Electronic Supplementary Material (ESI) for Materials Horizons.

Supporting Information

Co/CoP Embedded in Hairy Nitrogen-Doped Carbon Polyhedron as an Advanced Tri-functional Electrocatalyst

Yongchao Hao[a, b, c], Yuqi Xu[a, c], Wen Liu[a, c*], Xiaoming Sun[a, d*]

a. State Key Laboratory of Chemical Resource Engineering, Beijing University of Chemical Technology, Beijing, 100029, China.

b. School of Chemistry, Sun Yat-Sen University, Guangzhou, 510275, China

c. Faculty of science, Beijing University of Chemical Technology

d. Beijing Advanced Innovation Centre for Soft Matter Science and Engineering, College of Energy, Beijing University of Chemical Technology

*Authors to whom correspondence should be addressed: wenliu@mail.buct.edu.cn; sunxm@mail.buct.edu.cn

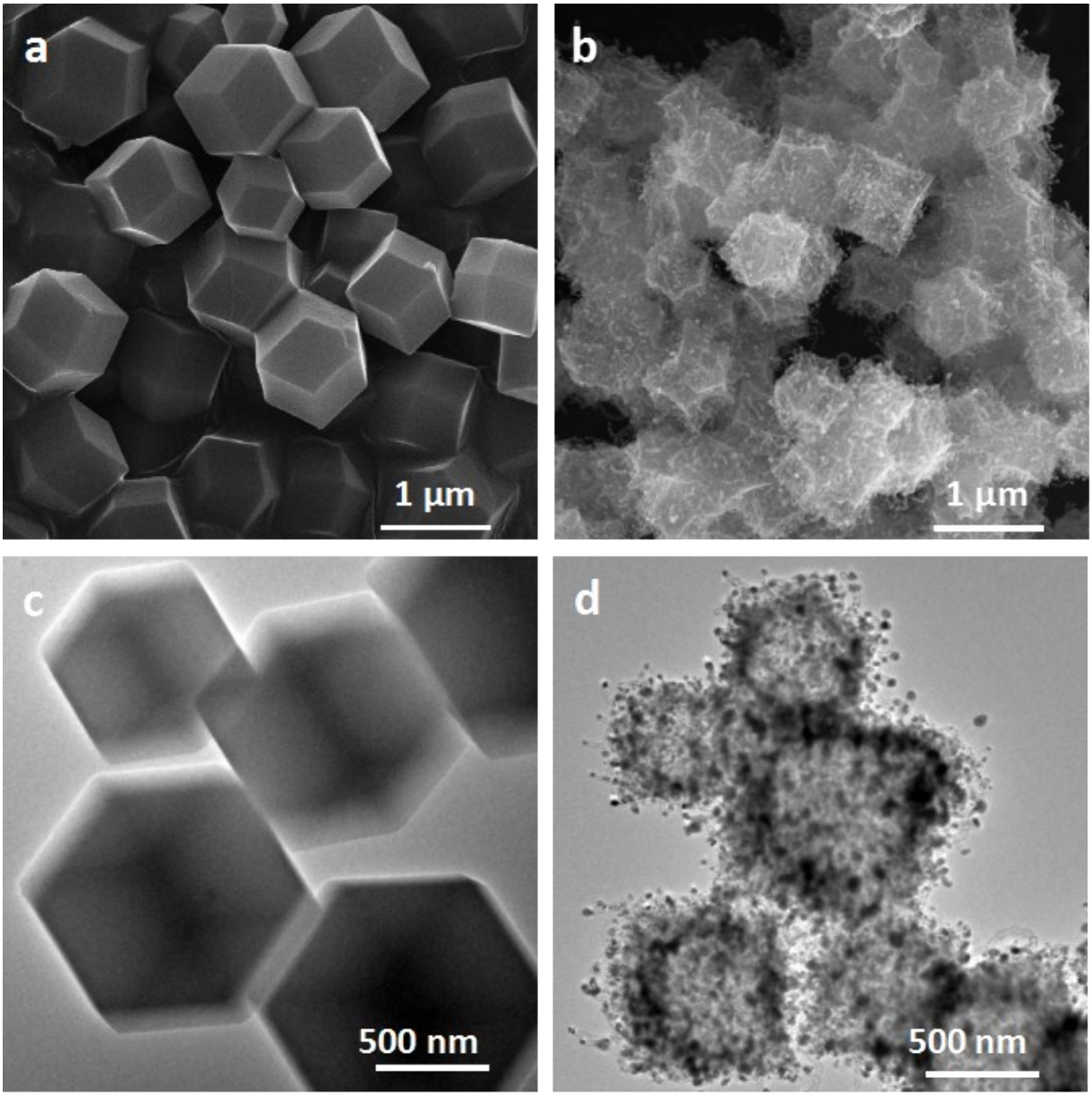

Fig. S1 The SEM images and corresponding TEM images of ZIF-67 (a, c) and Co-HNC pre (b, d).

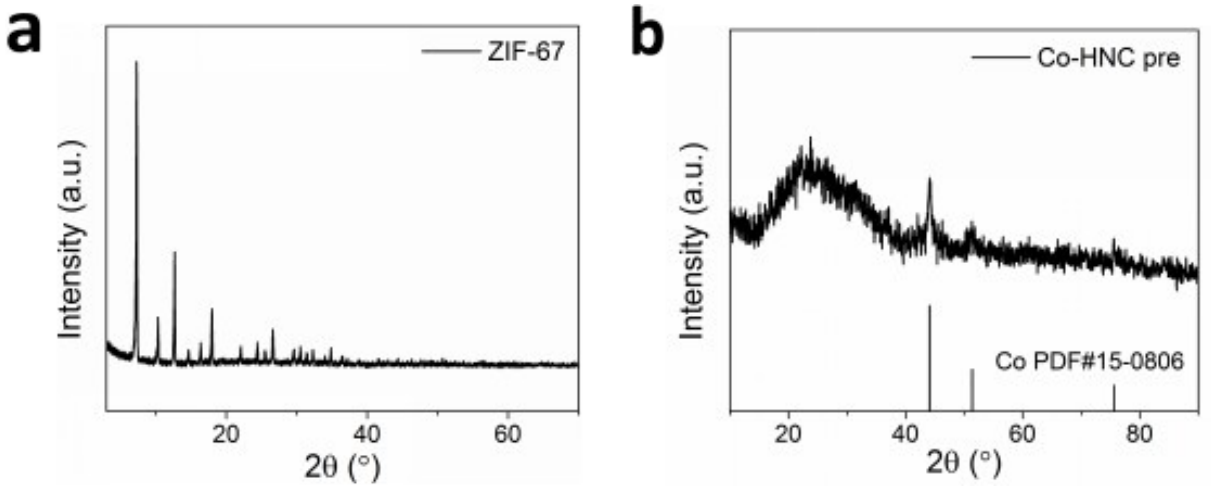

Fig. S2 The XRD spectra of (a) ZIF-67 and (b) Co-HNC pre.

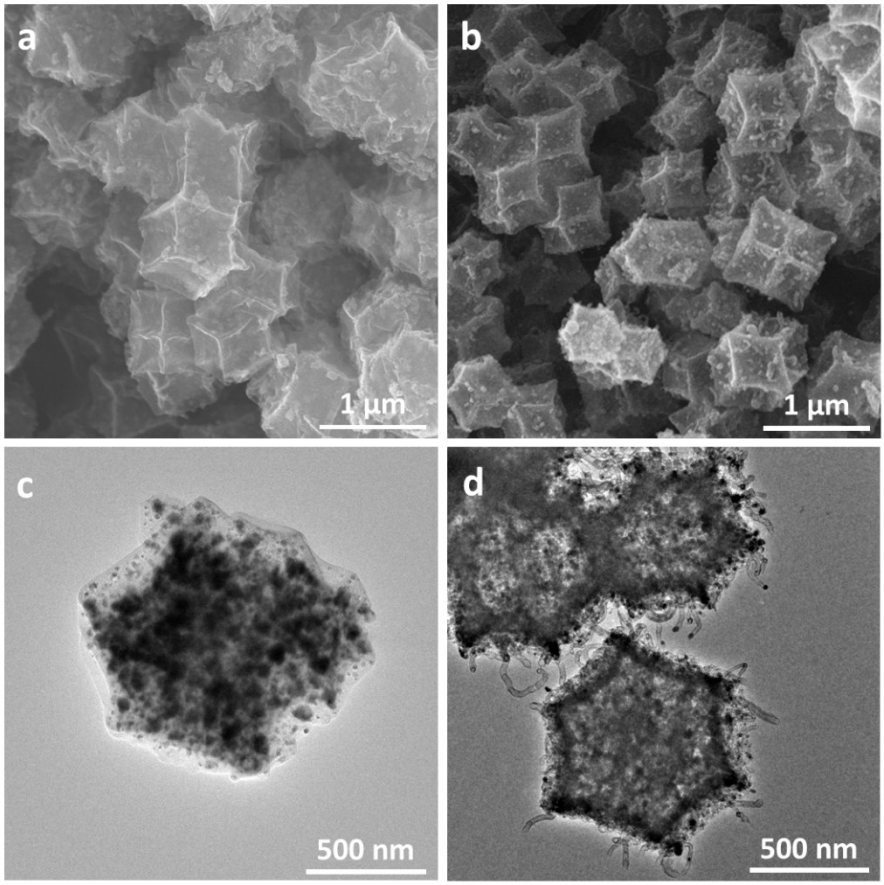

Fig. S3 The SEM images and their corresponding TEM images of Co/CoP-NC (a, c), Co-HNC (b, d).

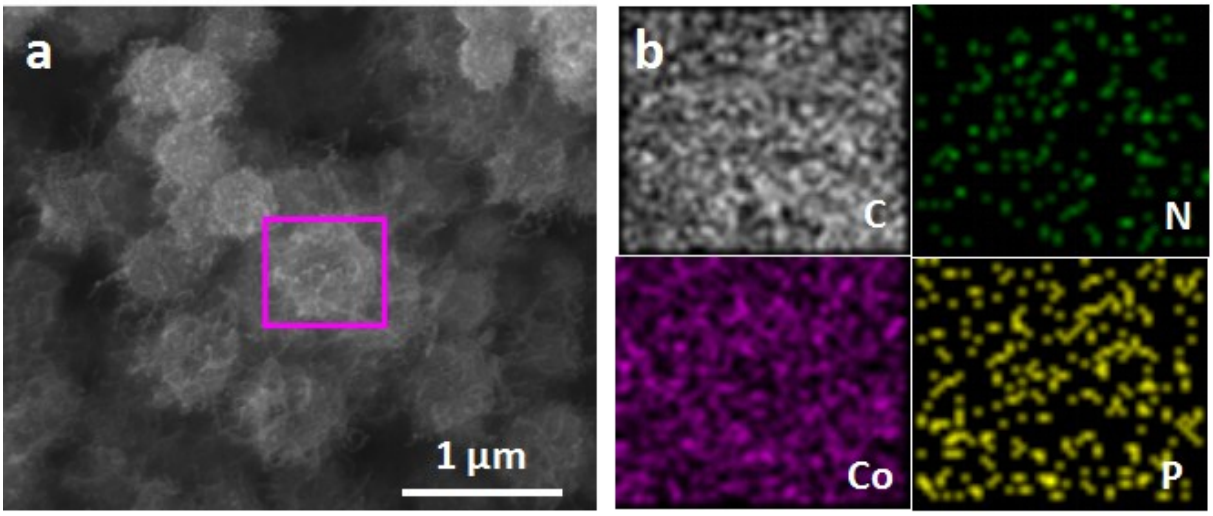

Fig. S4 The EDS mapping of Co/CoP-HNC.

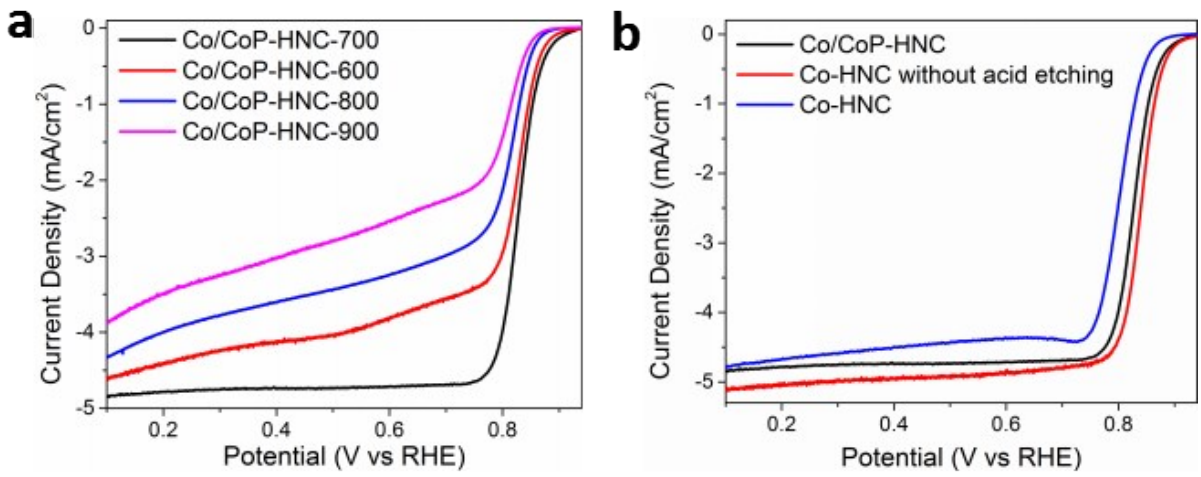

Fig. S5 The ORR evaluation for (a) Co/CoP-HNC with different pyrolysis temperature and (b) Co/CoP-HNC, Co-HNC pre, Co-HNC.

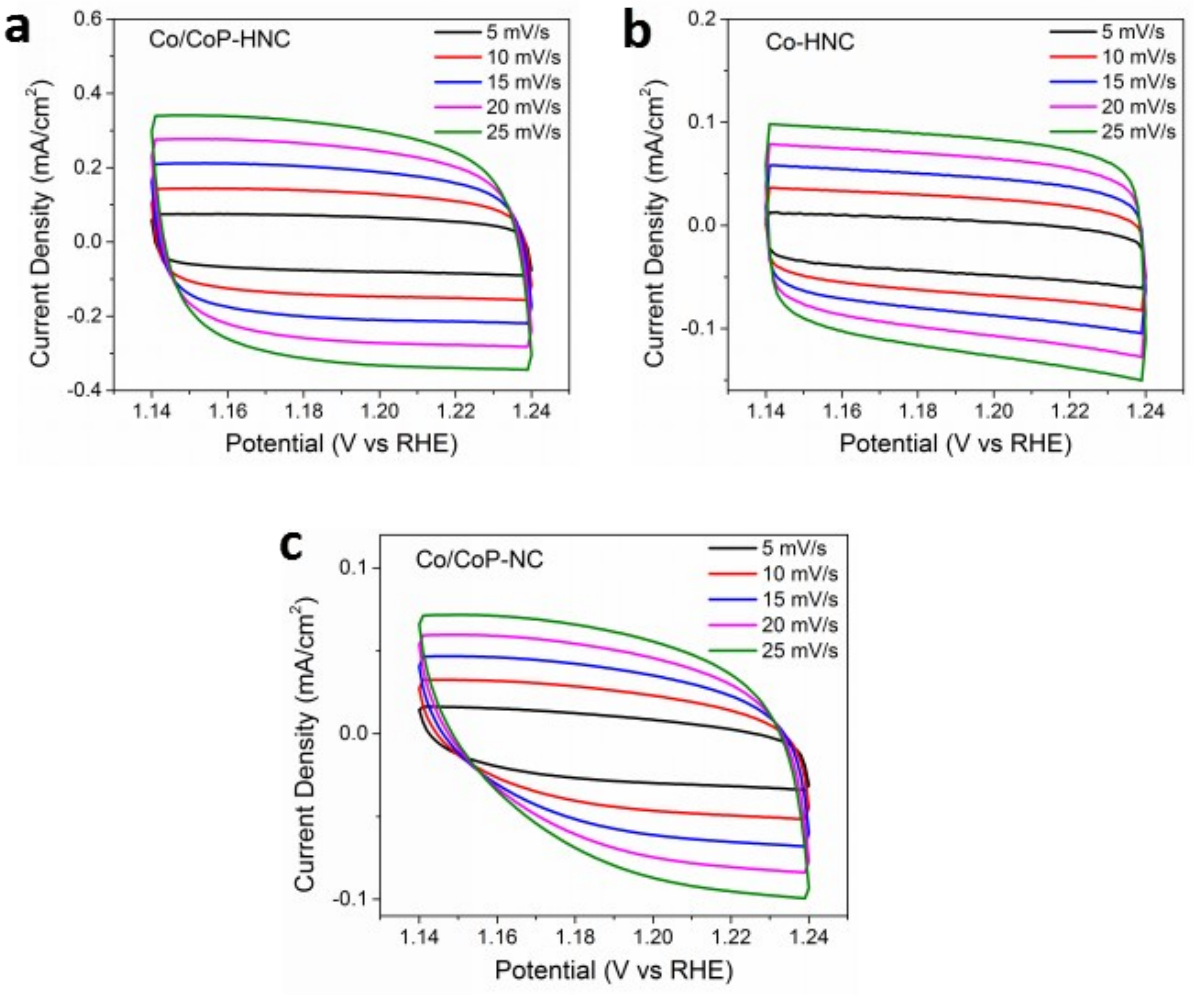

Fig. S6 The CV plots of (a) Co/CoP-HNC, (b) Co-HNC and (c) Co/CoP-NC with different scan rates.

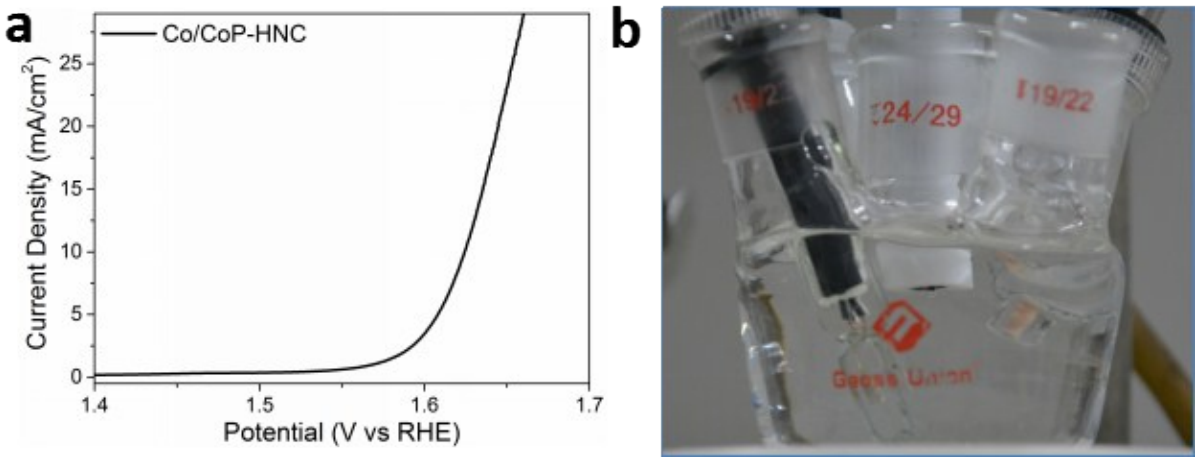

Fig. S7 (a) The OER performance of Co/CoP-HNC on GC in 0.1 M KOH. (b) A bubble was observed on GC after 400 s under a constant potential of 1.56 V.

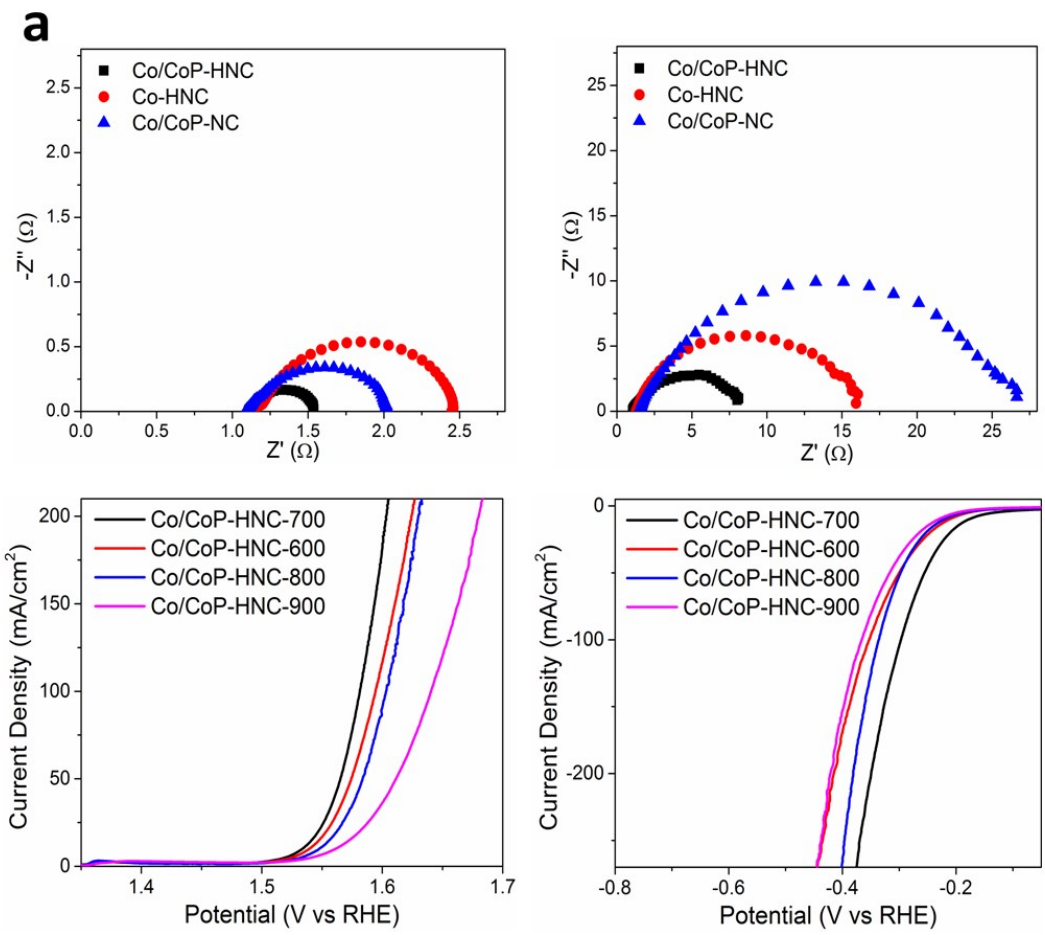

Fig. S8 The EIS spectra of Co/CoP-HNC, Co-HNC and Co/CoP-NC for (a) OER and (b) HER. The performance of Co/CoP-HNC with different pyrolysis temperature for (c) OER and (d) HER.

Table S1 Summary of state of the art bifunctional oxygen electrocatalysts in 0.1 M KOH.

Catalysts	Loading mg/cm²	E_{ORR}/V half-wave	E_{OER}/V 10 mA/cm²	ΔE/V	Ref.
Co/CoP-HNC	0.19	0.83	1.62	0.79	This work
NC@Co-NGC DSNCs	0.4	0.82	1.64	0.82	Ref. 1
PFSA-$Fe_{3.5}$Ni	~0.37	0.83	1.64	0.81	Ref. 2
S,S'-$CNT_{1000\,℃}$	0.23	0.79	1.58	0.79	Ref. 3 (1 M KOH)
NiO/CoN PINWs	0.2	0.68	1.55	0.87	Ref. 4
Co@Co_3O_4/NC-1	0.21	0.8	1.65	0.85	Ref. 5
N/Co-doped PCP//NRGO	0.714	0.86	--	0.80	Ref. 6
	0.357	--	1.66		
Co-CoO/N-rGO	0.21	0.78	1.62	0.84	Ref. 7
FeNO-CNT-CNFF	0.4	0.87	1.66	0.79	Ref. 8
N-GCNT/FeCo-3	0.2	0.92	1.73	0.81	Ref. 9
N-PC@G-0.02	~0.41	0.80	1.63	0.83	Ref. 10
$NiCo_2S_4$/N-CNT	0.248	0.80	1.60	0.80	Ref. 11
S,N-Fe/N/C-CNT	0.6	0.85	1.60	0.75	Ref. 12
A-PBCCF-H	~0.25	0.76	1.64	0.88	Ref. 13
$Pb_2Ru_2O_{6.5}$/KB	0.637	0.81	> 1.6	> 0.79	Ref. 14
N, S-doped porous carbon	0.42	0.88	1.69	0.81	Ref. 15

Table S2 Summary of state of the art bifunctional electrocatalyst in 1 M KOH for water splitting.

Catalysts	Loading mg/cm²	E_{OER}/V 10 mA/cm²	E_{HER}/V 10 mA/cm²	Ref.
Co/CoP-HNC	0.2	1.53 V	-0.18 V	This work
Co-P/NC	0.283	1.574	-0.191 V	Ref. 16
$Cu_{0.3}Co_{2.7}P$/NC	0.4	1.42 V	-0.22 V	Ref. 17
CoO_x@CN	1	1.49 V		Ref. 18
	0.42		-0.232 V	
Co/CoP-5	0.22	1.57 V	-0.253 V	Ref. 19
Fe/P/C	0.46	1.56 V	-0.256 V	Ref. 20
VOOH	0.8	1.50 V	-0.164 V	Ref. 21
N, S-CNT	-	1.59 V	< -0.4 V	Ref. 22
SNCF-NR	0.46	1.60 V	-0.232 V	Ref. 23
$CoMoS_4$/β-$Co(OH)_2$	1	1.572 V	-0.143 V	Ref. 24
CoP-2ph-CMP-800	0.14	1.60 V	-0.36 V	Ref. 25
CoS-$Co(OH)_2$ @aMoS_x/NF	0.2	1.61 V	-0.143 V	Ref. 26
Ni_5P_4	--		-0.15 V	Ref. 27
NiOOH/Ni_5P_4	--	1.52 V		

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