Supporting Information

N-doped Carbon Nanowire Arrays Encapsulated Cobalt Phosphides as a Highly Efficient Bifunctional Electroactivity for Hydrogen and Oxygen Evolution

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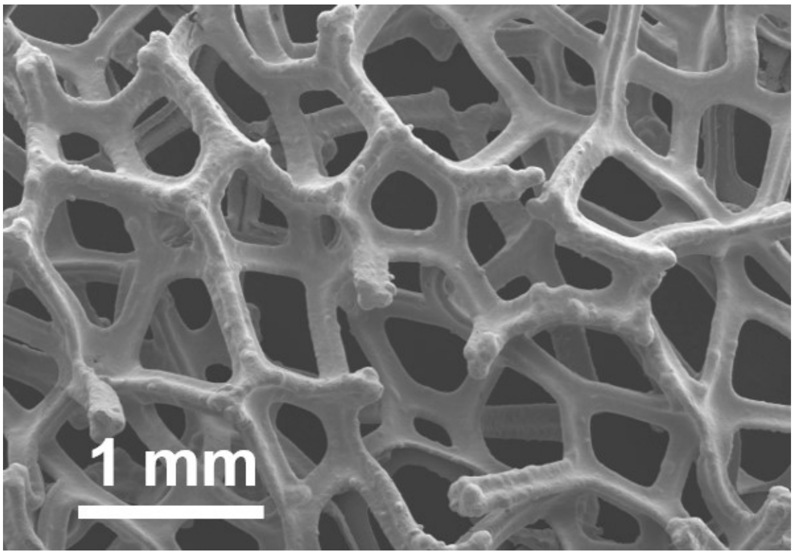

Fig. S1. SEM image of bare CF.

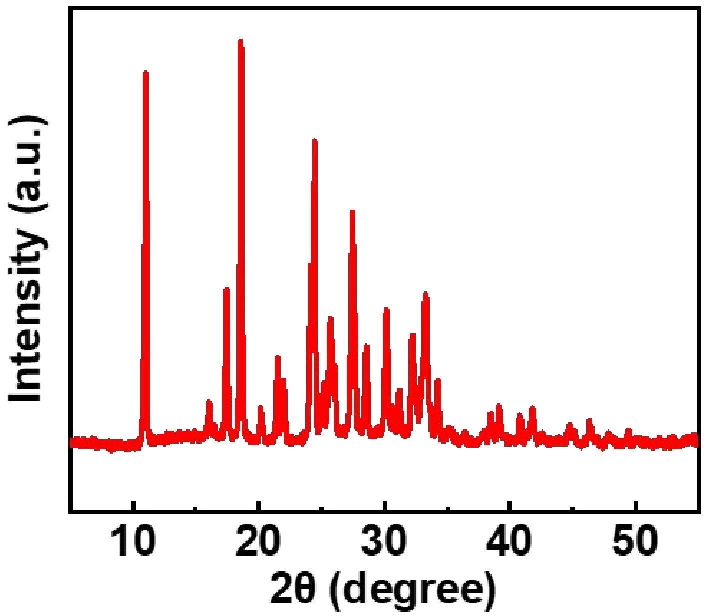

Fig. S2. XRD pattern of pure TCNQ.

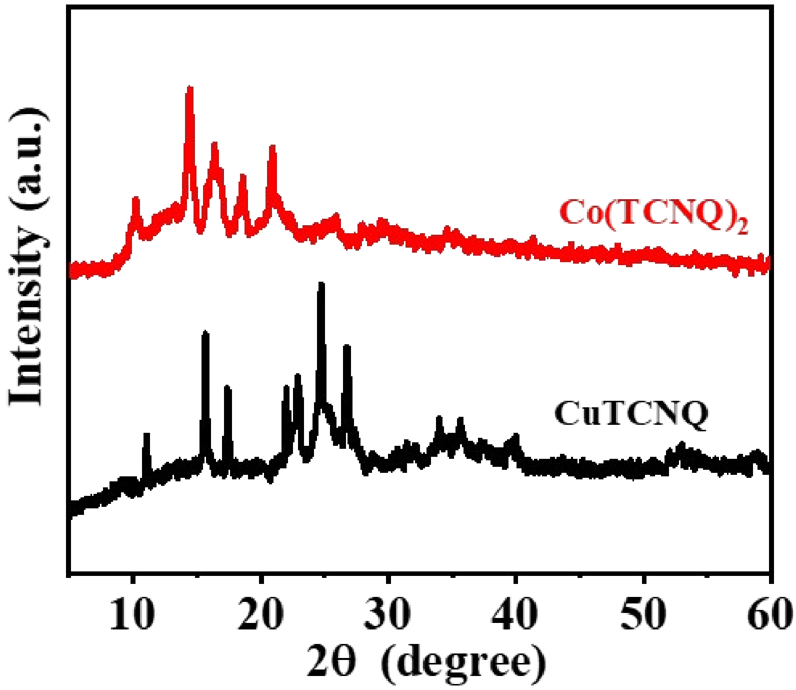

Fig. S3. XRD pattern of CuTCNQ and Co(TCNQ)$_2$.

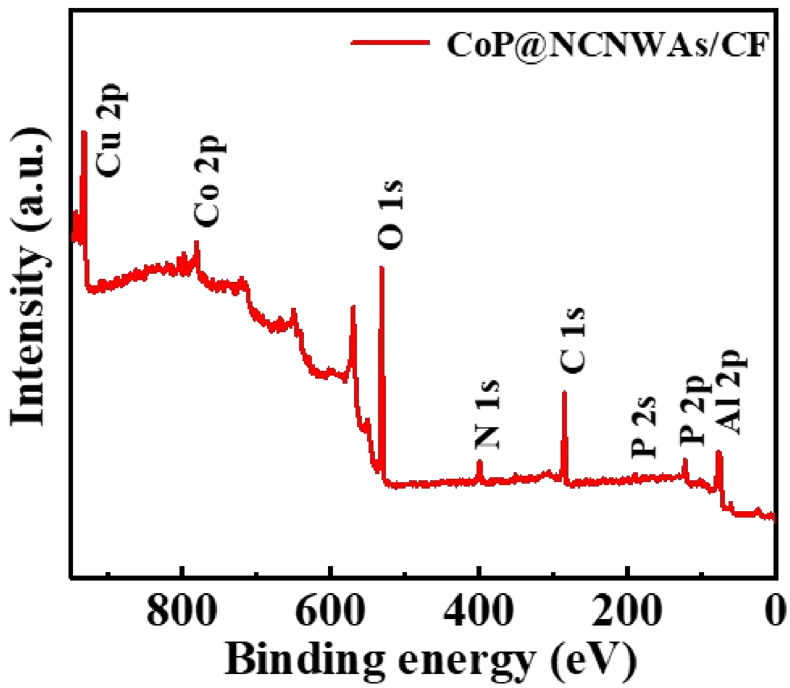

Fig. S4. The full XPS spectrum of CoP@NCNWAs/CF.

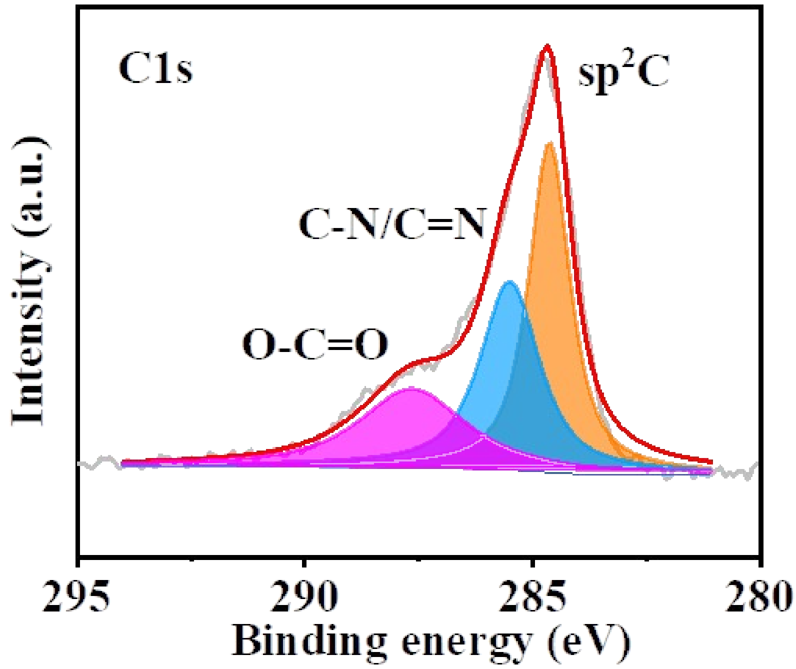

Fig. S5. The C1s spectrum of the CoP@NCNWAs.

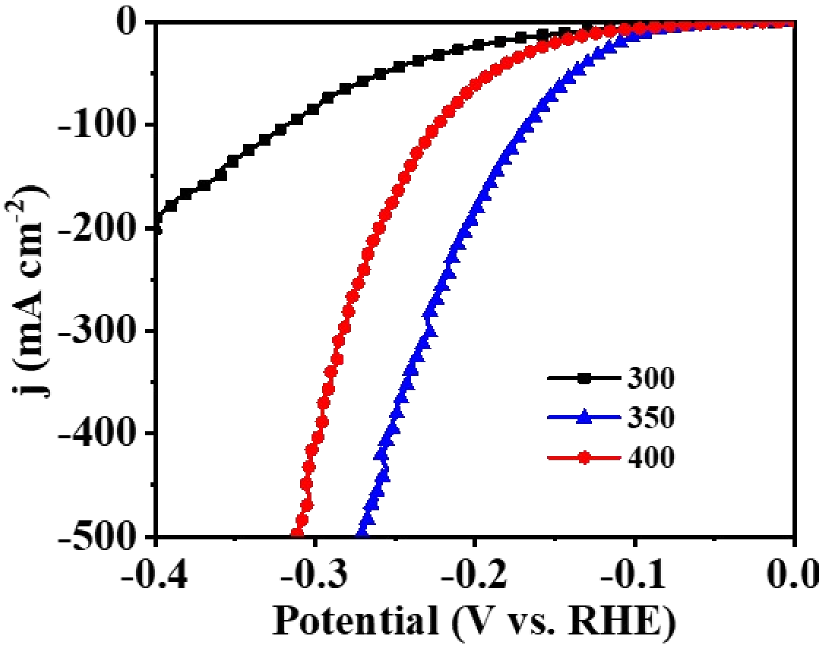

Fig. S6. The influence of the phosphidation temperatures on electrocatalytic HER performance.

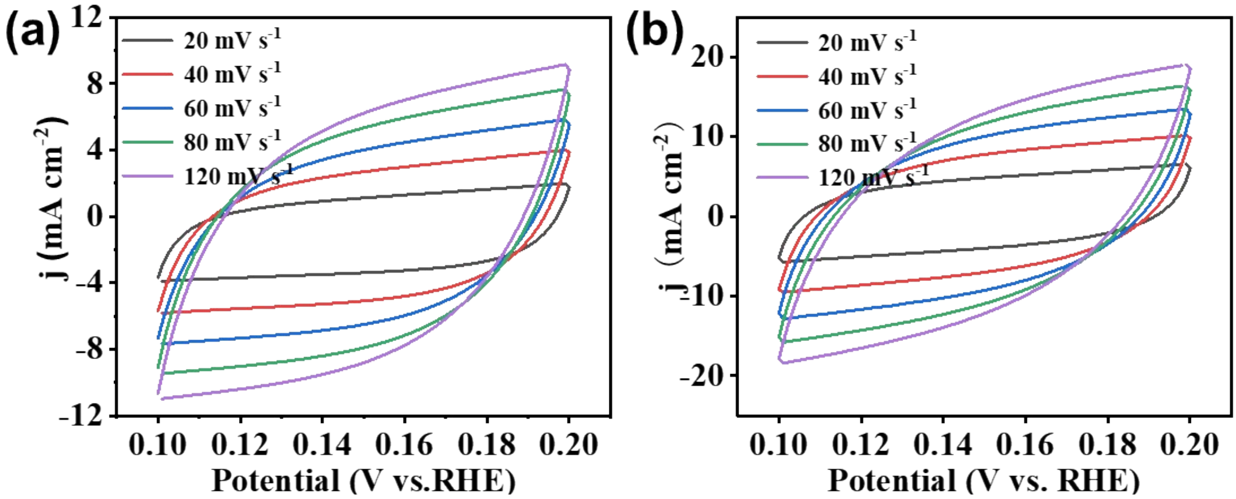

Fig. S7. (a, b) CV curves of CoP/CF and CoP@NCNWAs/CF between 0.1 and 0.2 V vs. RHE with different scan rate (20, 40, 60, 80 and 100 mV s^{-1}).

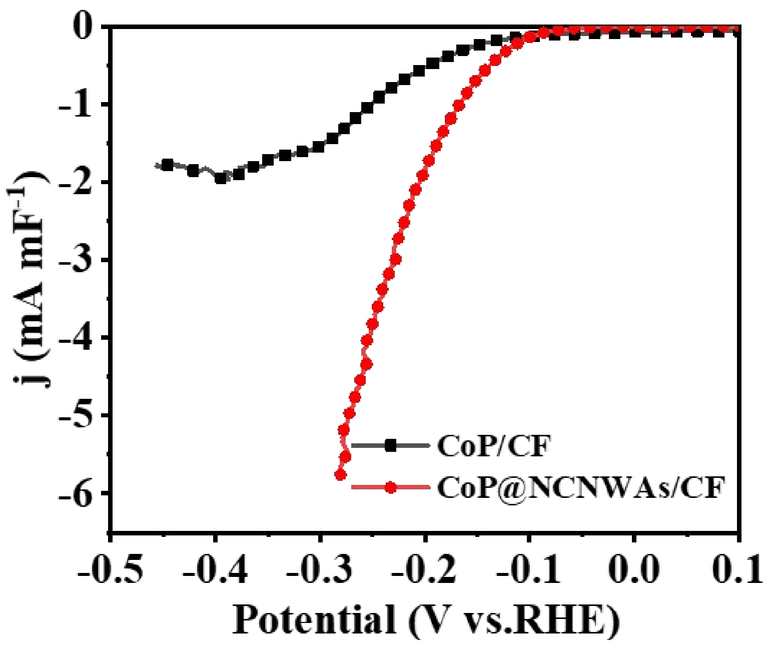

Fig. S8. The HER LSV normalized by ECSA.

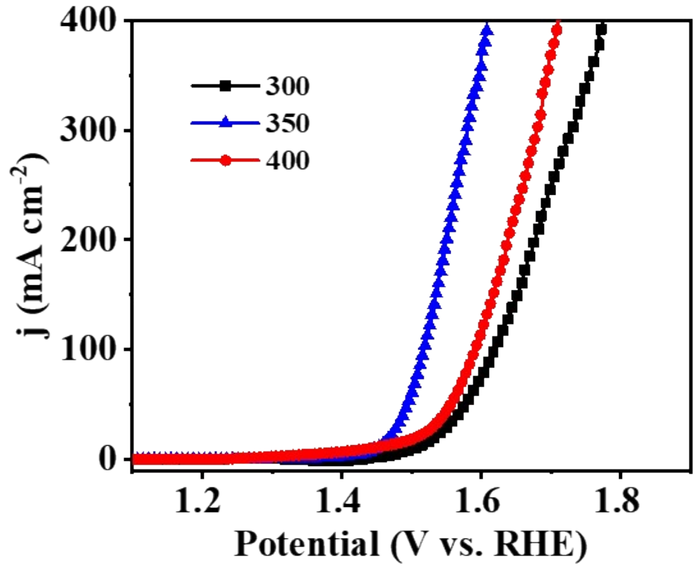

Fig. S9. The influence of the phosphidation temperatures on electrocatalytic HER performance.

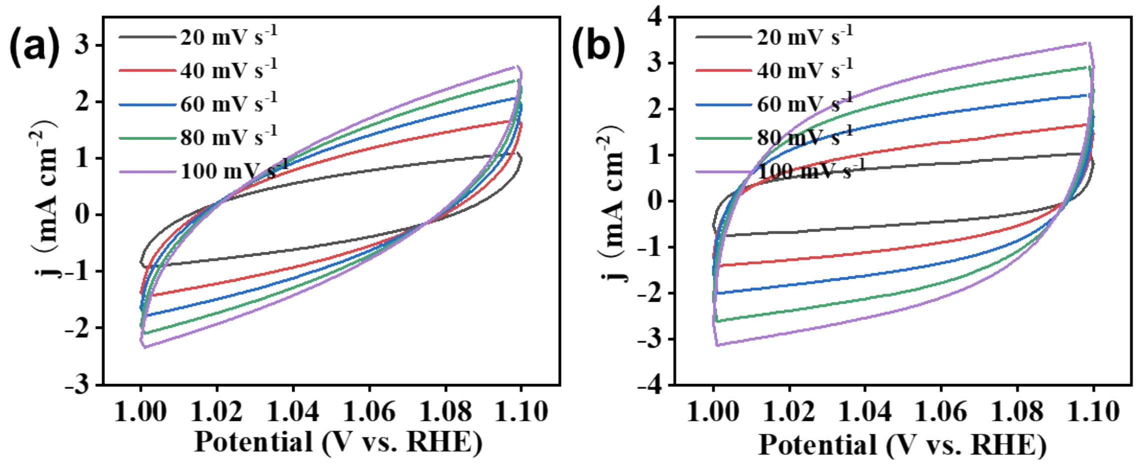

Fig. S10. CV curves of CoP/CF and CoP@NCNWAs/CF between 1.0 and 1.1 V vs. RHE with different scan rate (20, 40, 60, 80 and 100 mV s^{-1}).

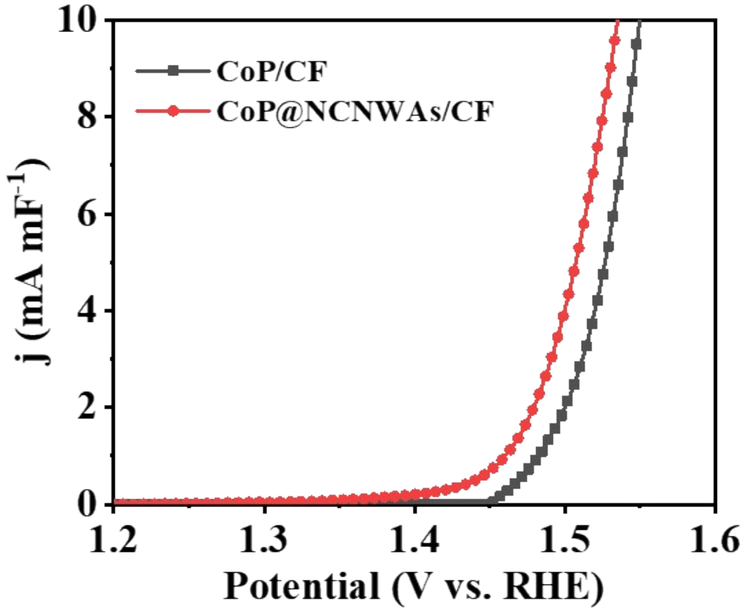

Fig. S11. The OER LSV normalized by ECSV.

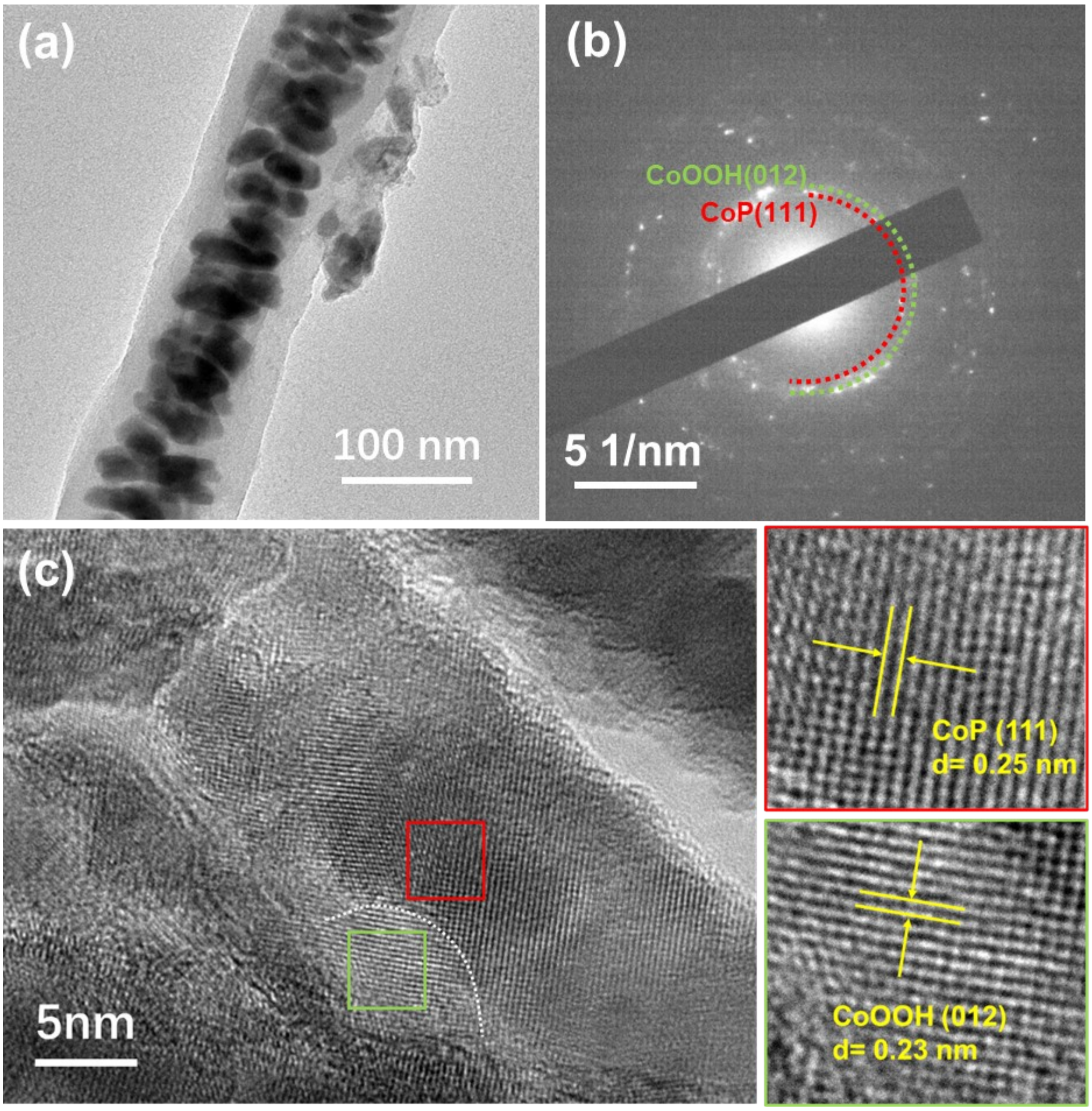

Fig. S12. (a) TEM, (b) the corresponding the SAED pattern and (c) HRTEM images of CoP@NCNWAs/NF after OER test.

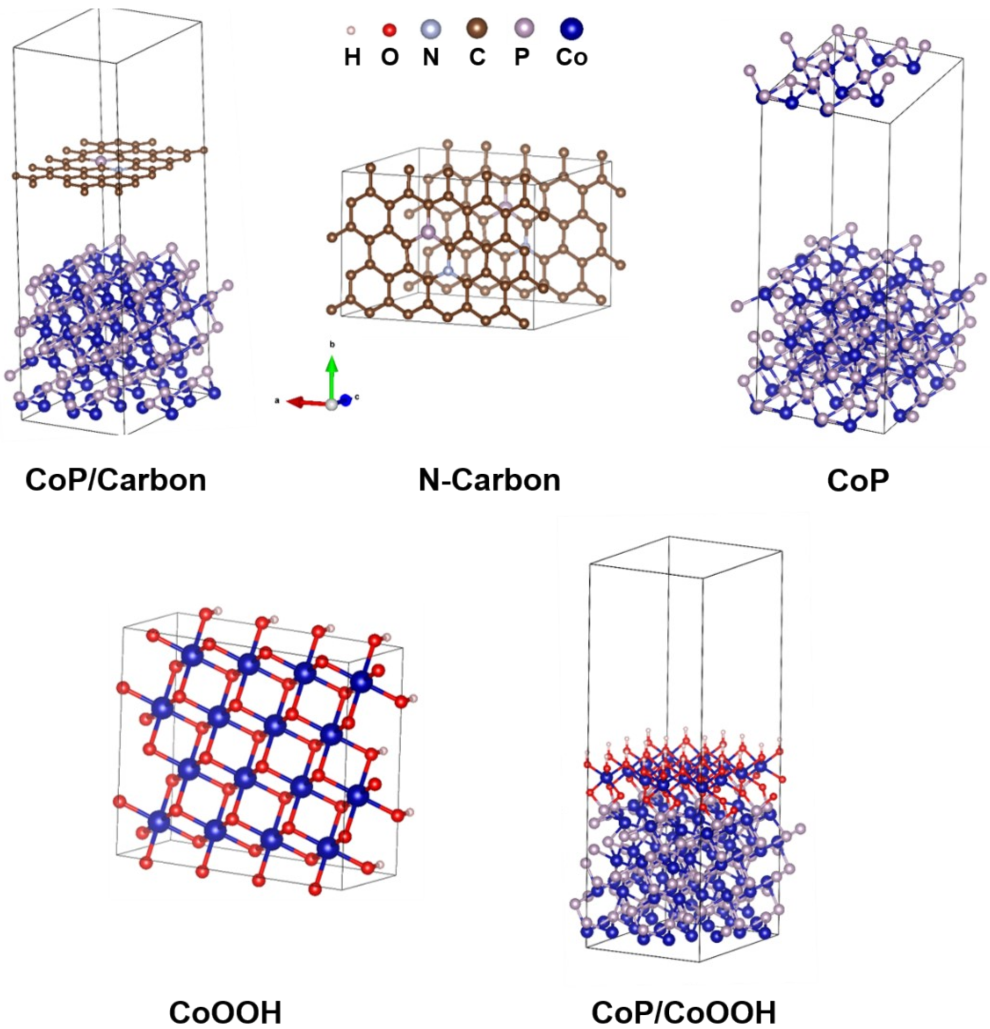

Fig. S13. Schematic illustration of the atomic structure of CoP, CoOOH, N-carbon, CoP/carbon interface and CoP/CoOOH interface.

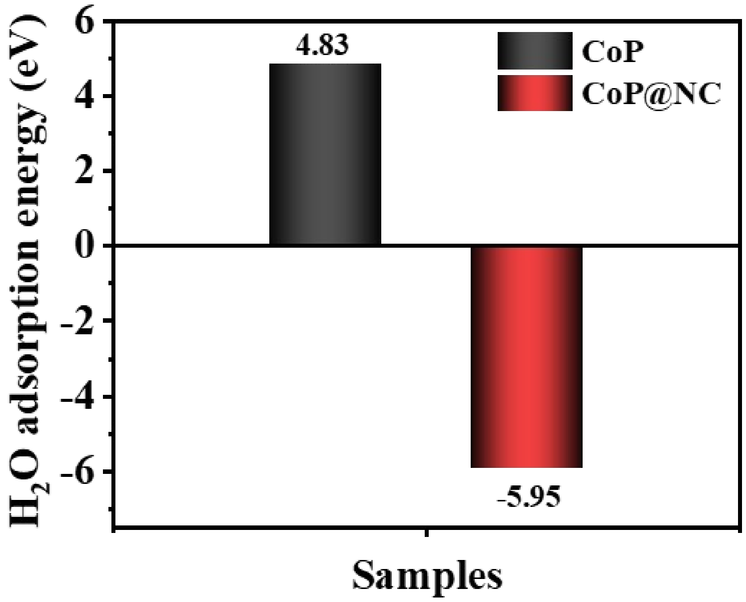

Fig. S14. H_2O adsorption energy of CoP and CoP/NC

Table S1. The amount of all elements in the as-synthesized CoP@NCNWAs/CF

Element	**P**	**Co**
Content (wt.%)	18.32	36.73

Table S2. Comparison of HER performance of CoP@NCNWAs/CF with non-precious metal-based self-supported electrocatalysts reported recently in 1.0 M KOH.

Electrocatalysts	η@100 mA cm^{-2} (mV)	Tafel slope (mV dec^{-1})	References
Co_4N-CeO_2/GP [1]	103	61	Adv. Funct. Mater. 2020, 30, 1910596
Ni_3N-VN/NF [2]	218	37	Adv. Mater. 2019, 31, 1901174
$NiSe_2$/Ni_3Se_4/NF [3]	228	69.7	Appl. Catal., B. 2022, 303, 120915
TMP NiZn-Ni/NF [4]	115	47.3	Nano Energy, 2021, 89, 106402
CoTeNR/NF [5]	340	115	Small Methods, 2019, 3, 1900113
Ni-Gr-CNTs-Ni_2P [6]	124	41	ACS Nano 2021, 15, 5586-5599
O, Mo-CoP/NF [7]	192	65.4	ChemElectroChem, 2021, 8, 103-111
Ni/Mo_2C-NCSs [8]	131	66	Chem. Eng. J. 2022, 431, 134126
CoS_2/MoS_2@CC [9]	159	62.8	ChemSusChem, 2020, 14, 699-708
NF-Ni_3S_2/MnO_2 [10]	197	69	Appl. Catal., B. 2019, 254, 329-338
Co/CoMoN/NF [11]	173	68.9	Adv. Sci. 2022, 2105313
CrO_x-Ni_3N [12]	220	73.4	Small, 2022, 2106554
CFeCoNiP-NF [13]	150	31	J. Mater. Chem. A, 2020, 8, 9939-9950
NF@Mo-$Ni_{0.85}$Se [14]	260	98.98	Chem. Eng. J. 2021, 422, 130125
Ni-MoO_2/NF-IH [15]	204	75	Adv. Funct. Mater. 2021, 31, 2009580
CoP@NCNWAs/CF	**166**	**43.46**	**This work**

Table S3. Comparison of OER performance of CoP@NCNWAs/CF with non-precious metal-based self-supported electrocatalysts reported recently in 1.0 M KOH.

Electrocatalysts	100 mA cm^{-2} (mV)	Tafel slope (mV dec^{-1})	References
CoP_x@CNS [16]	1.55	70	Angew. Chem. Int. Ed. 2020, 59, 21360-21366
Ni_2P-VP_2/NF [2]	1.628	49	Adv. Mater. 2019, 31, 1901174
Ce-m-$Ni(OH)_2$@$NiSe_2$ [17]	1.47	27	Adv. Energy Mater. 2021, 11, 2101266
a-LNFBPO [18]	1.525	37	Adv. Energy Mater. 2021, 11, 2100624
Fe/Mo_2C-NCSs [8]	1.523	83	Chem. Eng. J. 2022, 431, 134126
Co_4N-CeO_2/GP [1]	1.54	37.1	Adv. Funct. Mater. 2020, 30, 1910596
N-Co_3O_4@C@NF [19]	1.62	89	Adv. Sci. 2019, 6, 1900272
CoS_2/MoS_2@CC [9]	1.57	57.5	ChemSusChem, 2020, 14, 699-708
CoNi-HAB/$Co(OH)_2$/CFP [20]	1.62	42	Small, 2020, 16, 1907043
CoTeNR/NF [5]	1.58	75	Small Methods, 2019, 3, 1900113
Vo_x/Ni_3S_2@NF [21]	1.588	82	J. Mater. Chem. A, 2019, 7, 10534-10542
Co/CoMoN/NF [11]	1.533	56	Adv. Sci. 2022, 2105313
Co-CH@NiFe-LDH/NF [22]	1.462	56	Chem. Eng. J. 2021, 422, 130123
FeNi-HDNAs [23]	1.53	91.66	Appl. Catal., B. 2020, 261, 118193
Ni-Gr-CNTs-Ni_2P [6]	1.53	42	ACS Nano, 2021, 15, 5586-5599
CoP@NCNWAs/CF	**1.517**	**88.79**	**This work**

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