

Supplementary Material for

Tracking Accelerated Oxygen Evolution Reaction Enabled by Explosive Reconstruction of Active Species based on Co_xN@NC

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Table S1. Calculated ZPE and entropy corrections terms for individual reactants and full reaction steps.

Reactant	ZPE [eV]	TS [eV]	Reaction	Δ ZPE-T Δ S [eV]
O	0.06	0.01	1	0.32
OH	0.34	0.06	2	-0.30
OOH	0.43	0.07	3	0.41
H ₂ O	0.56	0.67	4	-0.37
H ₂	0.27	0.41	-	-

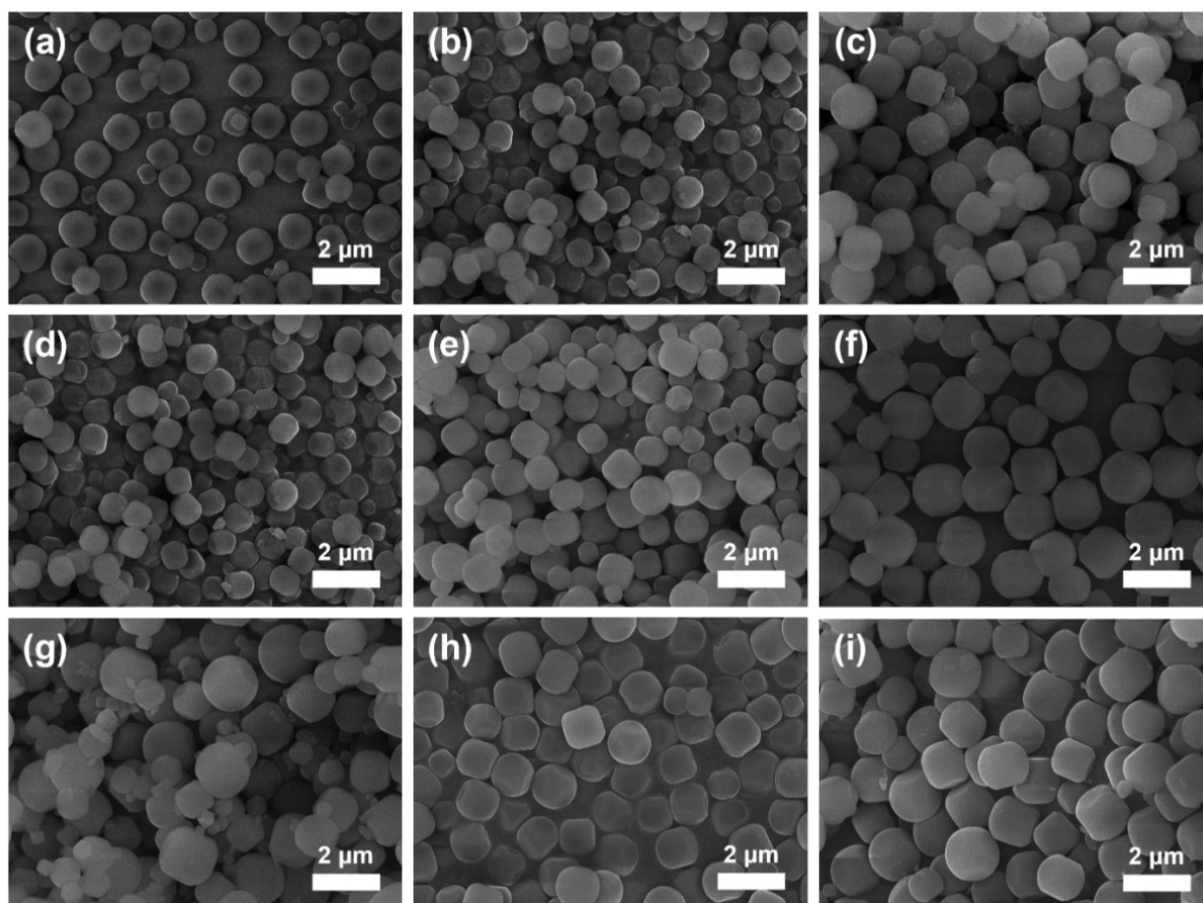


Fig. S1. SEM images of the $\text{Co}_3[\text{Co}(\text{CN})_6]_2$ PBAs synthesized at various condition. $\text{Co}_3[\text{Co}(\text{CN})_6]_2$ PBAs synthesized with control of the amount of SDBS as (a) 1 g, (b) 1.25 g, (c) 1.5 g, control of pH as (d) 3, (e) 2, (f) 1, and control of temperature as (g) 50 °C, (h) 55 °C, and (i) 60 °C.

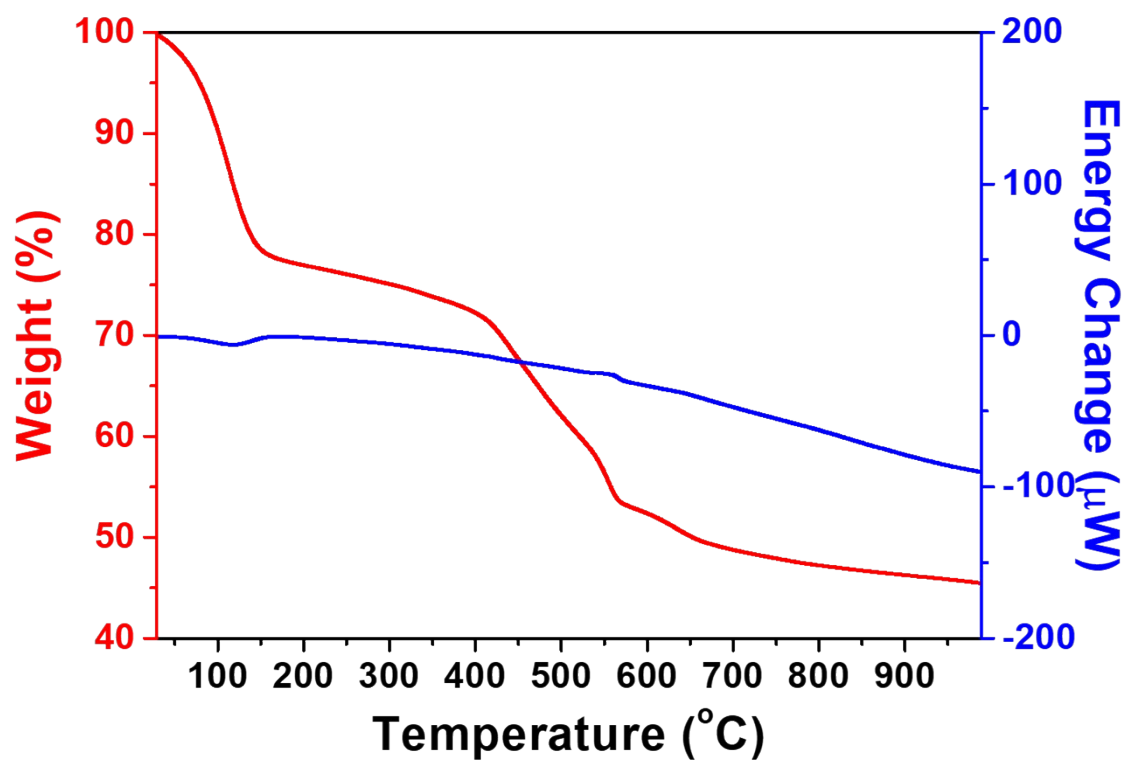


Fig. S2. TG-DTA curves of the $Co_3[Co(CN)_6]_2$ PBA@PDA coated for 18 h.

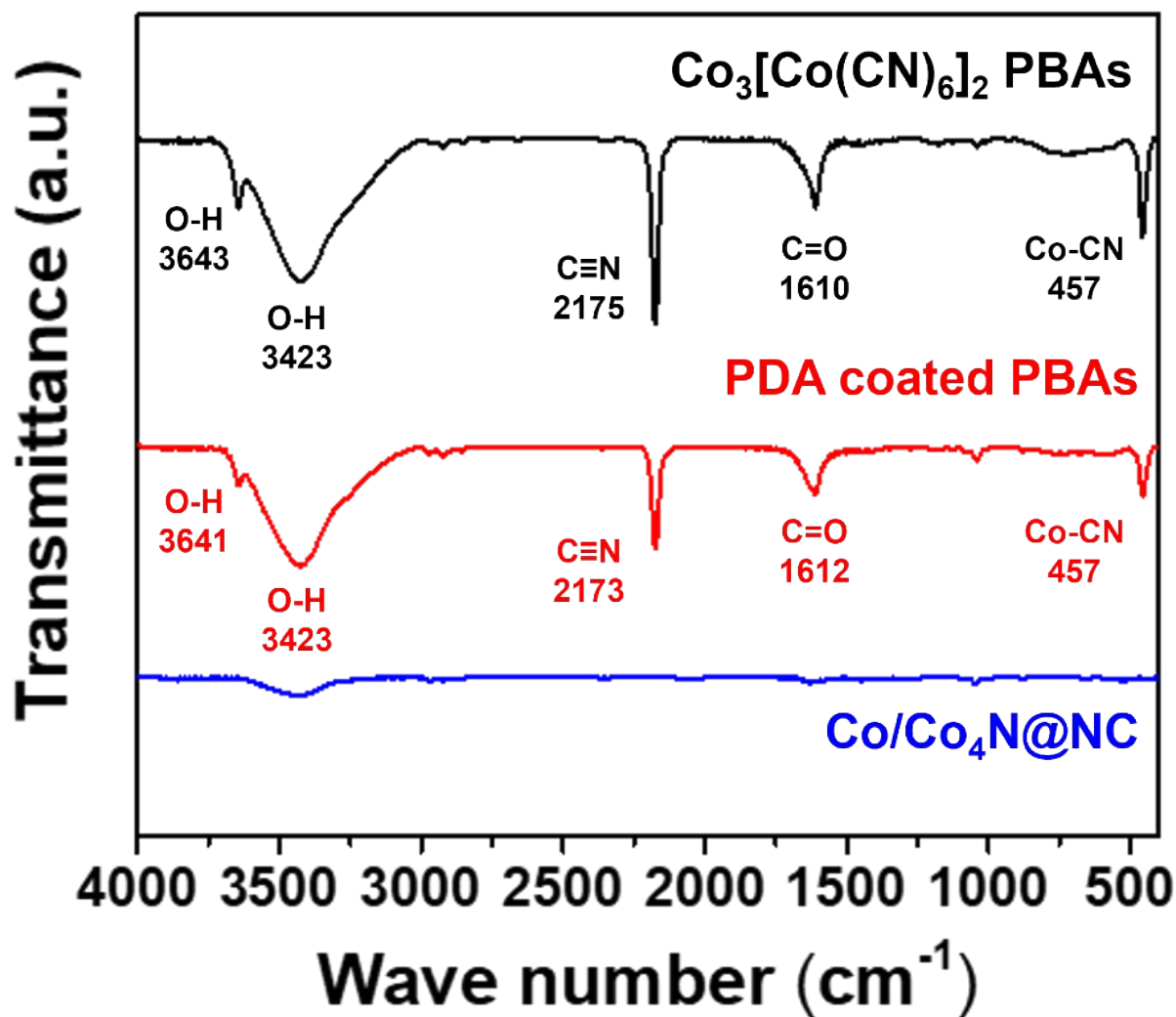


Fig. S3. FT-IR spectra of the $\text{Co}_3[\text{Co}(\text{CN})_6]_2$ PBA, $\text{Co}_3[\text{Co}(\text{CN})_6]_2$ PBA@PDA coated for 18 h, and $\text{Co}/\text{Co}_4\text{N}@/\text{NC}$.

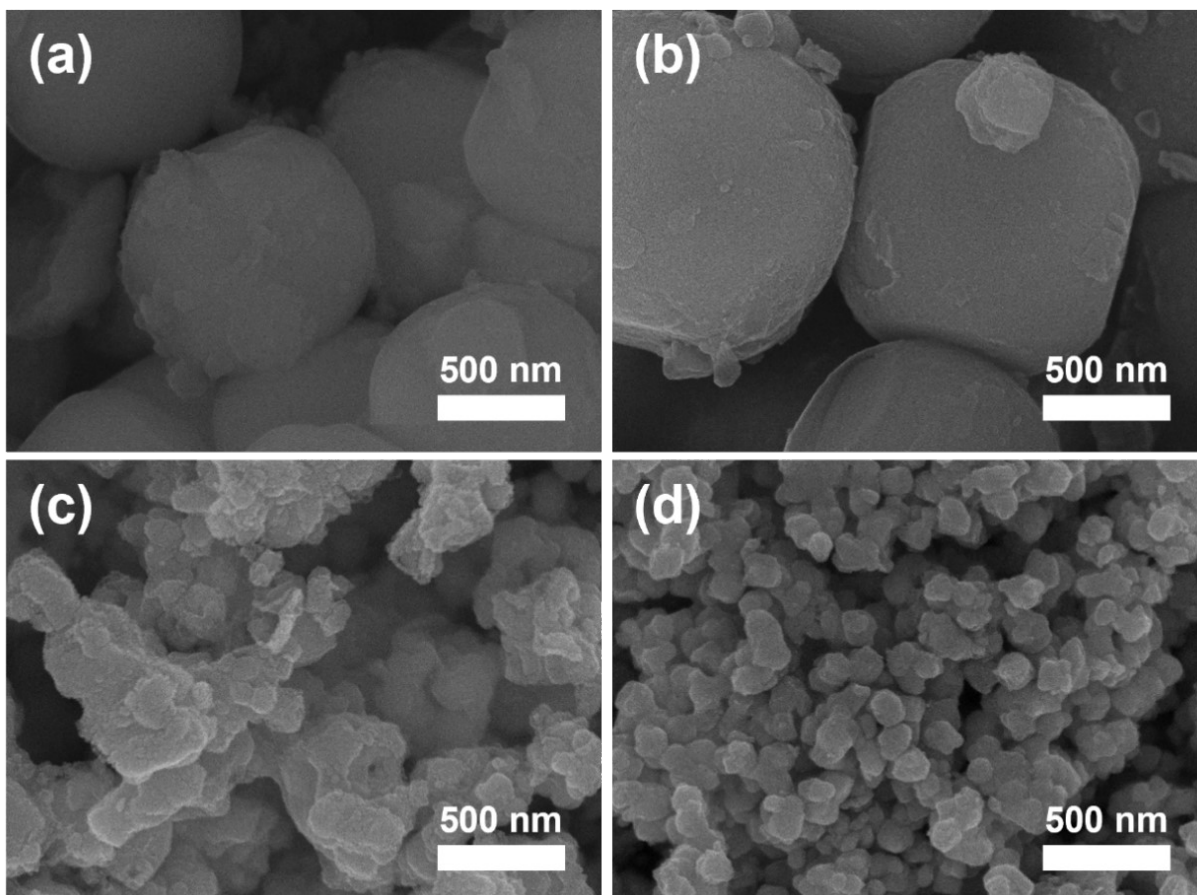


Fig. S4. SEM images of the $\text{Co}_3[\text{Co}(\text{CN})_6]_2$ PBA@PDA with polymerization for (a) 6 h and (b) 12 h. SEM images after the nitridation of (c) the $\text{Co}_3[\text{Co}(\text{CN})_6]_2$ PBA@PDA coated for 6 h and (d) $\text{Co}_3[\text{Co}(\text{CN})_6]_2$ PBA@PDA coated for 12 h.

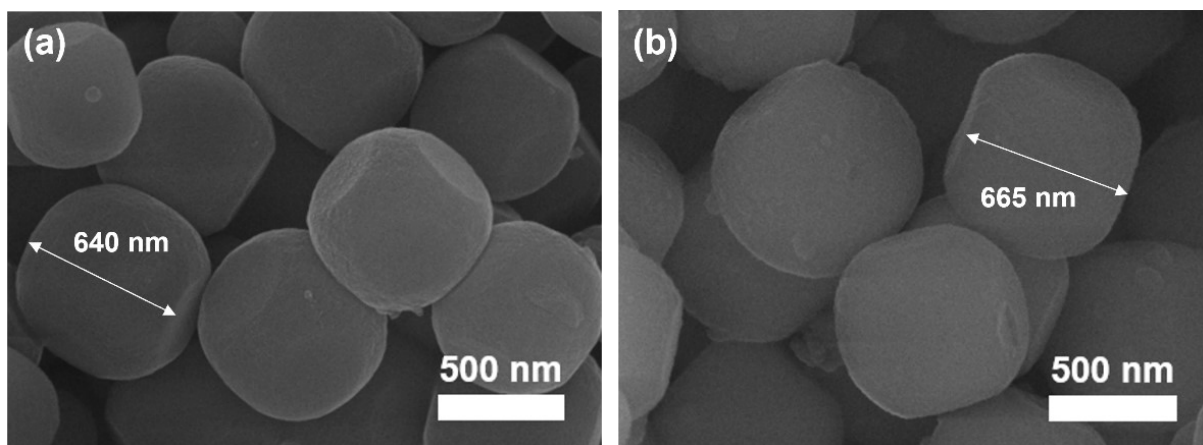


Fig. S5. SEM images of (a) the $\text{Co}_3[\text{Co}(\text{CN})_6]_2$ PBA and (b) $\text{Co}_3[\text{Co}(\text{CN})_6]_2$ PBA@PDA with polymerization for 18 h.

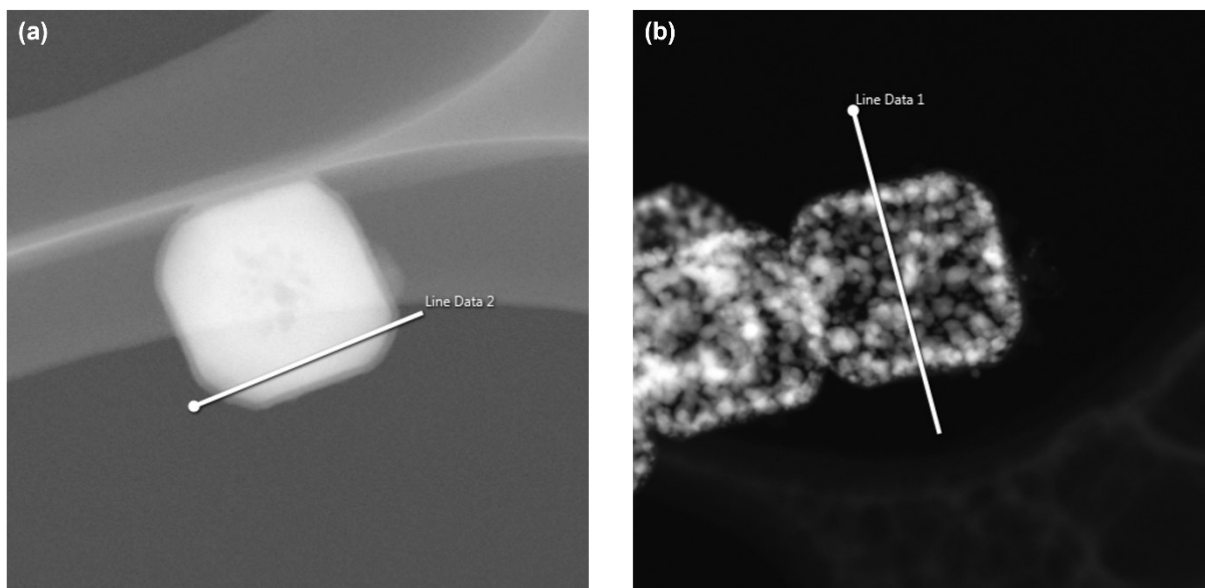


Fig. S6. Line EDS profile of (a) $\text{Co}_3[\text{Co}(\text{CN})_6]_2$ PBAs@PDA and (b) Co/Co₄N@NC.

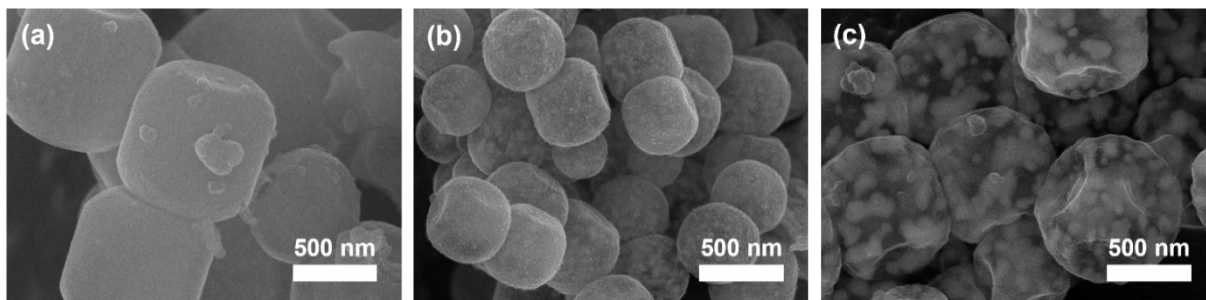


Fig. S7. SEM images of (a) the $\text{Co}_3\text{N@NC}$, (b) $\text{Co/Co}_3\text{N@NC}$, and (c) $\text{Co/Co}_4\text{N@NC}$.

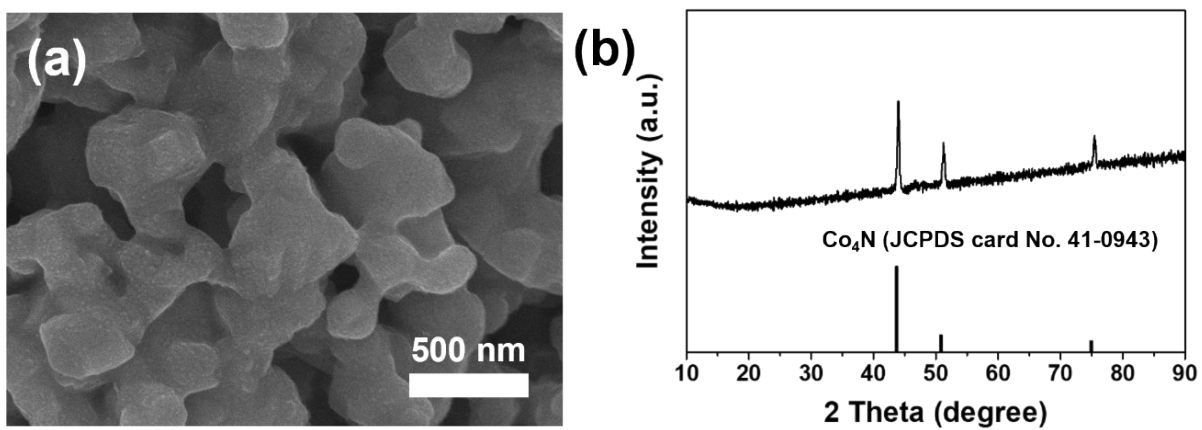


Fig. S8. (a) SEM image and (b) XRD pattern of the bulk Co_xN .

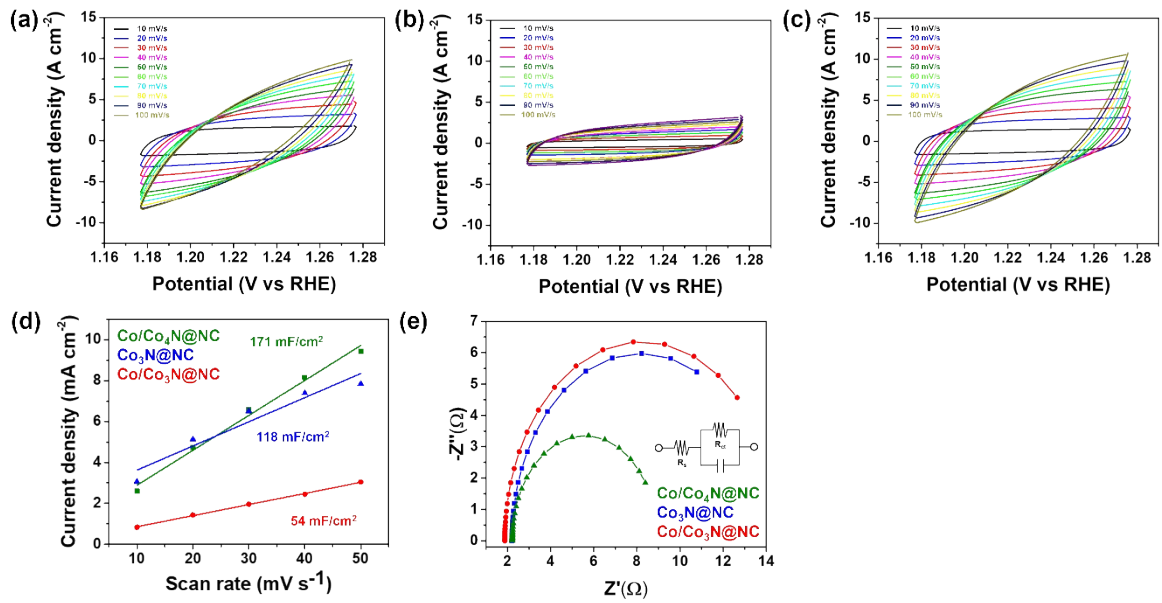


Fig. S9. CV curves for (a) the $\text{Co}_3\text{N@NC}$, (b) $\text{Co/Co}_3\text{N@NC}$, and (c) $\text{Co/Co}_4\text{N@NC}$ at different scan rates of 10 – 100 mV s^{-1} . (d) ECSA with Cdl calculated from CV and (e) Nyquist plots of the $\text{Co}_3\text{N@NC}$, $\text{Co/Co}_3\text{N@NC}$, and $\text{Co/Co}_4\text{N@NC}$.

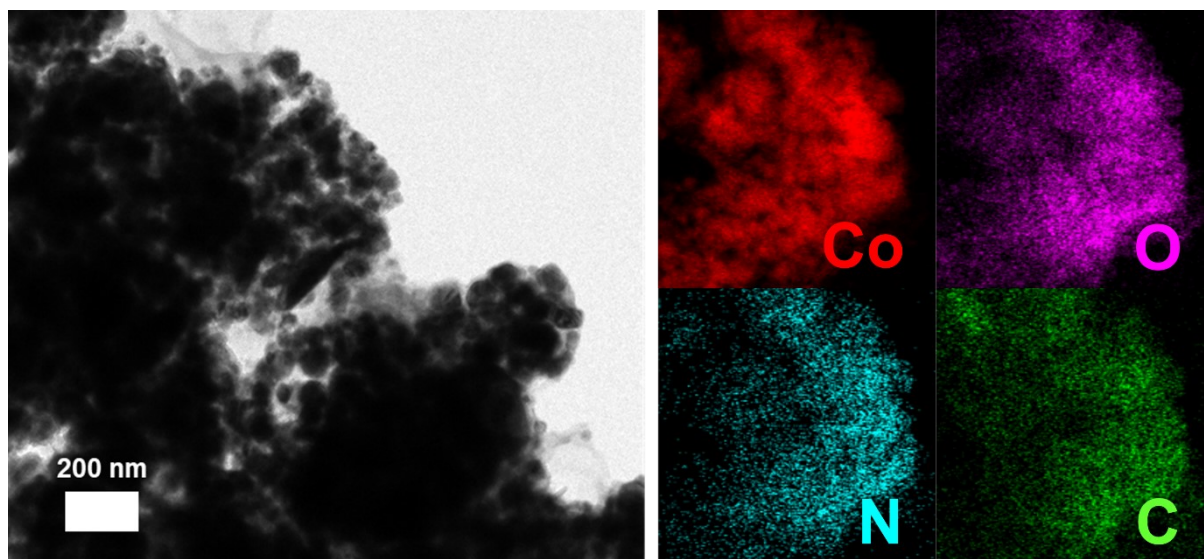


Fig. S10. TEM image and EDS mapping results of the Co/Co₄N@NC after 24 h of stability test.

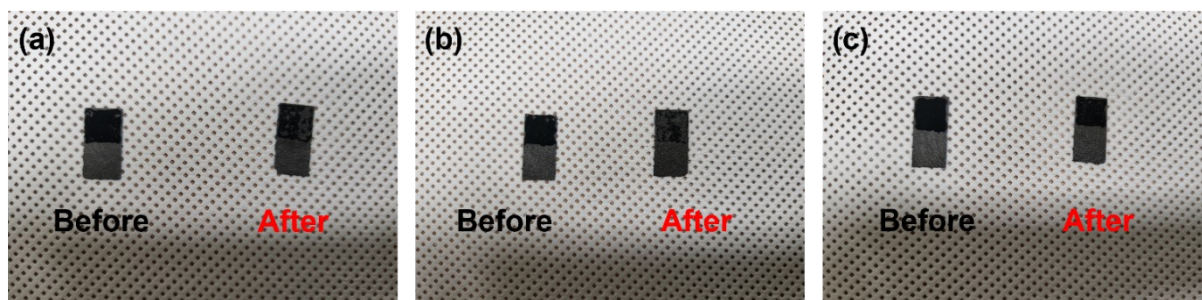


Fig. S11. Image of electrocatalysts on carbon paper electrode of (a) Co₃N@NC electrode, (b) Co/Co₃N@NC electrode, and (c) Co/Co₄N@NC electrode.

Table S2. Summary of EIS results.

Catalyst	R_s (Ω)	R_{ct} (Ω)	Capacitor (F)
Co ₃ N@NC	2.202	11.96	0.0835
Co/Co ₃ N@NC	1.875	12.71	0.05307
Co/Co ₄ N@NC	2.222	6.725	0.07094

Table S3. Summary of results related to OER activity obtained for the various electrocatalysts.

Catalysts	Substrate Electrode	Electrolyte	Overpotential	Reference
Co/Co ₄ N@NC	Carbon paper	1.0 M KOH	262 mV@10 mA cm ⁻² 408 mV@100 mA cm ⁻²	This work
CoNi/NC-YS	Carbon fiber paper	1.0 M KOH	292 mV@10 mA cm ⁻²	[1]
Co-N doped CTP	Glassy carbon	0.1 M KOH	334 mV@10 mA cm ⁻²	[2]
Co@BNPCFs	Glassy carbon	1.0 M KOH	324 mV@10 mA cm ⁻²	[4]
Co-Fe binary oxide	Carbon fiber paper	1.0 M KOH	369 mV@20 mA cm ⁻² 406 mV@100 mA cm ⁻²	[5]
Co-NC@Mo ₂ C	Glassy carbon	1.0 M KOH	347 mV@10 mA cm ⁻²	[10]
NiMo-FG	Ni foam	1.0 M KOH	338 mV@10 mA cm ⁻²	[6]
GNiPy350N	Glassy carbon	0.5 M H ₂ SO ₄	320 mV@10 mA cm ⁻²	[7]
Fe-doped NiSe NSs/CNT	Carbon paper	1.0 M KOH	282 mV@10 mA cm ⁻²	[8]
NiFeP@NPC	Glassy carbon	1.0 M KOH	350 mV@10 mA cm ⁻²	[9]
Ru-G/CC	Carbon cloth	1.0 M KOH	270 mV@10 mA cm ⁻²	[3]

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