Supporting Information for

Post Cobalt Doping and Defect Engineering of NbSSe for Efficient Hydrogen Evolution Reaction

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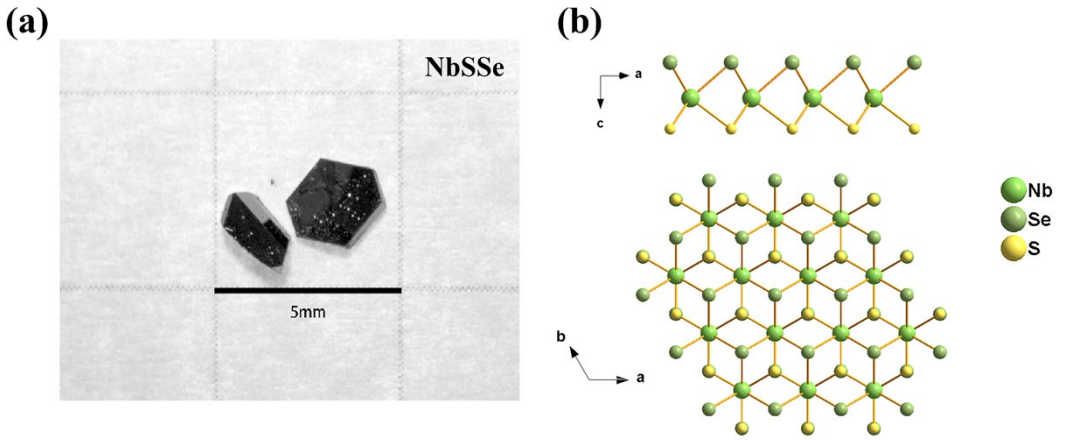


Fig. S1 (a) Optical image of the single crystal flakes of NbSSe (b) Schematic crystal structure of NbSSe.

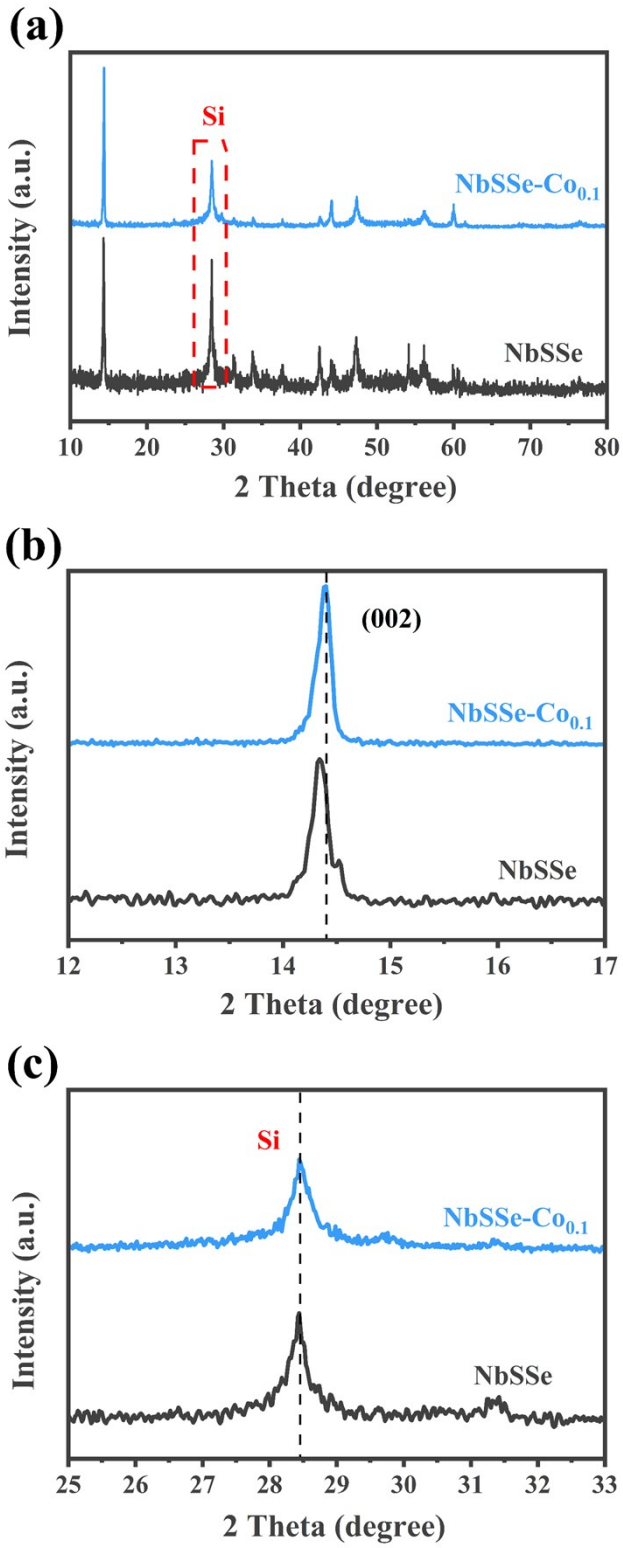


Fig. S2 (a) XRD patterns of NbSSe with added standard sample (Si) and NbSSe-$Co_{0.1}$ with added standard sample (Si) (b-c) the partially enlarged XRD patterns of (a).

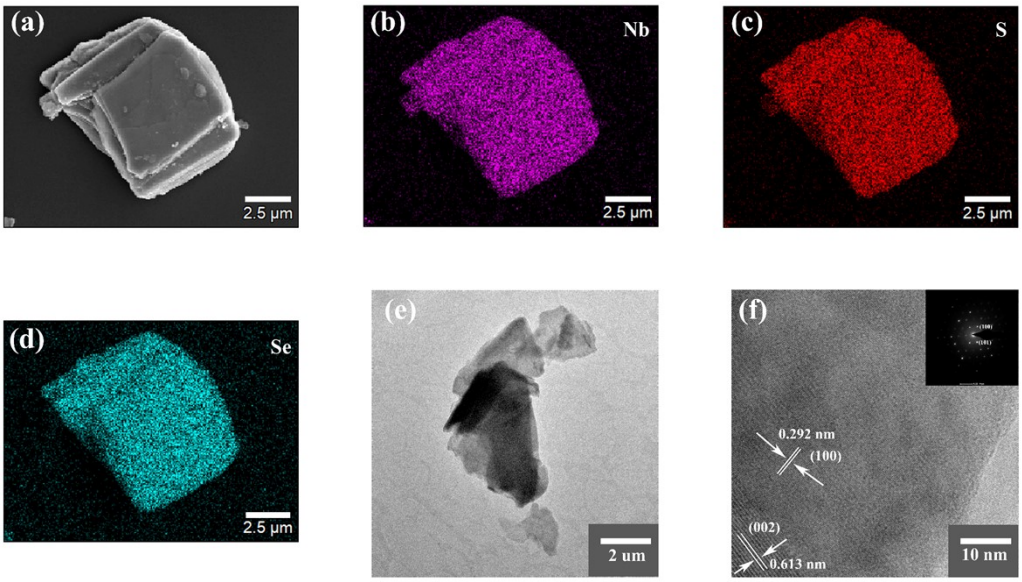


Fig. S3 (a) SEM image of NbSSe. (b-d) element mapping images of Nb, S and Se, respectively. (e) TEM image of NbSSe. (f) The HRTEM image of NbSSe. Inset shows the selected area electron diffraction image of NbSSe.

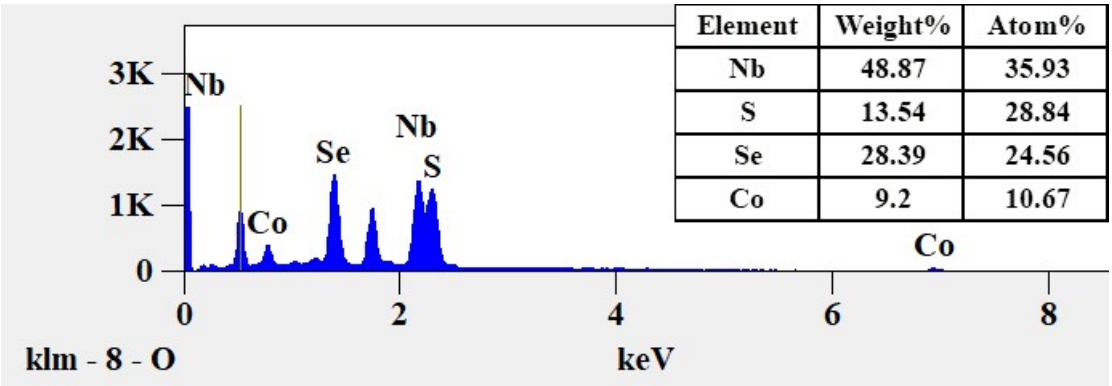
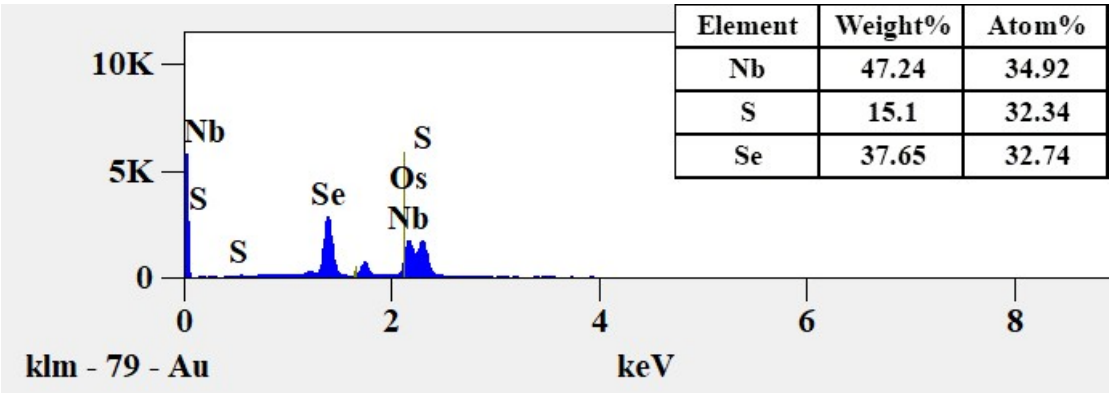
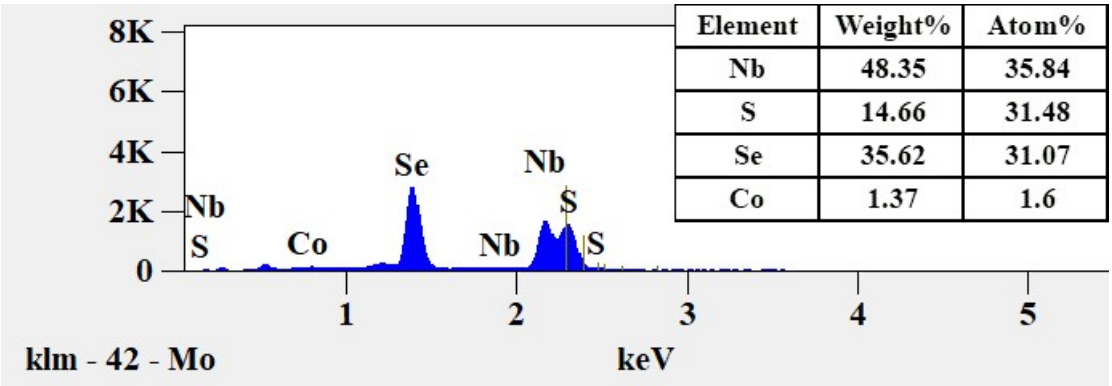


Fig. S4 SEM-EDAX results of the NbSSe-$Co_{0.1}$



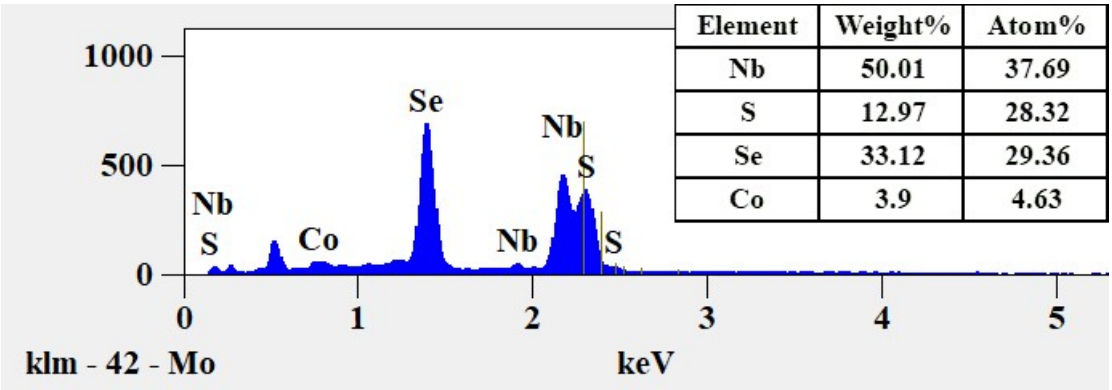
Element	Weight%	Atom%
Nb	47.24	34.92
S	15.1	32.34
Se	37.65	32.74

Fig. S5 SEM-EDAX results of the NbSSe.



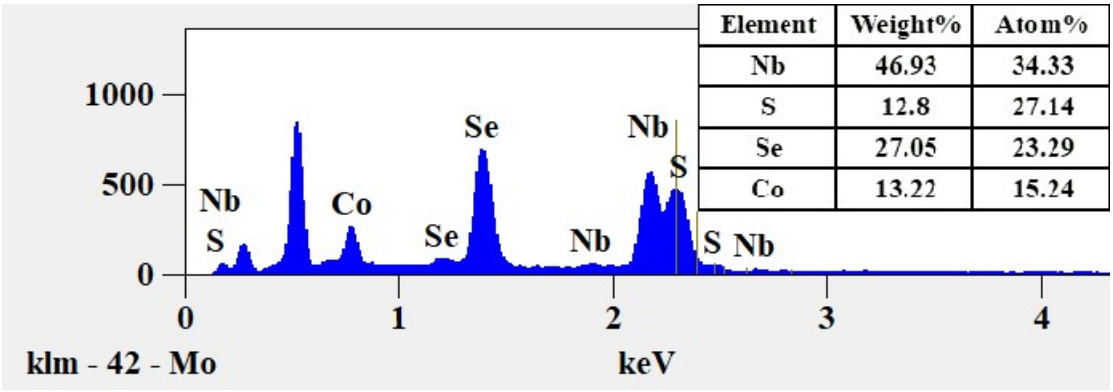
Element	Weight%	Atom%
Nb	48.35	35.84
S	14.66	31.48
Se	35.62	31.07
Co	1.37	1.6

Fig. S6 SEM-EDAX results of the NbSSe-$Co_{0.02.}$



Element	Weight%	Atom%
Nb	50.01	37.69
S	12.97	28.32
Se	33.12	29.36
Co	3.9	4.63

Fig. S7 SEM-EDAX results of the NbSSe-$Co_{0.05}$.



Element	Weight%	Atom%
Nb	46.93	34.33
S	12.8	27.14
Se	27.05	23.29
Co	13.22	15.24

Fig. S8 SEM-EDAX results of the NbSSe-$Co_{0.15}$.

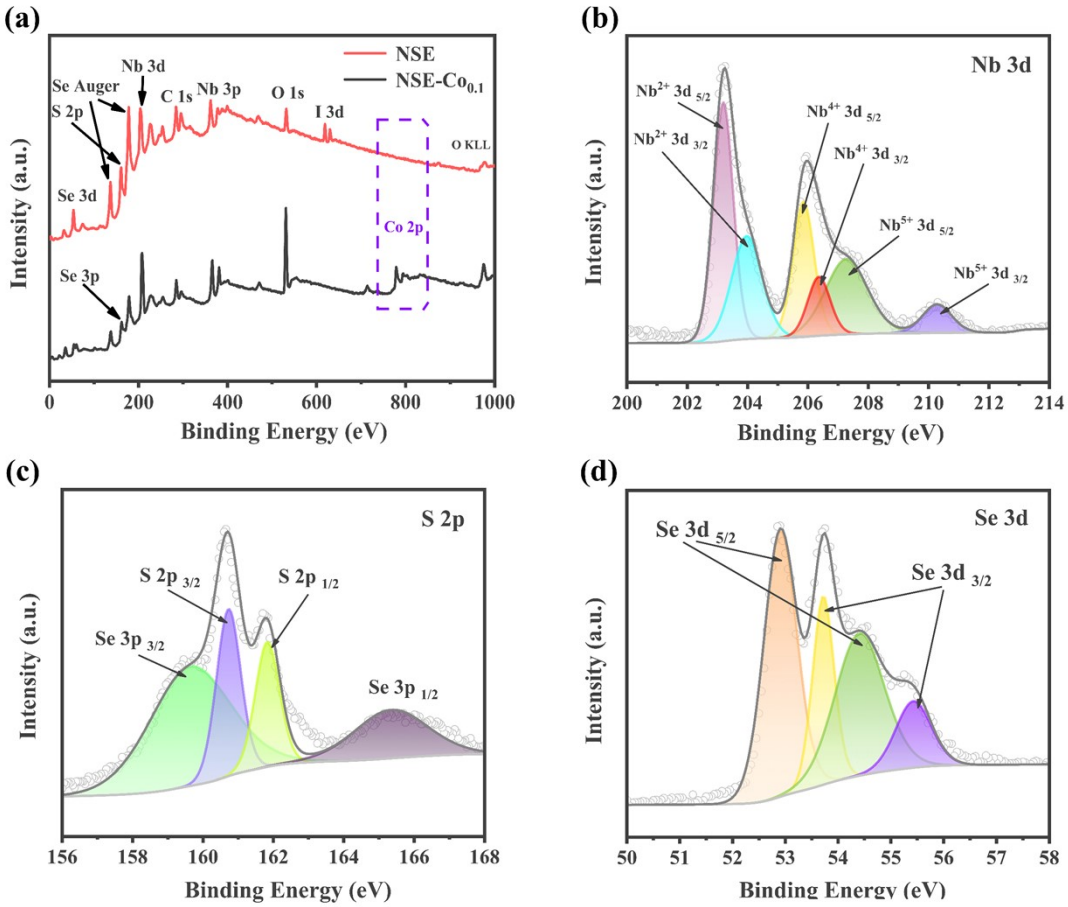


Fig. S9 XPS spectra of NbSSe (a) XPS survey spectra. (b-d) high-resolution spectra of Nb 3d, S 2P and Se 3d, respectively

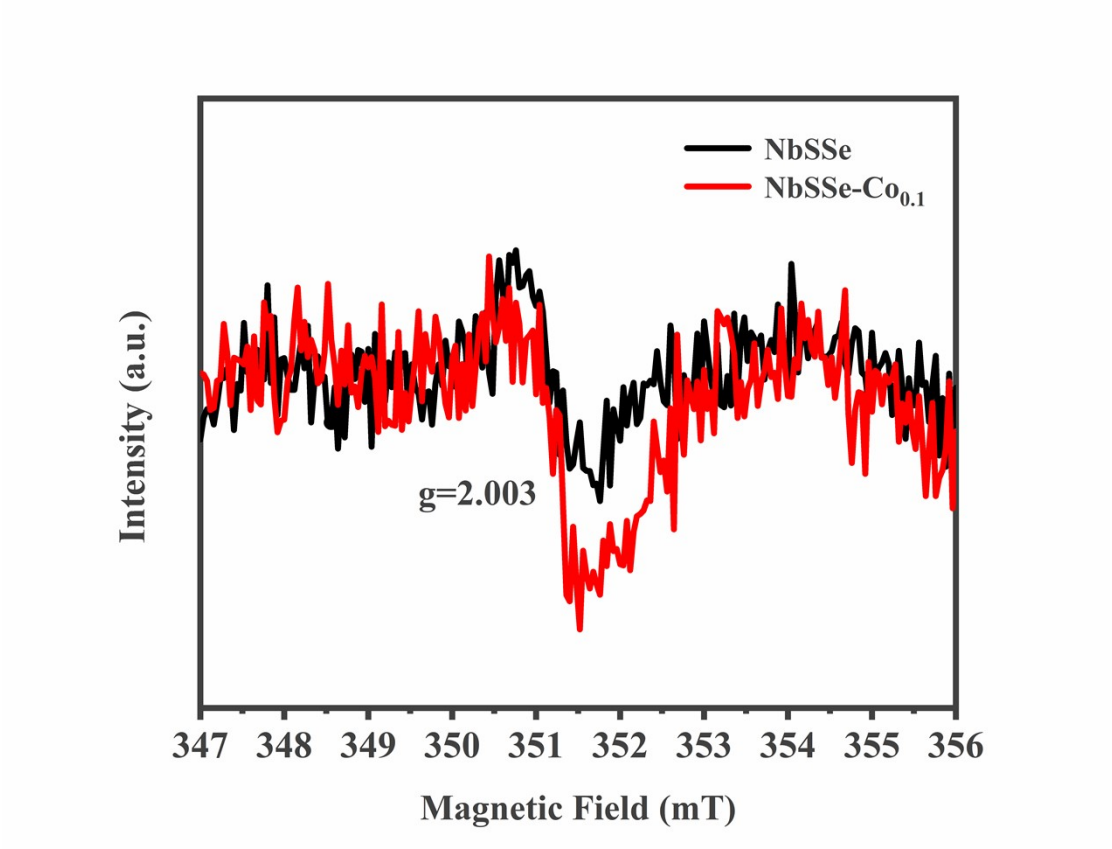


Fig. S10 EPR spectra of NbSSe and NbSSe-$Co_{0.1.}$

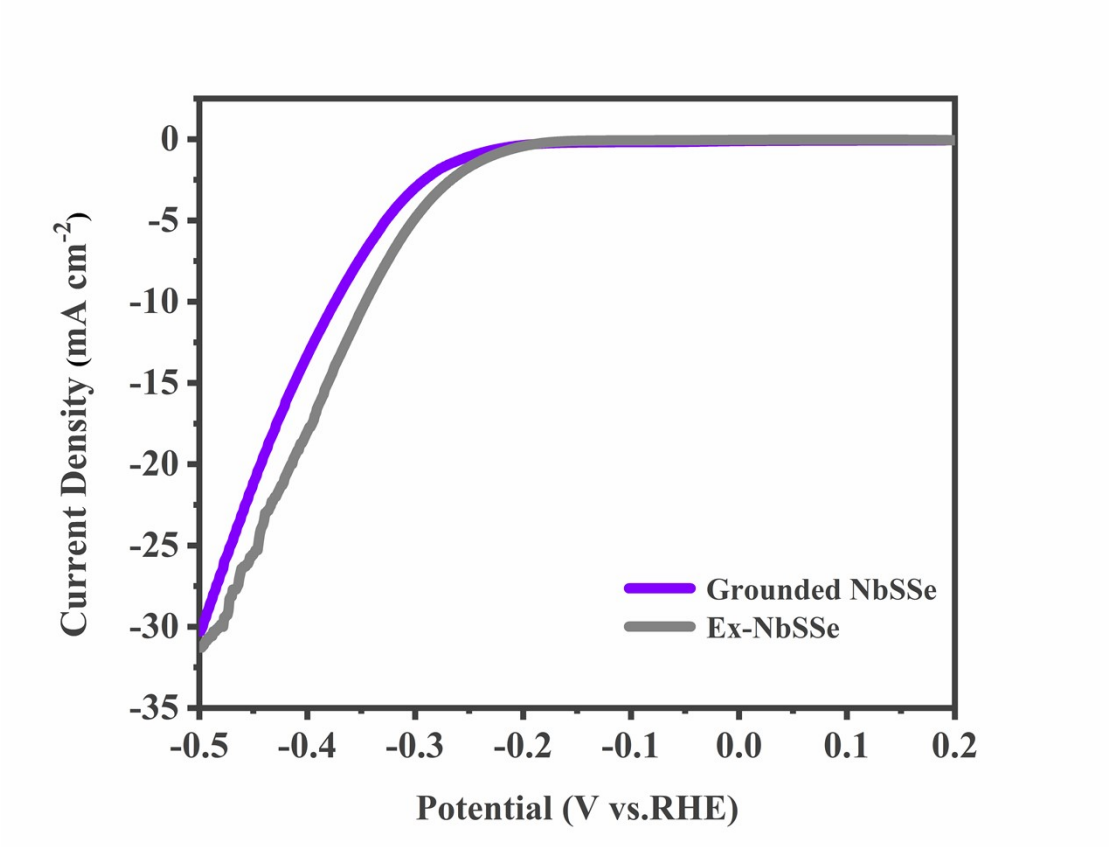


Fig. S11 The HER polarization curves for Grounded NbSSe and Ex-NbSSe.

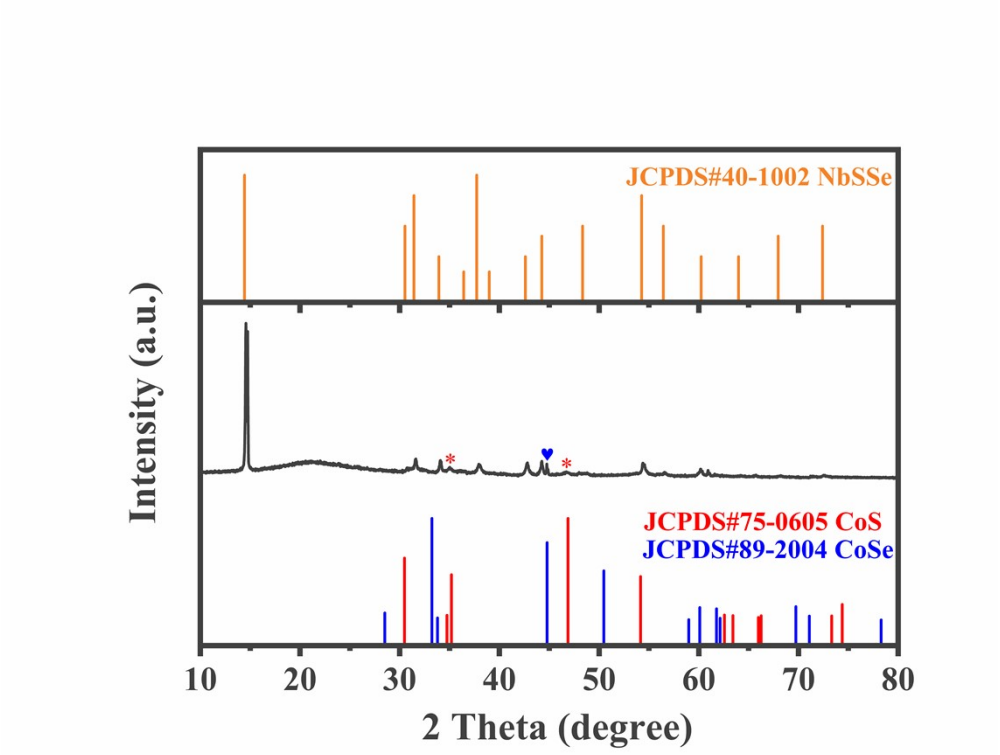


Fig. S12 XRD patterns of NbSSe doped with 15% Co.

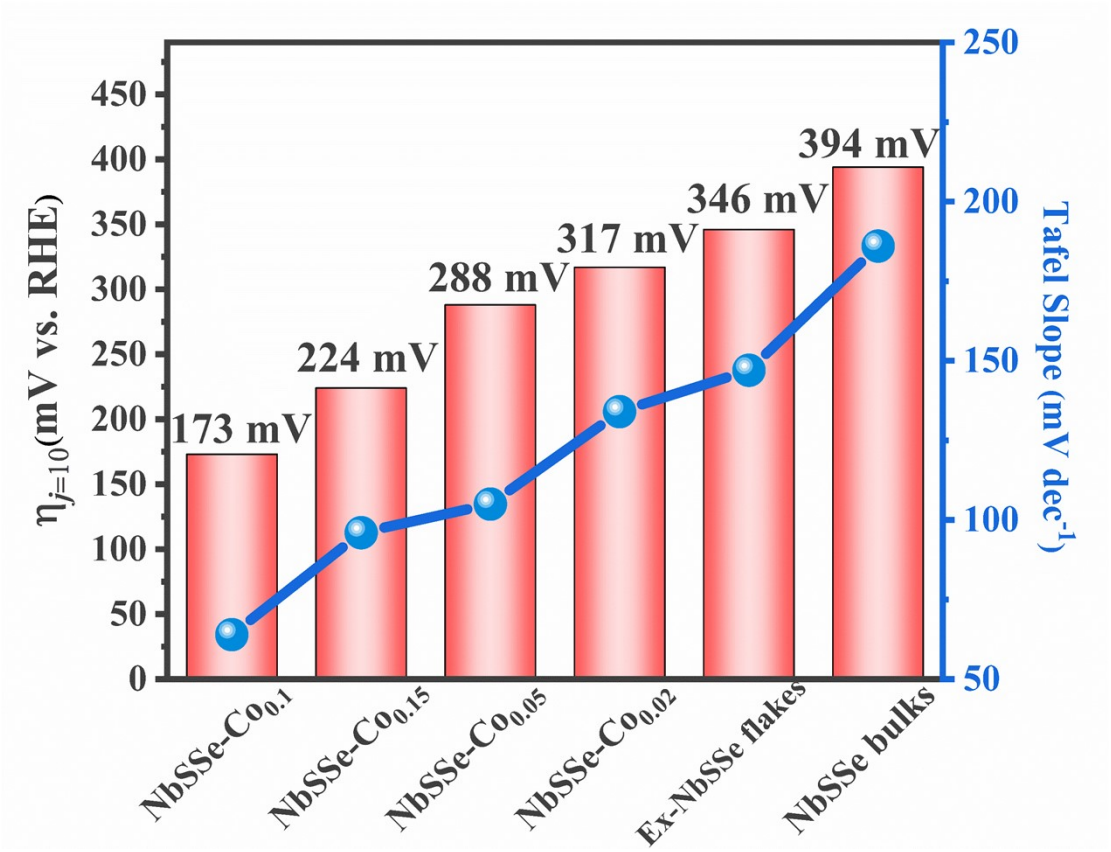


Fig. S13 Overpotentials at 10 mAcm^{-2} and Tafel slope of NbSSe bulks, Ex-NbSSe flakes, and Co-doped NbSSe.

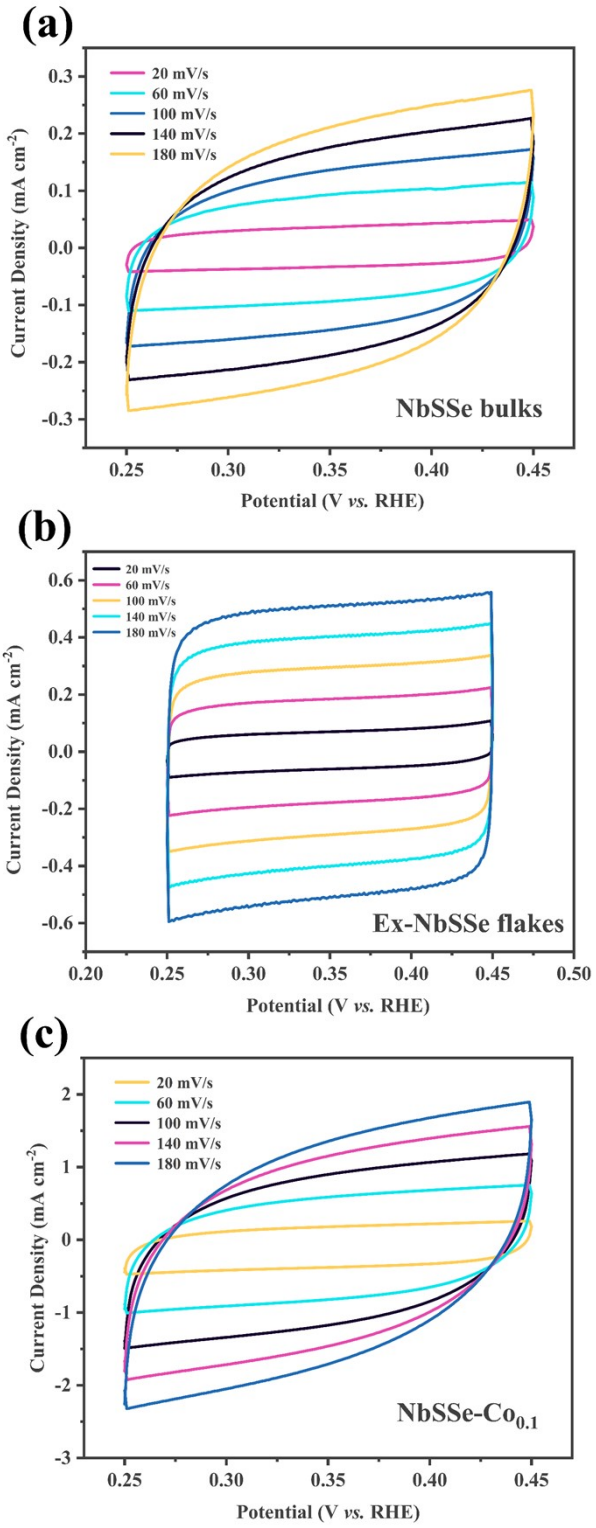


Fig. S14 Cyclic voltammograms in the region of 0.25–0.45 V vs. RHE for the (a) NbSSe bulks (b) Ex-NbSSe flakes and (c) NbSSe-$Co_{0.1}$.

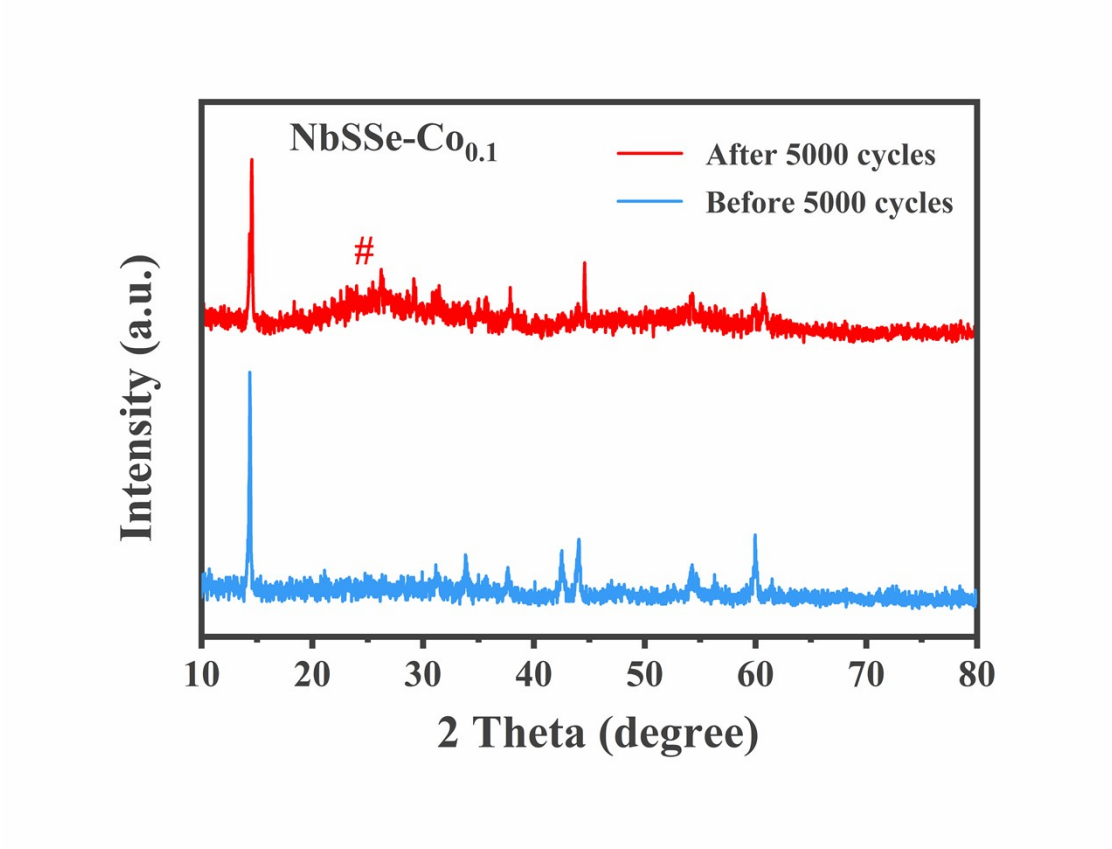


Fig. S15 XRD patterns of NbSSe-$Co_{0.1}$ before and after 5000 cycles. (The broad peak labeled as # belongs to the sample holder).