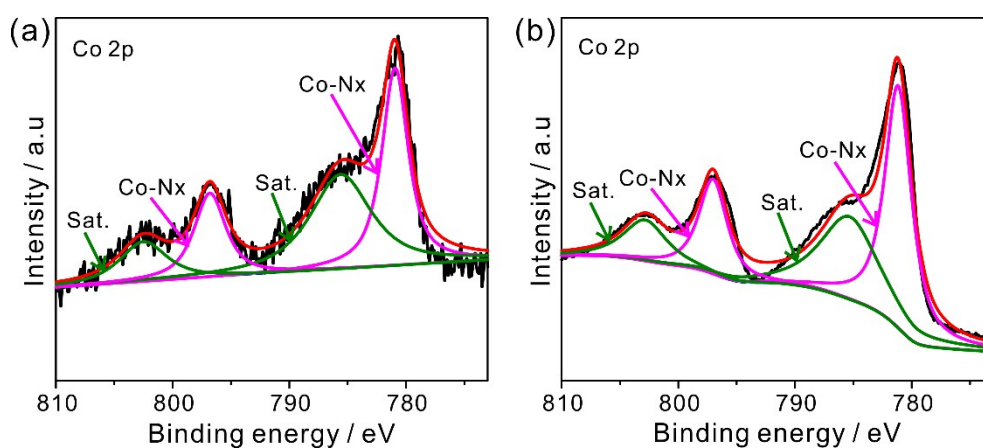


Fig. S12 Co 2p spectra of (a) Co-NC/CFP and (b) Co-NC/CFP-PTFE after long cycle stability.

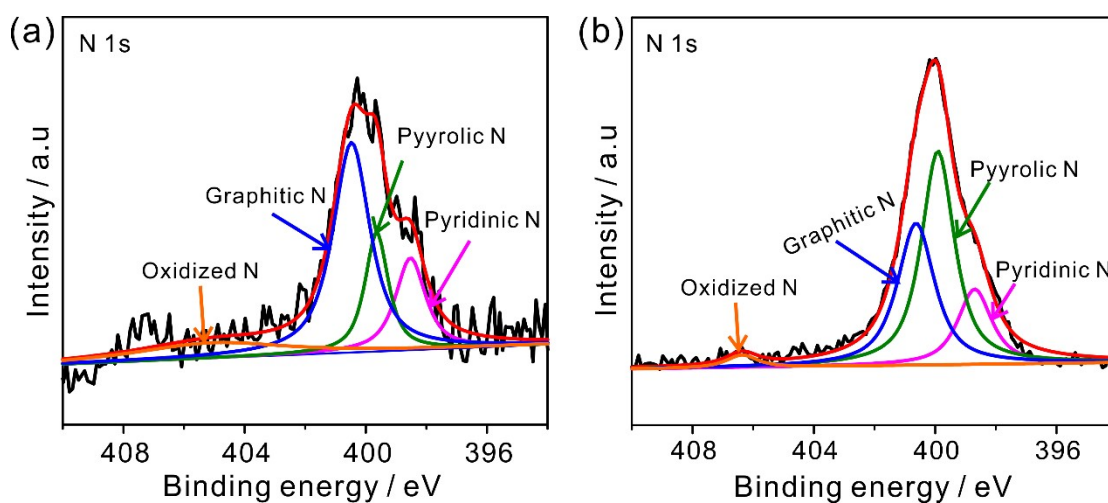


Fig. S13 N 1s spectra of (a) Co-NC/CFP and (b) Co-NC/CFP-PTFE after long cycle stability.

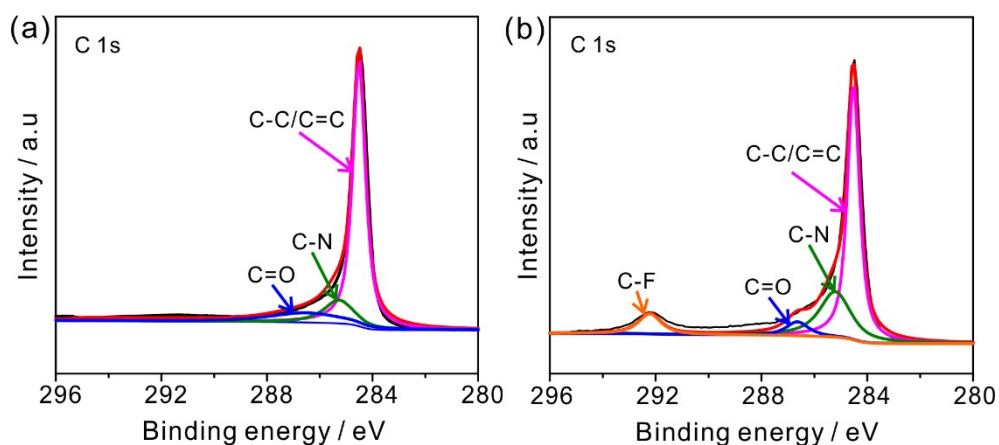


Fig. S14 C 1s spectra of (a) Co-NC/CFP and (b) Co-NC/CFP-PTFE after long cycle stability.

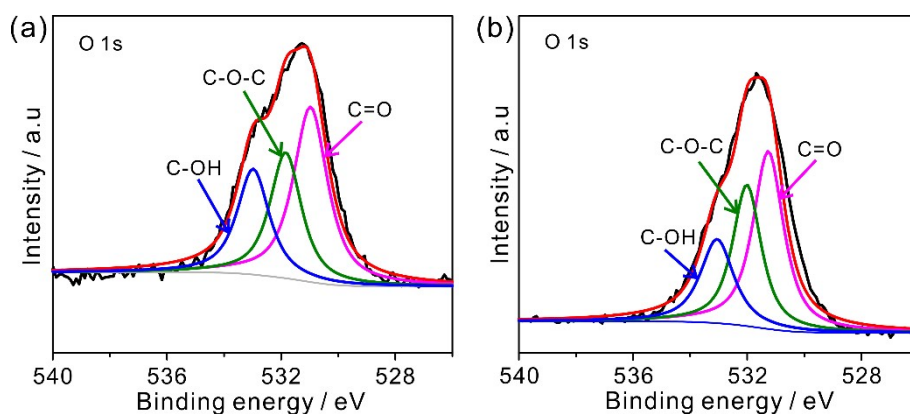


Fig. S15 O 1s spectra of (a) Co-NC/CFP and (b) Co-NC/CFP-PTFE after long cycle stability.

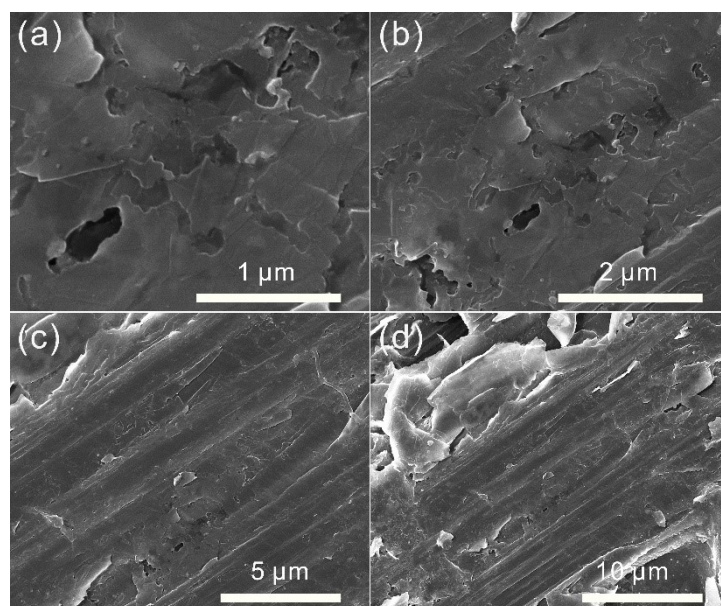


Fig. S16 (a–d) SEM images of Co-NC/CFP after long cycle stability.

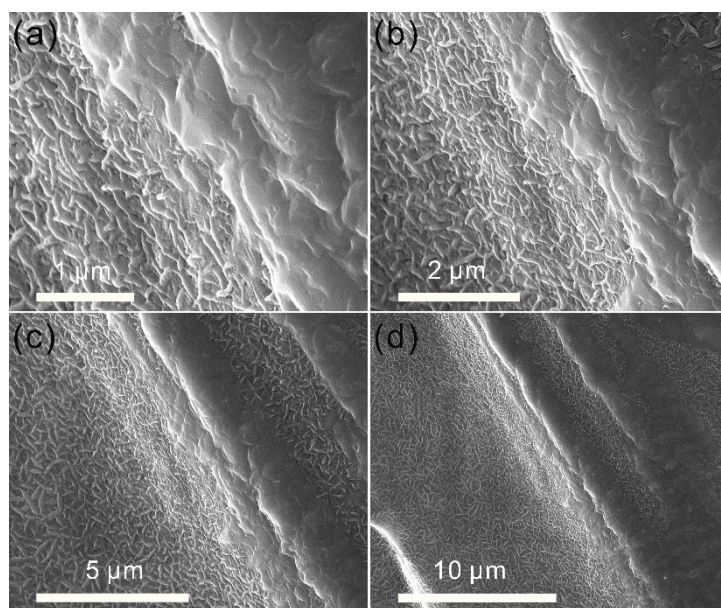


Fig. S17 (a–d) SEM images of Co-NC/CFP-PTFE after long cycle stability.

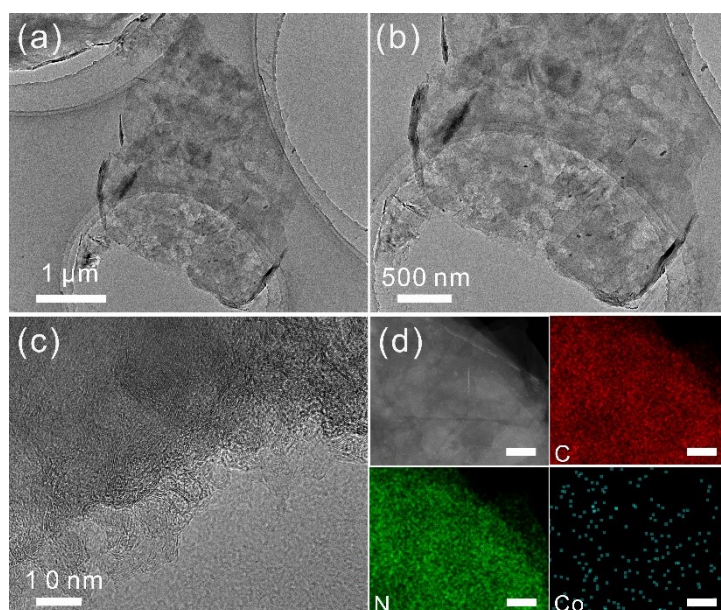


Fig. S18 (a–c) TEM images and (d) mapping images of Co-NC/CFP.

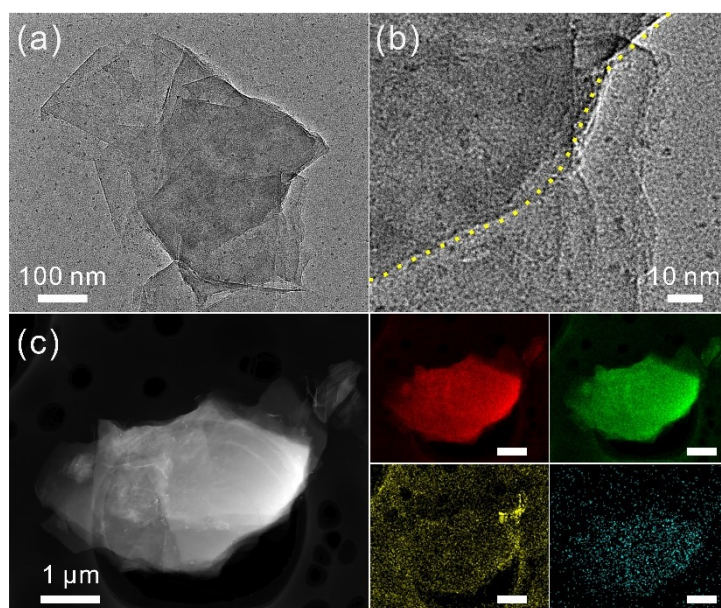


Fig. S19 (a, b) TEM images and (c) mapping images of Co-NC/CFP-PTFE.

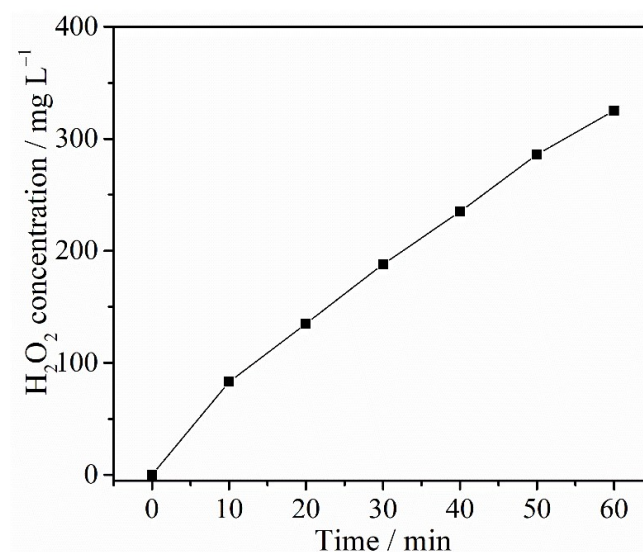


Fig. S20 H_2O_2 concentration versus time in a dual-cathode process.

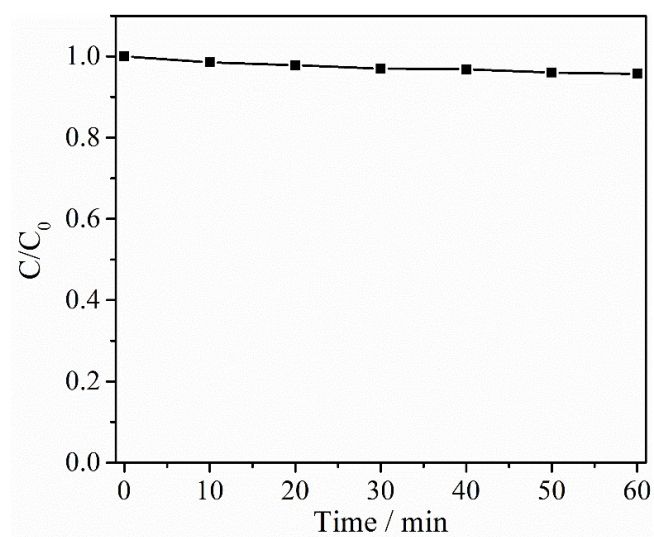


Fig. S21 RhB degradation of CFP with a dual-cathode process.

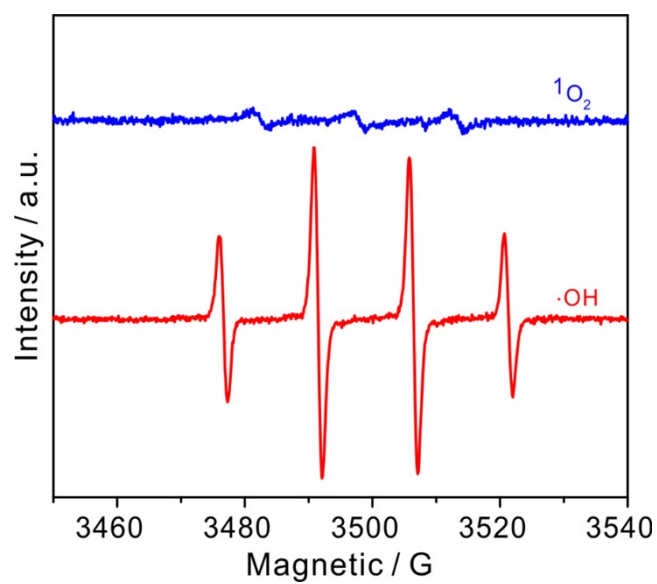


Fig. S22 Detection of common ROSs in the dual-cathode system.

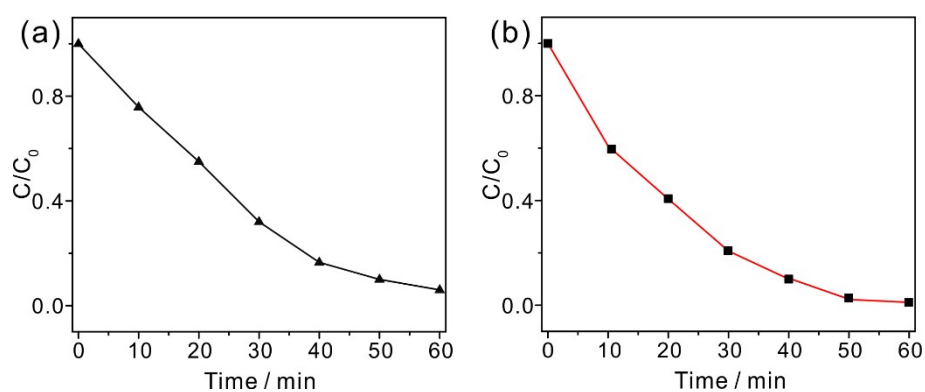


Fig. S23 RhB degradation of Co-NC/CFP-PTFE based dual-cathode system in 0.05 M H₂SO₄ and 0.1 M KOH.

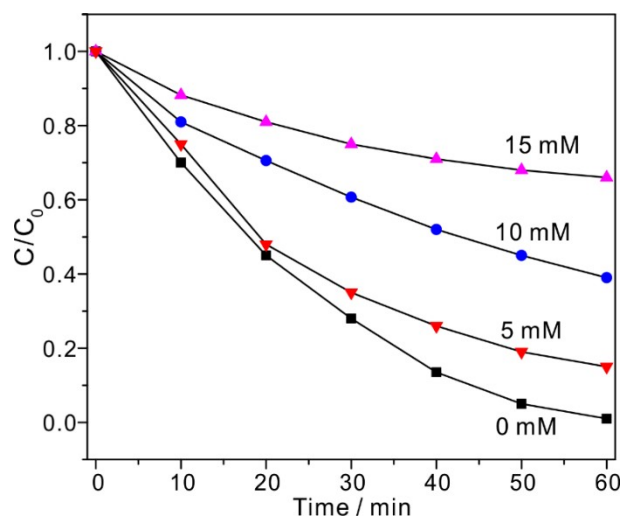


Fig. S24 Effects of quenching agent TBA on the removal efficiency of RhB.

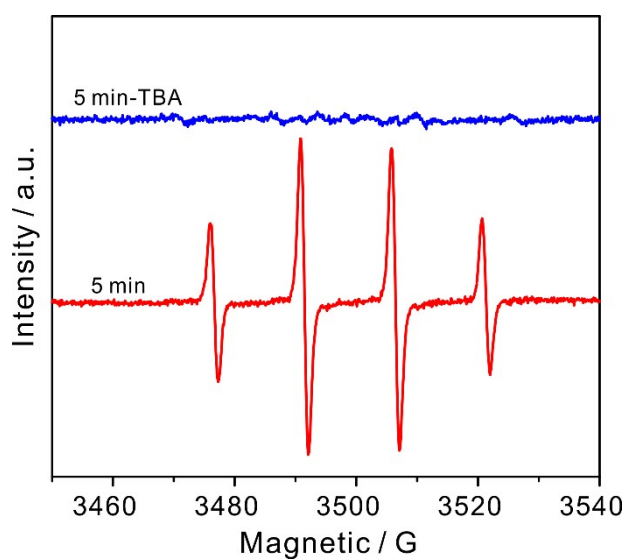


Fig. S25 EPR spin trapping with DMPO at 5-min operation with/without TBA addition.