Supporting Information:

Reversible hydrogen electrode potential conversion. In electrochemical measurements, the applied bias voltage is converted to a potential relative to the RHE using the Nernst equation (Equation 1). A three-electrode configuration was employed in the experiment, with foam nickel, NF-$NiSe_2$, and NF-$NiSe_2$/$CoSeO_3$ electrodes serving as the working electrodes, a Pt electrode as the counter electrode, and a Hg/HgO electrode as the reference electrode.

$$E_{RHE} = E_{Hg/HgO} + 0.059\,pH + 0.098 \tag{1}$$

where Hg/HgO is the bias pressure applied relative to the Hg/HgO electrode with a pH of 13.9.

The double-layer capacitance current is calculated as half of the difference between the anodic and cathodic currents (Δj = ja-jc) in the CV curve. A linear fit is performed with the scan rate, and the slope of the resulting line corresponds to 2Cdl, from which the Cdl value is then calculated.

Supplementary Note.

Fig. S1 SEM morphology of $NiSe_2$ and corresponding Ni and Se element mappings.
Fig. S2 SEM morphology of NF.
Fig. S3 TEM and HRTEM images of $NiSe_2$/$CoSeO_3$.
Fig. S4 XPS high-resolution spectrum of Co in $NiSe_2$/$CoSeO_3$.
Fig. S5 CV curves corresponding to the calculated Cdl of nickel foam, NF-$NiSe_2$, and NF-$NiSe_2$/$CoSeO_3$.
Fig S6 Enlarged view of the Cdl for nickel foam and NF-$NiSe_2$.
Fig S7 Impedance fitting circuit diagram at open-circuit potential.
Fig.S8 27-hour stability test of NF-$NiSe_2$ and NF-$NiSe_2$/$CoSeO_3$.
Table S1 Fitting values corresponding to the impedance spectra equivalent circuit diagram.

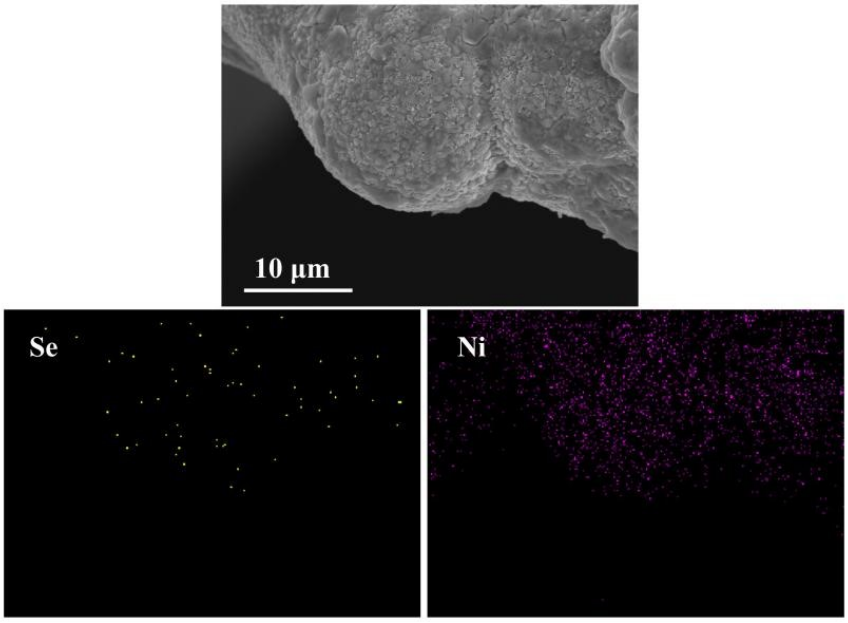

Fig. S1 SEM morphology of $NiSe_2$ and corresponding Ni and Se element mappings.

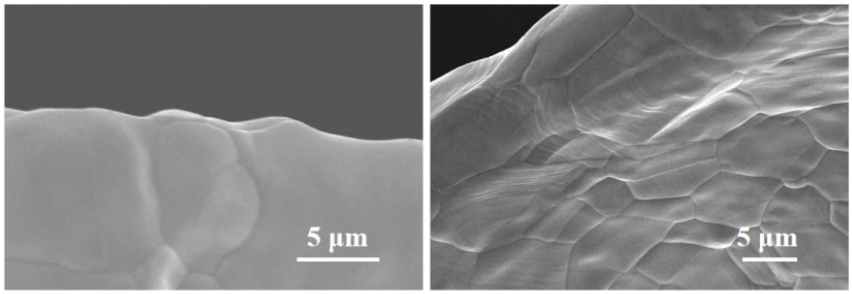

Fig. S2 SEM morphology of NF.

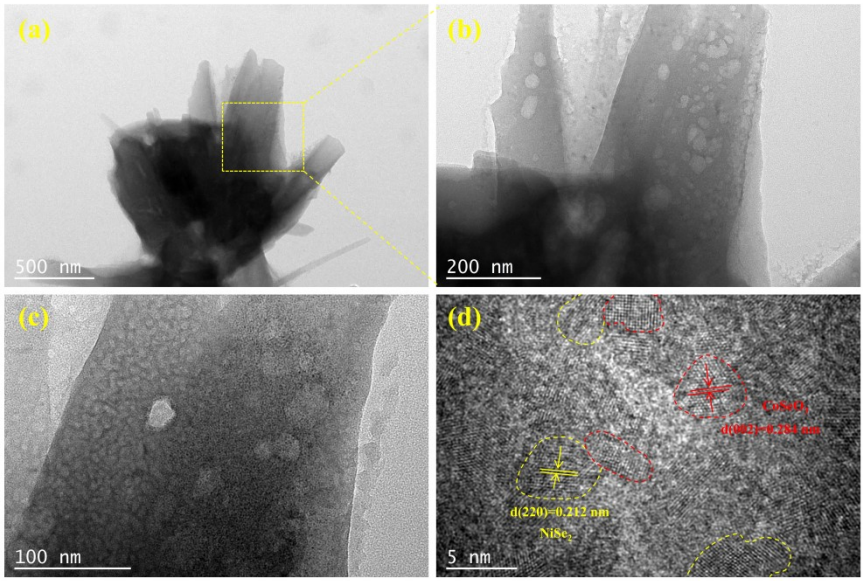

Fig. S3 TEM and HRTEM images of $NiSe_2/CoSeO_3$.

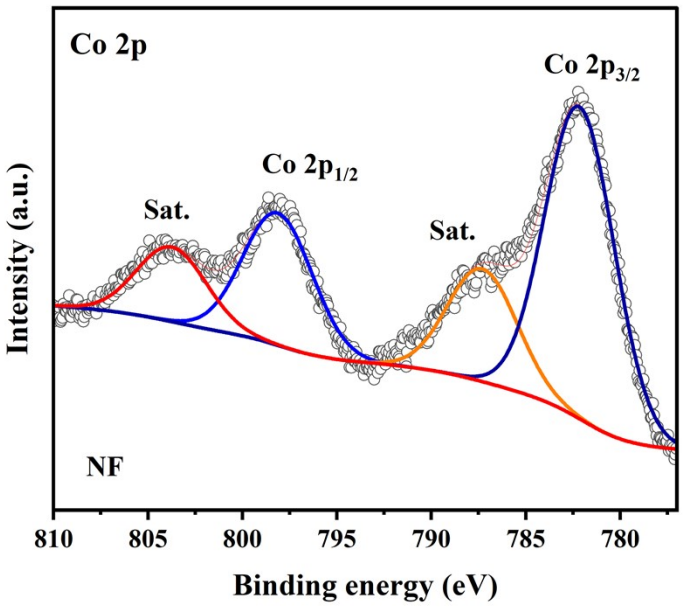

Fig. S4 XPS high-resolution spectrum of Co in $NiSe_2/CoSeO_3$.

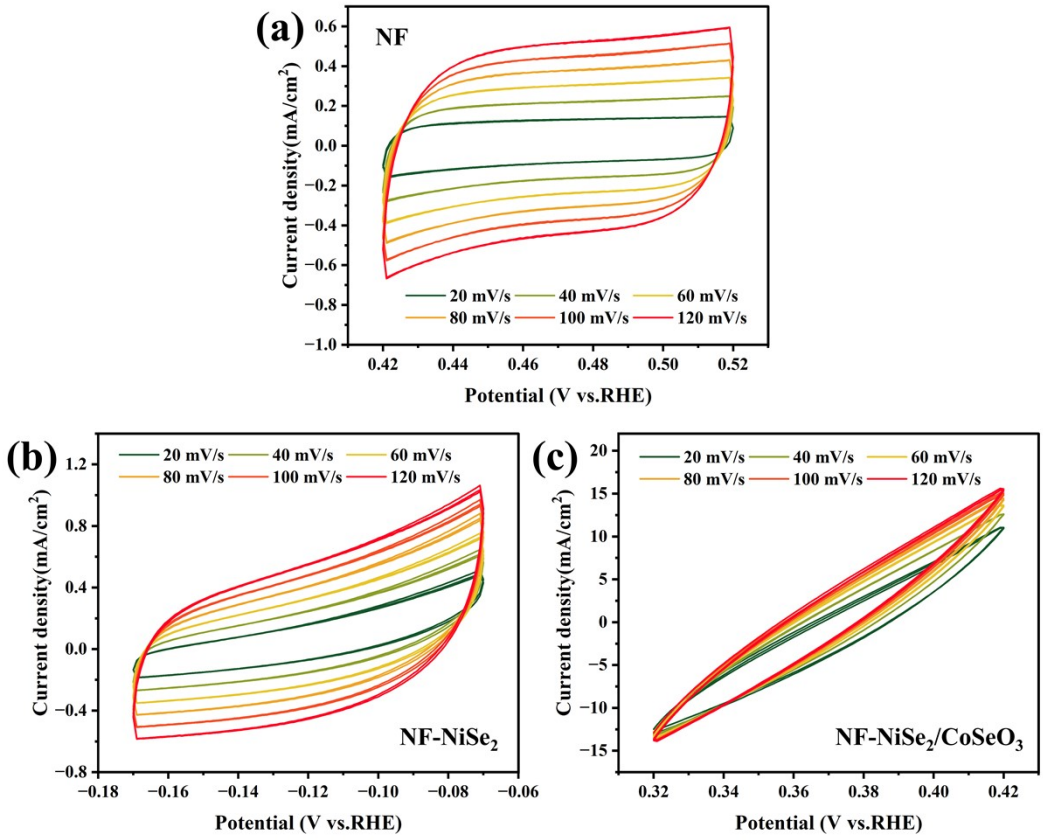

Fig. S5 CV curves corresponding to the calculated Cdl of nickel foam, NF-$NiSe_2$, and NF-$NiSe_2/CoSeO_3$.

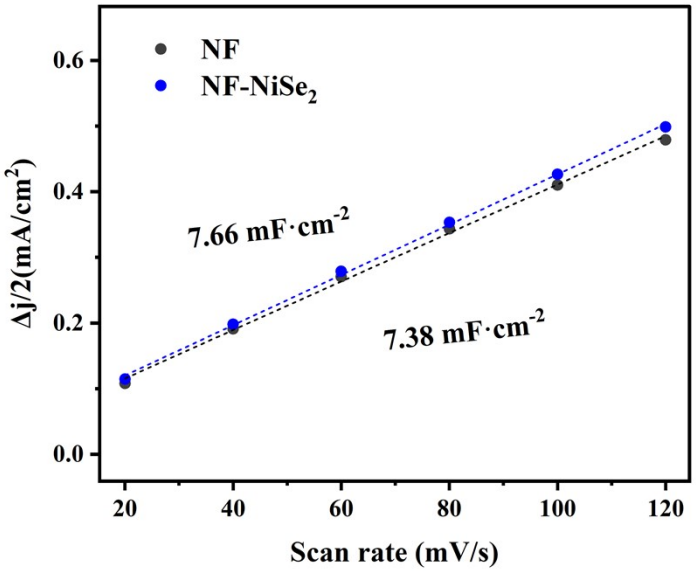

Fig S6 Enlarged view of the Cdl for nickel foam and NF-$NiSe_2$.

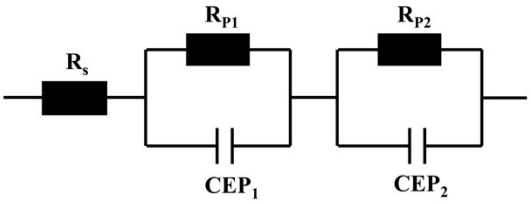

Fig S7 Impedance fitting circuit diagram at open-circuit potential.

Supplementary Note 1 In the equivalent circuit, R_s represents the Ohmic resistance of the electrolyte, electrode, and their contact interface; R_p represents the impedance of charge transfer at the electrode/electrolyte interface, reflecting the kinetics of the electrocatalytic reaction; CPE describes the double-layer capacitance at the interface and the roughness or heterogeneity of the electrode surface.

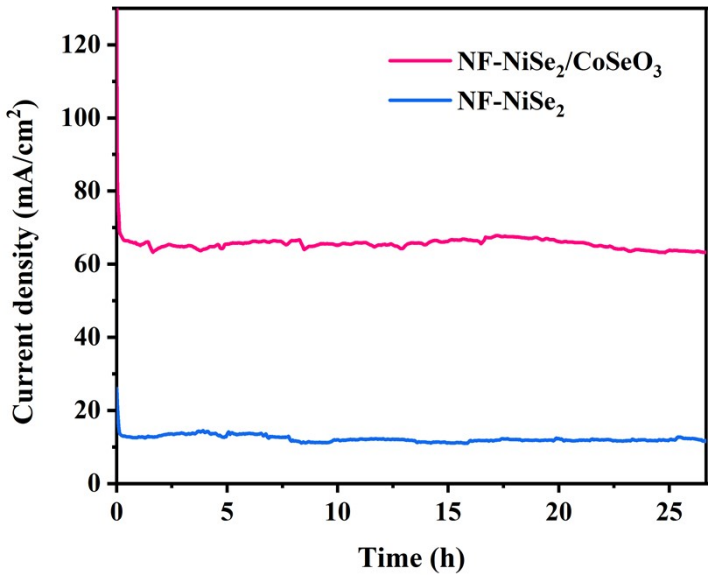

Fig.S7 27-hour stability test of NF-$NiSe_2$ and NF-$NiSe_2$/$CoSeO_3$.

Table S1 Fitting values corresponding to the impedance spectra equivalent circuit diagram.

Samples	R_s	R_{p1}	α_1	R_{p2}	α_2
NF	2.309	614.3	0.540	72.24	0.945
NF-$NiSe_2$	2.063	396.7	0.708	66.17	1.157
NF-$NiSe_2$/$CoSeO_3$	2.763	210.3	0.785	59.28	1.337