Electronic Supplementary Material (ESI) for RSC Advances.

Electronic Supplementary Information

Competent Overall Water-Splitting Electrocatalysts Derived from ZIF-67 Grown on Carbon Cloth

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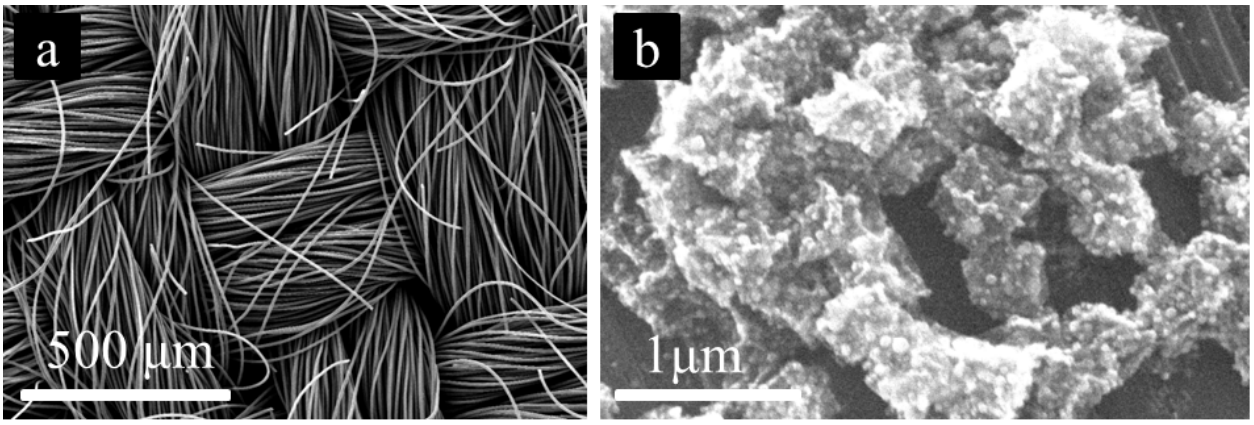

Fig.S1 SEM images of (a) carbon cloth, (b) magnified SEM image of Co/NC/CC.

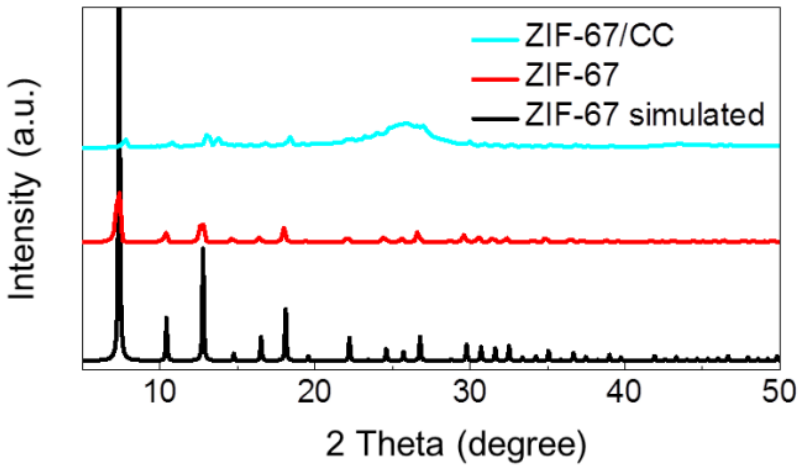

Fig. S2 XRD patterns of simulated ZIF-67 (black), ZIF-67 (red), and ZIF-67/CC (green).

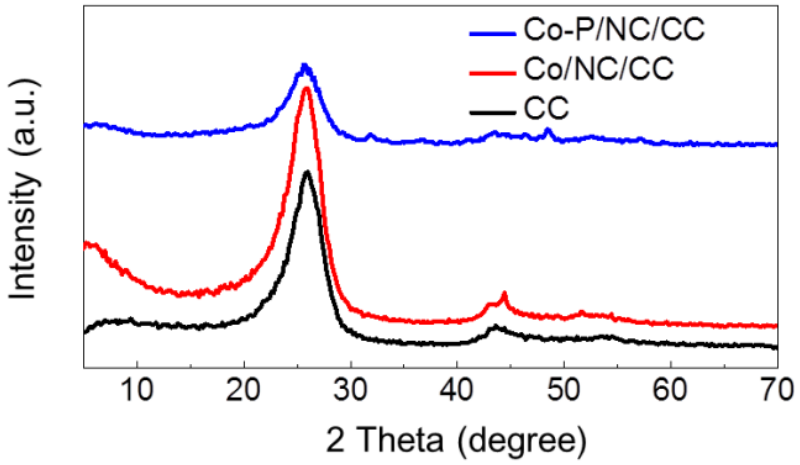

Fig. S3 XRD patterns of carbon cloth (black), Co/NC/CC (red), and Co-P/NC/CC (blue).

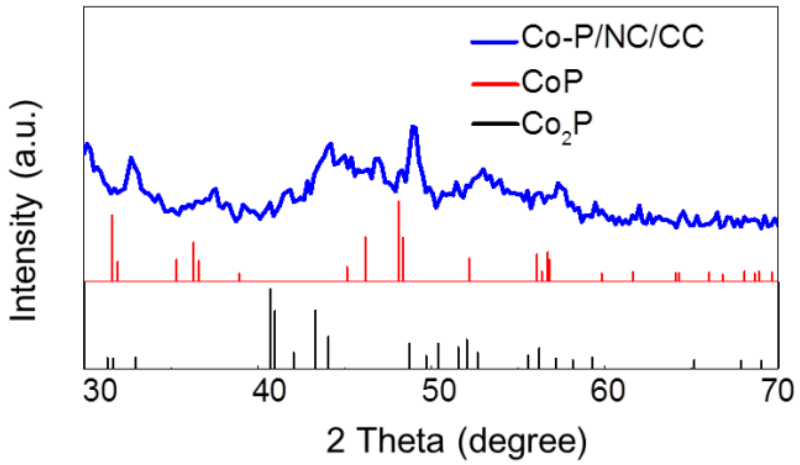

Fig. S4 XRD patterns of standard CoP (red) and Co_2P (black), and Co-P/NC/CC (blue).

Table S1. ICP tests each element loading amount of ZIF-67/CC and Co-P/NC/CC on carbon cloth.

Samples	Co (mg cm^{-2})	P (mg cm^{-2})
ZIF-67/CC	0.064	-
Co-P/NC/CC	0.043	0.005

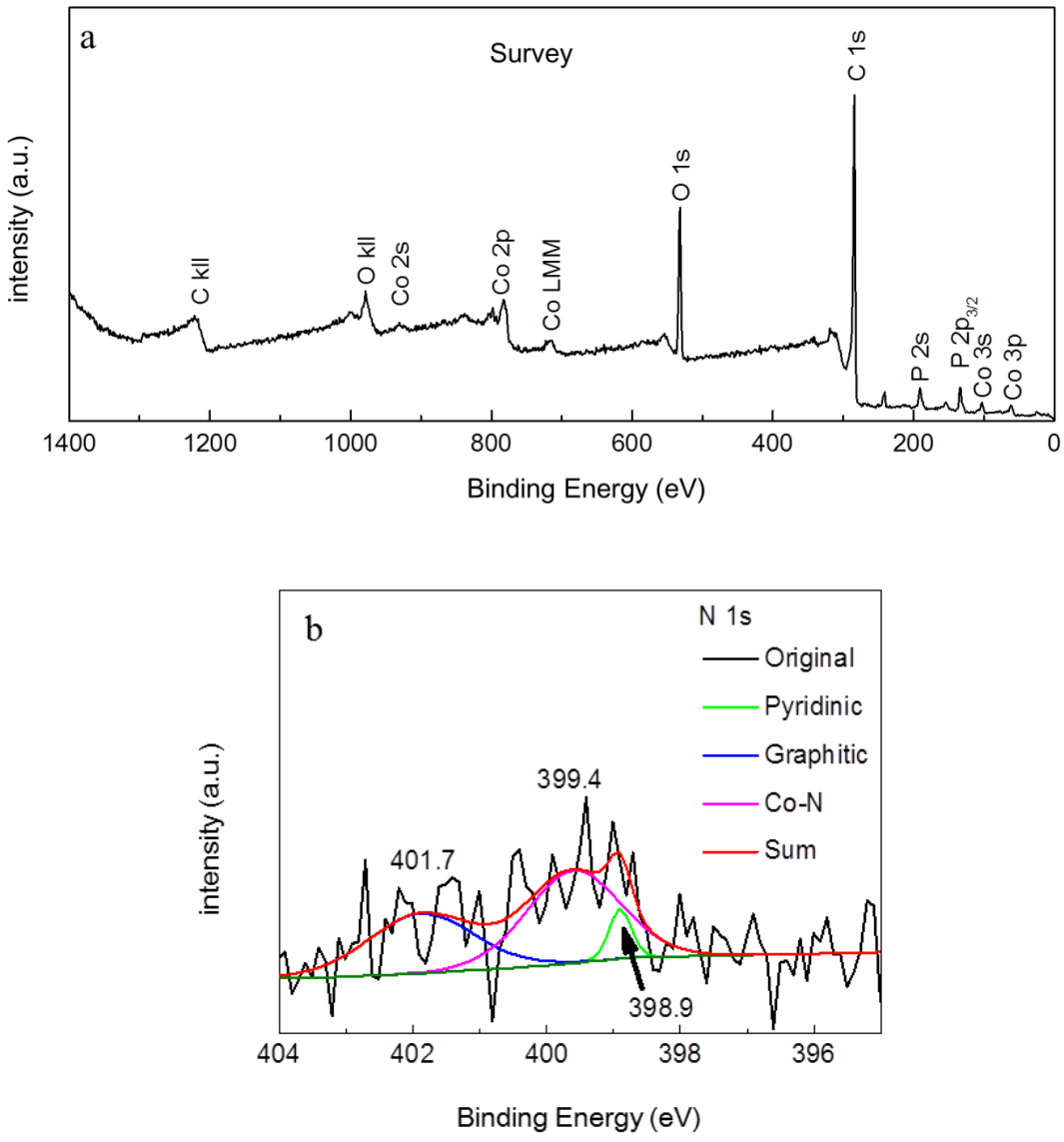

Fig. S5 XPS spectra for (a) survey and (b) high-resolution N 1s region of Co-P/NC/CC.

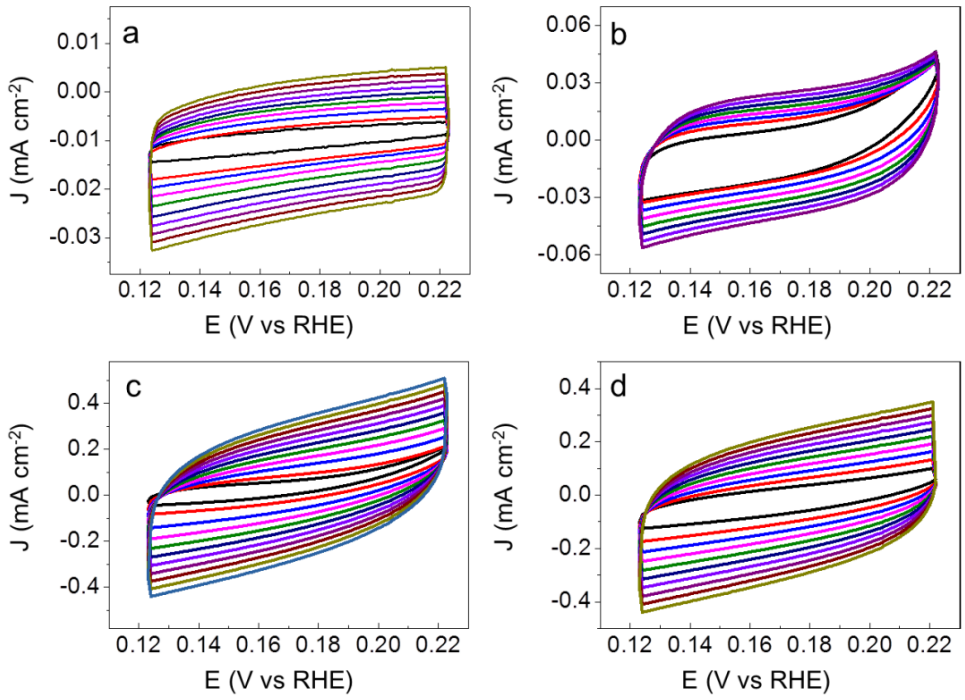

Fig. S6 Cyclic voltammograms of carbon cloth (a), ZIF-67/CC (b), Co/NC/CC (c), and Co-P/NC/CC (d) in 1.0 M KOH at scan rates ranging from 4 to 40 mV s^{-1}.

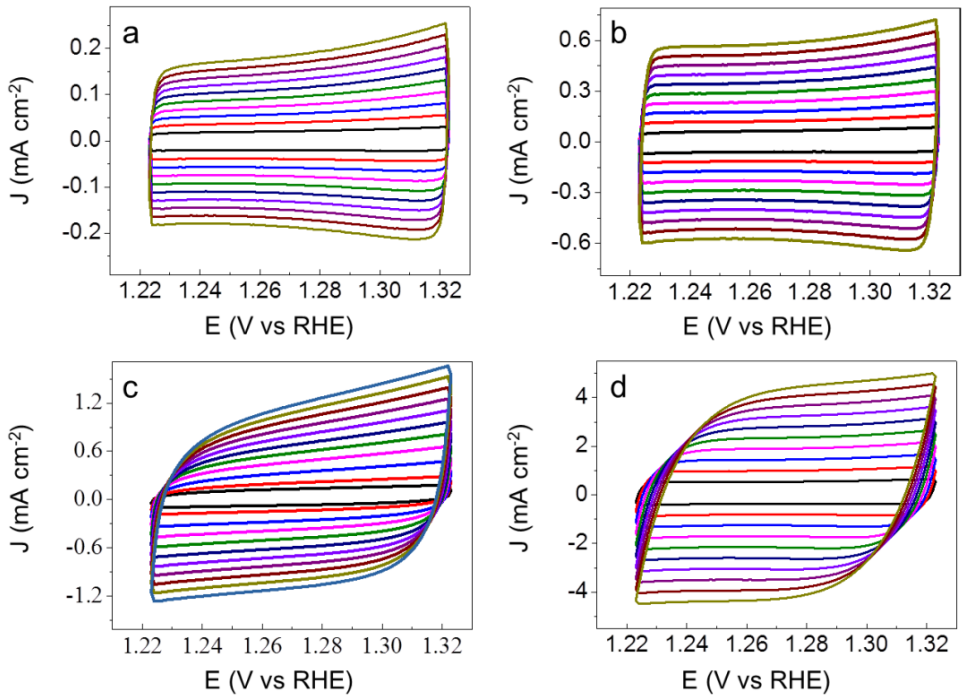

Fig. S7 Cyclic voltammograms of carbon cloth (a), ZIF-67/CC (b), Co/NC/CC (c), and Co-P/NC/CC (d) in 1.0 M KOH at scan rates ranging from 4 to 40 mV s^{-1}.

Table S2. Comparison of HER performances of Co-P/NC/CC with reported HER electrocatalysts in alkaline media (usually 1.0 M KOH).

Catalysts	Mass loading (mg cm^{-2})	Tafel slope (mV dec^{-1})	J (mA cm^{-2})	η (mV)	Reference
Co-P/NC/CC	0.206	52	10 20 100 300	171 188 243 306	This work
Co-P/NC	0.283	51	10 20 100	191 212 277	Chem. Mater., 2015, 27, 7636.
CP/CTs/Co-S	0.32	131	10	190	ACS Nano, 2016, 10, 2342.
CoP	3.3	60	10	95	ChemSusChem, 2016, 9, 472.
a-CoSe/Ti	3.8	84	10	121	Chem. Commun., 2015, 51, 16683.
FeP NAs/CC	1.5	146	10	218	ACS Catal., 2014, 4, 4065.
IPNTs	1.6	59.5	10	120	Chem. Eur. J., 2015, 21, 18062.
Co-P film	2.71	42	10	94	Angew. Chem. Int. Ed., 2015, 54, 6251.
CoP/CC	0.92	129	10	209	J. Am. Chem. Soc., 2014, 136, 7587.
CoO_x@CN	0.42	-	10	232	J. Am. Chem. Soc., 2015, 137, 2688.
PCPTF	0.1	53	30	430	Adv. Mater., 2015, 27, 3175.
Co-NRCNTs	0.28		10	370	Angew. Chem. Int. Ed., 2014, 53, 4372.
MoB	2.3	59	10	225	Angew. Chem. Int. Ed., 2012, 51, 12703.
MoS_{2+x}/FTO	0.02	-	10	310	Angew. Chem. Int. Ed., 2015, 54, 664.
Ni_2P	0.38	-	20	205	Phys. Chem. Chem. Phys., 2014, 16, 5917.
MoC_x/C	0.8	59	10	151	Nat. Commun., 2015, 6, 6512.
$Zn_{0.30}Co_{2.70}S_4$	0.285		10	85	J. Am. Chem. Soc., 2016, 138, 1359.

Table S3. Comparison of OER performances of Co-P/NC/CC with other OER electrocatalysts in alkaline media (usually 1.0 M KOH).

Catalysts	Mass loading (mg cm^{-2})	Tafel slope (mV dec^{-1})	η (mV) at (10 mA cm^{-2})	Reference
Co-P/NC/CC	0.206	61	330	This work
CP/CTs/Co-S	0.32	72	306	ACS Nano, 2016, 10, 2342.
Co-P film	2.71	47	345	Angew. Chem. Int. Ed., 2015, 54, 6251.
NiCo LDH	0.17	40	367	Nano Lett., 2015, 15, 1421.
FeNi-rGO LDH	0.25	39	210	Angew. Chem. Int. Ed., 2014, 53, 7584.
CoCo LDH	0.07	59	393	Nat. Commun., 2014, 5, 1.
CoMn LDH	0.142	43	324	J. Am. Chem. Soc., 2014, 136, 16481.
MnO_x film		49	563	J. Am. Chem. Soc., 2012, 134, 17253.
Fe-Ni oxides		51	>375	ACS Catal., 2012, 2, 1793.
Co NPs	0.2	10	390	J. Am. Chem. Soc., 2015, 137, 7071.
CoO_x film		42	403	J. Am. Chem. Soc., 2012, 134, 17253.
$Ni_xCo_{3-x}O_4$	2.3	59	~370	Adv. Mater., 2010, 22, 1926.
CoP NP/C	0.71	71	320	ACS Catal., 2015, 5, 6874.
$MnCo_2O_x$	0.222	84	410	J. Am. Chem. Soc., 2014, 136, 16481.
N-CG-CoO	0.7	71	340	Energy Environ. Sci., 2014, 7, 609.
a-CoSe/Ti	3.8	69	292	Chem. Commun., 2015, 51, 16683.
Ni@NC	0.4	40	390	Adv. Energy Mater., 2015, 5, 1401660.
Ni_2P/Ni/NF		10	200	ACS Catal., 2016, 6, 714.

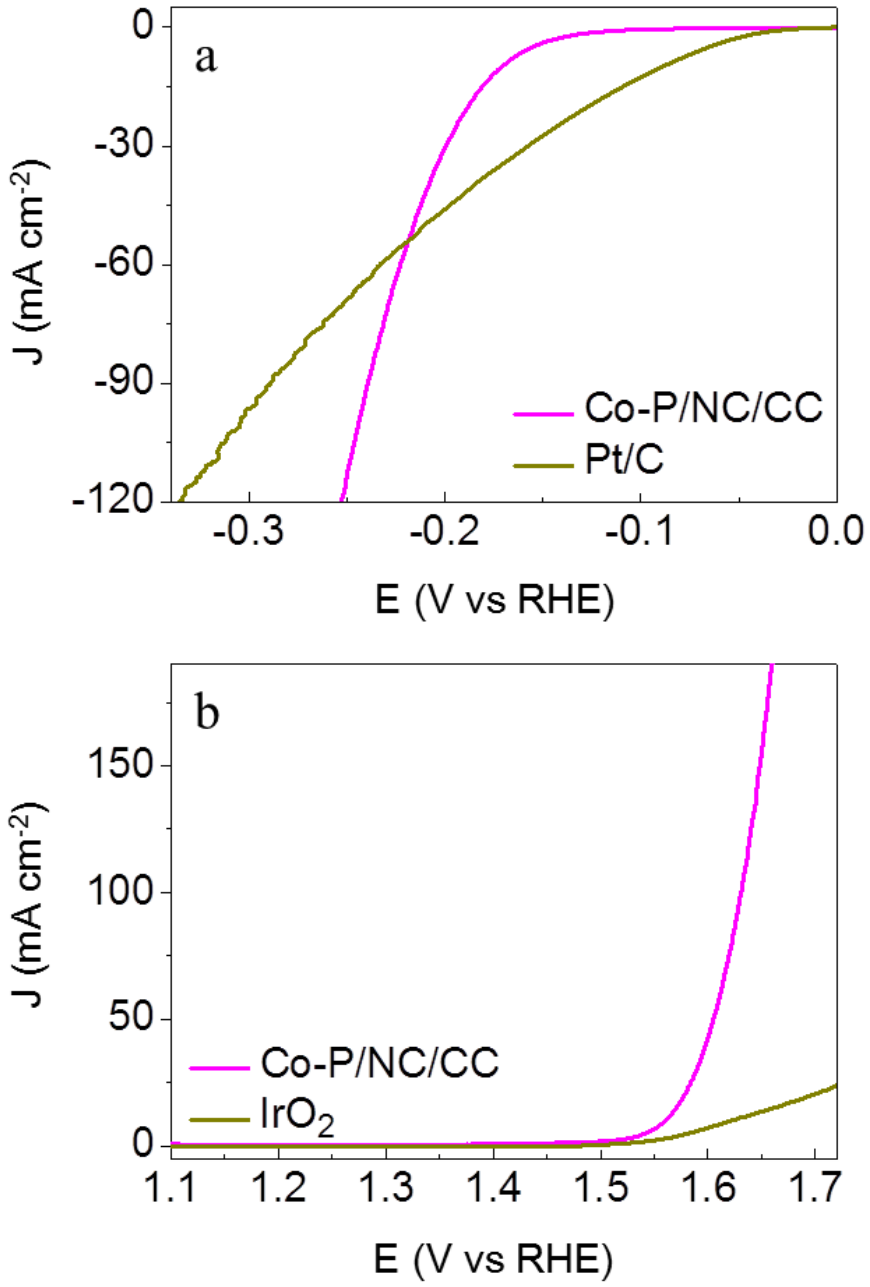

Fig. S8 (a) LSV curves of Co-P/NC/CC (purple) and Pt/C (dark yellow, loading: 0.28 mg cm^{-2}) for HER in 1.0 M KOH at a scan rate of 2 mV s^{-1}. (b) LSV curves of Co-P/NC/CC (purple) and IrO_2 (dark yellow, loading: 0.28 mg cm^{-2}) for OER in 1.0 M KOH at a scan rate of 2 mV s^{-1}.

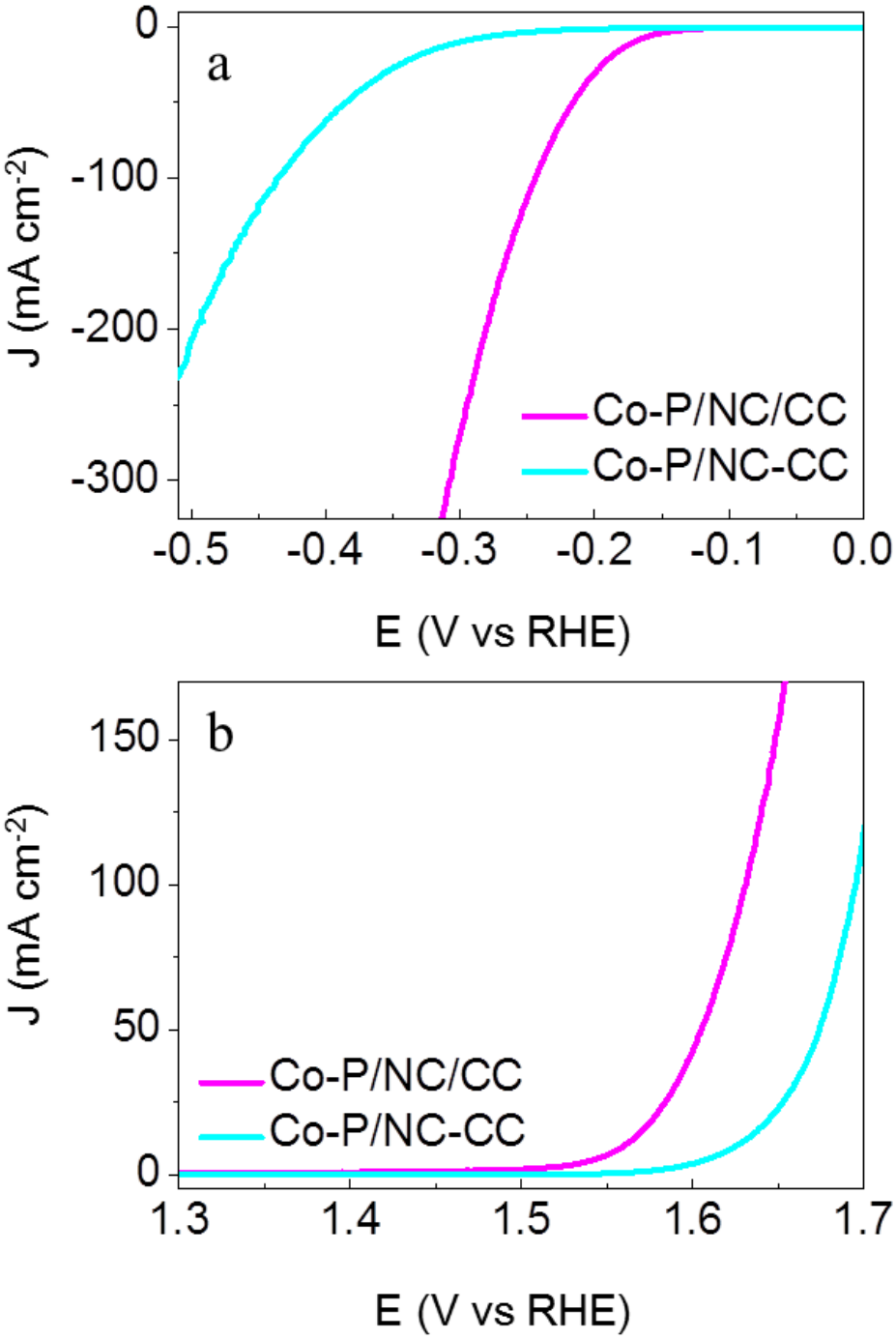

Fig. S9 (a) HER polarization curves of Co-P/NC/CC (purple) and Co-P/NC-CC (green) and (b) OER polarization curves of Co-P/NC/CC (purple) and Co-P/NC-CC (green) in 1.0 M KOH.

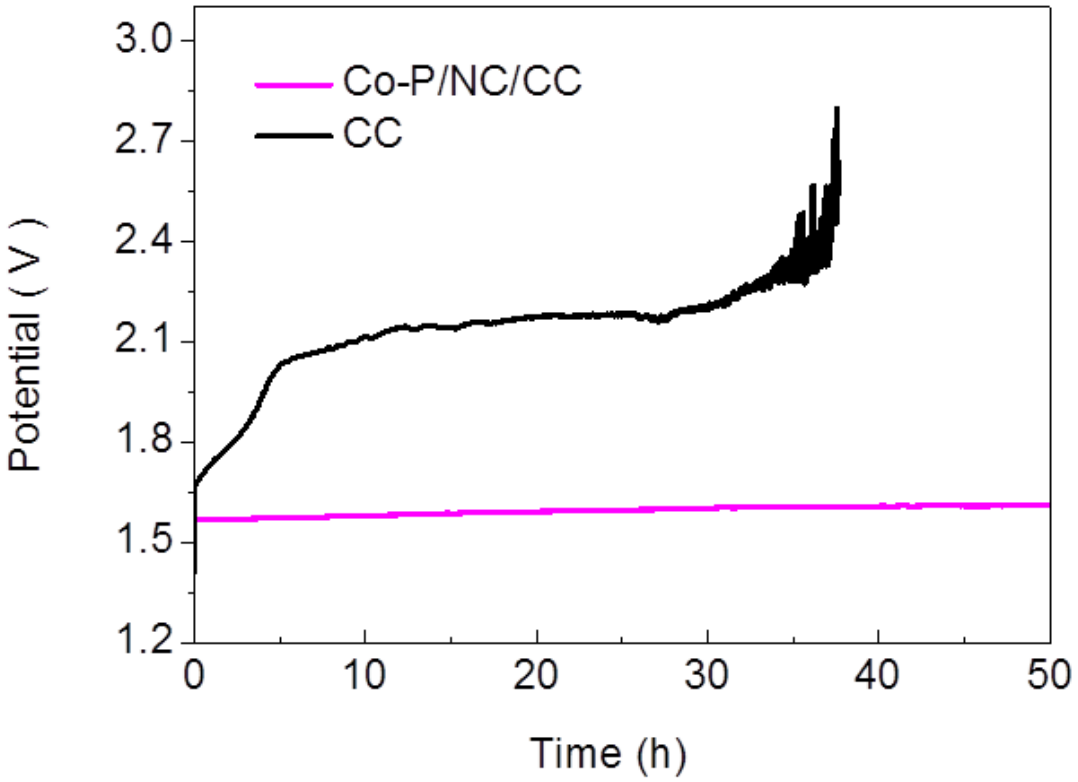

Fig. S10 Chronopotentiometric curves of Co-P/NC/CC (black) and CC (red) in 1.0 M KOH with a current density of 10 mA cm^{-2} for 50 h.

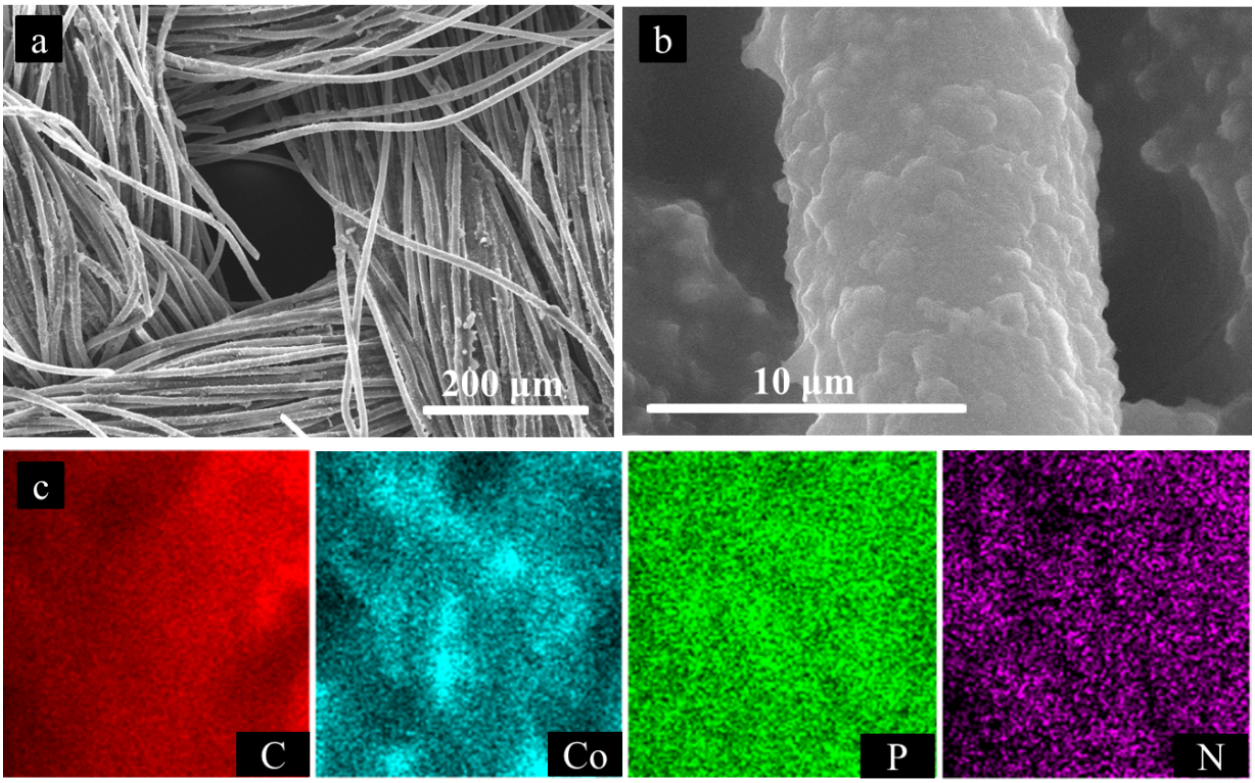

Fig. S11 (a, b) SEM and (c) elemental mapping images of Co-P/NC/CC as a cathode after 20 h overall water splitting with a current density of 10 mA cm^{-2} 1.0 M KOH.

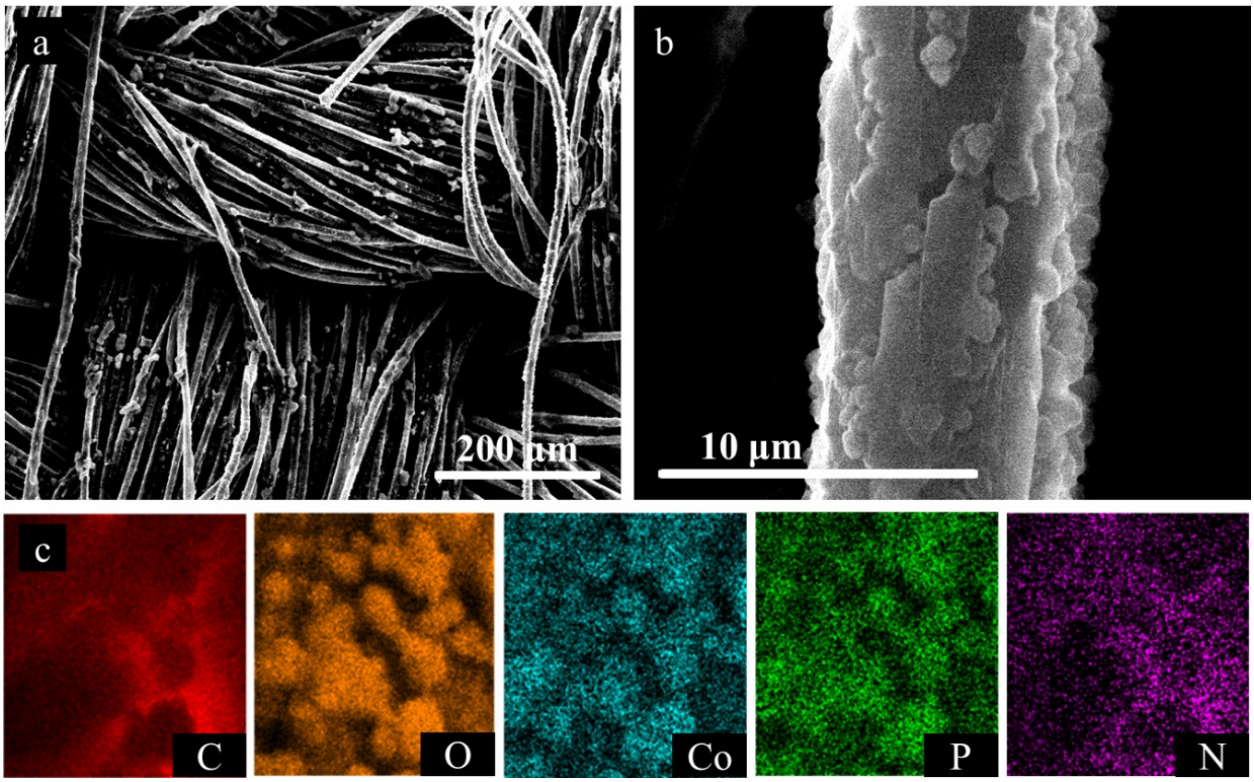

Fig. S12 (a, b) SEM and (c) elemental mapping images of Co-P/NC/CC as an anode after 20 h overall water splitting with a current density of 10 mA cm^{-2} 1.0 M KOH.