Supplementary Material for

Construction of CoP/MnP/Cu_3P heterojunction for efficient methanol oxidation-assisted seawater splitting

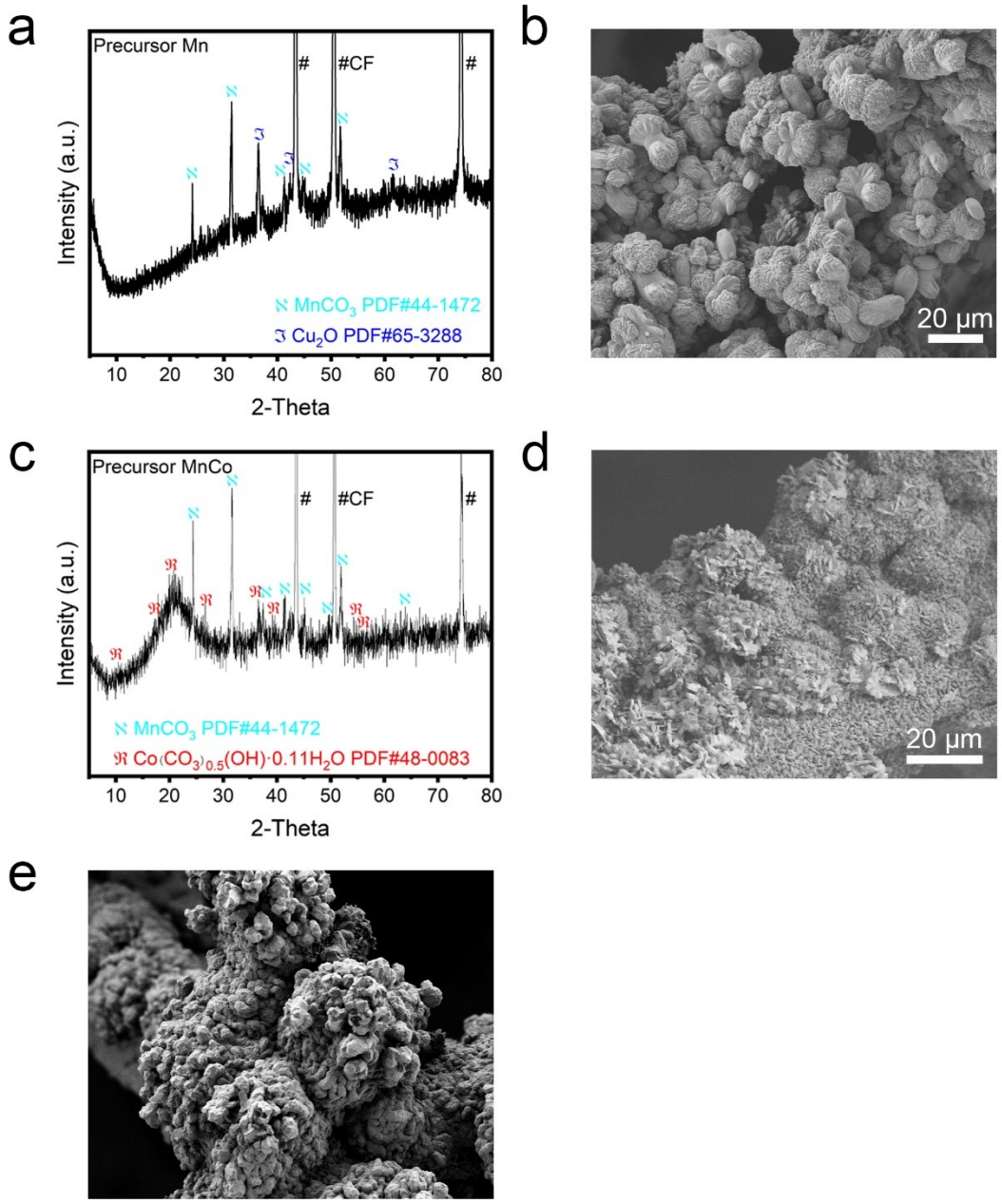

Figure S1. (a) XRD pattern of precursor Mn and its (b) SEM; (c) XRD pattern of precursor MnCo and its (d) SEM; (e) SEM of CoP/MnP/Cu_3P@CF.

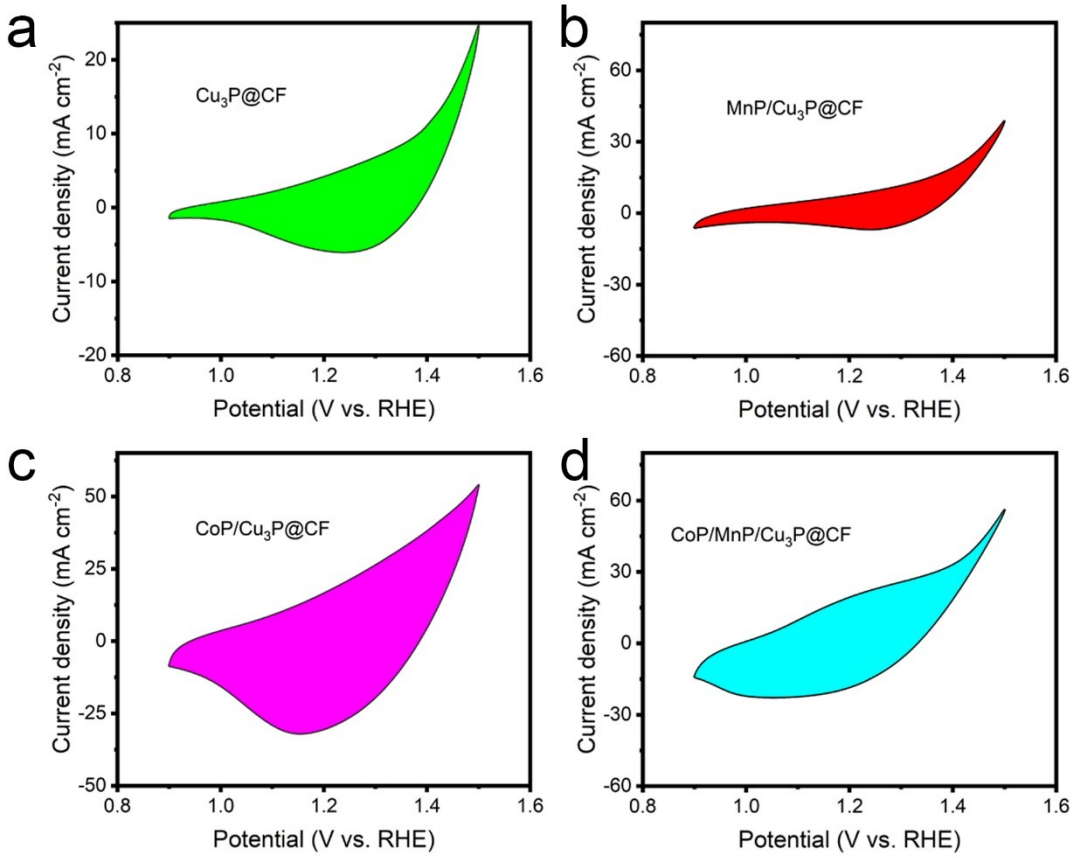

Figure S2. CV curves in the range of 0.9 ~ 1.5 V vs. RHE at a scan rate of 50 mV s^{-1} used to calculate the TOF of the OER.

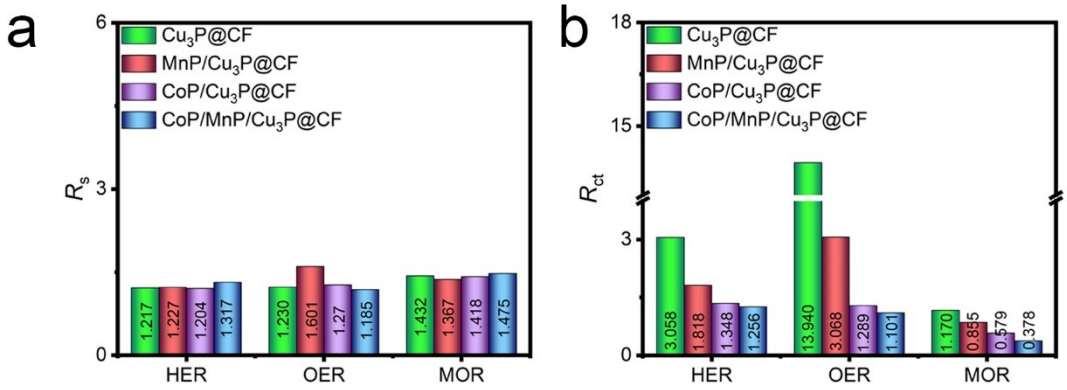

Figure S3. Comparison of R_s and R_{ct} values of equivalent circuits at HER, OER, and MOR for different samples in different electrolytes, respectively.

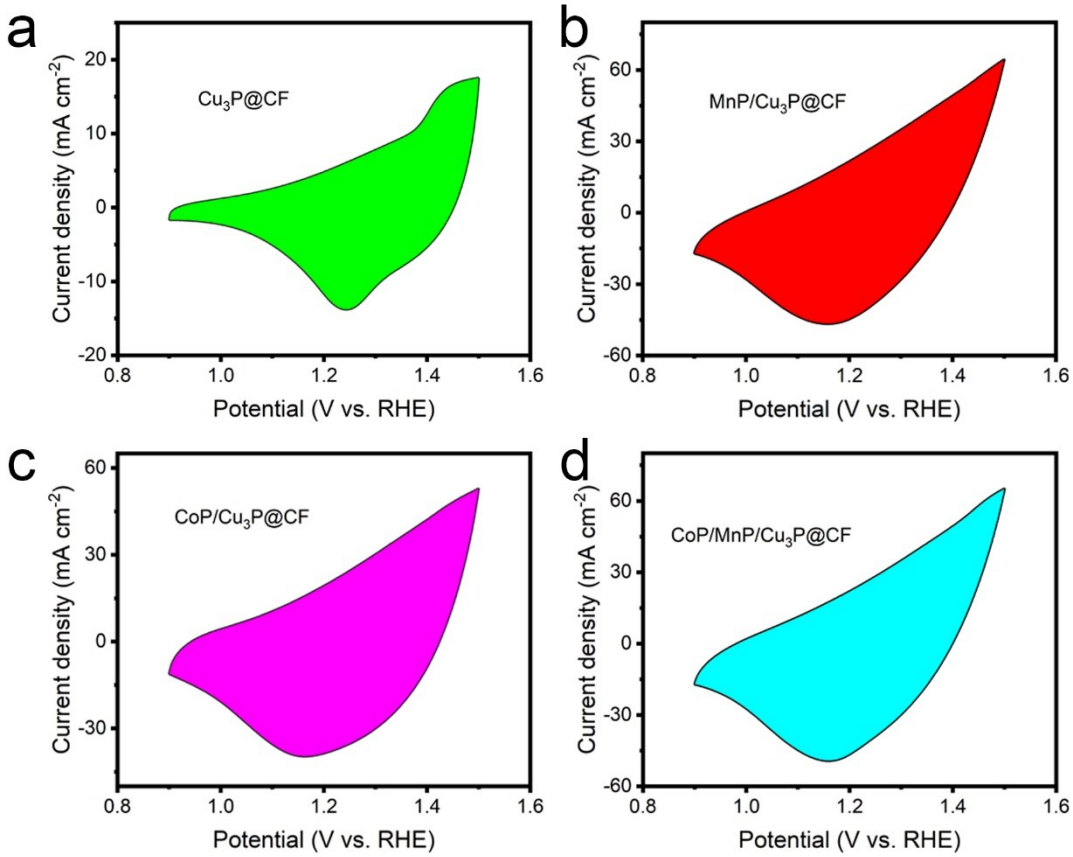

Figure S4. CV curves in the range of 0.9 ~ 1.5 V vs. RHE at a scan rate of 50 mV s^{-1} used to calculate the TOF of the MOR.

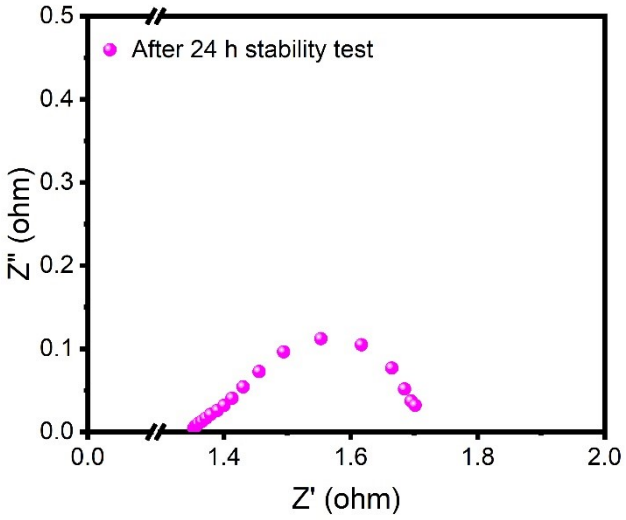

Figure S5. Nyquist plot of CoP/MnP/Cu_3P@CF in seawater + 1M KOH + 1M methanol electrolyte after 24 h of stability test.

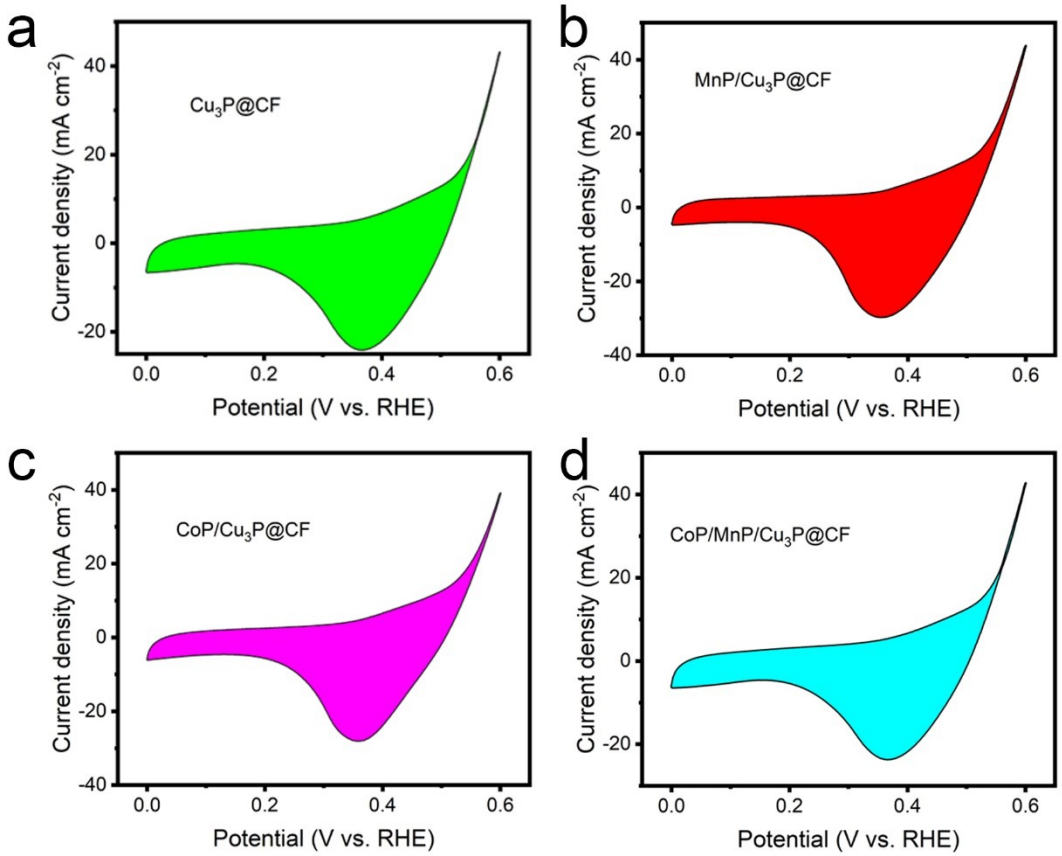

Figure S6. CV curves in the range 0 ~ 0.6 V vs. RHE at a scan rate of 50 mV s^{-1} used to calculate the TOF of the HER.

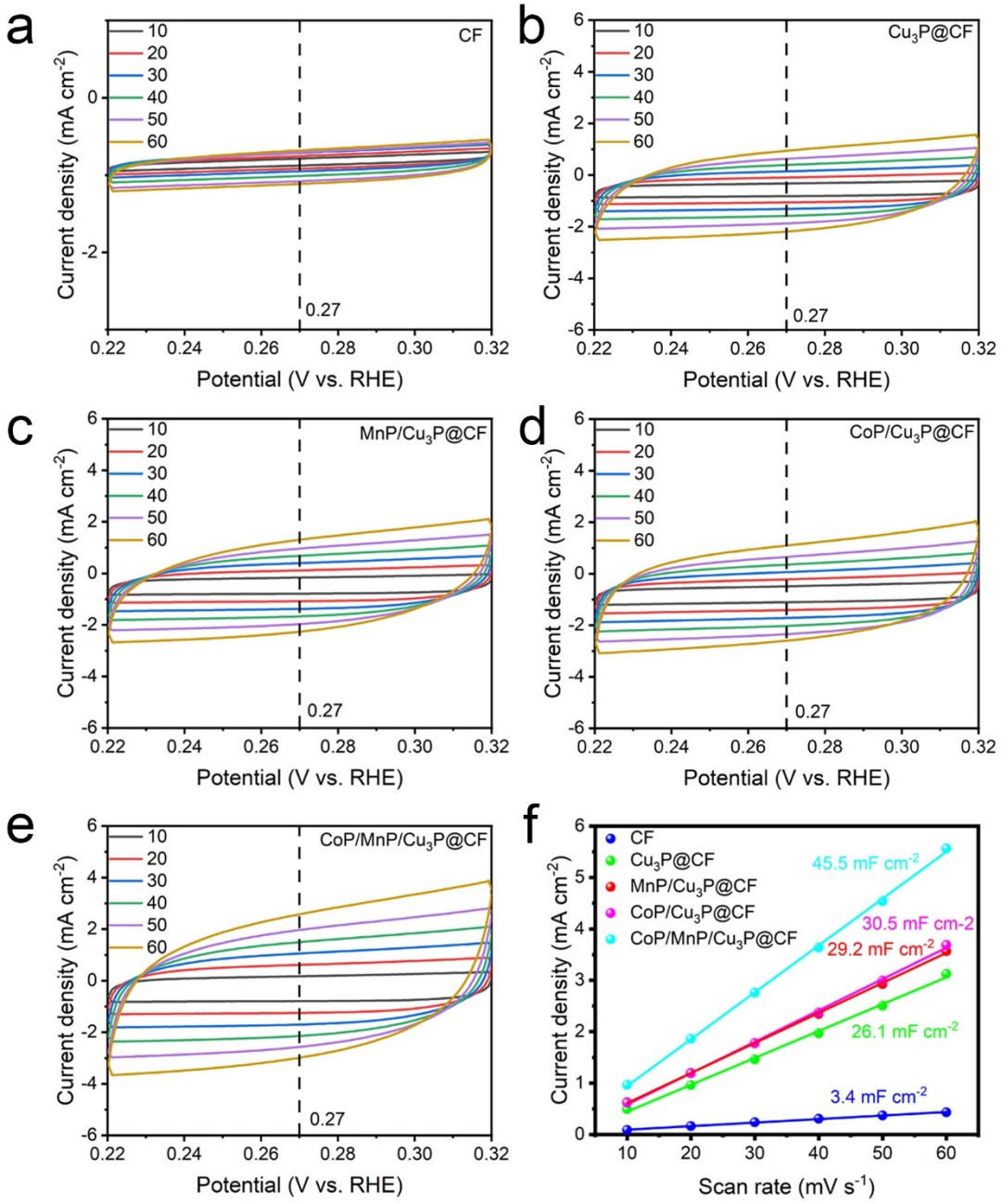

Figure S7. CV curves and corresponding C_{dl} values for (a) CF, (b) Cu_3P@CF, (c) MnP/Cu_3P@CF, (d) CoP/Cu_3P@CF, and (e) CoP/MnP/Cu_3P@CF in the non-Faraday region (0.22 ~ 0.32 V vs. RHE).

Table S1. Comparison of OER performances of MnP/CoP/Cu_3P@CF with other reported electrocatalysts.

Material	Electrolyte	Tafel slope (mV dec^{-1})	Current density @ Potential	Reference
CoP/MnP/Cu_3P@CF	1 M KOH + Seawater	43	10 mA cm^{-2} at 1.530 V (vs. RHE)	This work
NiMoPx@Ni_5P_4	1 M KOH	–	10 mA cm^{-2} at ~1.56 V (vs. RHE)	[1]
Ni_3S_2-CNFs@CC	1 M KOH	–	10 mA cm^{-2} at ~1.540 V (vs. RHE)	[2]
$Co_{10\%}$-CuV	1 M KOH	141	10 mA cm^{-2} at ~1.610 V (vs. RHE)	[3]
$Co_2V_2O_7$ NRs@NF	1 M KOH	76	10 mA cm^{-2} at ~1.570 V (vs. RHE)	[4]
NiVP/Pi-VC	1 M KOH	120	10 mA cm^{-2} at ~1.530 V (vs. RHE)	[5]
r-Se/$NiSe_2$@NF	1 M KOH + Seawater	90	10 mA cm^{-2} at ~1.550 V (vs. RHE)	[6]

Table S2. Comparison of MOR performances of MnP/CoP/Cu_3P@CF with other reported electrocatalysts.

Material	Electrolyte	Tafel slope (mV dec^{-1})	Current density @ Potential	Reference
CoP/MnP/Cu_3P@CF	1 M KOH + 1 M Methanol + Seawater	76.2	10 mA cm^{-2} at 1.356 V (vs. RHE)	This work
$NiFe_2O_4$@NF	1 M KOH + 0.5 + Methanol	28.5	10 mA cm^{-2} at ~ 1.410 V (vs. RHE)	[7]
$NiMoP_x$@Ni_5P_4	1 M KOH + 1 M Methanol	14.8	10 mA cm^{-2} at 1.360 mV (vs. RHE)	[1]
NiFe LDH@NiMo	1 M KOH + 0.5 + Methanol	54.0	10 mA cm^{-2} at 1.360 mV (vs. RHE)	[8]
Ni_3S_2-CNFs@CC	1 M KOH + 1 M Methanol	–	10 mA cm^{-2} at ~ 1.350 V (vs. RHE)	[2]
NiFe-LDH/NiFe-HAB@CF	1 M KOH + 3 M Methanol	–	10 mA cm^{-2} at ~ 1.400 V (vs. RHE)	[9]
r-Se/$NiSe_2$@NF	1 M KOH + 0.33 M Urea + Seawater	82	10 mA cm^{-2} at ~ 1.420 V (vs. RHE)	[6]

Table S3. Comparison of HER performances of MnP/CoP/Cu_3P@CF with other reported electrocatalysts.

Material	Electrolyte	Tafel slope (mV dec^{-1})	Current density @ Potential	Reference
MnP/CoP/Cu_3P@CF	1 M KOH + Seawater	85	10 mA cm^{-2} at 146 mV (vs. RHE)	This work
Cu-$Co_{0.85}Se$@NC	1 M KOH	162	10 mA cm^{-2} at 208 mV (vs. RHE)	[10]
$Co_{10\%}$-CuV	1 M KOH	94	10 mA cm^{-2} at 176 mV (vs. RHE)	[3]
$Co_2V_2O_7$ NRs@NF	1 M KOH	114	10 mA cm^{-2} at ~160 mV (vs. RHE)	[4]
NiVP/Pi-VC	1 M KOH	104	10 mA cm^{-2} at ~150 mV (vs. RHE)	[5]
r-Se/$NiSe_2$@NF	1 M KOH + Seawater	146	10 mA cm^{-2} at ~180 mV (vs. RHE)	[6]

Table S4. Comparison of OMS performances of CoP/MnP/Cu_3P@CF with other reported electrocatalysts.

Two-electrode electrolyzer	Electrolyte	Cell voltage	Reference
CoP/MnP/Cu_3P@CF || CoP/MnP/Cu_3P@CF	1 M KOH + 1 M Methanol + Seawater	1.410 V for 10 mA cm^{-2}	This work
$NiFe_2O_4$@NF || $NiFe_2O_4$@NF	1 M KOH + 0.5 M Methanol + Seawater	1.520 V for 10 mA cm^{-2}	[7]
NiMoPx@Ni_5P_4 || NiMoPx@Ni_5P_4	1 M KOH + 1 M Methanol	~1.42 V for 10 mA cm^{-2}	[1]
Cu-$Co_{0.85}$Se@NC || Cu-$Co_{0.85}$Se@NC	1 M KOH + 0.12 M Methanol	1.460 V for 10 mA cm^{-2}	[10]
NiFe LDH@NiMo || NiFe LDH@NiMo	1 M KOH + 0.5 M Methanol	~1.410 V for 10 mA cm^{-2}	[8]
$Co_2V_2O_7$ NRs@NF || $Co_2V_2O_7$ NRs@NF	1 M KOH + 50 mM Glucose	1.510 V for 10 mA cm^{-2}	[4]
r-Se/$NiSe_2$@NF || r-Se/$NiSe_2$@NF	1 M KOH + 0.33 M Urea+ Seawater	1.590 V for 10 mA cm^{-2}	[6]

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