Supporting Information

Formation of NiFe-MOF nanosheets on Fe foam to achieve advanced electrocatalytic oxygen evolution

Yutong Jia[a,b], Zhikun Xu[c,*], Lin Li[a,*], Shuangyan Lin[b,*]

[a] *Key Laboratory for Photonic and Electronic Bandgap Materials, Ministry of Education, School of Physics and Electronic Engineering, Harbin Normal University, Harbin 150025, PR China*

[b] *School of Chemistry, Guangdong University of Petrochemical Technology, Maoming, Guangdong 525000, PR China*

[c] *School of Science, Guangdong University of Petrochemical Technology, Maoming, Guangdong 525000, PR China*

*Corresponding author.

E-mail address: linshyan123@163.com (Lin S.)

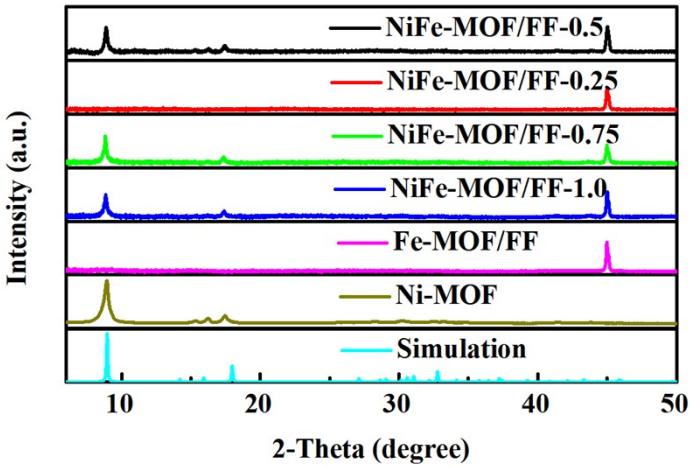

Figure S1. XRD images of NiFe-MOF/FF-0.25, NiFe-MOF/FF-0.5, NiFe-MOF/FF-0.75, NiFe-MOF/FF-1.0, Fe-MOF/FF and Ni-MOF.

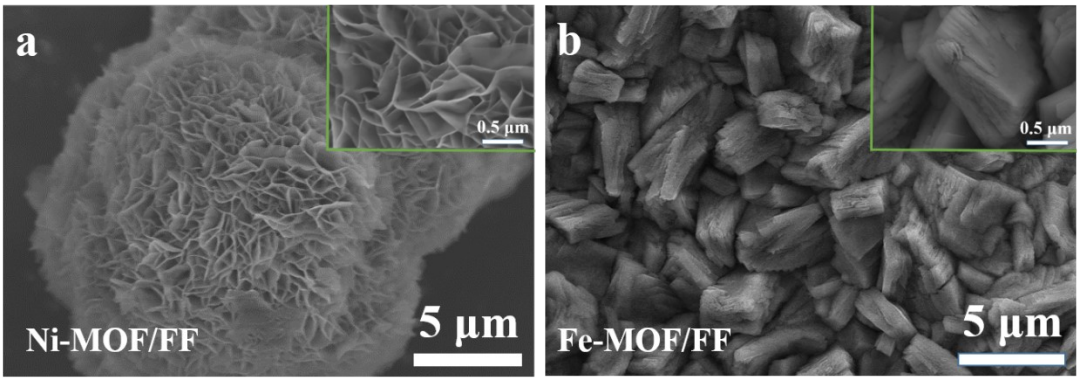

Figure S2. SEM images of a) Ni-MOF, b) Fe-MOF/FF.

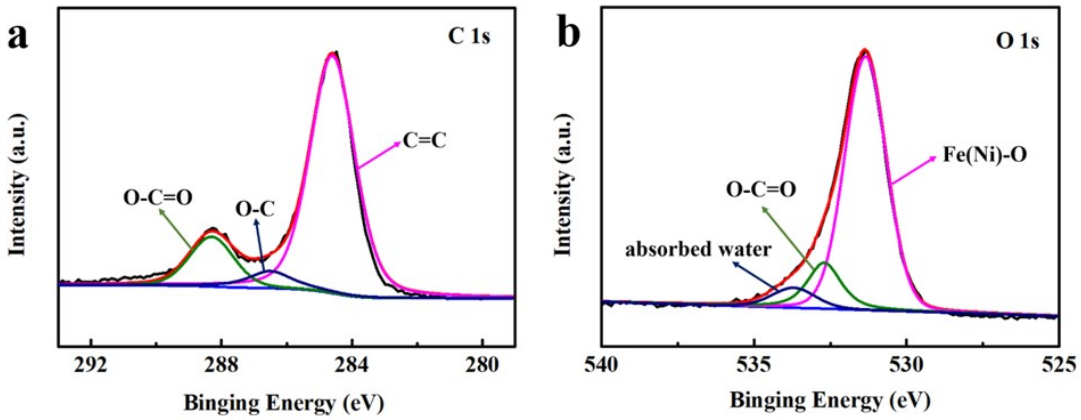

Figure S3. high-resolution XPS spectra of NiFe-MOF/FF: a) C 1s, b) O 1s.

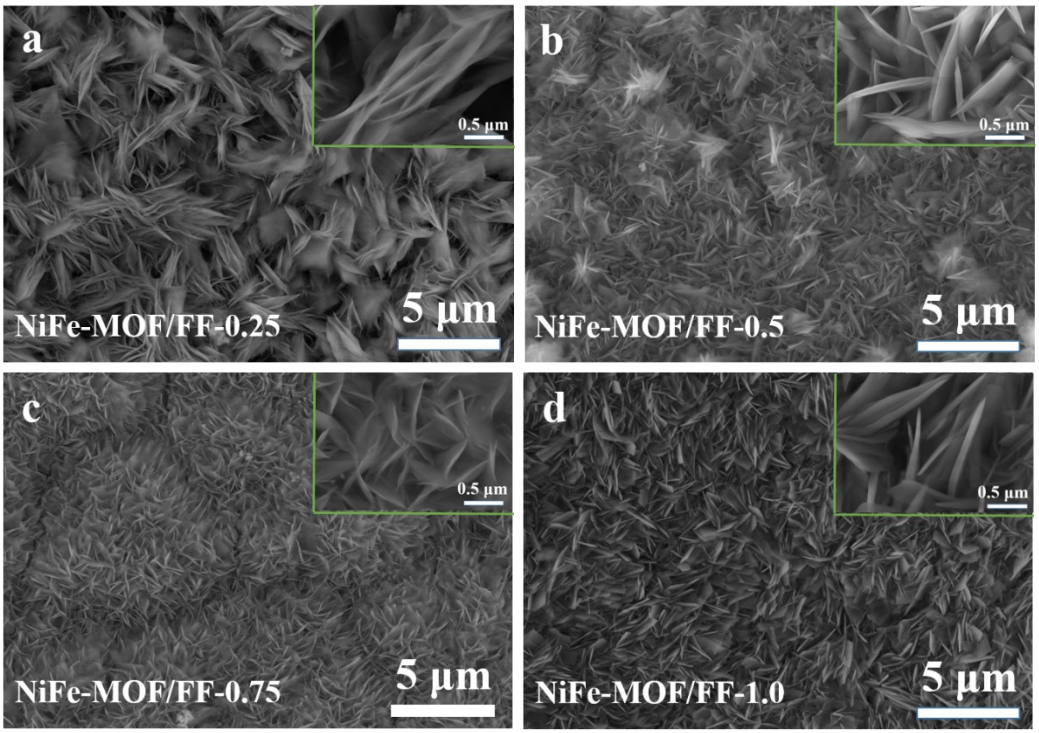

Figure S4. SEM images of a) NiFe-MOF/FF-0.25, b) NiFe-MOF/FF-0.5, c) NiFe-MOF/FF-0.75, and d) NiFe-MOF/FF-1.0.

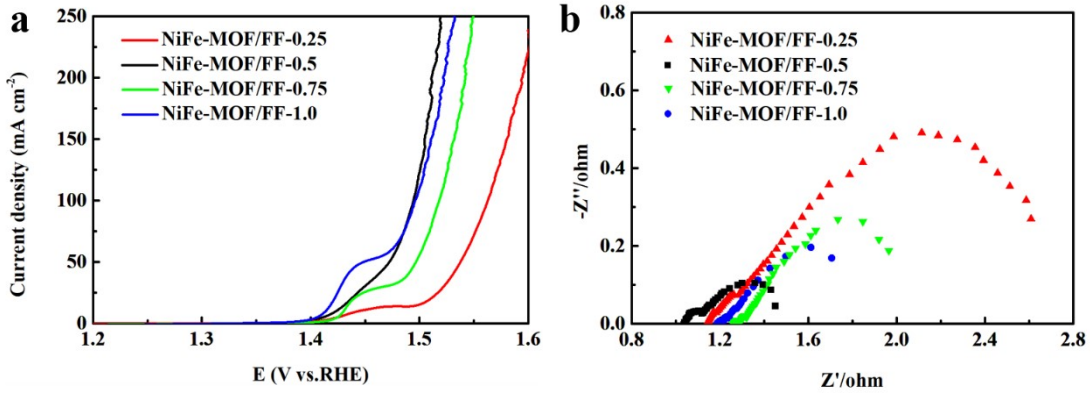

Figure S5. a) Polarization curves and b) Electrochemical impedance spectra (EIS) of NiFe-MOF/FF-0.25, NiFe-MOF/FF-0.5, NiFe-MOF/FF-0.75, and NiFe-MOF/FF-1.0.

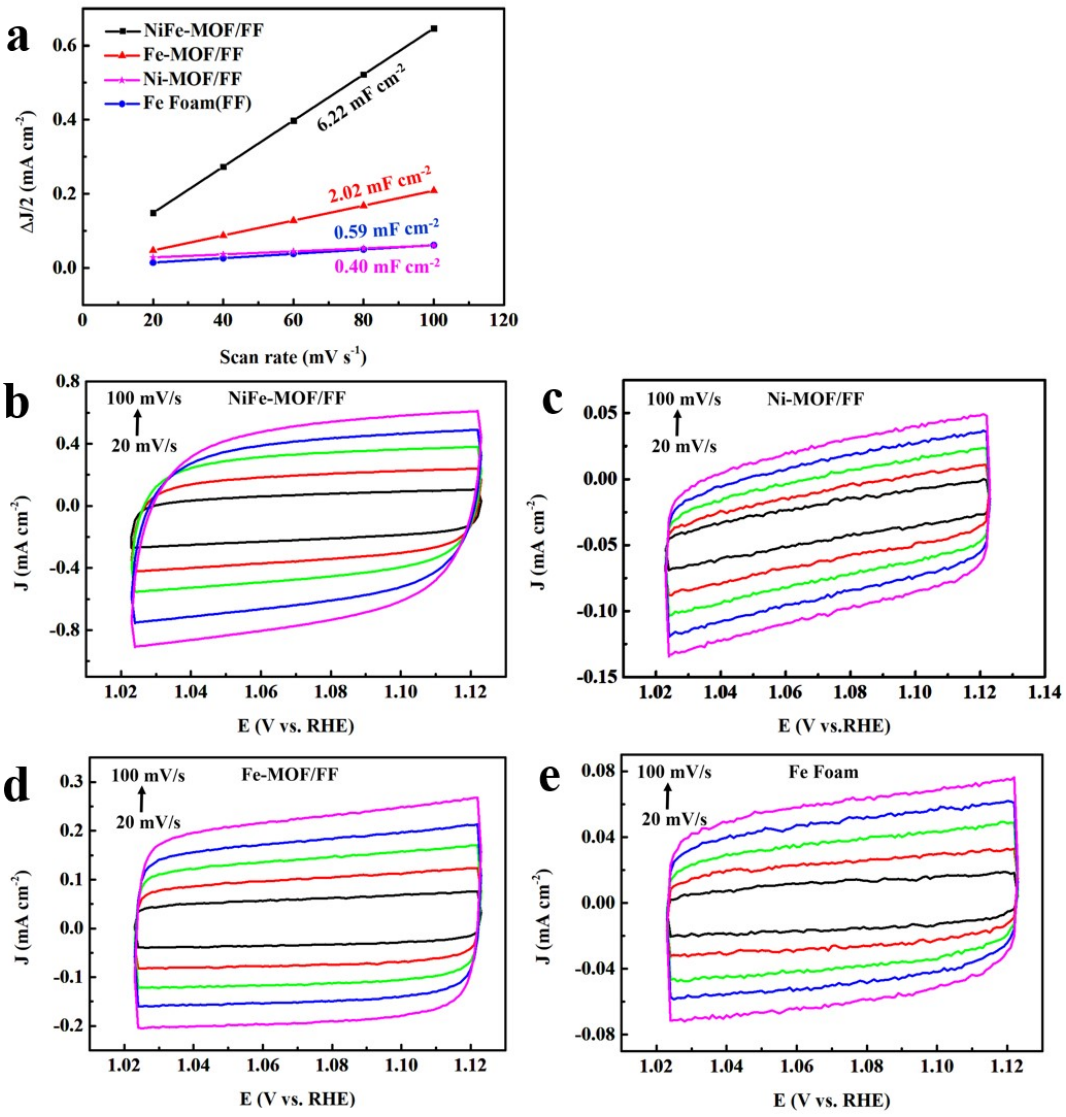

Figure S6. a) The Cdl value of NiFe-MOF/FF-0.5, Ni-MOF /FF, Fe-MOF /FF and Fe Foam. Cyclic voltammetry curves of b) NiFe-MOF/FF, c) Ni-MOF /FF, d) Fe-MOF /FF and e) Fe Foam.

Table S1. The Fe/Ni atomic ratios in NiFe-MOF/FF samples by EDS.

	Fe molar%	Ni molar%
NiFe-MOF/FF-0.25	7.15	3.76
NiFe-MOF/FF-0.5	6.32	4.94
NiFe-MOF/FF-0.75	1.97	7.75
NiFe-MOF/FF-1.0	1.22	11.29
Fe-MOF /FF	100	0
Ni-MOF	0	100

Table S2. Comparisons of OER performance of NiFe-MOF/FF-0.5 with bimetallic MOF and precious metal catalysts.

Catalyst	Electrolyte	Mass loading (mg cm^{-2})	Over potential (V) @ 10 mA cm^{-2}	Ref.
NiFe-MOF/FF-0.5	1 M KOH	–	0.216 V at 50 mA cm^{-2}	This work
MIL-53(FeNi)/NF	1 M KOH	2.63	0.233 at 50 mA cm^{-2}	[1]
NiCo-C/NF	1 M KOH	–	0.26	[2]
FCN-MOF/NF	1 M KOH	–	0.196	[3]
FeCo-NCNFs-800	0.1 M KOH	–	0.45	[4]
Co–Fe–BDC	1 M KOH	0.5	0.295	[5]
NiCo-BDC BMNSs	1 M KOH	–	0.23	[6]
CoNi1@C	1 M KOH	–	0.276	[7]
NiFe-MOF/NF	1 M KOH	–	0.225 at 50 mA cm^{-2}	[8]
NiFe MOF/OM-NFH	1 M KOH	0.4	0.27	[9]
IrO_2	1 M KOH	–	0.4	[7]
RuO_2	0.1 M KOH	–	0.316	[9]

References

[1] F. Z. Sun, G. Wang, Y. Q. Ding, C. Wang, B. B. Yuan, Y. Q. Lin. NiFe-Based Metal-Organic Framework Nanosheets Directly Supported on Nickel Foam Acting as Robust Electrodes for Electrochemical Oxygen Evolution Reaction. Adv. Energy Mater. **2018**, 8, 1800584.

[2] Y. C. Hao, Q. L. Liu, Y. Zhou, Z. Q. Yuan, Y. N. Fan, Z. F. Ke, C. -Y. Su, G. Q. Li. A 2D NiFe Bimetallic Metal-Organic Frameworks for Efficient Oxygen Evolution Electrocatalysis. Energy Environ. Mater. **2019**, 0, 1-4.

[3] L. Huang, G. Gao, H. Zhang, J. X. Chen, Y. X. Fang, S. J. Dong. Self-dissociation-assembly of ultrathin metal-organic framework nanosheet arrays for efficient oxygen evolution. Nano Energy, **2019**, 104296.

[4] F. Li, J. X. Li, L. H. Zhou, S. Dai. Enhanced OER performance of composite Co-Fe-based MOF catalysts via a one-pot ultrasonic-assisted synthetic approach. Sustain. Energy Fuels, **2021**, 5, 1095-1102.

[5] L. J. Yang, S. Z. Feng, G. C. Xu, B. Wei, L. Zhang. Electrospun MOF-Based FeCo Nanoparticles Embedded in Nitrogen-Doped Mesoporous Carbon Nanofibers as an Efficient Bifunctional Catalyst for Oxygen Reduction and Oxygen Evolution Reactions in Zinc-Air Batteries. ACS Sustain. Chem. Eng. **2019**, 7, 5462-5475.

[6] B. Q. Wang, J. Shang, C. Guo, J. Z. Zhang, F. N. Zhu, A.J. Han, J. F. Liu. A General Method to Ultrathin Bimetal-MOF Nanosheets Arrays via In Situ Transformation of Layered Double Hydroxides Arrays. Small **2019**, 1804761.

[7] X. Zhang, J. S. Luo, K. Wan, D. Plessers, B. Sels, J. X. Song, L. G. Chen, T. Zhang, P. Y. Tang, J. R. Morante, J. Arbiol, J. Fransaer. From rational design of a new bimetallic MOF family with tunable linkers to OER catalysts. J. Mater. Chem. A, **2019**,7, 1616-1628.

[8] T. Zhao, C. Cheng, D. Wang, D. Z. Zhong, G. Y. Hao, G. Liu, J. P. Li, Q. Zhao. Preparation of a Bimetallic NiFe-MOF on Nickel Foam as a Highly Efficient Electrocatalyst for Oxygen Evolution Reaction. ChemistrySelect **2021**, 6, 1320-1327.

[9] X. F. Li, D. -D. Ma, C. S. Cao, R. Q. Zou, Q. Xu, X. -T. Wu, Q. -L. Zhu. Inlaying Ultrathin Bimetallic MOF Nanosheets into 3D Ordered Macroporous Hydroxide for Superior Electrocatalytic Oxygen Evolution. Small **2019**, 1902218.