Electronic Supplementary Information

Efficient water splitting catalyzed by flexible NiP_2 nanosheet array electrodes under both neutral and alkaline solutions

Zonghua Pu,[a] Ya Xue,[b] Wenqiang Li,[a] Ibrahim Saana Amiinu,[a] and Shichun Mu[a]*

[a]State Key Laboratory of Advanced Technology for Materials Synthesis and Processing, Wuhan University of Technology, Wuhan 430070, P. R. China

[b]Laboratory of Southwest China Wildlife Resources Conservation, China West Normal University, Nanchong 637009, P. R. China

E-mail: msc@whut.edu.cn

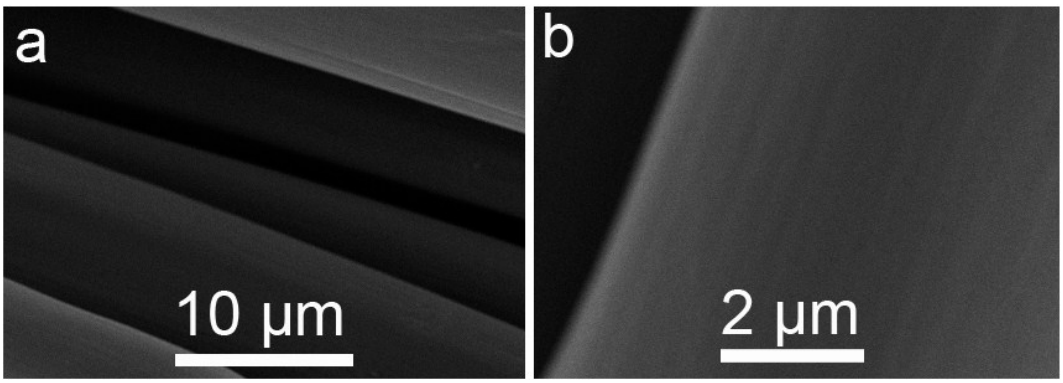

Fig. S1 SEM image of blank CC.

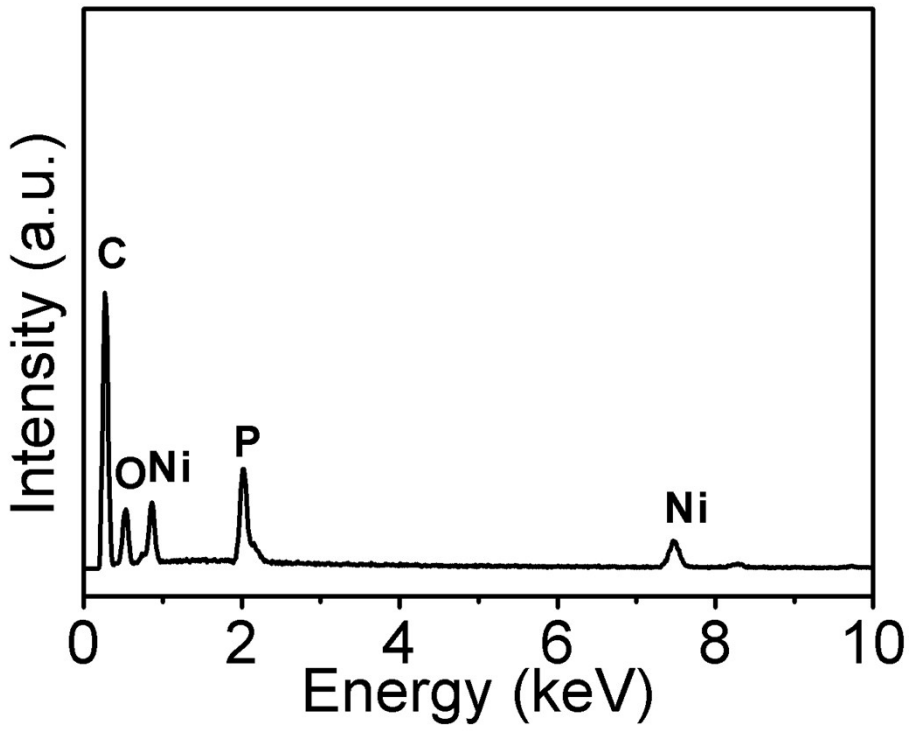

Fig. S2 EDX spectrum of NiP_2/CC.

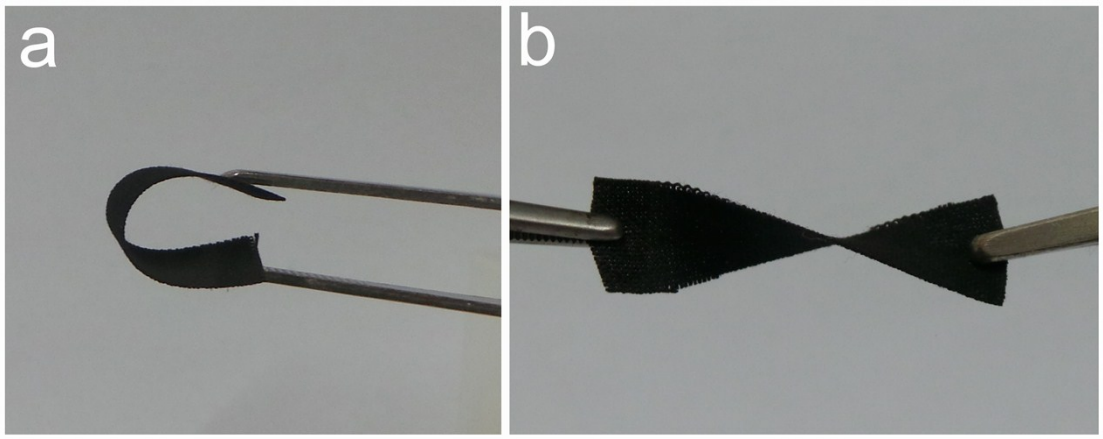

Fig. S3 Optical photographs of the as-synthesized NiP_2/CC.

Fig. S4 Optical photographs of the de-ionized water and seawater.

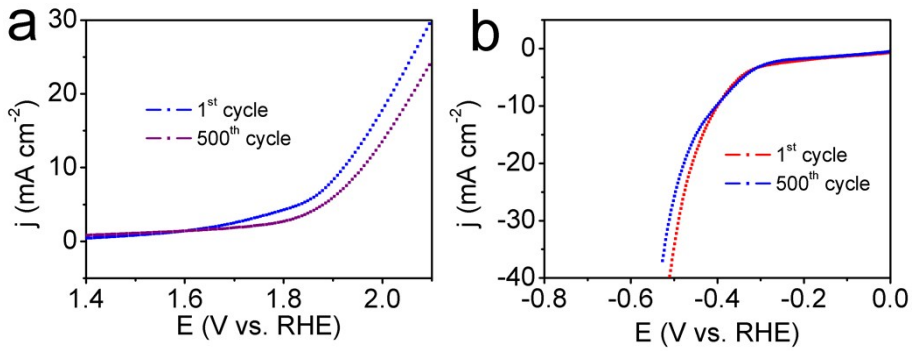

Fig. S5 (a) OER and (b) HER polarization curves for NiP_2/CC in seawater.

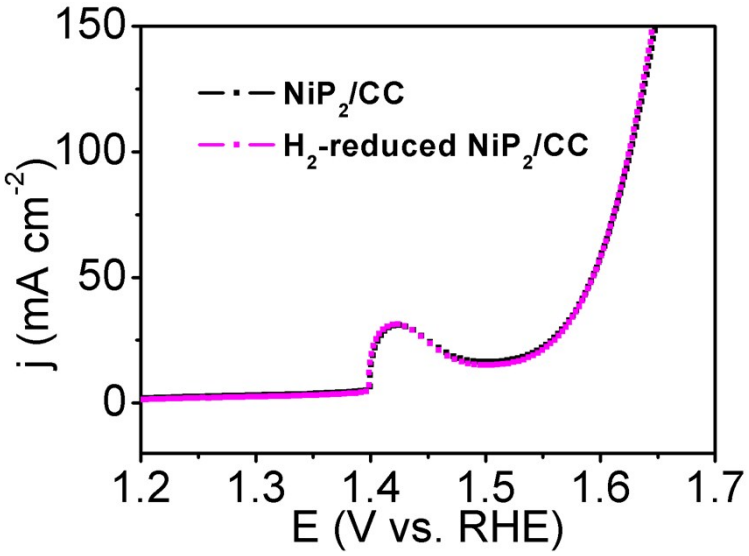

Fig. S6. Polarization curves for NiP_2/CC and H_2-reduced NiP_2/CC in 1.0 M KOH at a scan rate of 2 mV s^{-1} for OER.

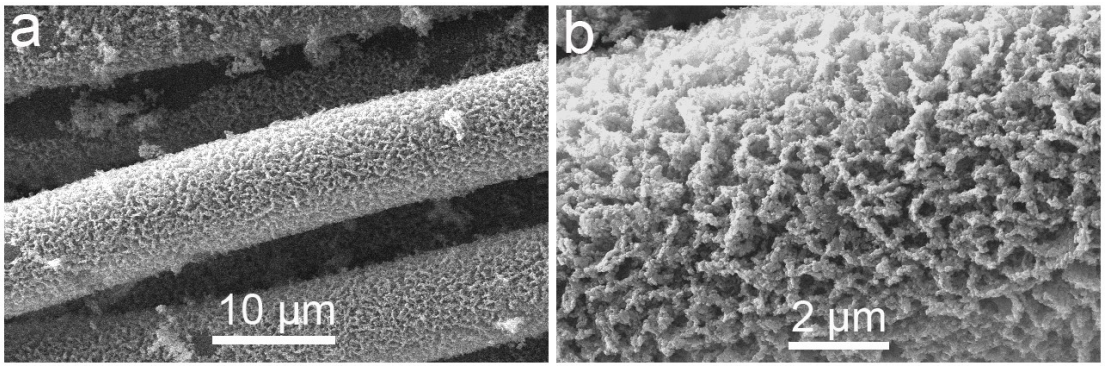

Fig. S7 SEM images of NiP_2/CC after OER electrolysis.

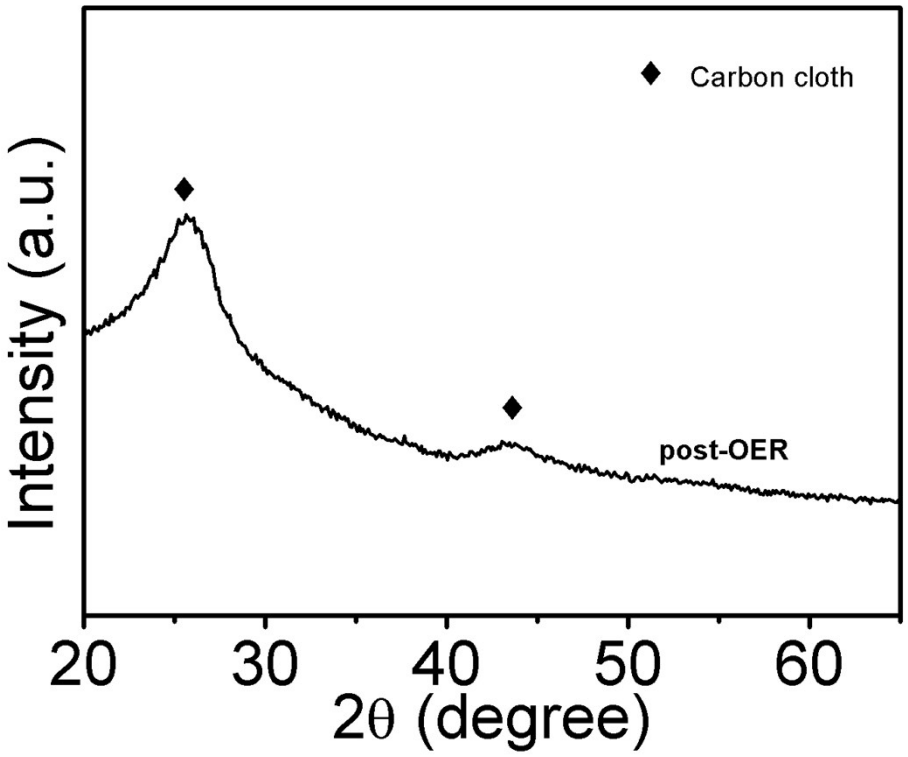

Fig. S8 XRD pattern of NiP_2/CC post-OER.

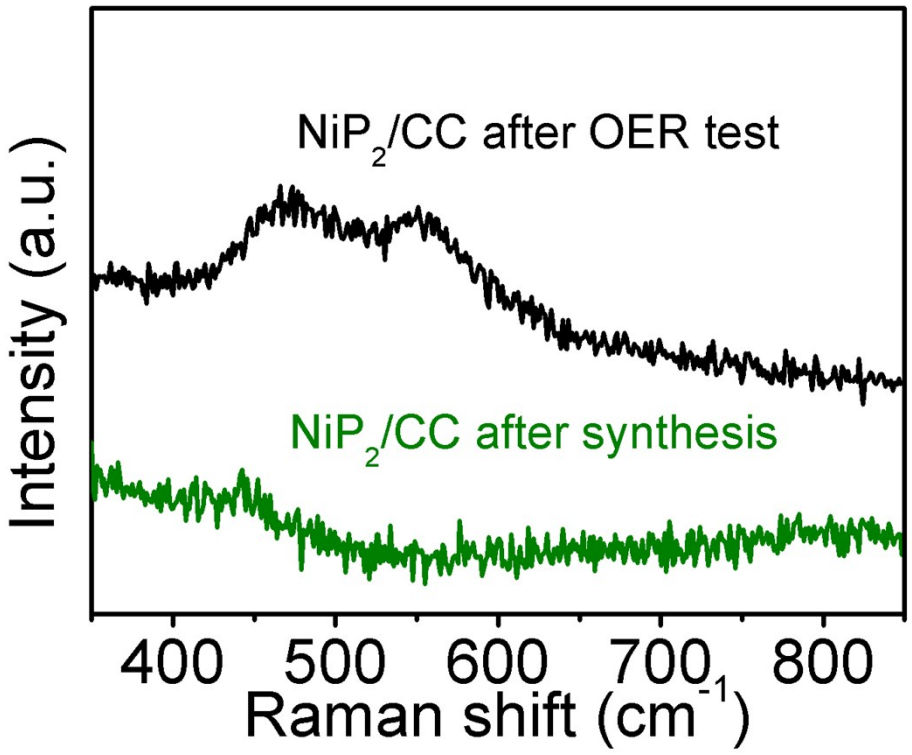

Fig. S9 Raman spectra for NiP_2/CC before and after OER durability tests in 1.0 M KOH.

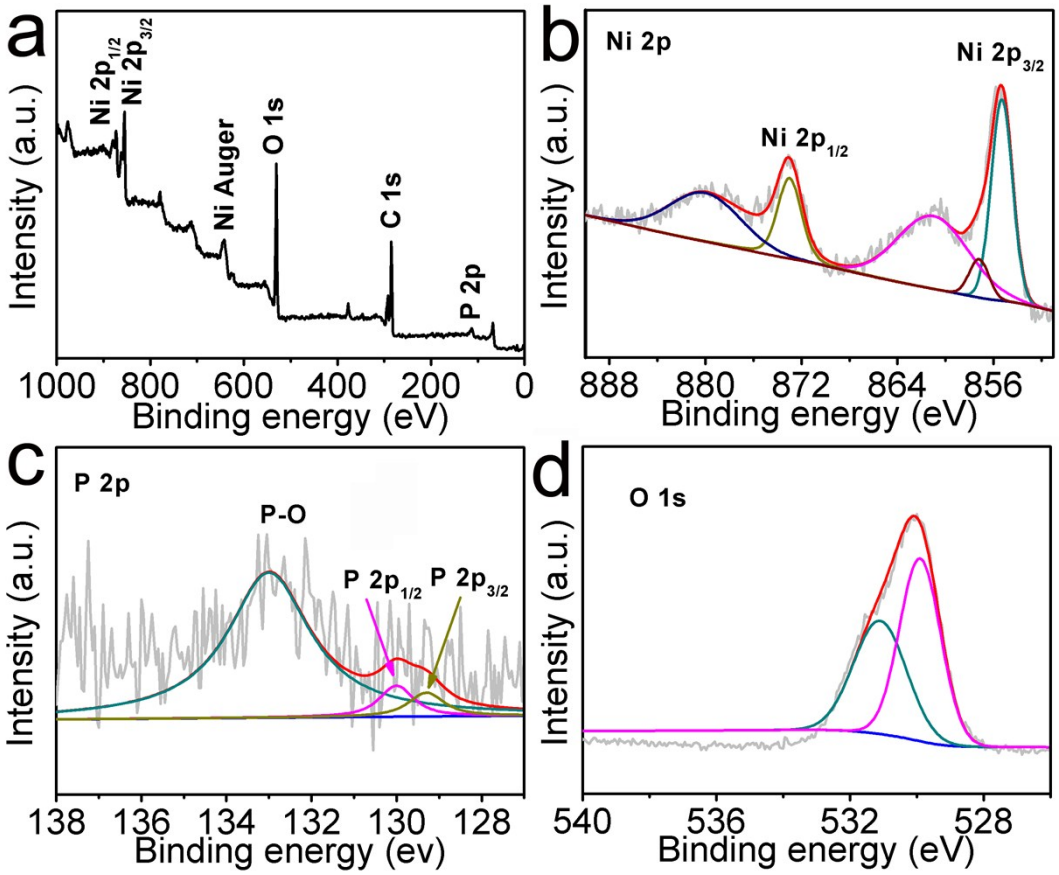

Fig. S10 (a) XPS survey spectrum for post-OER NiP_2/CC. XPS spectra for post-OER NiP_2/CC in the (b) Ni 2p, (c) P 2p, and (d) O 1s regions.

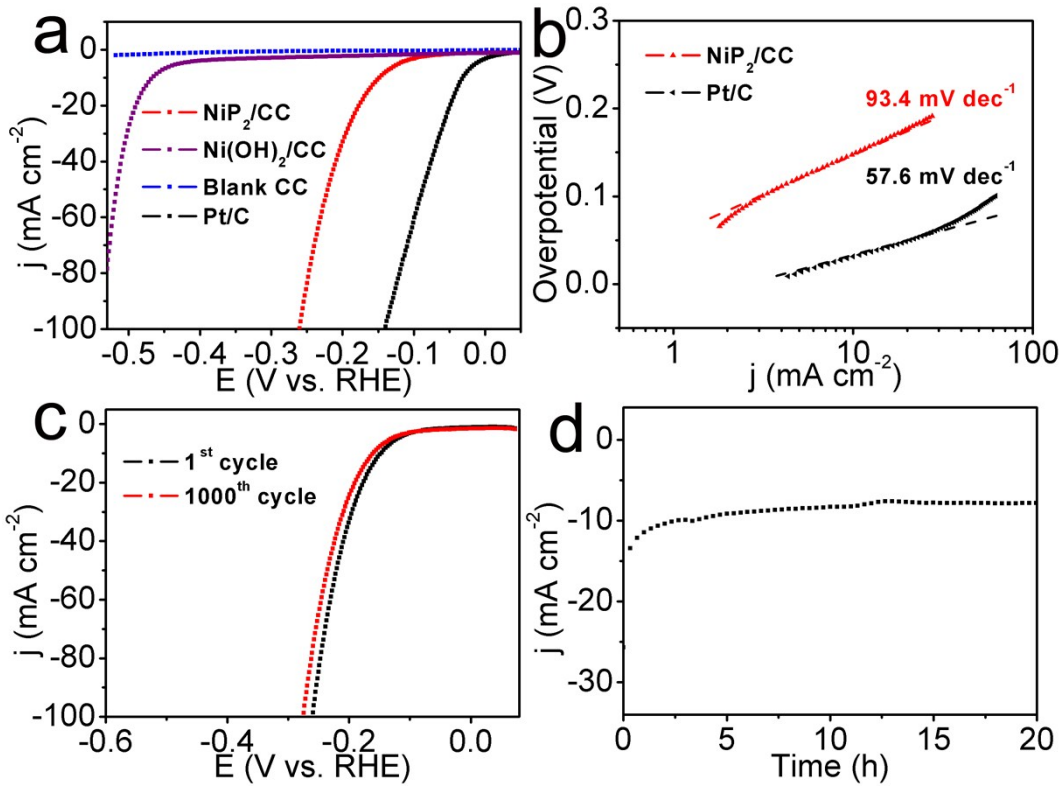

Fig. S11. (a) Polarization curves of NiP_2/CC, $Ni(OH)_2$/CC, Pt/C on CC and blank CC in 1.0 M KOH at a scan rate of 2 mV s^{-1}. (b) Tafel plots of NiP_2/CC and Pt/C on CC. (c) Polarization curves recorded for NiP_2/CC before and after 1000 CV cycles at a scan rate of 2 mV s^{-1}. (d) Time-dependent current density curve for NiP_2/CC under static overpotential of 160 mV for 20 h in 1.0 M KOH (without iR correction).

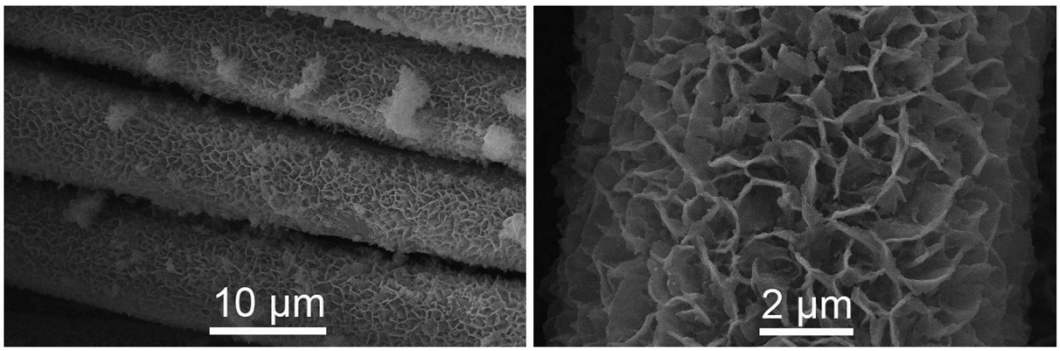

Fig. S12 SEM images of NiP_2/CC after HER electrolysis.

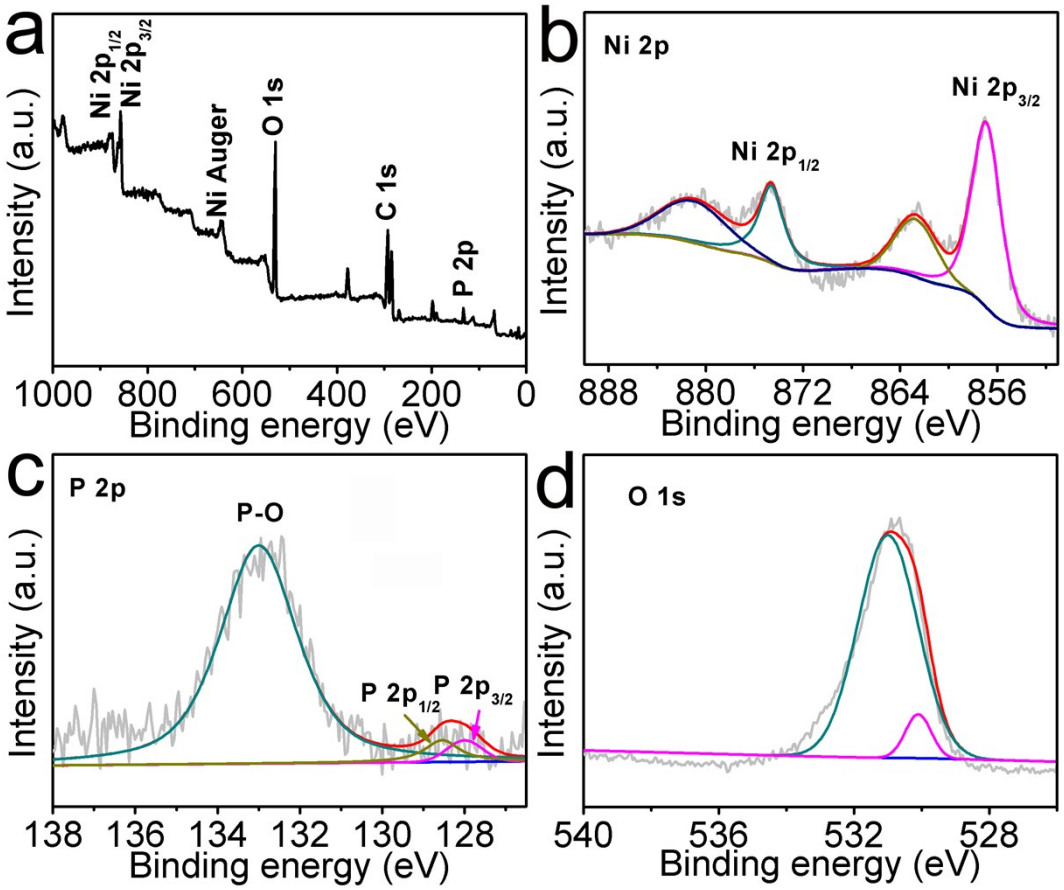

Fig. S13 (a) XPS survey spectrum for post-HER NiP_2/CC. XPS spectra for post-HER NiP_2/CC in the (b) Ni 2p, (c) P 2p, and (d) O 1s regions.

Table S1 Comparison of OER catalytic activity for well-developed electrocatalysts in neutral media.

Catalysts	Electrolyte/pH	j (mA cm^{-2}) @ overpotential (mV)	Ref.
NiP_2/CC	1.0 M PBS	4.0@570	This work
$LiCoPO_4$	7.0	0.5@570	1
$LiMnP_2O_7$	7.0	0.09@570	2
Co-Pi	6.4	0.57@570	3
$Mn_3(PO_4)_2 \cdot 3H_2O$	7.0	0.05@570	4
Ni-Bi film	9.2	1.0@540	5
NiO_x-MWCNT	9.2	0.5@330	6
Co_3O_4/SWNTS	7.0	6.0@570	7
Fe-based film	7.0	5.1@570	8
ZrS_3 nanosheets	6.9	0.025@570	9
Co-Bi NS	7.0	5.3@570	10

Table S2 Comparison of selected nonprecious OER electrocatalysts in alkaline media.

Catalysts	Electrolyte	j (mA cm^{-2})	η (mV) at the corresponding j	Ref.
NiP_2/CC	1.0 M KOH	20	310	This work
$NiCo_2S_4$ nanowires/CC	1.0 M KOH	20	336	11
NiSe nanowire/NF	1.0 M KOH	20	270	12
Ni_2P nanoparticles	1.0 M KOH	10	290	13
Ni_5P_4/Ni plate	1.0 M KOH	10	290	14
Ni_3S_2 nanosheet/NF	1.0 M KOH	10	260	15
urchin-like Ni_2P/NF	1.0 M KOH	10	200	16
Co-S/Ti mesh	1.0 M KOH	10	340	17
Co-P film	1.0 M KOH	10	345	18
Co_3O_4/rm-GO	1.0 M KOH	10	310	19
$NiFeO_x$ film	1.0 M NaOH	10	N/A	20
$Zn_xCo_{3-x}O_4$ nanowire array	1.0 M KOH	10	320	21
$Ni_xCo_{3-x}O_4$ nanowire array	1.0 M KOH	10	370	22
N-doped graphene-CoO	1.0 M KOH	10	340	23
CoCo LDH	1.0 M KOH	10	393	24
CoMn LDH	1.0 M KOH	10	324	25
NiCo LDH	1.0 M KOH	10	367	26
CoO_x film	1.0 M KOH	10	403	27
Cu-N-C/graphene	0.1 M KOH	10	N/A	28

Table S3 Comparison of electrocatalytic performance of the NiP_2/CC with other previously reported electrocatalysts for overall water splitting in a two-electrode cell.

Catalyst	Electrolyte	Voltage@10 mA cm^{-2} (V)	Ref.
NiP_2/CC	1.0 M KOH	1.65	This work
$NiCo_2S_4$ nanowires	1.0 M KOH	1.68	11
NiSe nanowire/NF	1.0 M KOH	1.63	12
Ni_2P nanoparticles	1.0 M KOH	1.63	13
Ni_5P_4/Ni plate	1.0 M KOH	1.7	14
urchin-like Ni_2P/NF	1.0 M KOH	1.49	16
Co-P film	1.0 M KOH	1.65	18
CoP	1.0 M KOH	1.587	29
CoSe	1.0 M KOH	1.65	30
NiMo alloy	1.0 M KOH	1.64	31
PNC/Co	1.0 M KOH	1.64	32
Co-P/NC	1.0 M KOH	1.7	33
CoOx@CN	1.0 M KOH	1.55@20mA cm^{-2}	34
CoP nanoneedle arrays	1.0 M KOH	~1.62	35
$NiSe_2$/Ti	1.0 M KOH	1.66	36

Movie S1 This movie shows hydrogen and oxygen evolution on NiP_2/CC electrodes in a two-electrode setup driven by a ~1.5 V AA battery in 1.0 M KOH.

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