Electronic Supplementary Material (ESI) for Sustainable Energy & Fuels.

Supporting information

Nanosized High Entropy Spinel Oxide $(FeCoNiCrMn)_3O_4$ as a High-active and Ultra-stable Electrocatalyst for Oxygen Evolution Reaction

Chanqin Duan, [a] Xinglong Li, [a] Dan Wang, [a,b] Zhiyuan Wang,*[a,b] Hongyu Sun, [b] Runguo Zheng, [a,b] Yanguo Liu,*[a,b]

[a] School of Materials Science and Engineering, Northeastern University, Shenyang 110819, P.R. China;

[b] School of Resources and Materials, Northeastern University at Qinhuangdao, Qinhuangdao 066004, China;

Corresponding author: (WZY) zhiyuanwang@neuq.edu.cn; (LYG) lyg@neuq.edu.cn

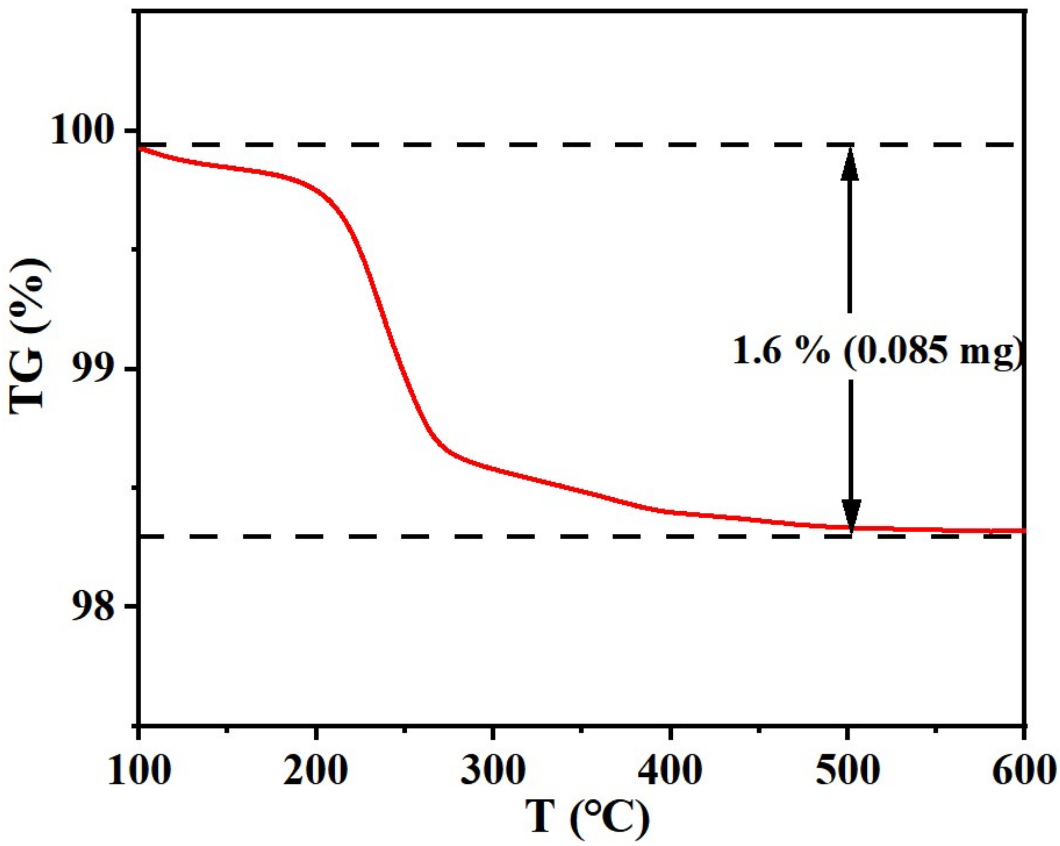


Fig.S1 The TG pattern of the HEO precursor

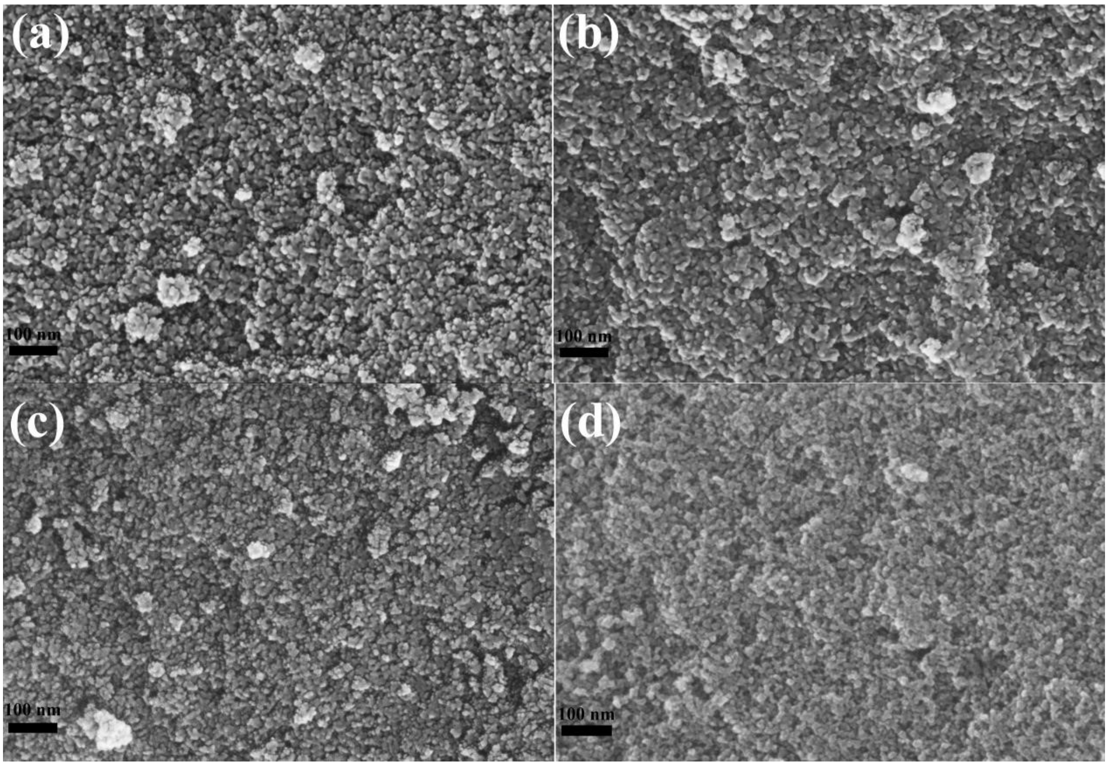


Fig.S2 SEM image of M_3O_4-T(T=0、300、400、500℃)

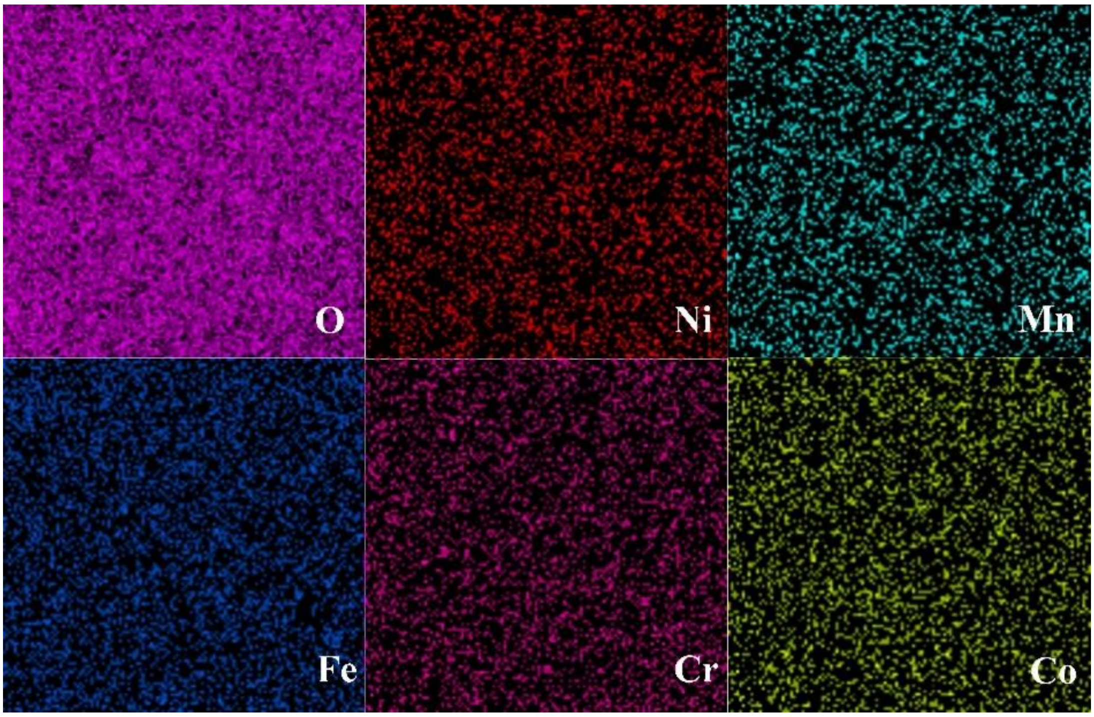


Fig.S3 SEM-EDS-Mapping of M_3O_4-400

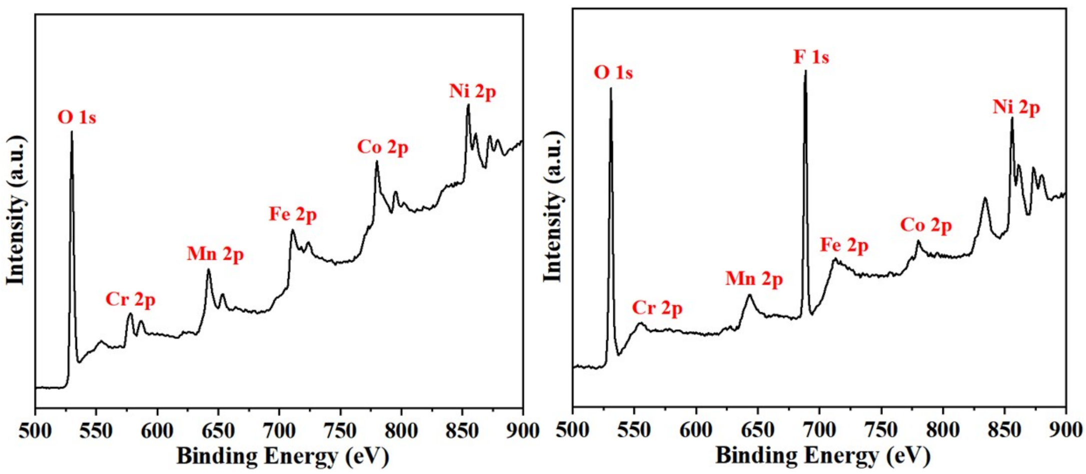


Fig.S4 The survey XPS spectra of M_3O_4-400: (a) before OER test (b) after OER test

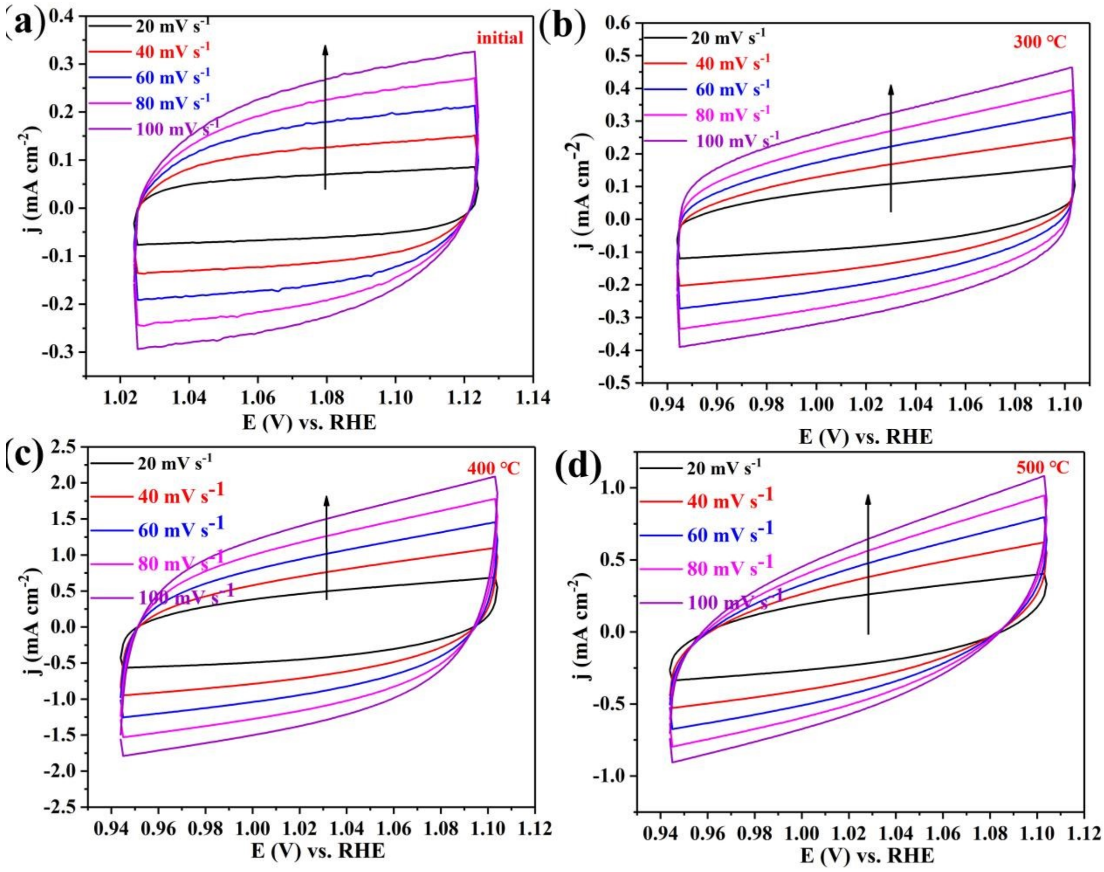


Fig.S5 CV curves at 20 -100 mV s^{-1} scan rates of M_3O_4-T (T=0、300、400、500 ℃)

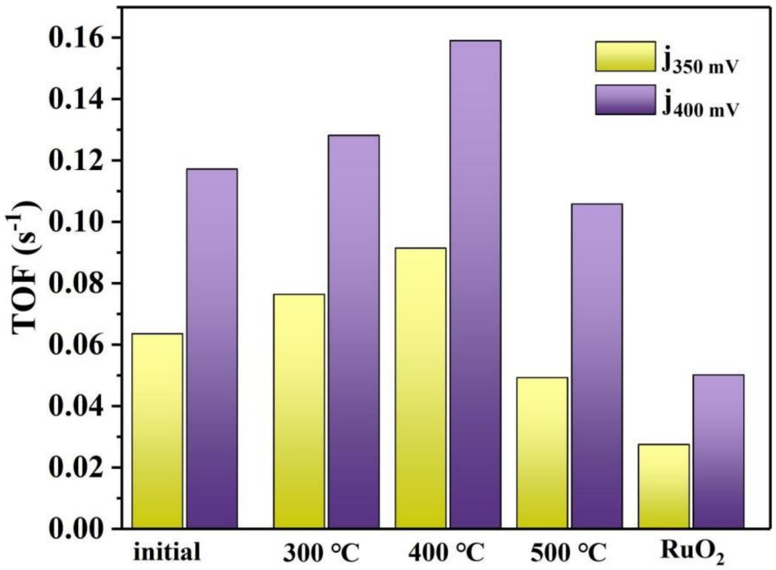
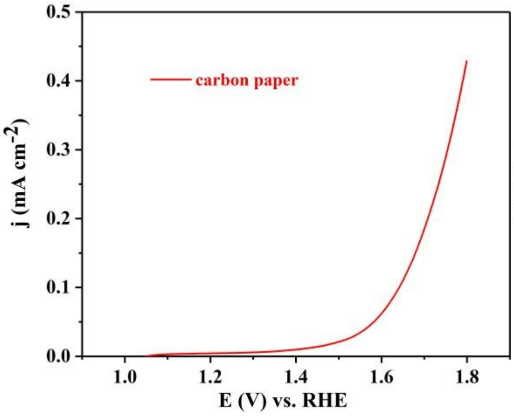


Fig.S6 TOF values of M_3O_4-T(T=0、300、400、500°C) and RuO_2 at $j_{350\ mV}$ and $j_{400\ mV}$

The TOF was calculated at the overpotential of 400 mV and 350 mV as the follow equation:

$$TOF = \frac{jA}{4Fn}$$

where, j is current density (A cm^{-2}), A is the geometric area of the electrode (3*3 cm^2), F is Faraday constant (96485 s A mol^{-1}), and n is the number of moles of the metal in the electrode.



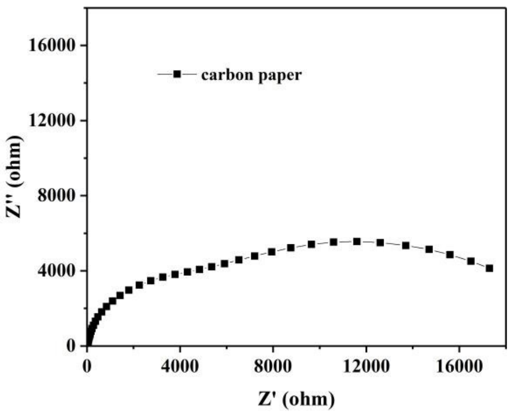


Fig. S7. Carbon paper performance test: (a) LSV curves, (b) Nyquist plots

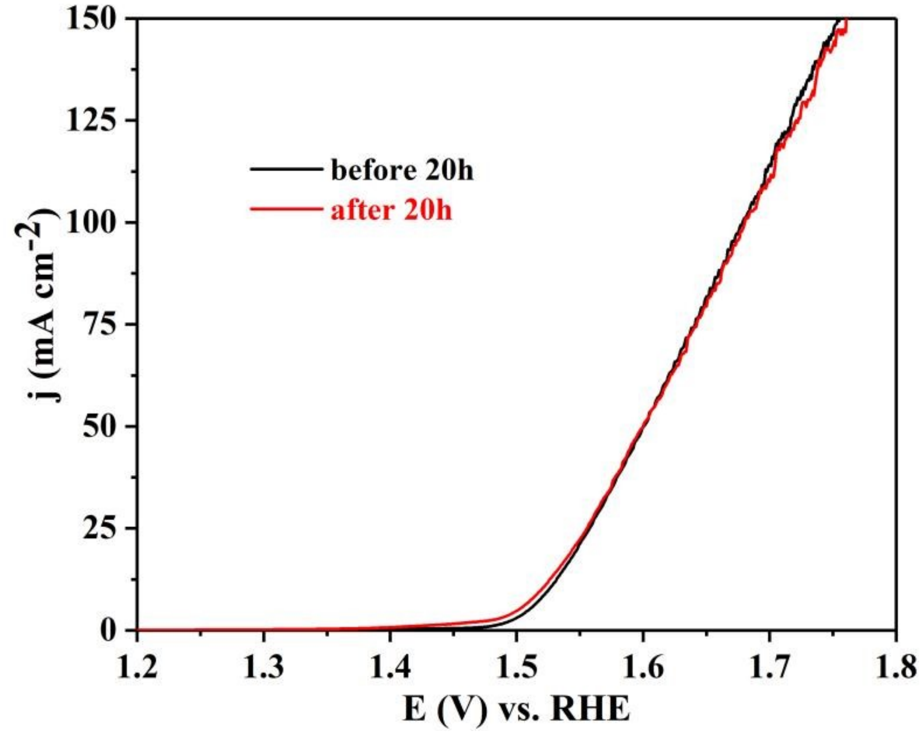


Fig.S8 before and after time-dependent current density for 20h

Table S1 Element composition of M_3O_4-400 (SEM-EDS)

element	atomic percentage (%)
O	65.54
Cr	5.01
Mn	3.53
Fe	8.54
Co	8.48
Ni	8.91

Table S2 Element composition of M_3O_4-400 (TEM-EDS)

element	atomic percentage (%)
O	67.19
Cr	4.79
Mn	3.70
Fe	8.82
Co	7.98
Ni	7.52

Table1 S3 summary of metal oxide for oxygen evolution reaction

Catalysts	η_{10} (V)	Tafel slope (mV dec^{-1})	journal	Ref.
$(Fe,Co,Ni,Cr,Mn)_3O_4$	1.51	60		This work
$(Co, Cu, Fe, Mn,Ni)_3O_4$	1.58	59.5	J. Mater. Chem. A	[1]
$(CoNiMnZnFe)_3O_{3.2}$	1.57	47.5	J. Alloy. Compd.	[2]
$La(CrMnFeCo_2Ni)O_3$	1.56	51.2	Adv. Funct. Mater.	[3]
NiCo-$(FeCrCoNiAl_{0.1})O_x$	1.56	97.4	J. Alloy. Compd.	[4]
$(Co_{0.2}Mn_{0.2}Ni_{0.2}Fe_{0.2} Zn_{0.2})Fe_2O_4$	1.57	53.6	ACS Appl. Mater. Interfaces	[5]
$La_{0.6}Sr_{0.4}Co_{0.8}Fe_{0.1}Mn_{0.1}O_{3-\delta}$	1.57	63	Chem. Eng. J.	[6]
meso-NPC/Co_2NiOx	1.56	54	ACS Appl. Mater. Interfaces	[7]
S-Co_3O_4	1.54	67.4	Appl. Surf. Sci.	[8]
$NiCo_2O_4$	1.52	53	Angew. Chem.-Int. Edit.	[9]
Fe-$La_{0.6}Sr_{0.4}CoO_3$	1.57	63	Chemical Engineering Journal	[10]
$Mn_{0.6}Zn_{0.4}Co_2O_4$	1.55	80.6	Int. J. Hydrog. Energy	[11]
$CoFe_2O_4$/CNTs/FA	1.62	82	Ceramics International	[12]
Vo-$MnCo_2O_4$	1.63	87	Chem. Eng. J.	[13]
NiO	1.55	52.4	Electrochimica Acta	[14]
Mn_3O_4	1.55	85.6	Int. J. Hydrog. Energy	[15]

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