Supporting Information

Iron-doped novel Co-based metal-organic frameworks for preparation of bifunctional catalysts with amorphous structure for OER/HER in alkaline solution

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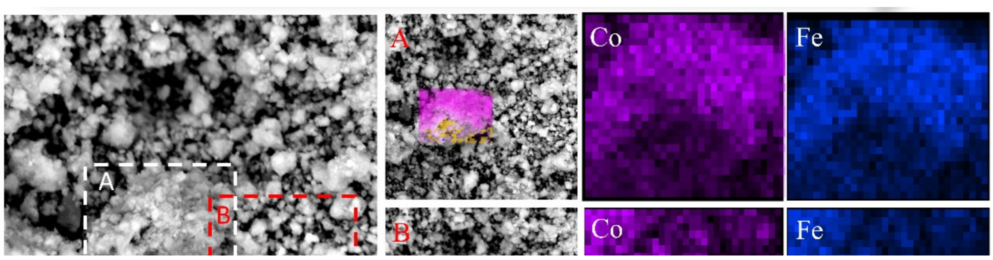

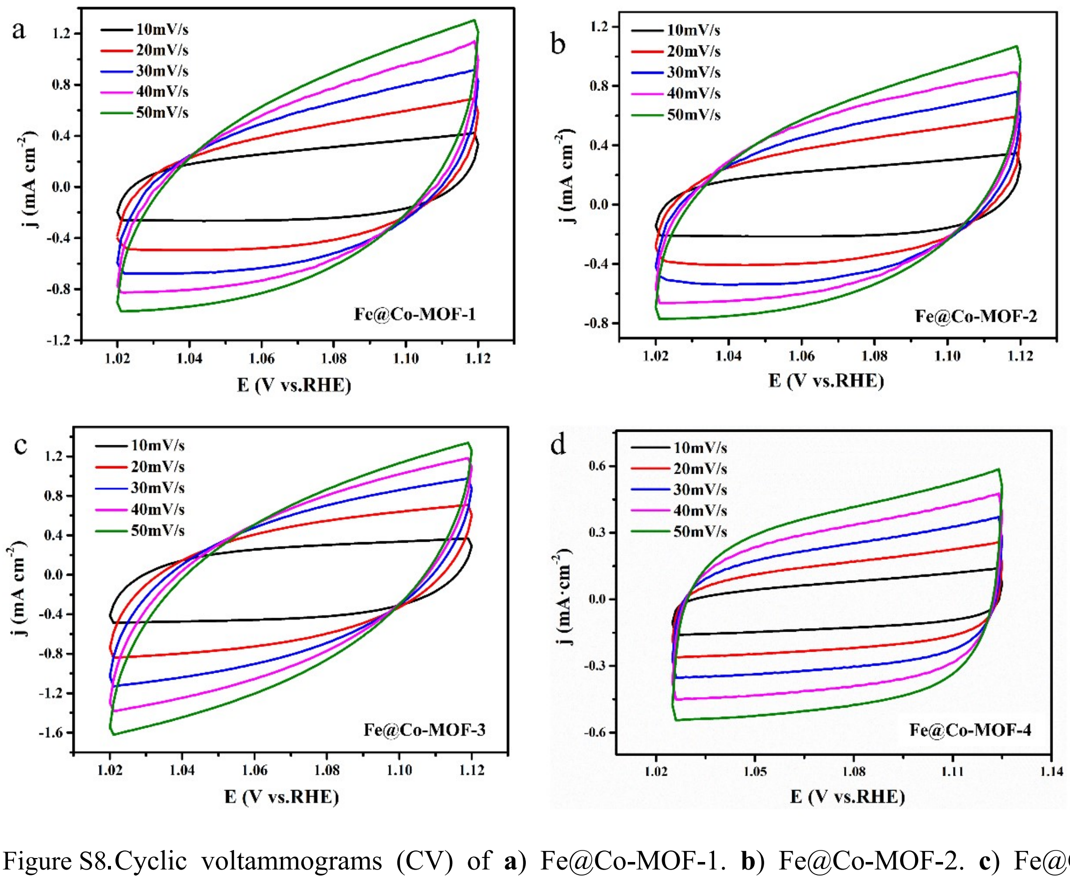

Figure S8.Cyclic voltammograms (CV) of **a**) Fe@Co-MOF-1. **b**) Fe@Co-MOF-2. **c**) Fe@Co-MOF-3. **d**) Fe@Co-MOF-4.

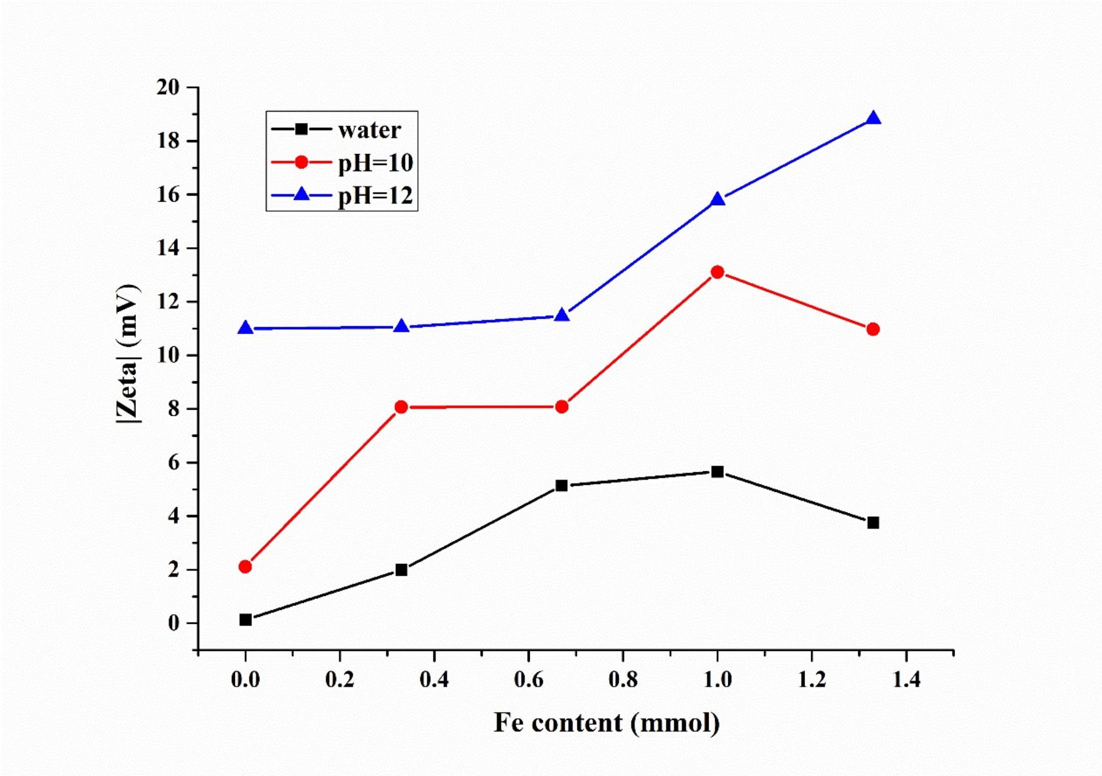

Figure S9. Zeta potential measurement data for Co-MOF, Fe@Co-MOF-1, Fe@Co-MOF-2, Fe@Co-MOF-3 and Fe@Co-MOF-4.

Table S1. List of ingredients for different catalysts.

	Co-MOF	$FeSO_4•7H_2O$
Co-MOF	0.1 mmol	0
Fe@Co-MOF-1	0.1 mmol	0.033 mmol
Fe@Co-MOF-2	0.1 mmol	0.066 mmol
Fe@Co-MOF-3	0.1 mmol	0.1 mmol
Fe@Co-MOF-4	0.1 mmol	0.133 mmol

Table S2. Crystallographic data and structural refinements for Co-MOF.

Compound	Co
chemical formula	$C_{26}H_{16}CoN_6O_5$
formula weight	697.57
crystal size (mm)	0.11
temperature (K)	273(2)
radiation	0.71073
crystal system	Monoclinic
space group	$P2_1/c$
Unit cell dimensions	*a*=13.942(2) (Å)
	b=13.1857(19) (Å)

	c=18.636(3) (Å)
	α=90.00°
	β=111.414(3) °
	γ=90.00°
Volume/V(Å^3)	3189.5(8)
Z	4
ρ($_{calc}$) (g/cm^3)	1.453
F (000)	1444.0
μ (mm^{-1})	0.600
θ range (deg)	1.569 to 25.008
Independent reflections	15957 (R_{int} =0.0666, Rsigma =0.0852)
Data/restraints/parameters	5615/ 231/ 485
GOF	0.991
R_1/wR_2 [$I > 2\sigma(I)$]	0.0548/ 0.1224
R_1/wR_2 (all data)	0.1098/ 0.1534
large peak and hole(e/Å^3)	0.379/ -0.443

Table S3. Selected Bond lengths (Å) and Angles (°) for Co-MOF.

Parameter	Value	Parameter	Value
Co(1)-O(4)#3	2.156(3)	Co(1)-O(5)#3	2.192(3)
Co(1)-O(1)	2.033(3)	Co(1)-O(2)#2	2.019(3)
Co(1)-N(6)#1	2.181(3)	Co(1)-N(1)	2.151(3)
O(4)#3-Co(1)-N(6)#1	90.31(12)	O(2)#2-Co(1)-O(1)	116.88(11)
O(4)#3-Co(1)-O(5)#3	60.04(11)	O(2)#2-Co(1)-N(6)#1	87.65(13)
O(1)-Co(1)-O(4)#3	150.30(12)	O(2)#2-Co(1)-O(5)#3	152.38(12)
O(1)-Co(1)-N(6)#1	87.03(12)	O(2)#2-Co(1)-N(1)	92.11(13)
O(1)-Co(1)-O(5)#3	90.33(11)	N(1)-Co(1)-O(4)#3	92.58(12)
O(1)-Co(1)-N(1)	90.51(12)	N(1)-Co(1)-N(6)#1	177.11(12)
N(6)#1-Co(1)-O(5)#3	89.21(12)	N(1)-Co(1)-O(5)#3	92.33(12)
O(2)#2-Co(1)-O(4)#3	92.53(12)		

Complex **1** Symmetry code: #1= x, 1+y, z; #2= -x, -y, -z; #3= 1+x, 1/2-y, 1/2+z.

Table S4. Hydrogen-bonding Geometry of Co-MOF**.** (Å and °)

D-H···A	D-H	H···A	[D···A]	∠D-H···A
C10-H10···O4#1	0.93(5)	2.6(3)	3.497(4)	162.3(2)
C17-H17···O5#2	0.929(5)	2.559(3)	3.386(7)	148.4 (2)

Symmetry code: #1= -1-x, -1/2+y, -1/2-z; #2= -1-x, -y, -z

Table S5. The OER performance of recently reported most active MOFs-based catalysts in alkaline media.

Number	Catalyst	Electrolyte	Overpotential (mV)	Ref.
1	**Fe@Co-MOF-3**	**1 M KOH**	**247 mV@50mA·cm^{-2}**	***This work***
2	**Co-MOF**	**1 M KOH**	**315 mV@10mA·cm^{-2}**	***This work***
3	ZIF-FeCo/C	1 M KOH	250 mV@10mA·cm^{-2}	1
4	ZIF-67/CoNiAl-LDH/NF	1 M KOH	303 mV@10mA·cm^{-2}	2
5	CoP-InNC@CNT	1 M KOH	270 mV@10mA·cm^{-2}	3
7	FeCo-MNS-1.0	0.1 M KOH	367 mV@150mA·cm^{-2}	4
8	CoP/NF	1 M KOH	317 mV@50mA·cm^{-2}	5
9	FCO-Vo@NC	1 M KOH	318 mV@10mA·cm^{-2}	6
10	CoCu-MOF NBs	1 M KOH	271 mV@10mA·cm^{-2}	7
11	Fe_2Ni MIL-88B	1 M KOH	264 mV@10 mA·cm^{-2}	8
13	CoNi MOF-mCNTs	1 M KOH	306 mV@10mA·cm^{-2}	9
14	Co_3S_4/EC-MOF	1 M KOH	336 mV@100mA·cm^{-2}	10
15	CoNiFe LTHs	1 M KOH	262 mV@10mA·cm^{-2}	11
16	3DGS-$Co_{3.0}Cu_{1.0}$-MOF	0.1 M KOH	460 mV@10mA·cm^{-2}	12
17	CuCo-MOF	1 M KOH	340 mV@10mA·cm^{-2}	13
16	$Ni_{0.75}Fe_{0.25}$ BDC	1 M KOH	310 mV@10mA·cm^{-2}	14
15	*a*$Co(OH)_2$-ZIF-L/NF-40	0.1 M KOH	290 mV@100mA·cm^{-2}	15

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