Electronic Supplementary Material (ESI) for Journal of Materials Chemistry A.

High-Entropy Effect of Metal Phosphide on Enhanced Overall Water Splitting Performance

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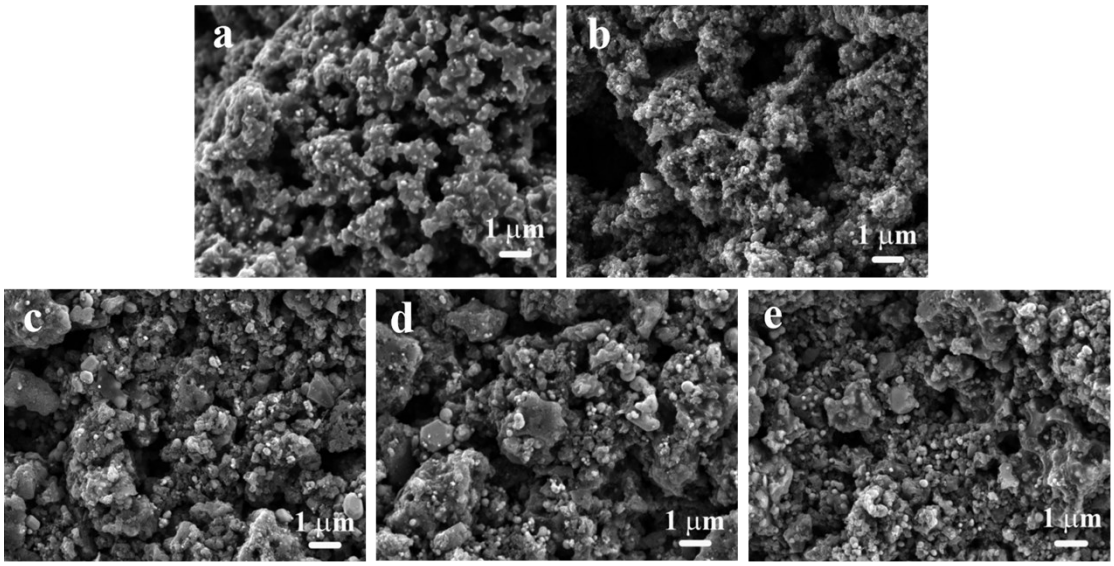

Figure S1 SEM images of (a) NiP, (b) NiCoP, (c) NiCoFeP, (d) NiCoFeMnP and (e) NiCoFeMnCrP NPs.

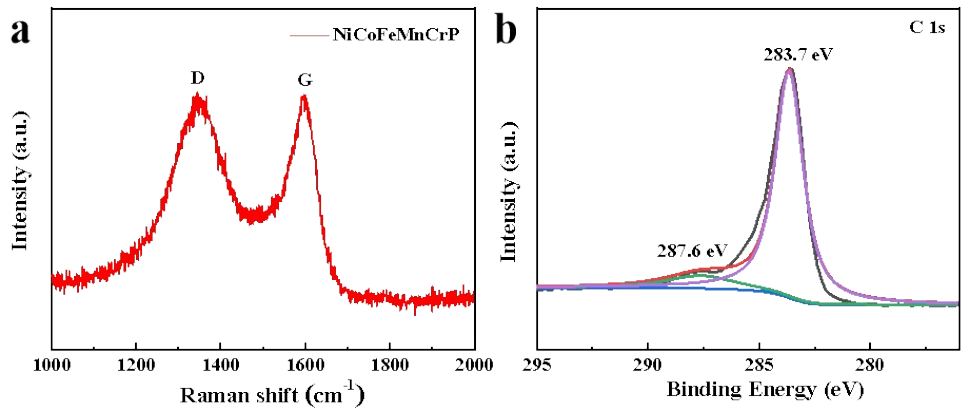

Figure S2 (a) Raman spectrum and (b) high resolution C1s XPS spectrum of the HEMP sample.

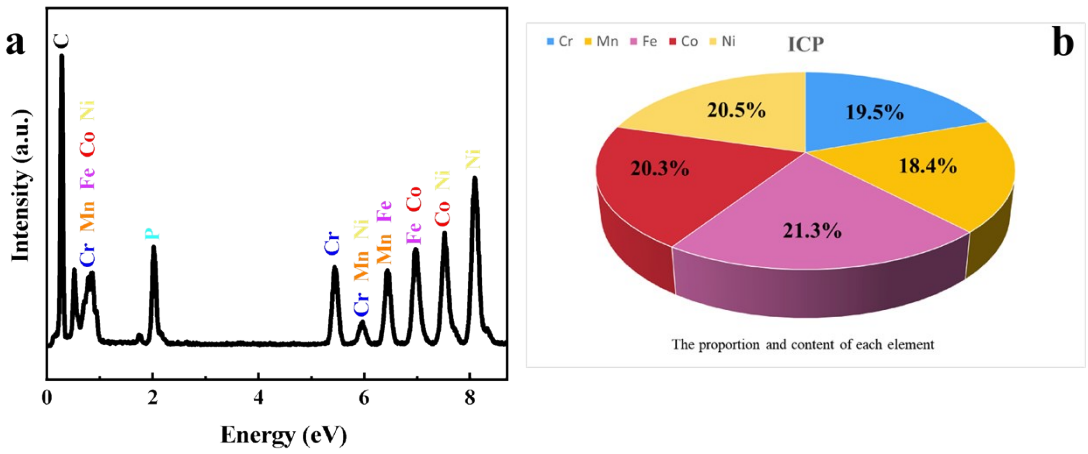

Figure S3 (a) EDS pattern and (b) ICP of the as-synthesized HMP NiCoFeMnCrP nanoparticles.

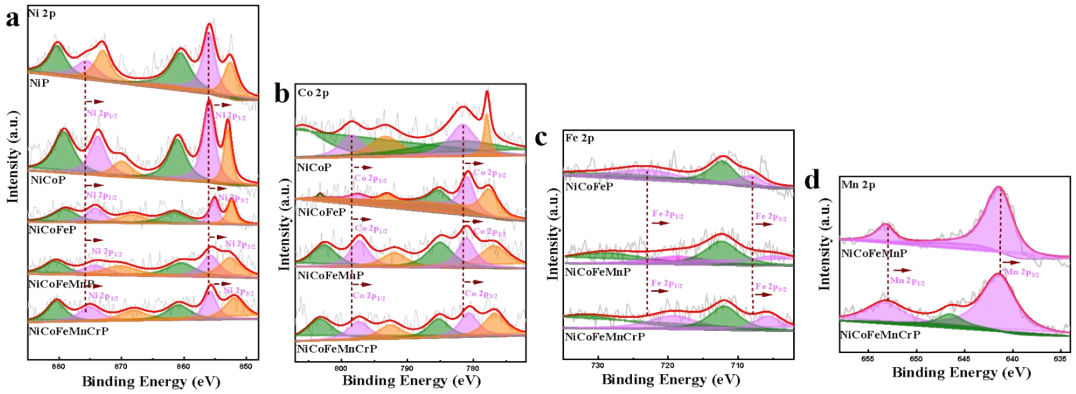

Figure S4 (a) Ni 2p, (b) Co 2p, (c) Fe 2p and (d) Mn 2p XPS spectra of the different phosphides.

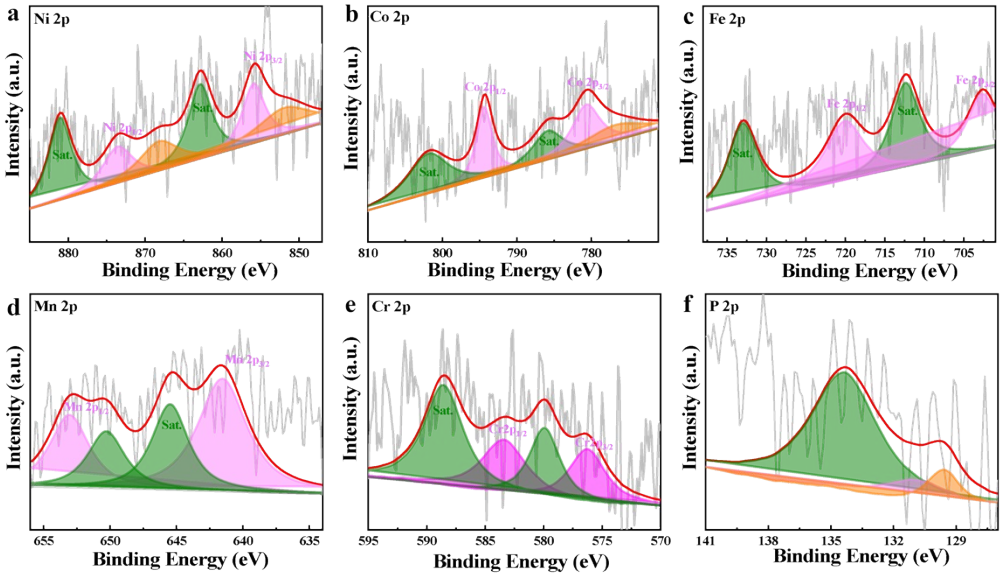

Figure S5 High-resolution XPS spectra of NiCoFeMnCrP NPs after stability test: (a) Ni 2p, (b) Co 2p, (c) Fe 2p, (d) Mn 2p, (e) Cr 2p and (f) P 2p.

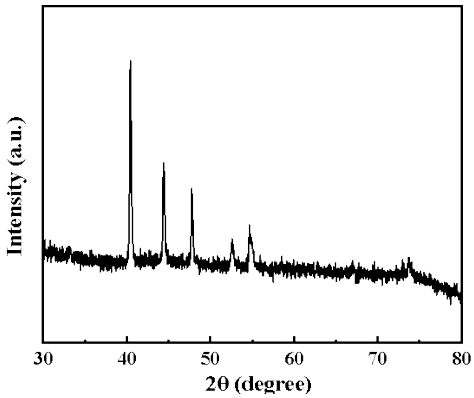

Figure S6 XRD pattern of NiCoFeMnCrP NPs after stability test.

Table S1 Comparison between the OER performances of the as-synthesized NiCoFeMnCrP NPs and the reported electrocatalysts.

Samples	Current density	Overpotential	Reference
NiCoFeMnCrP	**10 mA cm^{-2}**	**270 mV**	**This work**
CoFe-MOF	10 mA cm^{-2}	265 mV	ACS Catal. 9 (2019) 7356
Fe-Ni@NC-CNTs	10 mA cm^{-2}	274 mV	Angew. Chem. Int. Ed. 57 (2018) 8921
Ni_3N-NiMoN	10 mA cm^{-2}	277 mV	Nano Energy 44 (2018) 353
Ni-Fe LDH hollow prisms	10 mA cm^{-2}	280 mV	Angew. Chem. Int. Ed. 57 (2018) 172
$NiPS_3$-G-1:1	10 mA cm^{-2}	294 mV	ACS Nano 12 (2018) 5297
CNT-$Co_{1.33}Fe_{0.67}Px$	10 mA cm^{-2}	294 mV	J. Am. Chem. Soc. 142 (2020) 8490
SnCoFeAr	10 mA cm^{-2}	300 mV	Angew. Chem. Int. Ed. 57 (2018) 8691
N-doped Ni@carbon	10 mA cm^{-2}	307 mV	J. Am. Chem. Soc. 142 (2020) 7317
W_2N/WC	10 mA cm^{-2}	320 mV	Adv. Mater. 32 (2020) 1905679
PHI-Co	10 mA cm^{-2}	324 mV	Adv. Mater. 32 (2020) 1903942
$Co_2Mo_3O_8$@NC-800	10 mA cm^{-2}	331 mV	Angew. Chem. Int. Ed. 59 (2020) 11948
NCoM-SS-Ar	10 mA cm^{-2}	340 mV	Angew. Chem. Int. Ed. 58 (2019) 8330
NCoM-Cb-Ar	10 mA cm^{-2}	340 mV	Angew. Chem. Int. Ed. 58 (2019) 8330
COF-C_4N	10 mA cm^{-2}	349 mV	ACS Energy Lett. 4 (2019) 2251
CoO/Co	10 mA cm^{-2}	350 mV	ACS Energy Lett. 2 (2017) 1208
Mo_2C@N-CNTs	10 mA cm^{-2}	356 mV	Angew. Chem. Int. Ed. 58 (2019) 4923
$Fe_{0.2}Ni_{0.8}$@N-GR	10 mA cm^{-2}	380 mV	Adv. Funct. Mater. 28 (2018) 1706928

Table S2 Comparison between the HER performances of the as-synthesized NiCoFeMnCrP NPs and the reported electrocatalysts.

	Current density	Overpotential	Reference
NiCoFeMnCrP	**10 mA cm^{-2}**	**220 mV**	**This work**
CoP@BCN-1	10 mA cm^{-2}	215 mV	Adv. Energy Mater. 7 (2017) 601671
Fe_3C-Co/NC	10 mA cm^{-2}	238 mV	Adv. Funct. Mater. 29 (2019) 901949
Co_2P	10 mA cm^{-2}	247 mV	Adv. Mater. 29 (2017) 1606980
NiFeOF	10 mA cm^{-2}	253 mV	ACS Catal. 7 (2017) 8406
Co/CoP-5	10 mA cm^{-2}	253 mV	Adv. Energy Mater. 7 (2017) 602355
FeNi foam	10 mA cm^{-2}	299 mV	Adv. Mater. 30 (2018) 1803151
LDH-NS@DG	10 mA cm^{-2}	300 mV	Adv. Mater. 29 (2017) 1700017
NiFeP	10 mA cm^{-2}	355 mV	Int. J. Hydrogen Energy 43 (2018) 12929
N,S-CN	10 mA cm^{-2}	380 mV	ACS Nano 11 (2017) 7293

Table S3 Comparison between the overall water splitting performances of the as-synthesized NiCoFeMnCrP NPs and the reported electrocatalysts.

	Voltage	Current density	Reference
NiCoFeMnCrP	**1.32 V**	**10 mA cm^{-2}**	**This work**
N-Co_3O_4@C@NF	1.40 V	10 mA cm^{-2}	Adv. Sci. 6 (2019) 1900272
$Fe_{0.09}Co_{0.13}$-$NiSe_2$	1.52 V	10 mA cm^{-2}	Adv. Mater. 30 (2018) 1802121
Ni_3N-NiMoN-5	1.54 V	10 mA cm^{-2}	Nano Energy 44 (2018) 353
$CoSn_2$	1.55 V	10 mA cm^{-2}	Angew. Chem. Int. Ed. 57 (2018) 15237
Co_2P NC	1.56 V	10 mA cm^{-2}	Adv. Mater. 30 (2018) 1705796
W_2N/WC	1.58 V	10 mA cm^{-2}	Adv. Mater. 32 (2020) 1905679
NiCoP	1.59 V	10 mA cm^{-2}	Adv. Energy Mater. 8 (2018) 1802615
3DSe(NiCo)S_x/$(OH)_x$	1.6 V	10 mA cm^{-2}	Adv. Mater. 30 (2018) 1705538
NC@$CuCo_2N_x$/CF	1.62 V	10 mA cm^{-2}	Adv. Funct. Mater. 27 (2017) 1704169
δ-FeOOH NSs/NF	1.62 V	10 mA cm^{-2}	Adv. Mater. 30 (2018) 1803144
Ni-Co-P HNBs	1.62 V	10 mA cm^{-2}	Energy Environ. Sci. 11 (2018) 872
Co/b-Mo_2C@N-CNTs	1.64 V	10 mA cm^{-2}	Angew. Chem. Int. Ed. 58 (2019) 4923
Co/CNFs (1000)	1.69 V	10 mA cm^{-2}	Adv. Mater. 31 (2019) 1808043
$Co(OH)_2$@NCNTs@ NF	1.72 V	10 mA cm^{-2}	Nano Energy 47 (2018) 96
Fe_3C-Co/NC	1.77 V	10 mA cm^{-2}	Adv. Funct. Mater. 29 (2019) 1901949