Electronic Supplementary Information

Facile sequential ion exchange strategy to synthesize $CoSe_2/FeSe_2$ double-shelled hollow nanocuboids for highly active and stable oxygen evolution reaction

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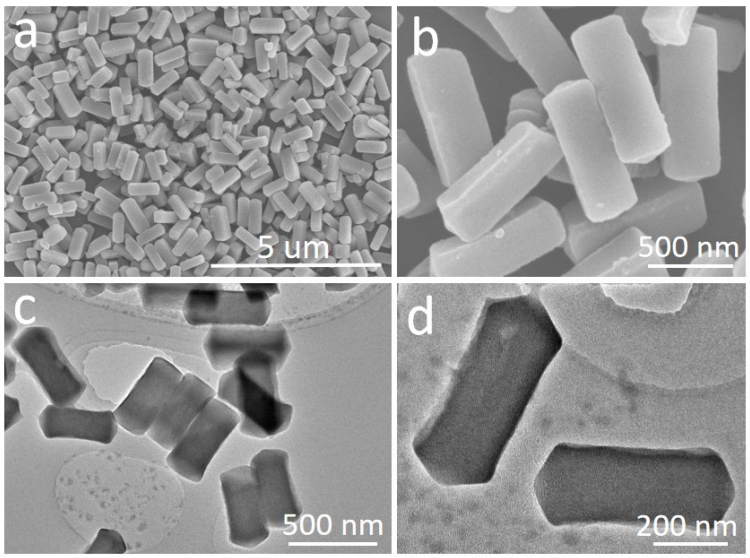

Fig. S1 (a, b) SEM images and (c, d) TEM images of the as-prepared Co-precursor NCs.

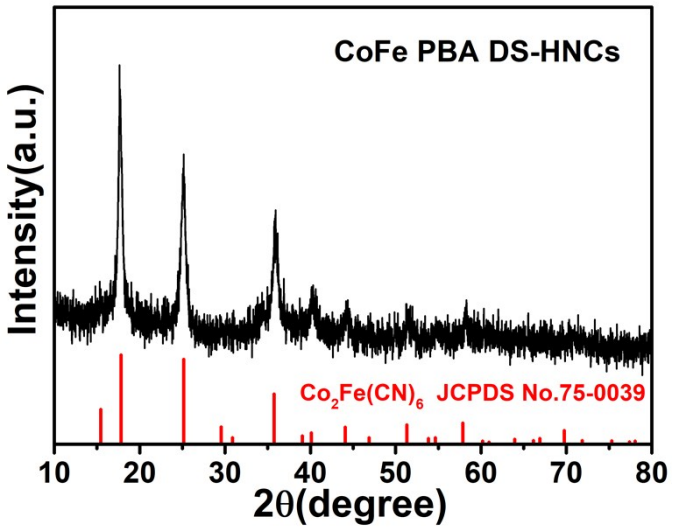

Fig. S2 XRD pattern of the as-prepared CoFe-PBA DS-HNCs.

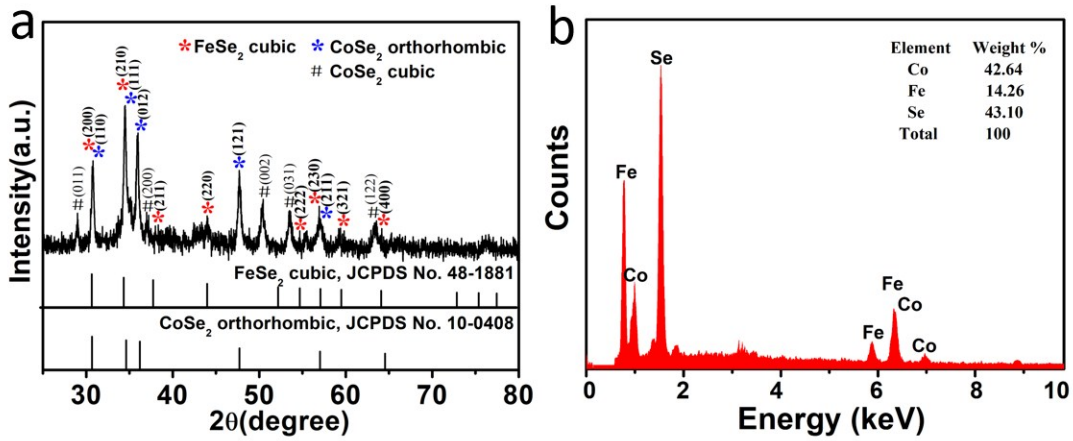

Fig. S3 (a) XRD pattern and (b) EDX spectrum of the as-prepared $CoSe_2/FeSe_2$ DS-HNCs.

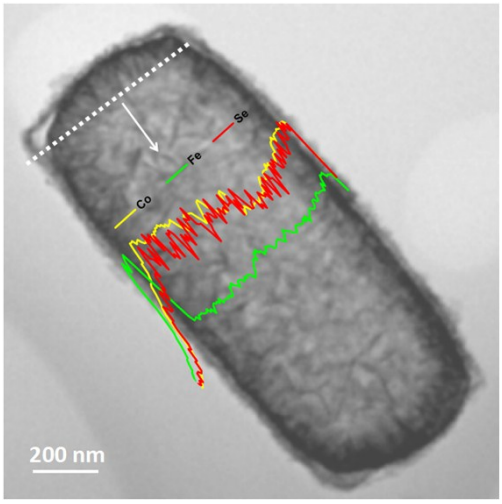

Fig. S4 STEM image and corresponding EDS line scanning of a single $CoSe_2/FeSe_2$ DS-HNC.

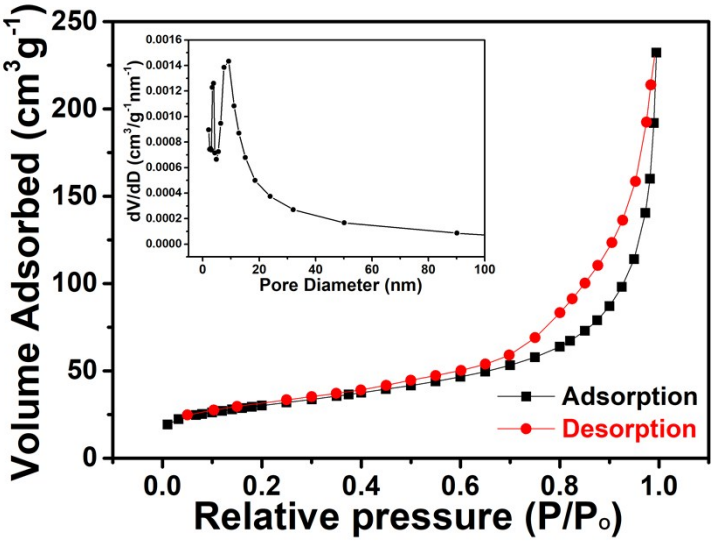

Fig. S5 N_2 adsorption-desorption isotherm and pore size distribution (inset) of the as-prepared $CoSe_2/FeSe_2$ DS-HNCs.

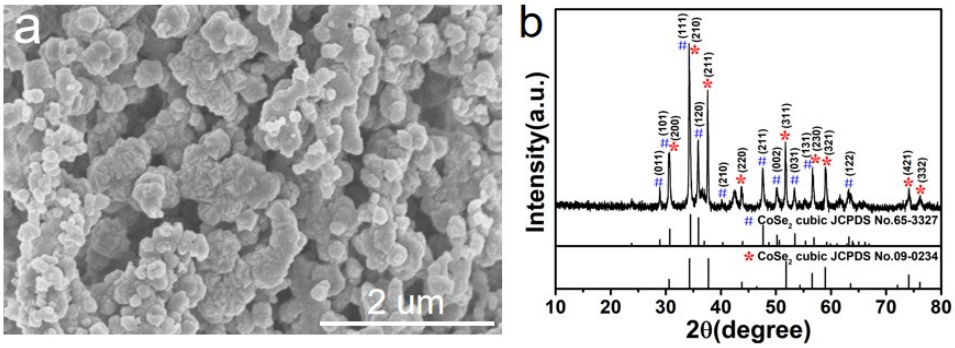

Fig. S6 (a) SEM image and (b) XRD pattern of the as-prepared $CoSe_2$ NPs.

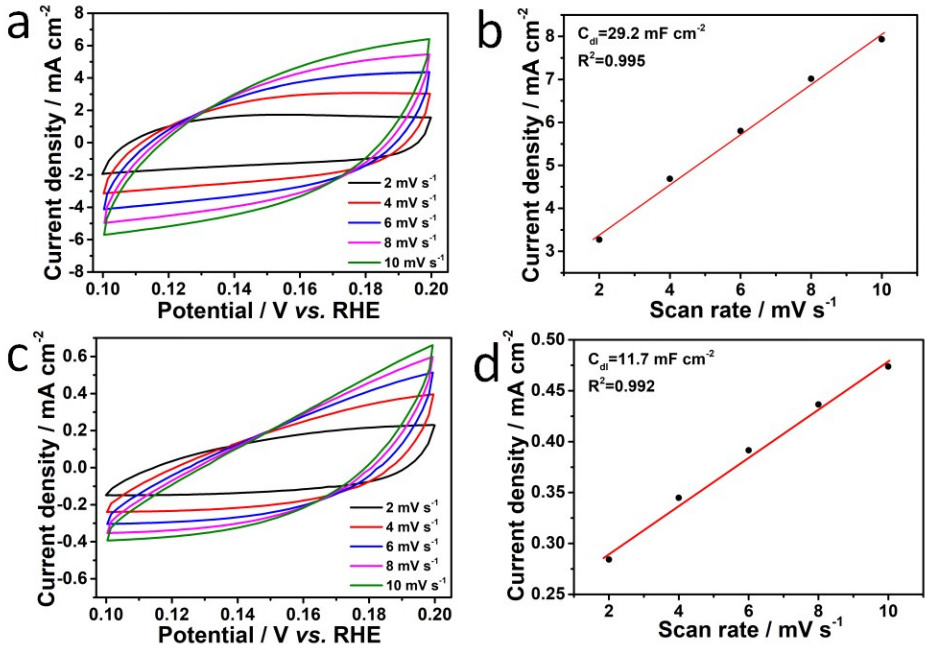

Fig. S7 Cyclic voltammogram (CV) curves of $CoSe_2/FeSe_2$ DS-HNCs (a) and $CoSe_2$ NPs (c) in the double layer region at scan rates of 2, 4, 6, 8 and 10 mV s^{-1} in 1.0 M KOH; (b) and (d) current density as a function of scan rate derived from (a) and (c), respectively.

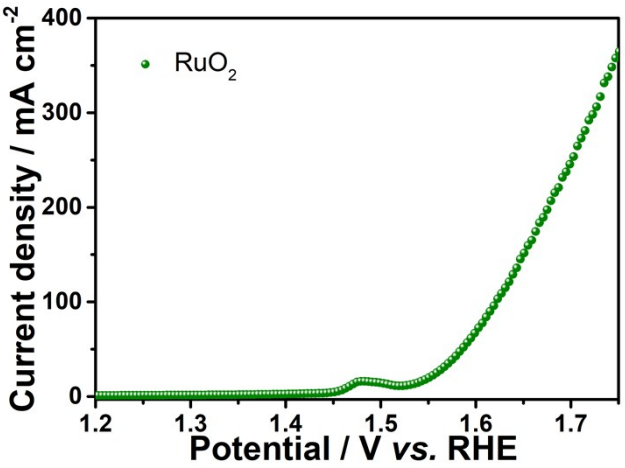

Fig. S8 LSV curve of RuO_2 for OER.

To achieve the current density of 10 mA cm^{-2}, RuO_2 catalyst needs an overpotential of 290 mV for OER.

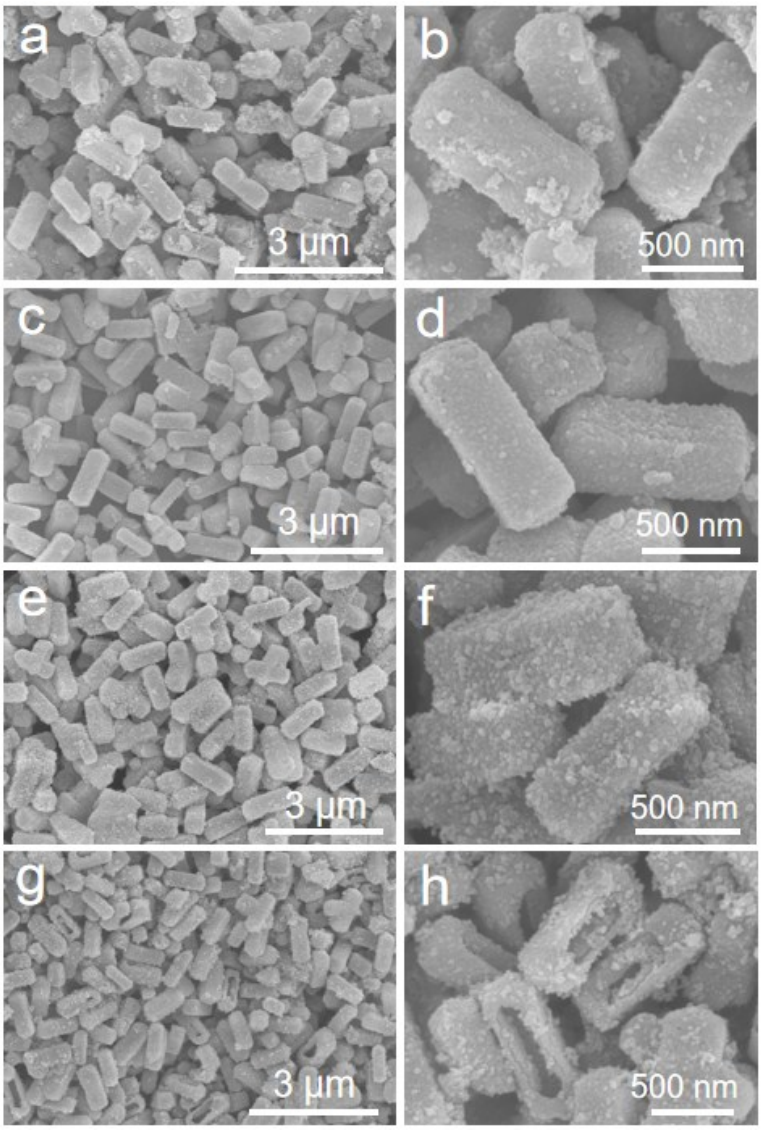

Fig. S9 SEM images of CoFe-PBA samples by using different amount of $K_3[Fe(CN)_6]$: (a, b) 20 mg, CoFe-PBA DS-HNCs-2, (c, d) 40 mg, CoFe-PBA DS-HNCs, (e, f) 60 mg, CoFe-PBA DS-HNCs-6 and (g, h) 80 mg, CoFe-PBA DS-HNCs-8.

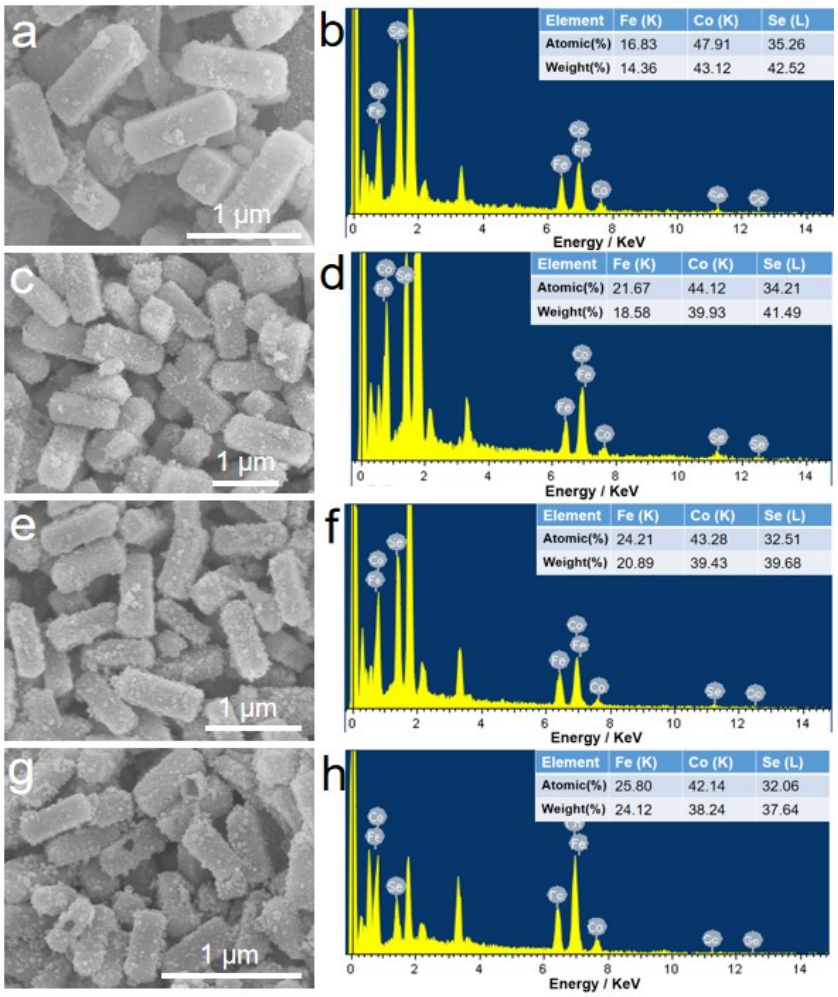

Fig. S10 SEM images, corresponding EDX patterns and the element contents (inset) of different $CoSe_2/FeSe_2$ DS-HNCs samples: (a, b) $CoSe_2/FeSe_2$ DS-HNCs-2, (c, d) $CoSe_2/FeSe_2$ DS-HNCs, (e, f) $CoSe_2/FeSe_2$ DS-HNCs-6 and (g, h) $CoSe_2/FeSe_2$ DS-HNCs-8.

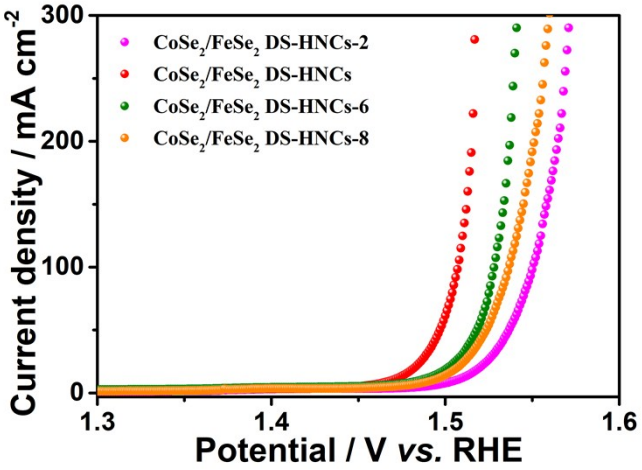

Fig. S11 LSV curves of different $CoSe_2/FeSe_2$ DS-HNCs samples.

Table S1. EIS data of $CoSe_2/FeSe_2$ DS-HNCs and $CoSe_2$ NPs for OER.

	$CoSe_2/FeSe_2$ DS-HNCs	$CoSe_2$ NPs
R_s (Ω cm^2)	1.56	1.06
R_{ct} (Ω cm^2)	2.52	7.04
CPE1-T	0.49	0.03
CPE1-P	0.97	0.71

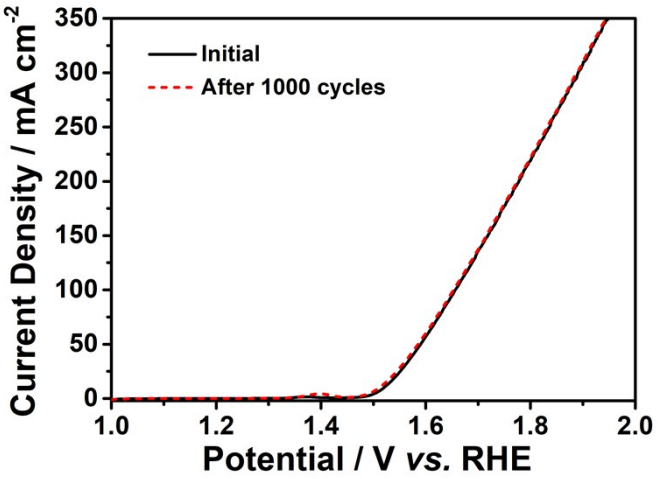

Fig. S12 The LSV curves for the $CoSe_2/FeSe_2$ DS-HNCs before and after 1000 cycles.

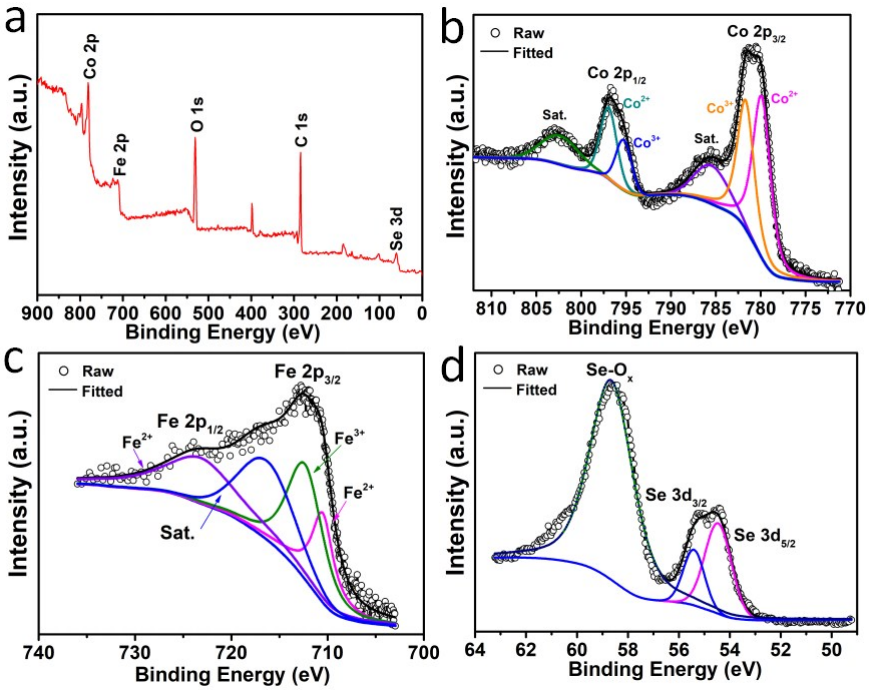

Fig. S13 XPS survey spectrum (a) and high-resolution XPS spectra of Co 2p (b), Fe 2p (c) and Se 3d (d) of the as-prepared $CoSe_2/FeSe_2$ DS-HNCs after OER test.

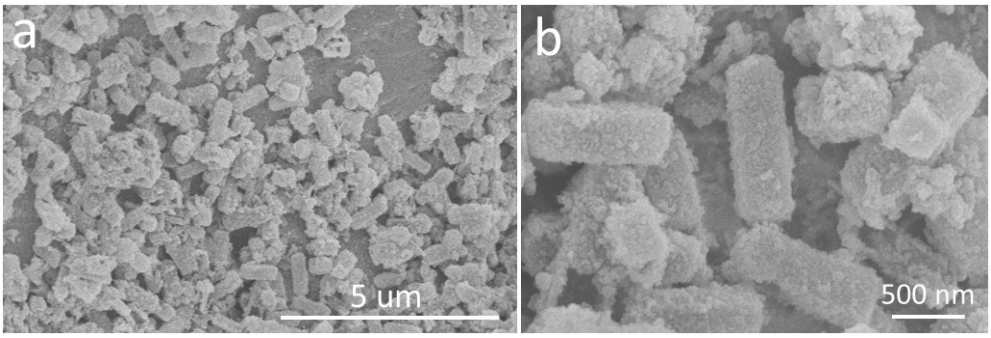

Fig. S14 SEM images of the as-prepared $CoSe_2/FeSe_2$ DS-HNCs after OER test.

Table S2. Comparison of OER performance with recently reported metal selenides catalysts in alkaline medium.

Catalysts	Overpotential (mV) at 10 mA cm^{-2}	References
$CoSe_2$ nanosheets	320	*J. Am. Chem. Soc.* **2014**, *136*, 15670.
$Co_{0.85}Se$	324	*Adv. Mater.* **2016**, *28*, 77.
Ag-$CoSe_2$-belt	320	*Angew. Chem. Int. Ed.* **2017**, *56*, 328.
$Ni_{0.88}Co_{1.22}Se_4$	320	*Chem. Mater.* **2017**, *29*, 7032.
(Ni,Co)Se-GA	250	*ACS Catal*. **2017**, *7*, 6394.
$Co_{0.85}Se$@NC	320	*J. Mater. Chem. A* **2017**, *5*, 7001.
NiSe	290	*Adv. Energy Mater.* **2018**, *8*, 1702704.
Fe-doped $NiSe_2$	268	*Angew. Chem. Int. Ed.* **2018**, *57*, 4020.
$FeSe_2$@$CoSe_2$/rGO	260	*ACS Appl. Mater. Interfaces* **2018**, *10*, 19258.
$Fe_{0.09}Co_{0.13}$-$NiSe_2$	251	*Adv. Mater.* **2018**, *30*, 1802121.
$CoSe_2$/$FeSe_2$ DS-HNCs	240	This work