Supporting Information

High-efficiency oxygen evolution electrode material of carbon material containing NiCo bimetal

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I. Materials

1.1 Chemicals:

Nickel foam (Ni purity 99.9%, porosity 95% -98%, pore size 0.2-0.5 mm, PPI 110), Changsha ChangdeLiyuan Technology Co., Ltd., hydrochloric acid (HCl, analytically pure), HebeiYongfei Chemical Factory, acetone (CH_3COCH_3, analytically pure), HebeiYongfei Chemical Factory, Potassium hydroxide (KOH, analytically pure)， N, N-dimethylformamide (DMF, analytically pure), absolute ethanol (C_2H_5OH, analytically pure), Tianjin Guangfu Technology Development Co., Ltd., nickel nitrate hexahydrate ($Ni(NO_3)_2$•$6H_2O$ analytical purity), cobalt nitrate hexahydrate ($Co(NO_3)_2$•$6H_2O$, analytical purity), para-dicarboxylic acid ($C_8H_6O_4$ analytically pure) , Aladdin.The above drugs have not been further purified.

1.2 Characterization:

X-ray diffractometer (XRD, Shimadzu XRD-6000, Japan) detected the phase purity and crystal structure of sample, surface morphology of the catalyst tested by field emission scanning electron microscope (FE-SEM, Hitachi S-4800, Japan). Brunner-Emmet-Teller (BET, ASAP 2020 HD88, USA) was used to test and analyze the specific surface area and pore size of the sample. And used simultaneous thermal analyzer (DSC/TG, STA 449C, Germany) to test pyrolysis temperature of analyzed material.

II. Supplementary Figures and Tables

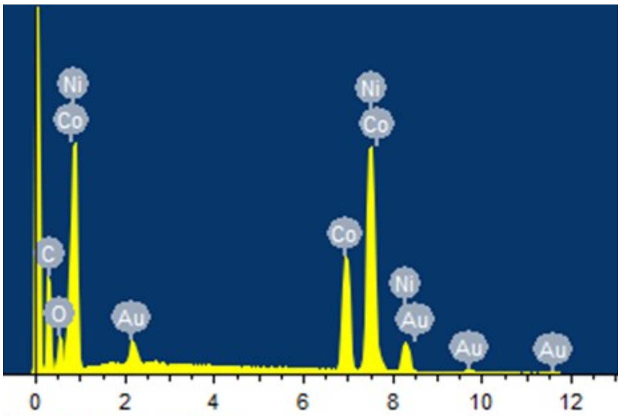

Figure S1. EDS Element spectrum for NiCo-C/NF

Table S1. EDS atomic percentage for NiCo-C/NF

element	C	O	Co	Ni	Au
Atomic percentage (%)	8.74	13.82	22.89	53.30	1.26

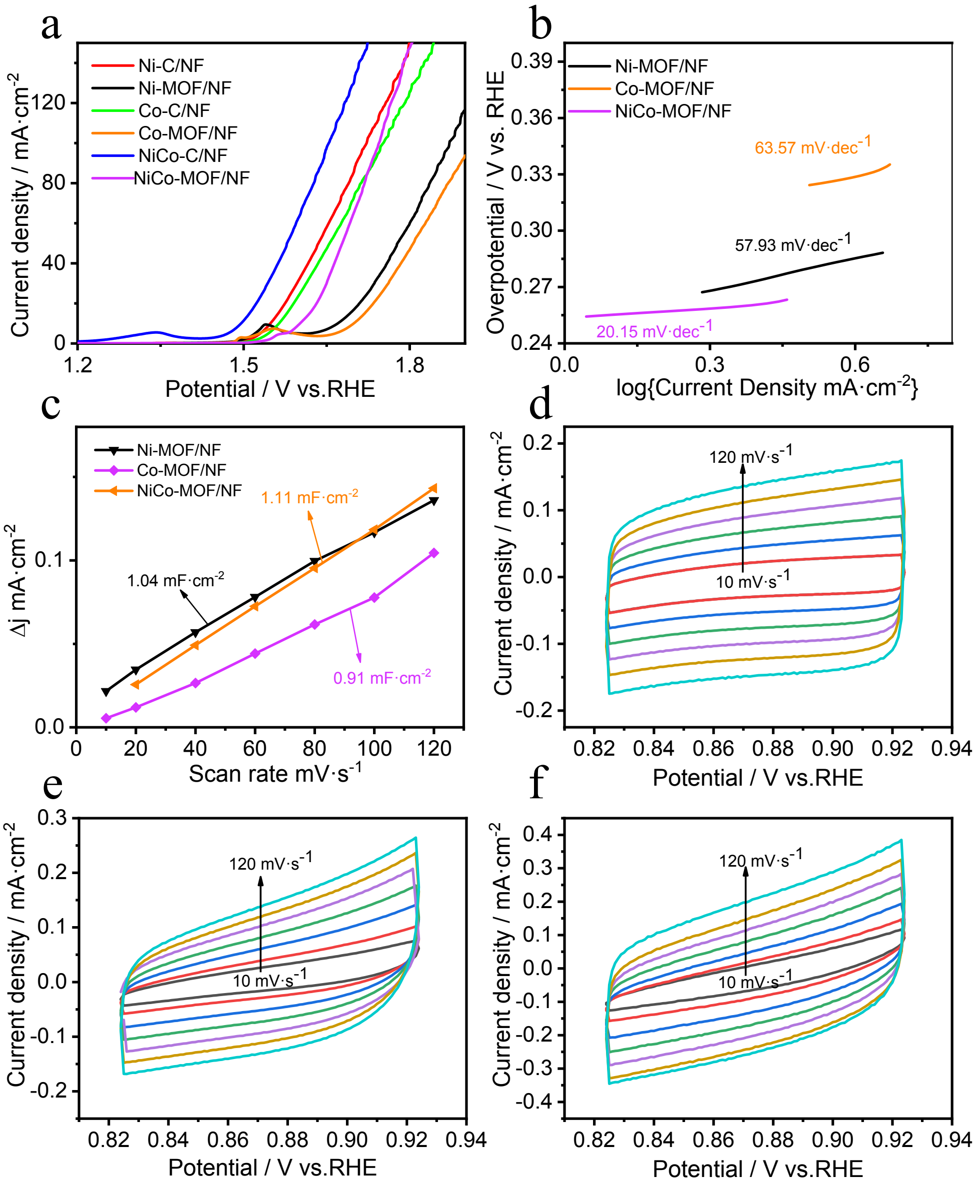

Figure S2. (a) Ni-MOF/NF, Co-MOF/NF, NiCo-MOF/NF, Ni-C/NF, Co-C/NF and NiCo-C/NF LSV curves; (b) Tafel plots; (c) Double layer capacitance (C_{dl}); (d-f) Ni-MOFs/NF, Co-MOF/NF and NiCo-MOF/NF CV curves were conducted in the voltage range 0.82-0.92 V vs. RHE with a scan rate of 10 - 120 mV·s^{-1}

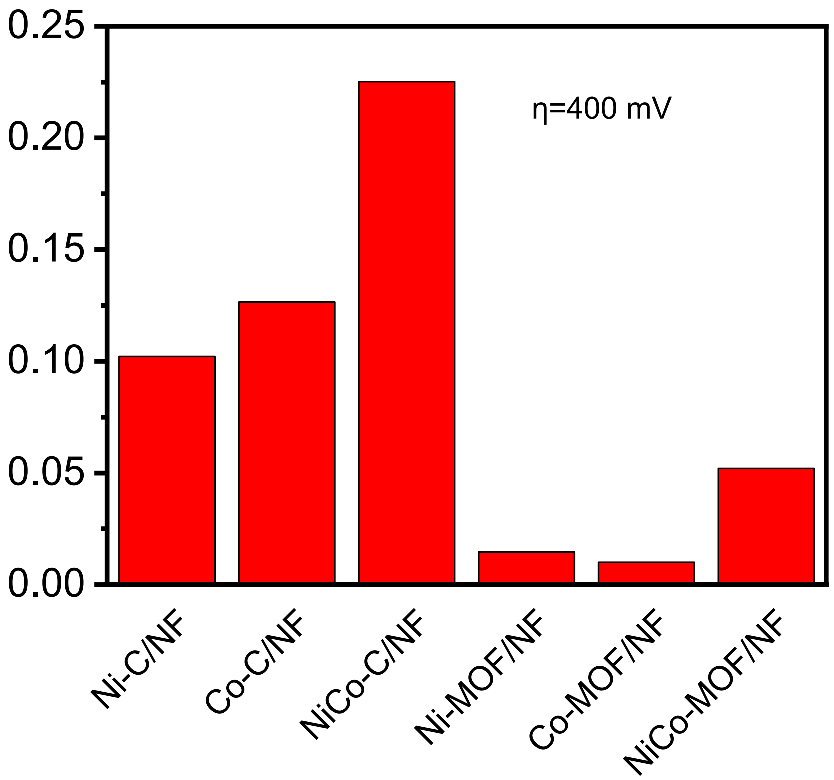

Figure S3. TOF of Ni-C/NF; Co-C/NF; NiCo-C/NF; Ni-MOF/NF; Co-MOF/NF and NiCo-MOF/NF current density at 400 mV overpotential.

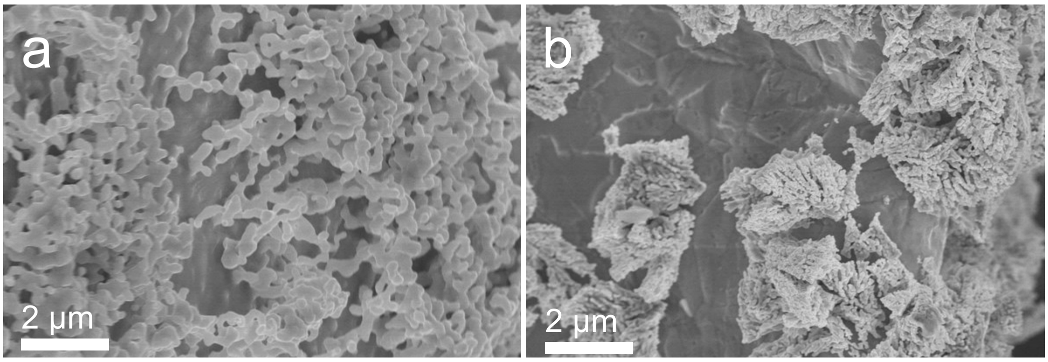

Figure S4. SEM after electrochemical test for :(a) Ni-C/NF; (b) Co-C/NF

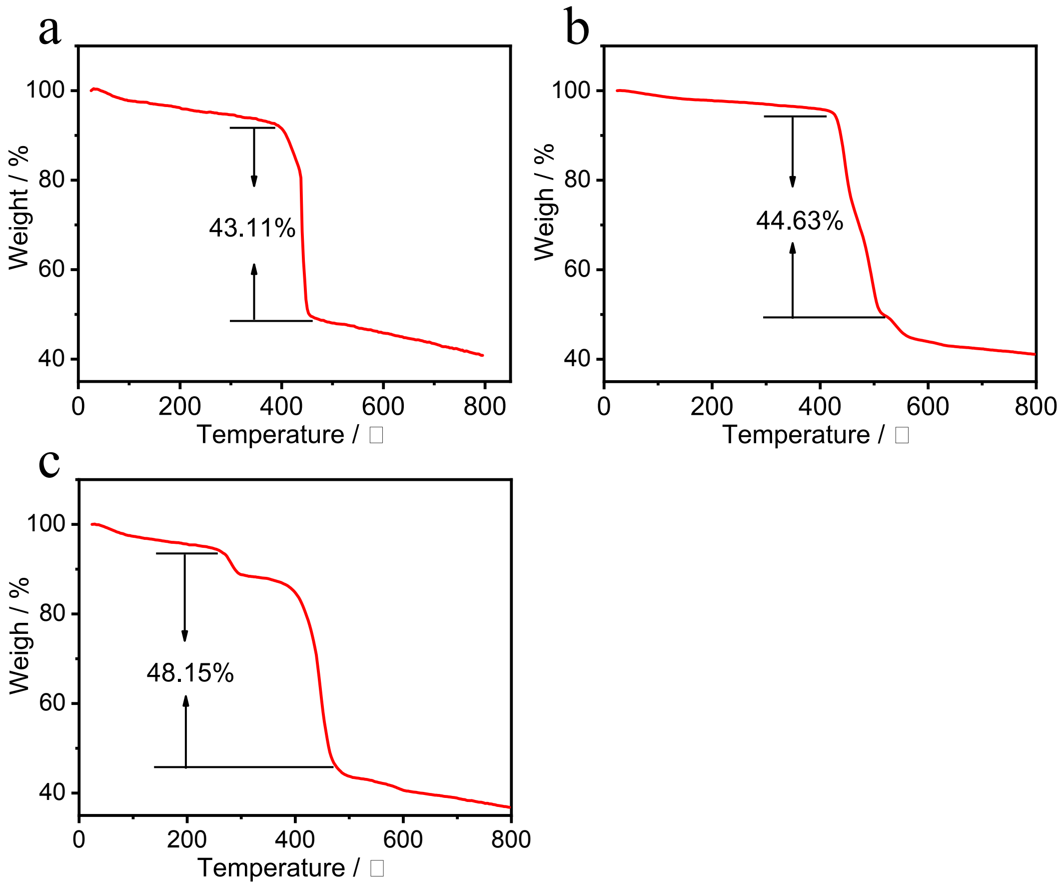

Figure S5. TG for Ni-MOF/NF; Co-MOF/NF; NiCo-MOF/NF.

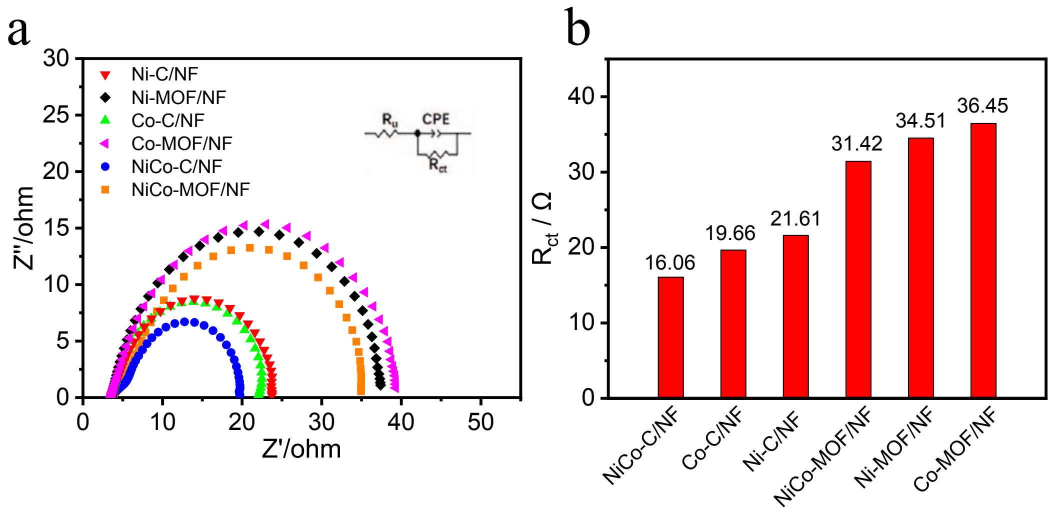

Figure S6. (a) Corresponding electrochemical impedance spectroscopy (EIS) Nyquist plots of different catalysts. (b) Rct data comparison chart of catalyst.

Table S2. The loading content of the catalyst (1 cm^2)

Material	Before the cycle	After the cycle	Loading weight
NF	49.3 mg	/	/
Ni-C/NF	61.6 mg	57.5 mg	12.3 mg
Co-C/NF	63.5 mg	58.6 mg	14.2 mg
NiCo-C/NF	62.2 mg	60.6 mg	12.9 mg

Table S3. Comparison for OER activity for NiCo-C/NF with other electrocatalysts

Material	Electolyte	Overpotenti(mV)	Ref
NiCo-MOF/NF	1.0 M KOH	260@10mA cm^{-2}	This work
IrO_2/NF	1.0 M KOH	320@10mA cm^{-2}	1
RuO_2	1.0 M KOH	299@10mA cm^{-2}	2
Co/W-C@NCNSs	1.0 M KOH	323@10mA cm^{-2}	3
Fe/Co-MOF	1.0 M KOH	410@10mA cm^{-2}	4
Co_2Fe-MOFs	1.0 M KOH	280@10mA cm^{-2}	5
Co3Fe-MOF	1.0 M KOH	280@10mA cm^{-2}	6
CuO@MIL-53(Cu)	1.0 M KOH	336@10mA cm^{-2}	7

AB&Ni-MOF(1:1)/GC	1.0 M KOH	379@10mA cm^{-2}	8
CoFe@SNCN	1.0 M KOH	306.4@10mA cm^{-2}	9
Co-Fe-P-Se/NC	1.0 M KOH	270@10mA cm^{-2}	10
SNNU-5-FeCoNi	1.0 M KOH	317@10mA cm^{-2}	11
CN-Fe2Co-Fe2Ni	1.0 M KOH	271@10mA cm^{-2}	12
Co-MOF_{72h}	1.0 M KOH	387@10mA cm^{-2}	13

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