

Electronic Supporting Information (ESI) for

Hierarchical Fe-Mn binary metal oxide core-shell nano-polyhedron as bifunctional electrocatalyst for efficient water splitting

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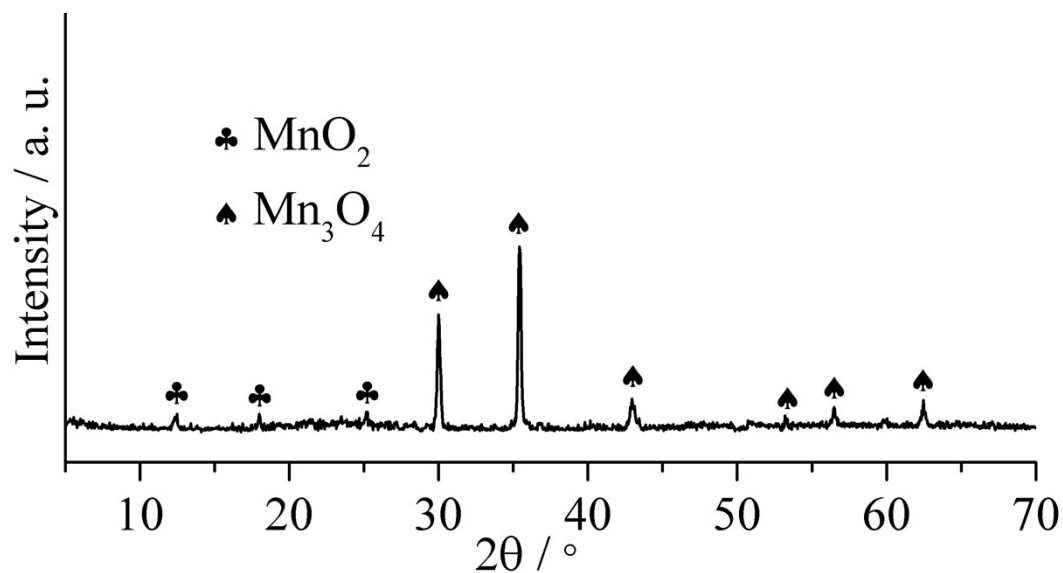


Fig. S1. The PXRD pattern of the reaction product without Fe_3O_4 .

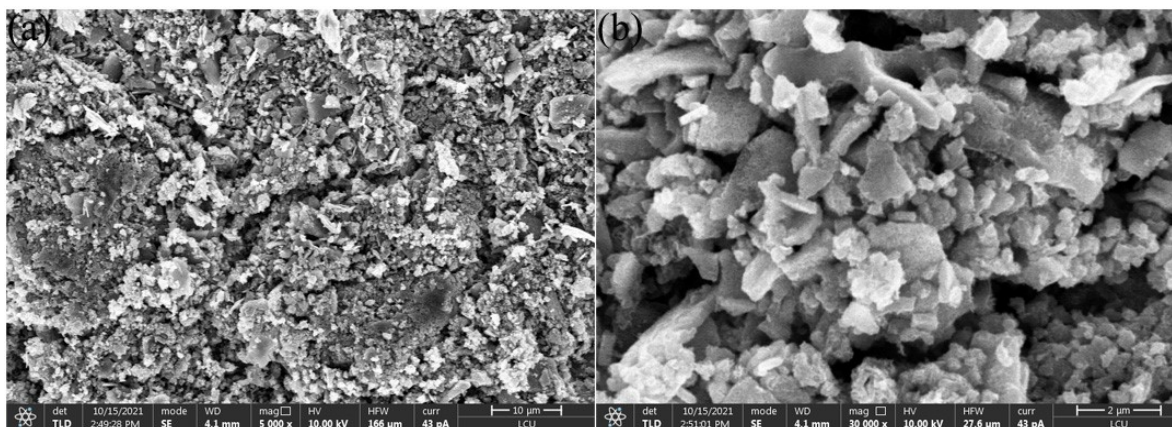


Fig. S2. The SEM pictures of the reaction product without Fe_3O_4 .

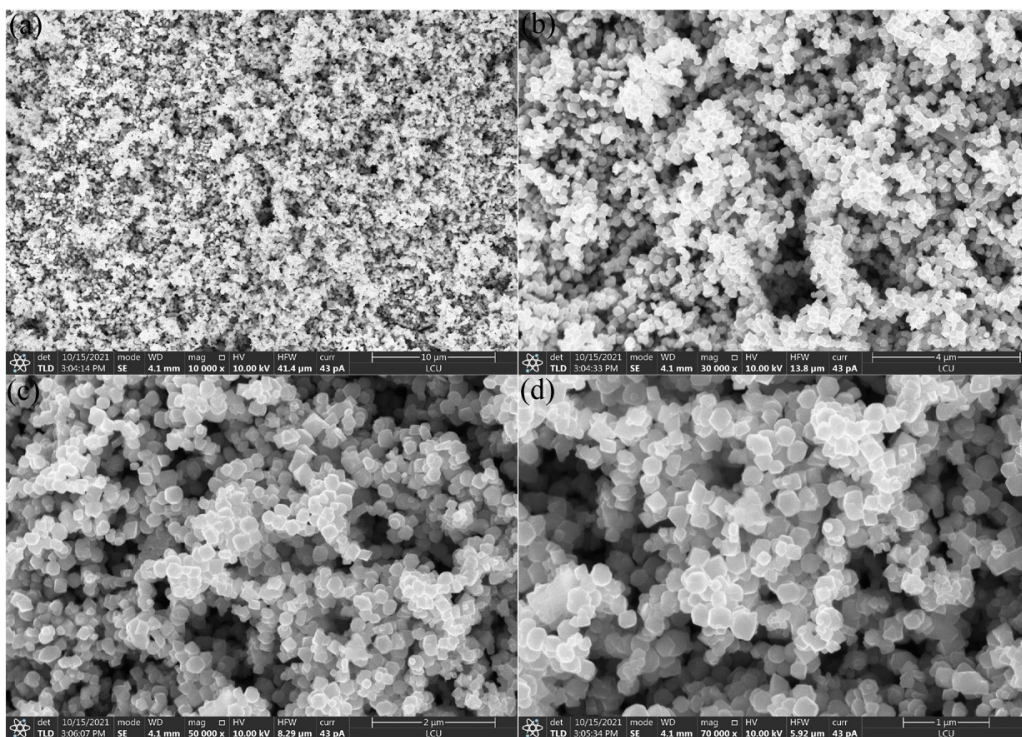


Fig. S3. The SEM pictures of pure Fe_3O_4 at different magnifications.

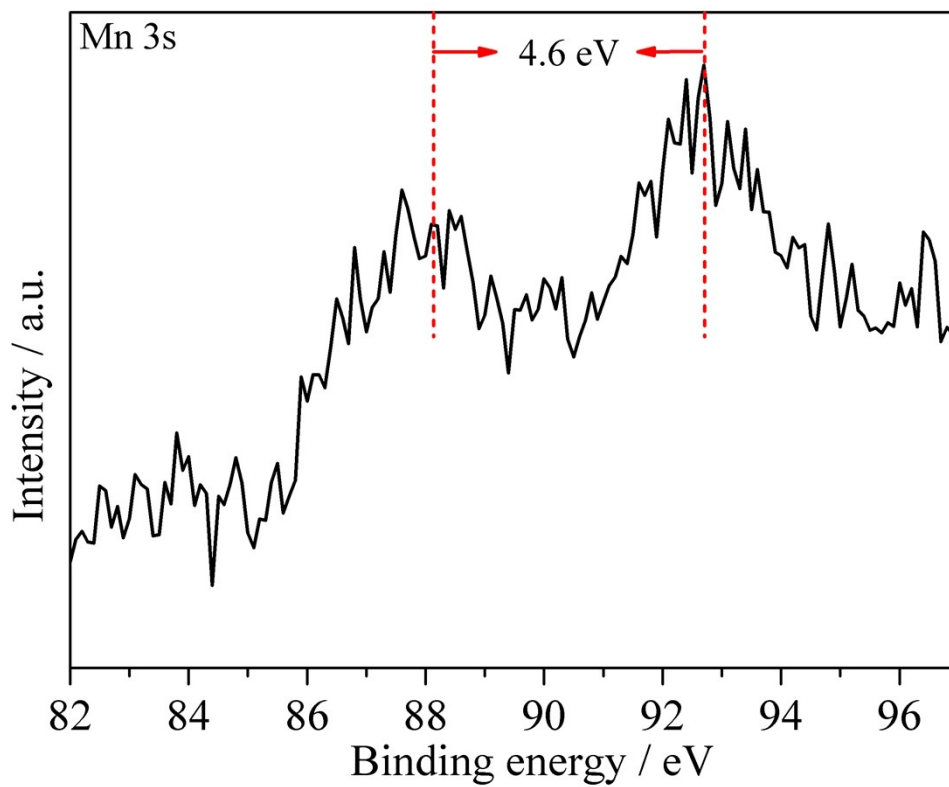


Fig. S4. The XPS of Mn 3s spectrum of FM-1.

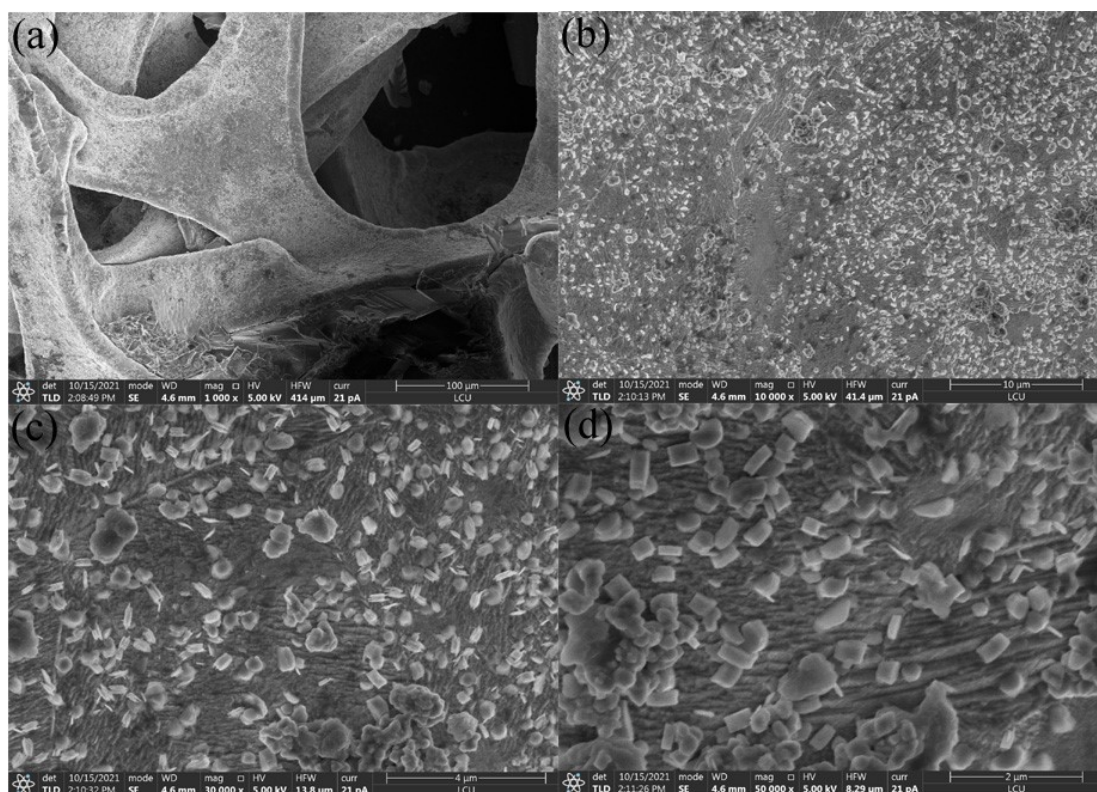


Fig. S5. The SEM pictures of FM-1 after stability test at different magnifications.

Table S1. Comparison of OER performances of FM-1 with recently reported catalysts coated on nickel foam (NF) in KOH.

Catalysts	η (mV) at $J = 10 \text{ mA cm}^{-2}$	Tafel slope (mV dec ⁻¹)	References
Fe₃O₄@MnO_x-NF	188	77.6	This work
S-NiFe ₂ O ₄ /NF	267	36.7	<i>Nano Energy</i> , 2017, 40 , 264.
S-Fe ₃ O ₄ /NF	279	40.2	
S-NiO/NF	306	48.3	
NiFe ₂ O ₄ /NF	343	51.1	
PtC/NF	359	70.4	
N-Ni ₃ S ₂ /NF	330	70	<i>Adv. Mater.</i> , 2017, 29 , 1701584.
Ni/Mo ₂ C-PC/NF	368	101	<i>Chem. Sci.</i> , 2017, 8 , 968.
FeNi ₃ N/NF	202	40	<i>Chem. Mater.</i> , 2016, 28 , 6934.
FeS ₂ CL@WS ₂ NS/NF	260	102	<i>Dalton Trans.</i> , 2020, 49 , 9804.
microsphere NiS/NF	302	89	<i>Chem. Commun.</i> , 2016, 52 , 1486.
Ni ₃ S ₂ /NF	260	--	<i>J. Am. Chem. Soc.</i> , 2015, 137 , 14023.
Fe ₃ O ₄ /NF	251	45	<i>J. Alloys Comp.</i> , 2021, 863 , 158742.
Pyrite FeS ₂ /C/NF	240	92	<i>Dalton Trans.</i> , 2018, 47 , 14917.
Fe ₃ O ₄ /NF	251	45	<i>J. Alloys Comp.</i> , 2021, 863 , 158742.
MnFe ₂ O ₄ /NF	310	65	<i>Appl. Surf. Sci.</i> , 2021, 546 , 149124.
V-FeNi ₂ P/NF	200	74	<i>ACS Appl. Energy Mater.</i> , 2020, 3 , 9449.
CoO _x @CN/NF	260	--	<i>J. Am. Chem. Soc.</i> , 2015, 137 , 2688.
MoO ₂ /NF	260	54	<i>Adv. Mater.</i> , 2016, 28 , 3785.
NS-MnO ₂ /NF	320	40	<i>Adv. Energy Mater.</i> , 2017, 7 , 1700005.
Ni-Fe-O/NF	244	39	<i>Adv. Energy Mater.</i> , 2018, 8 , 1701347.
R-TMO/NF	244	50	<i>J. Am. Chem. Soc.</i> , 2018, 140 , 13644.

CoMnO@CN/NF	263	97	<i>J. Am. Chem. Soc.</i> , 2015, 137 , 14305.
Mo ₂ CT _x NMs/NF	180	40	<i>Appl. Catal. B</i> , 2019, 243 , 678.
Fe-CoP/NF	190	36	<i>Adv. Sci.</i> , 2018, 5 , 1800949.
N-Ni ₃ S ₂ /NF	157	159.3	<i>Energy Environ. Sci.</i> , 2013, 6 , 2921.
TiO ₂ @Co ₉ S ₈ /NF	240	55	<i>Adv. Sci.</i> , 2018, 5 , 1700772.
(Ni,Fe)S ₂ @MoS ₂ /NF	270	43.21	<i>Appl. Catal. B</i> , 2019, 247 , 107.
MoS ₂ /Ni ₃ S ₂ /NF	218	88	<i>Angew. Chem. Int. Ed.</i> , 2016, 55 , 6702.
MoS ₂ -Ni ₃ S/NF	249	57	<i>ACS Catal.</i> , 2017, 7 , 2357.
NiOOH/FeOOH/NF	257	112.1	<i>ACS Omega</i> , 2018, 3 , 11009.
FeS ₂ /NF	189.5	71	<i>Dalton Trans.</i> , 2021, 50 , 6333.

Table S2. Comparison of overall water splitting performances of FM-1 with recently reported catalysts coated on nickel foam (NF) in KOH.

Catalysts	Cell voltage (V)	Substrate	References
Fe₃O₄@MnO_x	1.64	NF	This work
microsphere NiS	1.64	NF	<i>Chem. Commun.</i> , 2016, 52 , 1486.
Ni/Ni ₈ P ₃	1.61	NF	<i>Adv. Funct. Mater.</i> , 2016, 26 , 3314.
MoO ₂ nanosheets	1.53	NF	<i>Adv. Mater.</i> , 2016, 28 , 3785.
Ni/Mo ₂ C-PC	1.66	NF	<i>Chem. Sci.</i> , 2017, 8 , 968.
FeNi ₃ N	1.62	NF	<i>Chem. Mater.</i> , 2016, 28 , 6934.
MoS ₂ /Ni ₃ S ₂	1.56	NF	<i>Angew. Chem. Int. Ed.</i> , 2016, 55 , 6702.
NiCoP	1.58	NF	<i>Nano Lett.</i> , 2016, 16 , 7718.
NiSe	1.63	NF	<i>Angew. Chem. Int. Ed.</i> , 2015, 54 , 9351.
Ni ₅ P ₄	1.69	NF	<i>Angew. Chem. Int. Ed.</i> , 2015, 54 , 12361.
NiFeLDH	1.70	NF	<i>Science</i> , 2014, 345 , 1593.
3.5 nm Pt	1.71	NF	
Ni(OH) ₂	1.82	NF	
Ni ₃ S ₂	1.76	NF	<i>J. Am. Chem. Soc.</i> , 2015, 137 , 14023.
Ni-P	1.64	NF	<i>J. Mater. Chem. A</i> , 2016, 4 , 5639.
NiOOH/FeOOH	1.85	NF	<i>ACS Omega</i> , 2018, 3 , 11009.
Ni ₂ P	1.63	NF	<i>Energy Environ. Sci.</i> , 2015, 8 , 1027.
V-FeNi ₂ P	1.57	NF	<i>ACS Appl. Energy Mater.</i> , 2020, 3 , 9449.
S-NiFe ₂ O ₄	1.65	NF	<i>Nano Energy</i> , 2017, 40 , 264.
CoO _x @CN	1.55	NF	<i>J. Am. Chem. Soc.</i> , 2015, 137 , 2688.
Ni-Fe-O	1.64	NF	<i>Adv. Energy Mater.</i> , 2018, 8 , 1701347.

R-TMO-NF	1.61	NF	<i>J. Am. Chem. Soc.</i> , 2018, 140 , 13644.
CoMnO@CN	1.5	NF	<i>J. Am. Chem. Soc.</i> , 2015, 137 , 14305.
Mo ₂ CT _x NMs	1.7	NF	<i>Appl. Catal. B</i> , 2019, 243 , 678.
Fe-CoP	1.49	NF	<i>Adv. Sci.</i> , 2018, 5 , 1800949.
TiO ₂ @Co ₉ S ₈	1.56	NF	<i>Adv. Sci.</i> , 2018, 5 , 1700772.
MoS ₂ -Ni ₃ S	1.50	NF	<i>ACS Catal.</i> , 2017, 7 , 2357.