In-situ Electrochemical Metal (Co, Ni) Oxide Deposition on MoS_2 Nanosheets for Highly Efficient Electrocatalytic Water Splitting

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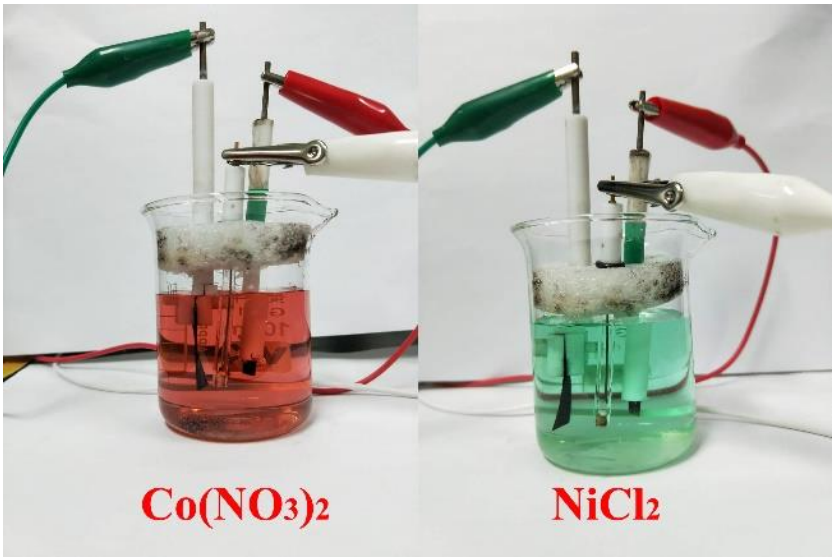

Fig. S1 Preparation devices of $Co/MoS_2/CC$ and $Ni/MoS_2/CC$.

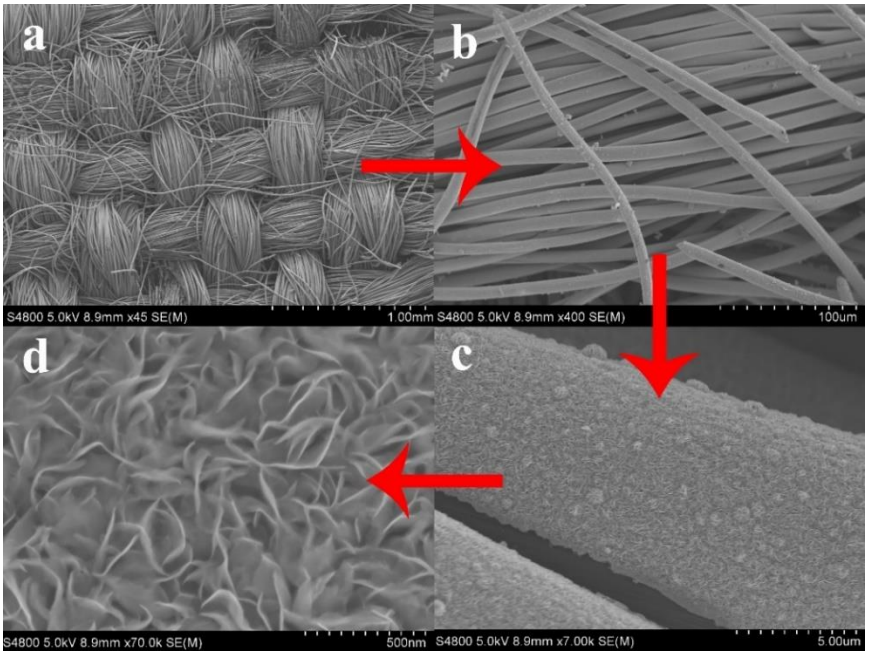

Fig. S2 The SEM images of MoS_2/CC with different magnifications.

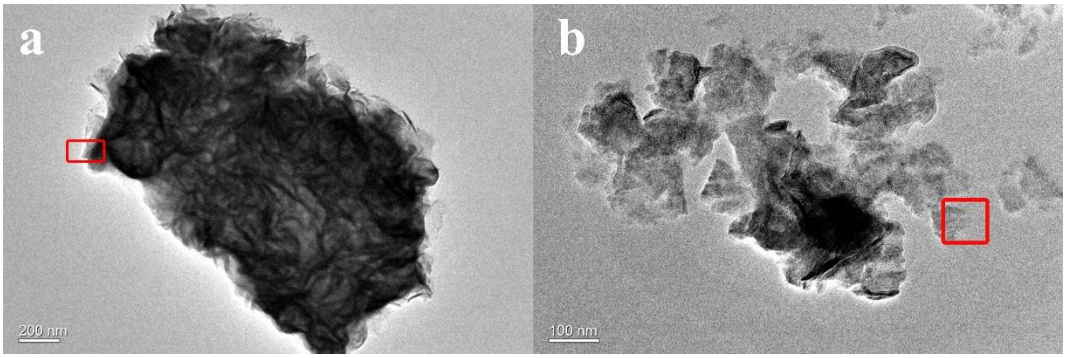

Fig. S3 TEM images of (a) CoO/MoS_2/CC, (b) NiO/MoS_2/C.

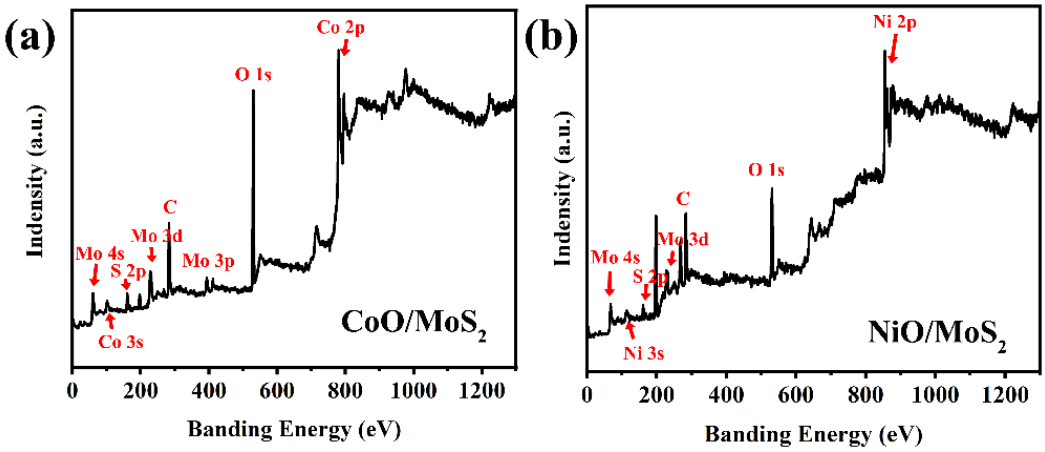

Fig. S4 XPS survey spectra of (a) CoO/MoS_2/CC and (b) NiO/MoS_2/CC.

Table S1 Comparison of the electrocatalytic performance of CoO/MoS_2/CC for HER with that of reported bifunctional MoS_2-based electrocatalysts tested under similar conditions.

	Overpotential for -10 mA cm^{-2} (mV)	**Overpotential for -100 mA cm^{-2} (mV)**	**Tafel slope (mV dec^{-1})**	**Ref.**
CoO/MoS_2/CC	93	162	57.9	This work
NiCo-MoS_2	70	~	38.1	[1]
Co_3O_4@MoO_2/CC	90	220	59.5	[2]
MoS_2/FNS/FeNi foam	122	300	45.1	[3]
MoS_2@NiOOH@C-MC	250	~	96	[4]
NiN@2M-MoS_2	~	97	43.2	[5]

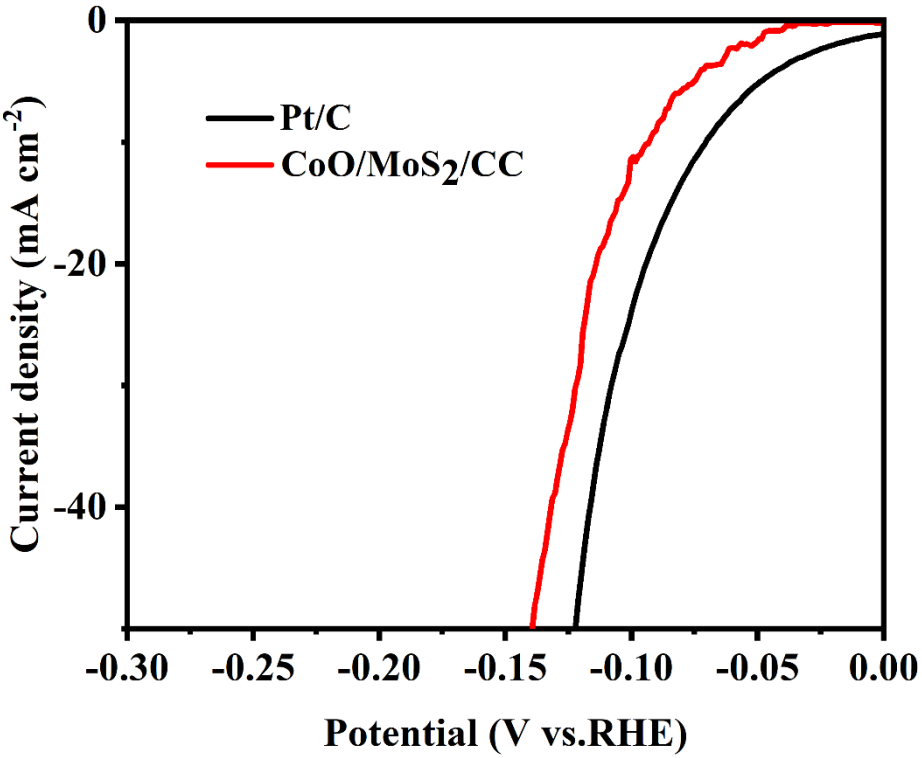

Fig. S5 Polarization curves of CoO/MoS_2/CC and commercial 20 wt% Pt/C.

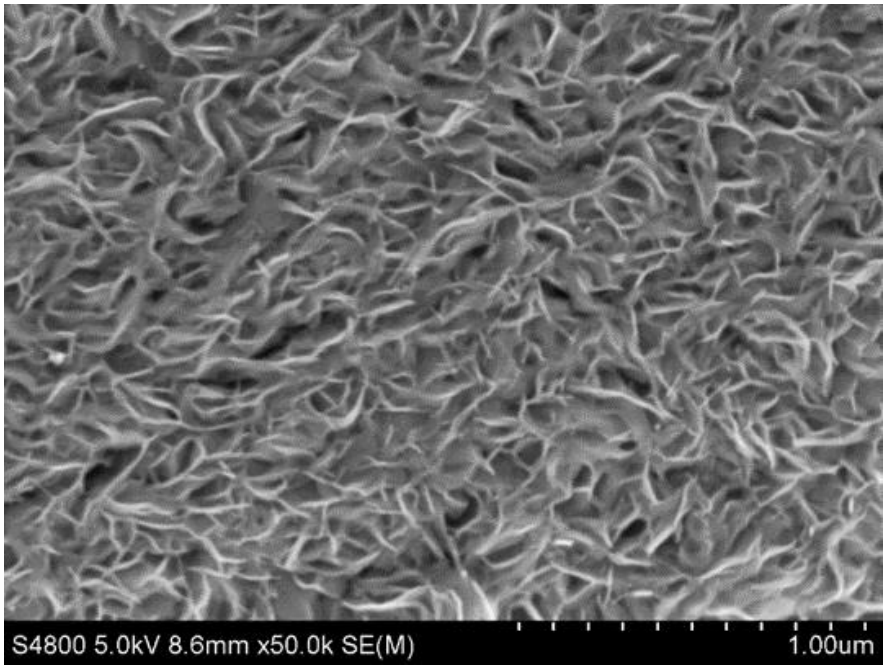

Fig. S6 SEM image of CoO/MoS_2/CC after HER stability test carry out for 14 h.

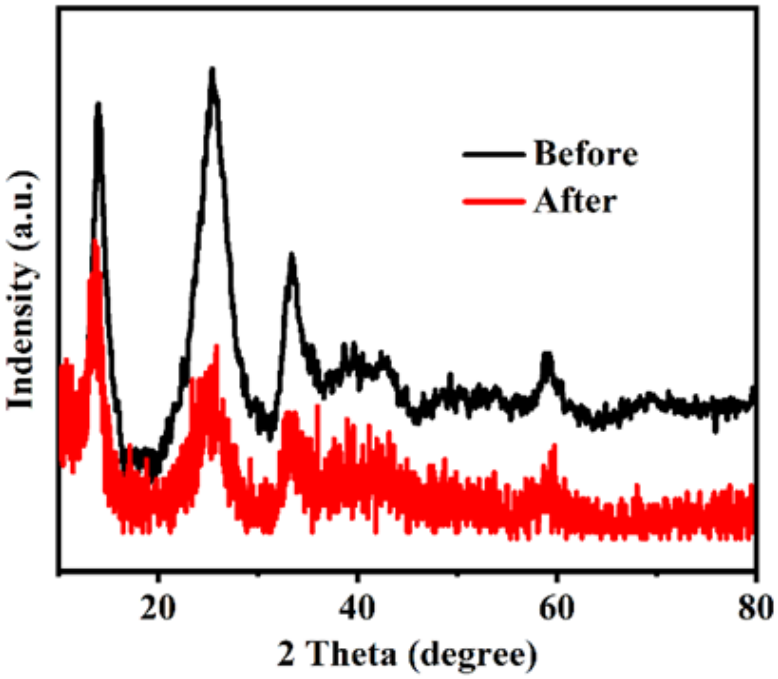

Fig. S7 XRD patterns of CoO/MoS_2/CC before and after HER stability test carry out for 14 h.

Table S2 Comparison of the electrocatalytic performance of CoO/MoS_2/CC for OER with that of reported bifunctional MoS_2-based elecrocatalysts tested under similar conditions.

Samples	Overpotential for 10 mA cm^{-2} (mV)	Overpotential for 50 mA cm^{-2} (mV)	Tafel slope (mV dec^{-1})	Ref.
CoO/MoS_2/CC8	210	450	282	This work
NiCo-MoS_2	235	330	45.7	[1]
Co_3O_4@MoO_2/CC	269	~	58	[2]
MoS_2/FNS/FeNi foam	204	210	28.6	[3]
MoS_2@NiOOH@C-MC	280	~	113	[4]
NiN@2M-MoS_2	~	207	38.9	[5]

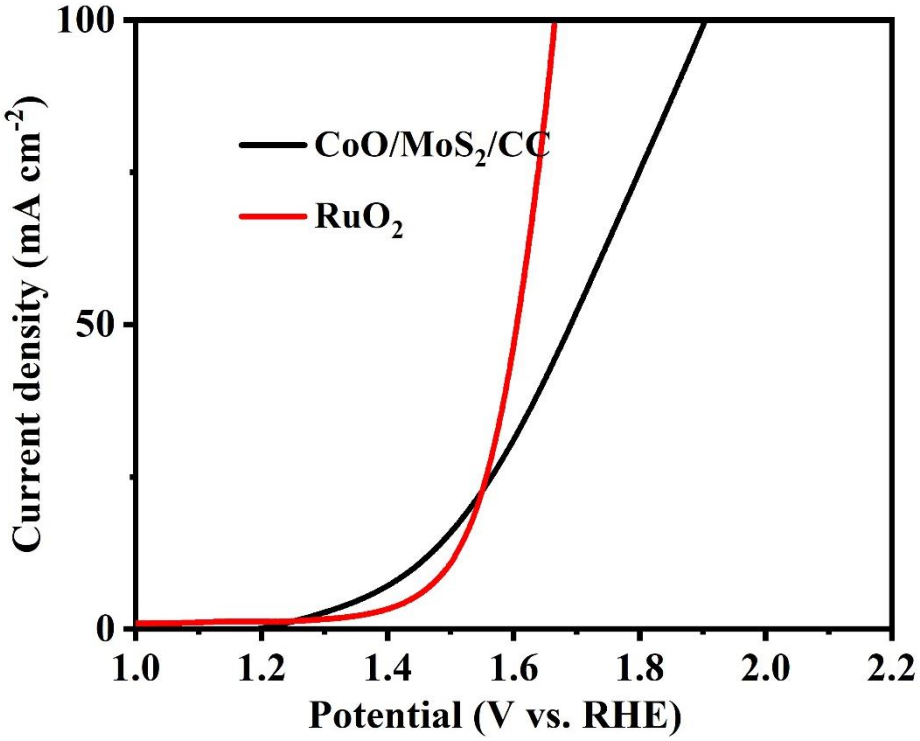

Fig. S8 Polarization curves of $CoO/MoS_2/CC$ and commercial RuO_2.

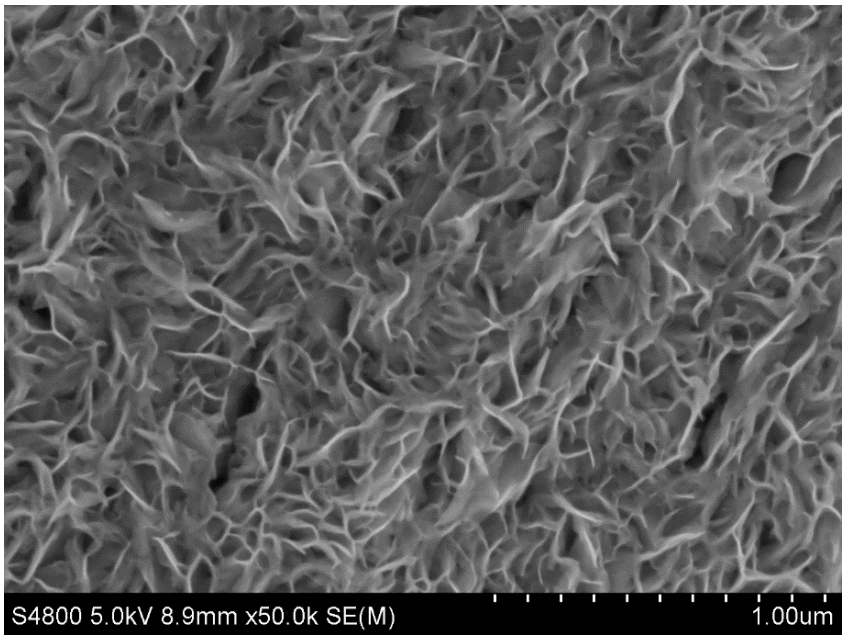

Fig. S9 SEM image of $CoO/MoS_2/CC$ after OER stability test carry out for 14 h.

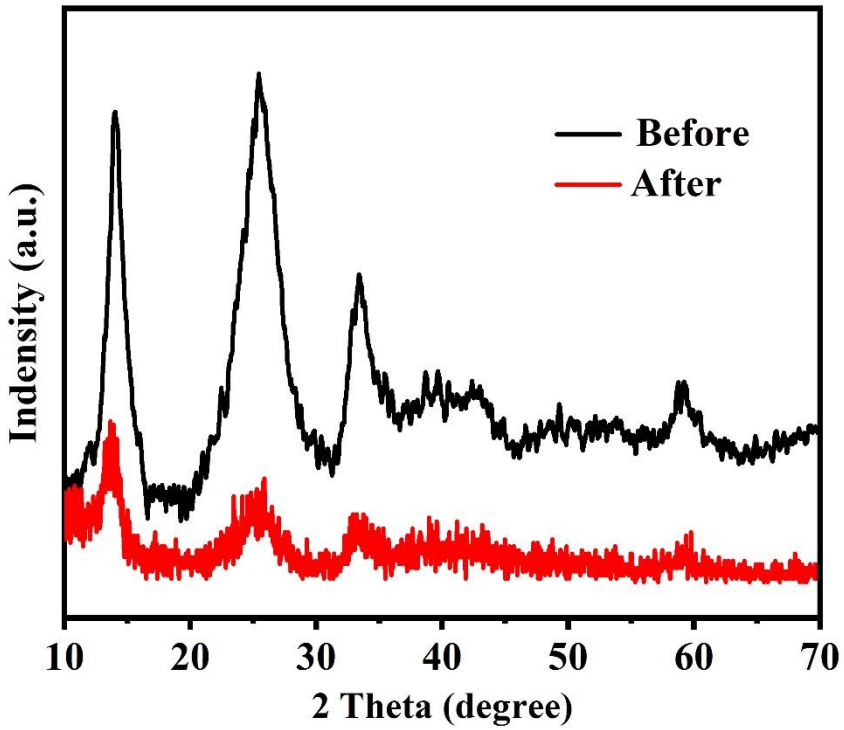

Fig.S10 XRD patterns of $CoO/MoS_2/CC$ before and after OER stability test carry out for 14 h.

Table S3 Comparison of the electrocatalytic performance of $CoO/MoS_2/CC$ for two-electrode overall water splitting with that of reported bifunctional MoS_2-based elecrocatalysts tested under similar conditions.

Samples	V_{10} (V)	V_{20} (V)	Durability test made	Ref.
$CoO/MoS_2/CC$	1.65	1.75	12 h @ 10 mA cm^{-2} (1.65 V)	This work
NiCo-MoS_2	1.48	1.58	24 h @ 10 mA cm^{-2} (1.49 V)	[1]
Co_3O_4@MoO_2/CC	1.59	1.64	12 h @ 10 mA cm^{-2} (1.65 V)	[2]
MoS_2/FNS/FeNi foam	1.62	1.76	40 h @ 10 mA cm^{-2} (1.62V)	[3]
NiN@2M-MoS_2	1.58	1.59	300 h @ 1000 mA cm^{-2} (1.65V)	[5]

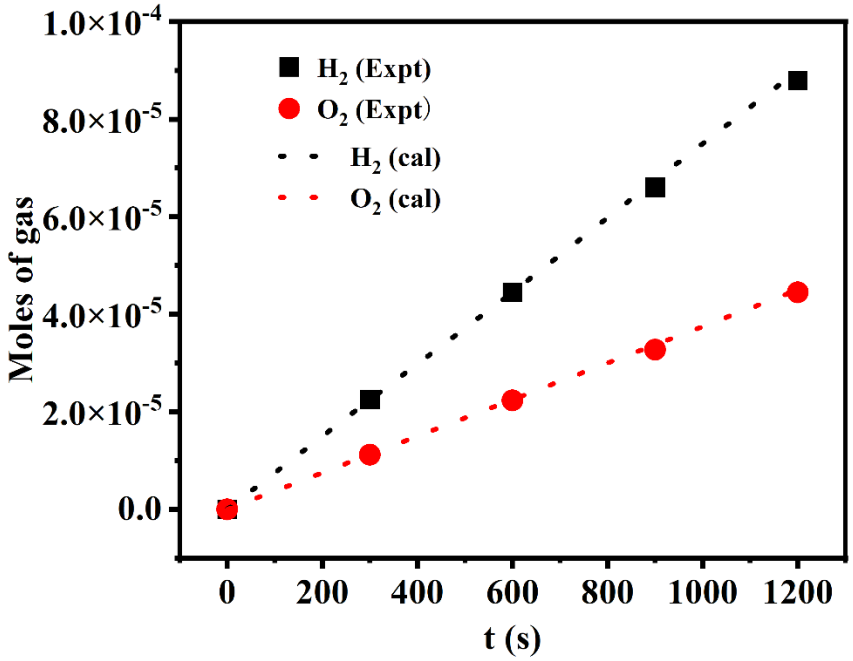

Fig. S11 Faradic current efficiency for HER and OER of CoO/MoS_2/CC electrode measured at 10 mA cm^{-2} using conventional water displacement. The active electrode area of the cathode and anode was 1.5 cm^2.

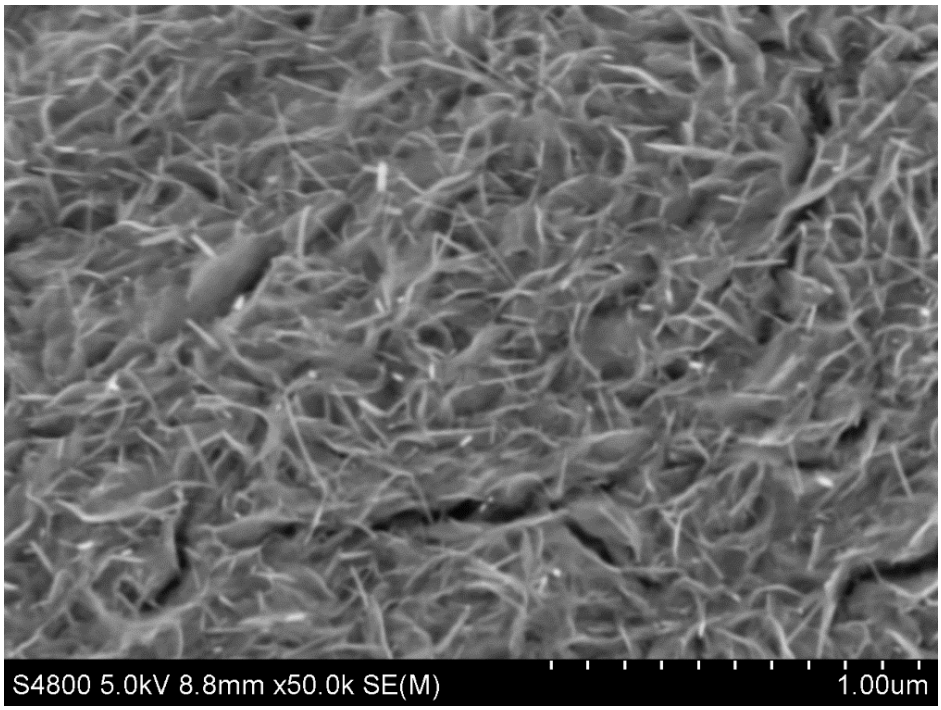

Fig. S12 SEM image of CoO/MoS_2/CC after 14 h chronopotentiometric curve test in a two-electrode configuration.

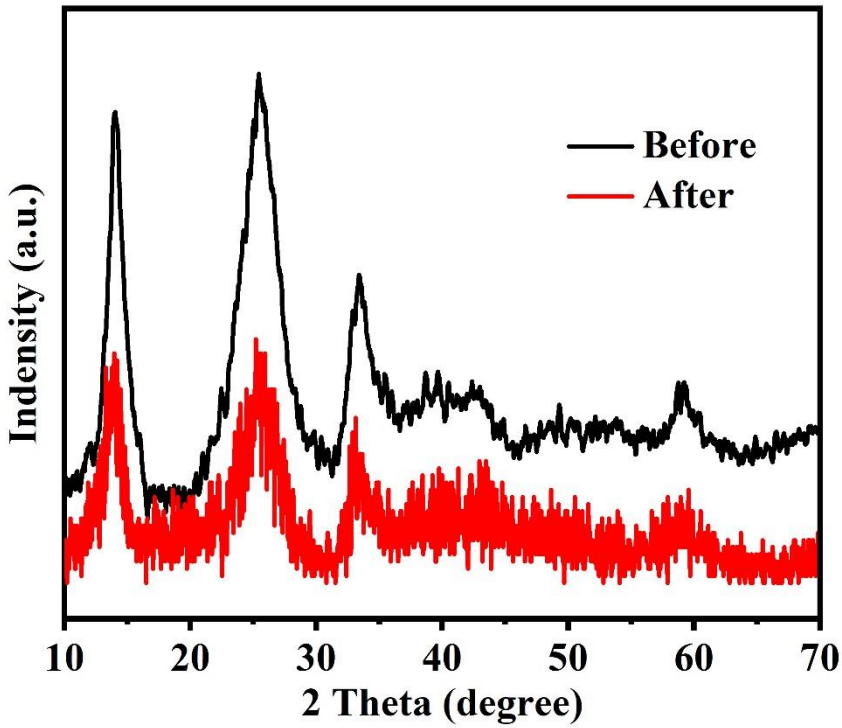

Fig. S13 XRD patterns of CoO/MoS_2/CC before and after 14 h chronopotentiometric curve test in a two-electrode configuration.

References:

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