Amorphous multimetal based catalyst for oxygen evolution reaction

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Table S1. Compositions for screening NiCoV catalysts and their corresponding potentials at the current density of 10 mA cm^{-2}.

Samples	Ni^{2+} (at. %)	Co^{2+} (at. %)	VO^{2+} (at. %)	η (10 mA cm^{-2}) (V vs. RHE)	Tafel slope (mV dec^{-1})
1	100	0	0	1.53	215
2	0	100	0	1.57	151
3	40	60	0	1.59	290
4	15	80	5	1.52	168
5	10	85	5	1.51	168
6	80	10	10	1.57	214
7	60	30	10	1.57	202
8	30	60	10	1.51	161
9	10	80	10	1.48	130
10	5	85	10	1.49	156
11	5	80	15	1.51	142
12	10	75	15	1.52	157
13	25	40	35	1.52	177
14	35	30	35	1.54	163
15	30	35	35	1.54	172

16	25	40	35	1.53	157
17	20	45	35	1.56	168
18	10	50	40	1.57	152
19	20	40	40	1.56	164
20	30	30	40	1.58	193
21	40	20	40	1.73	260
22	50	10	40	1.74	270
23	25	35	40	1.61	166
24	15	45	40	1.59	167
25	60	0	40	1.76	420
26	0	60	40	1.57	157
27	50	0	50	1.8	450
28	40	10	50	1.74	222
29	10	40	50	1.59	172
30	20	30	50	1.58	173
31	30	20	50	1.69	216
32	20	10	70	1.69	206
33	10	20	70	1.65	187

34	0	0	100	>1,70	>500

Table S2. Compositions of single metallic catalysts (Ni, Co, V), binary metallic catalysts (NiCo, NiV, CoV) and ternary metallic catalysts (NiCoV).

Catalyst abbreviation	Ni^{2+} (at. %)	Co^{2+} (at. %)	VO^{2+} (at. %)
Ni	100	0	0
Co	0	100	0
V	0	0	100
NiCo	40	60	0
NiV	60	0	40
CoV	0	60	40
NiCoV	10	80	10

Table S3. Summary of the OER overpotentials (at a current density of 10mA cm^{-2}) and Tafel slope of reported Co- and Ni- based OER catalysts.

Catalyst	Substrate	Solution	Overpotential (mA, at 10mA cm^{-2})	Tafel slope	Ref.
NiCoV/mesh	Stainless steel mesh	1M KOH	220	40	This work
RuO_2/mesh	Stainless steel mesh	1M KOH	190	73	This work

Ni_3S_2/NF	Ni foam	1M KOH	350	108	[1]
CoS_2 nanoparticles	Ni foam	1M KOH	430	81.4	[2]
$CoSe_2$ nanoparticles	Ni foam	1M KOH	424	78.3	[2]
$Co(S_{0.22}Se_{0.78})_2$	Ni foam	1M KOH	283	65.6	[2]
MoS_2/ Ni_3S_2	Ni foam	1M KOH	218	88	[3]
Ni_2P nanoparticles	Glassy carbon	1M KOH	290	59	[4]
FeNiO	Ni foam	1M KOH	297	37	[5]
NiCoP/C nanobox	Glassy carbon	1M KOH	330	115	[6]
Ni_3FeN nanosheets	Glassy carbon	1M KOH	280	46	[7]
Ni_3B	Glassy carbon	1M KOH	302	52	[8]

$NiCo_2O_4$ nanowires	Conductive electrode	1M KOH	460	90	[9]
$Co_{9-x}Ni_xS_8$ nanocages	Conductive electrode	1M NaOH	364	74.7	[10]
P-Co_3O_4	Conductive electrode	1M KOH	280	51.6	[11]

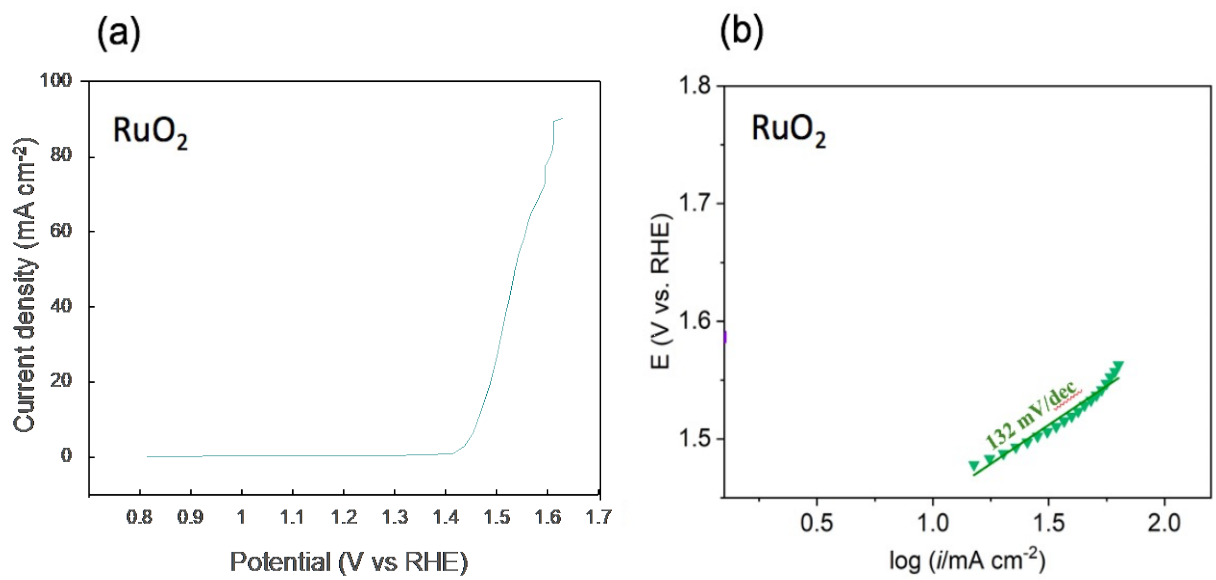

Figure S1. Electrochemical performance of RuO_2 catalysts on glassy carbon electrodes. (a) polarization curves of oxygen evolution reaction for different catalysts at a scan rate of 20 mV s^{-1} in 1M KOH, and (b) Tafel slopes of RuO_2 catalysts on glassy carbon electrodes.

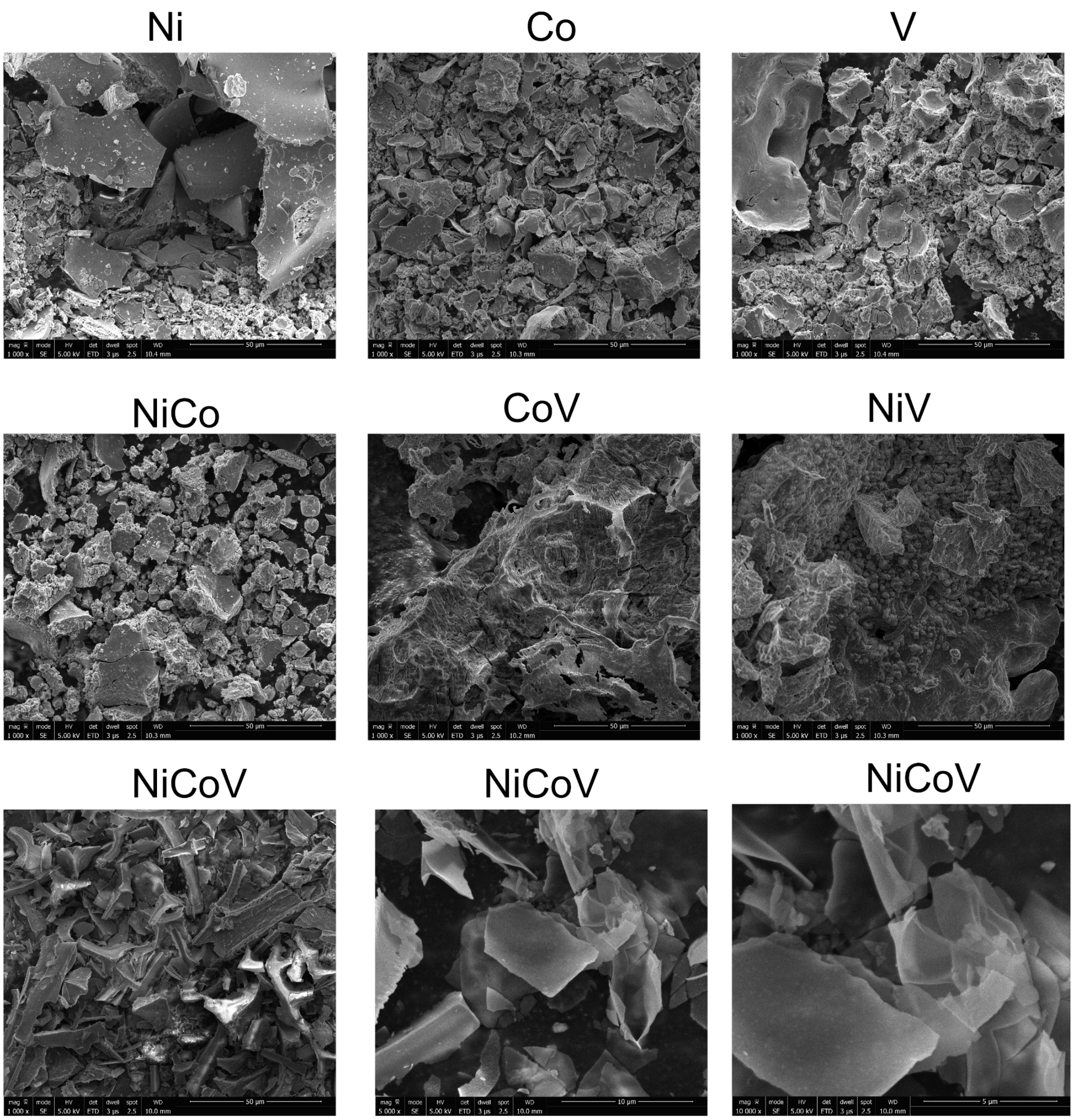

Figure S2. SEM images of various components of Ni, Co, V based catalysts. See details about each sample component in Table S2.

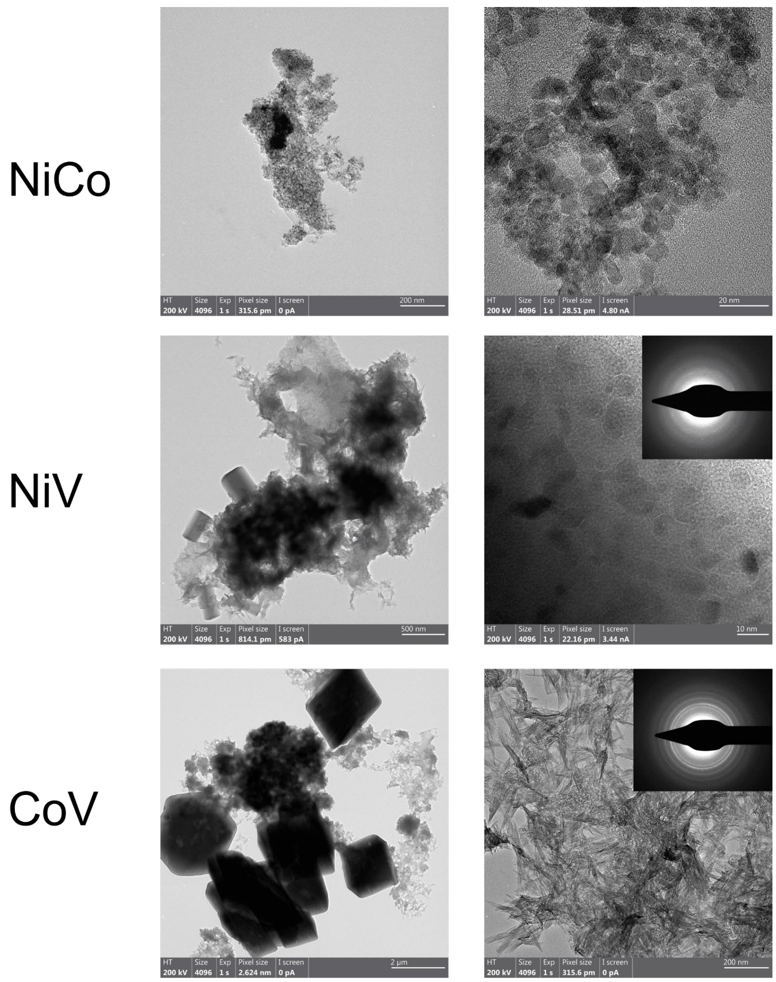

Figure S3. TEM images of NiCo, NiV and CoV.

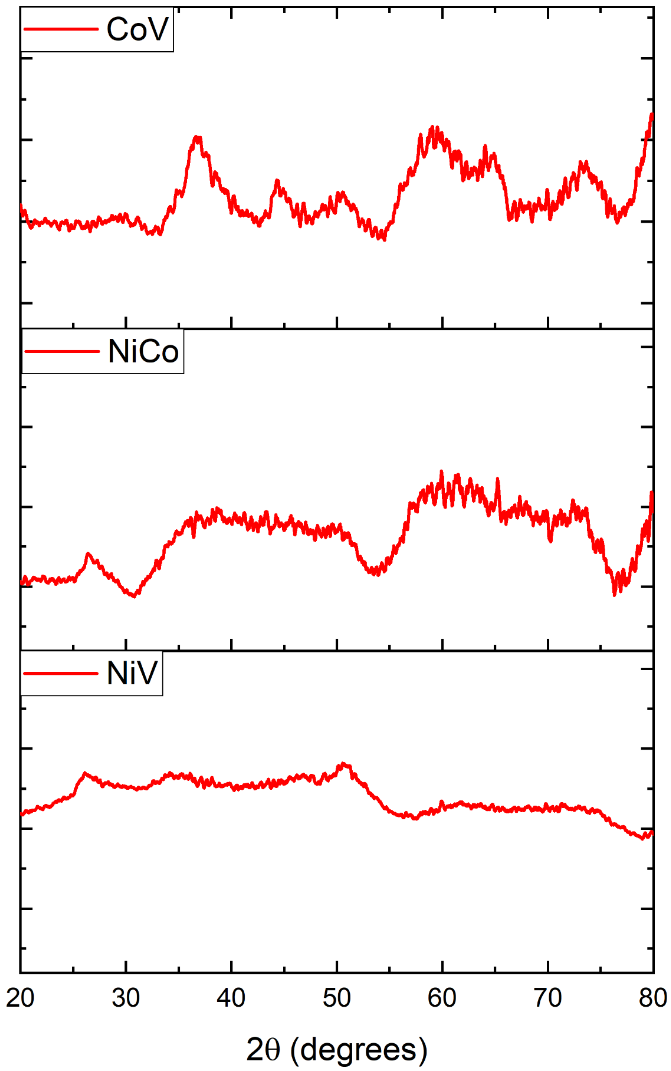

Figure S4. XRD patterns of **CoV**, **NiCo** and **NiV** samples. **NiV** shows less pronounced crystalline structure compared to **NiCo** and **CoV**.

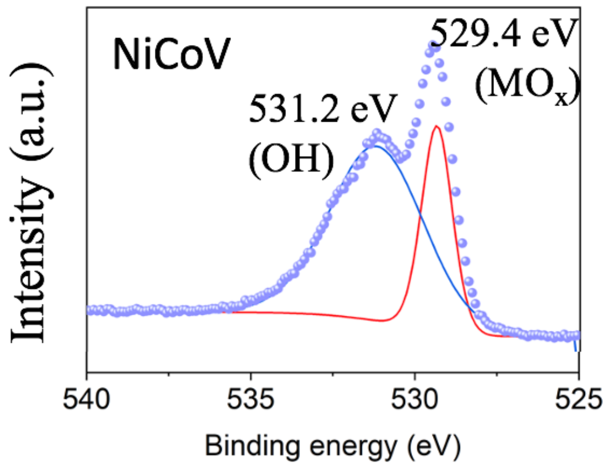

Figure S5. High resolution XPS spectra of O 1s for the **NiCoV** sample.

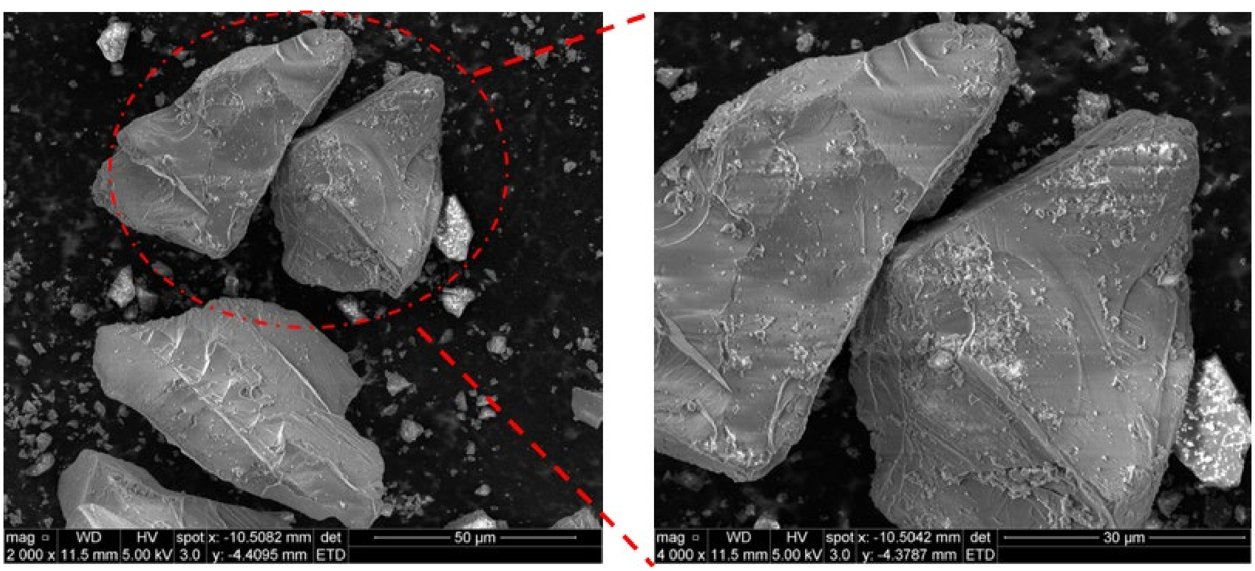

Figure S6. SEM images of corundum coated by NiCoV catalyst.

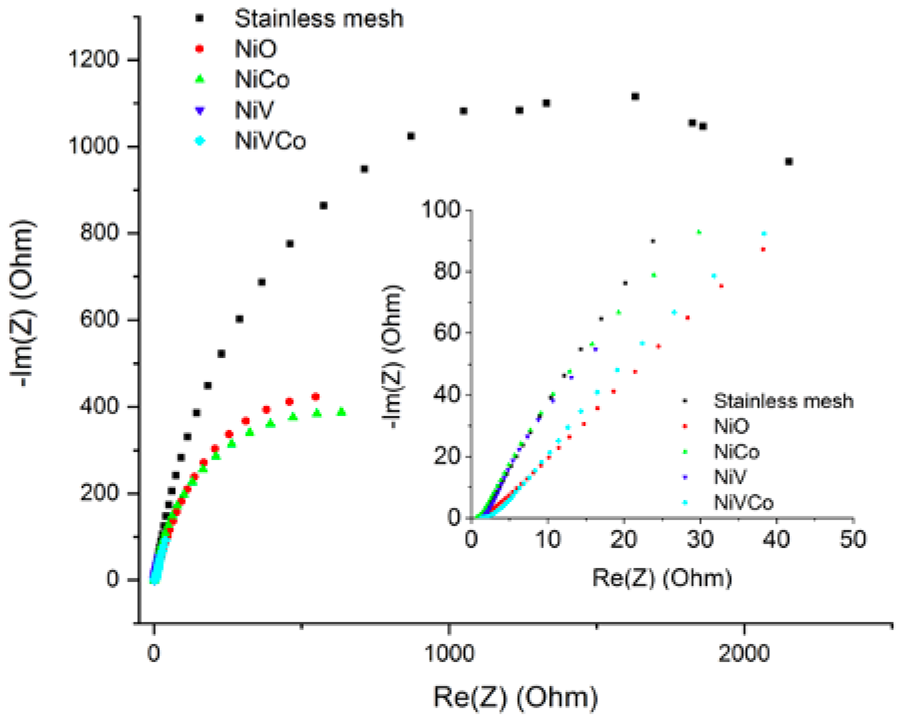

Figure S7. Nyquist plots of blank mesh, **Ni**, **NiCo**, **NiV** and **NiCoV** coated meshes.

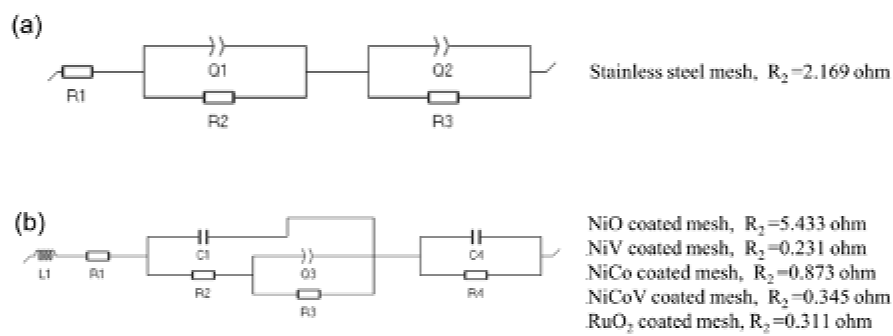

Figure S8. Corresponding equivalent electrical circuits for stainless steel mesh (a) and catalyst coated mesh (b) based on the Nyquist plots.

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