

## Supporting Information

### **Metal-organic framework (MOF) derived plate-shaped CoS<sub>1.097</sub> nanoparticles for improved hydrogen evolution reaction**

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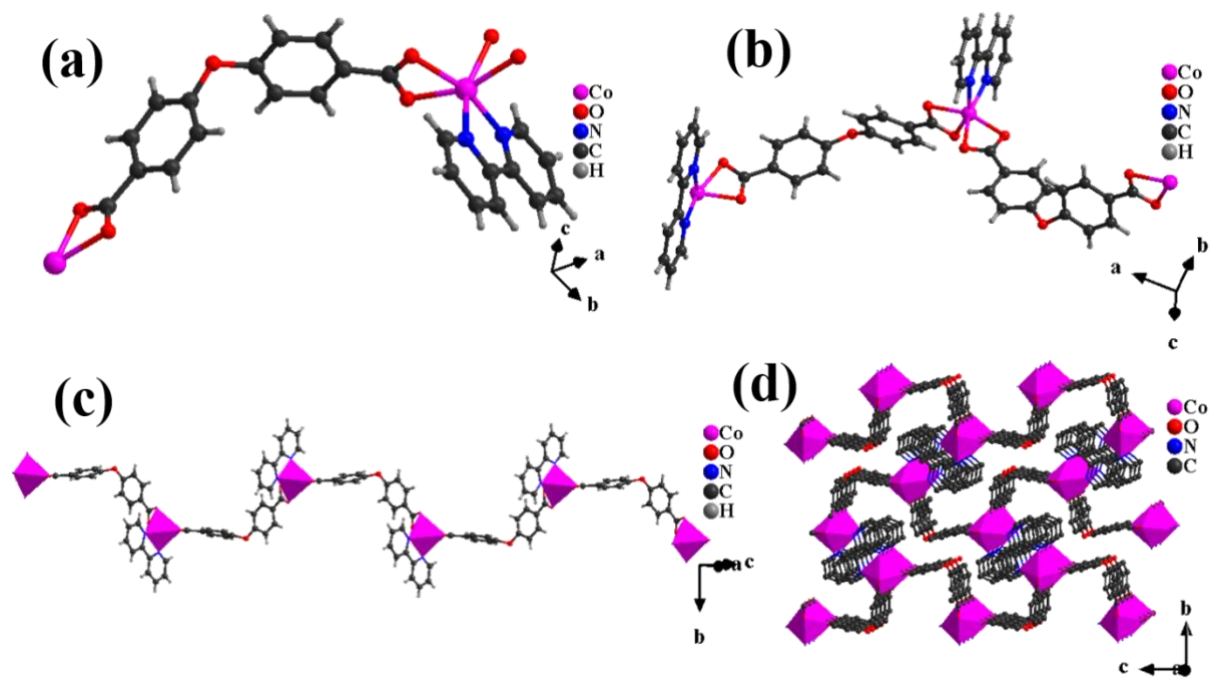


Fig. S1 Crystal structures arrangement of Co-MOF (a-d).

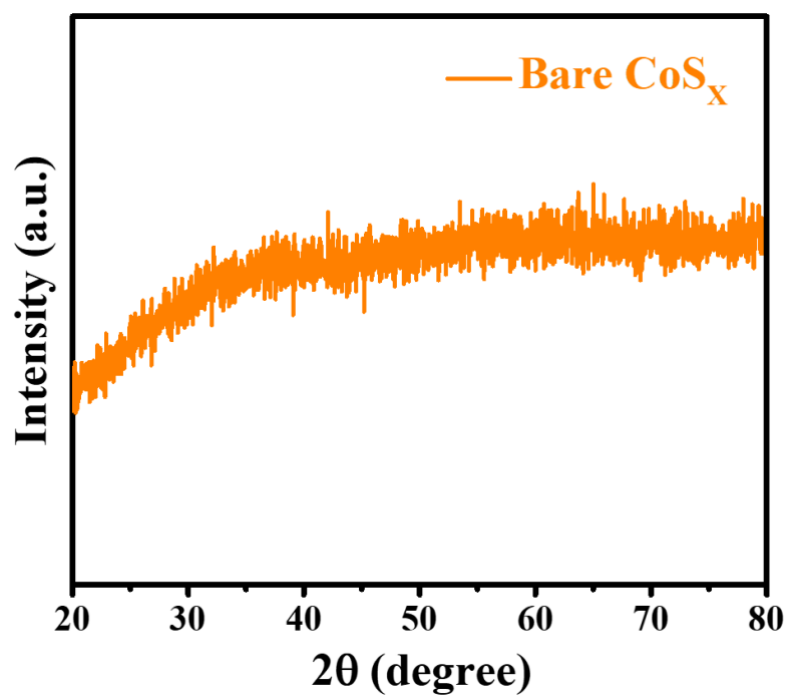
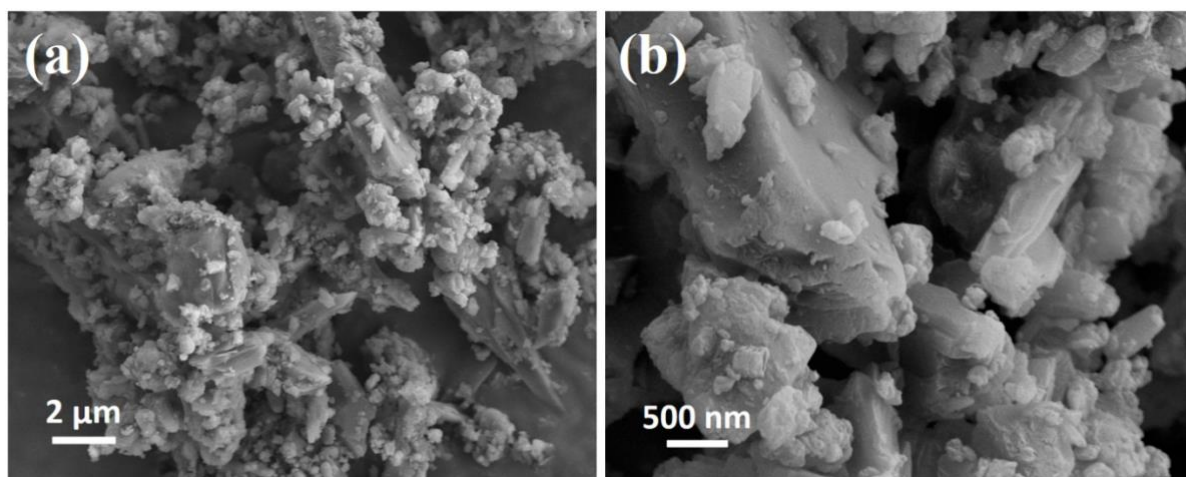
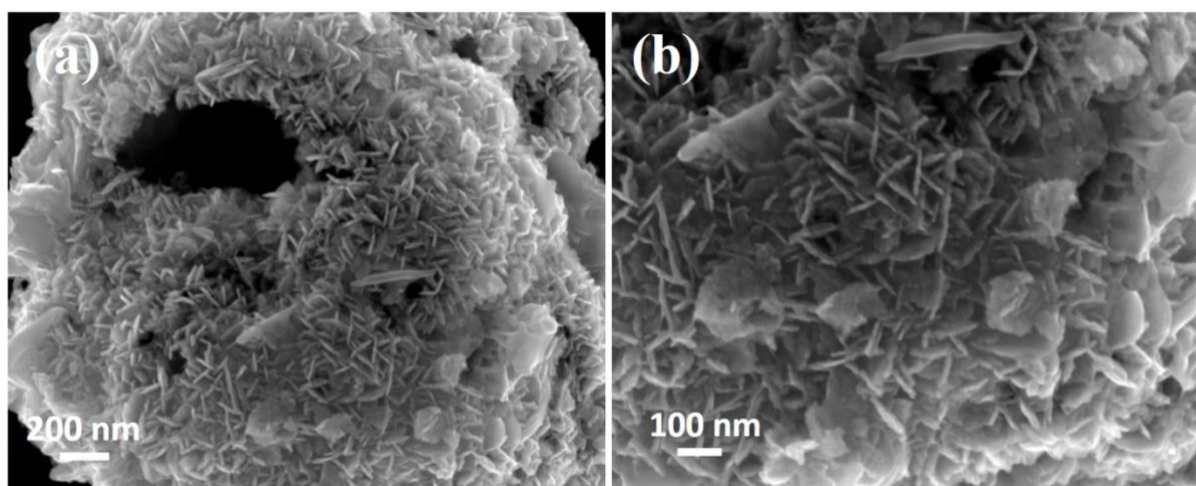


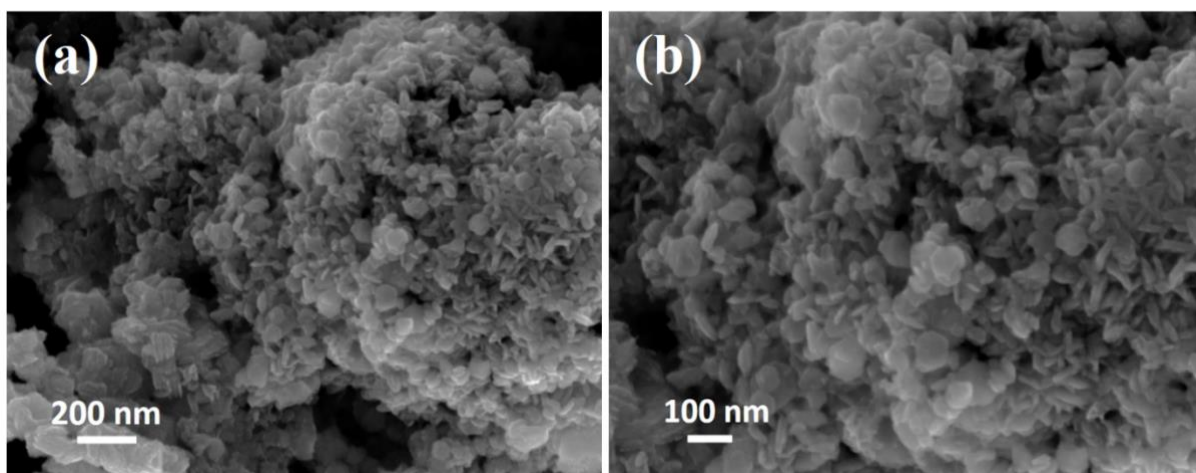
Fig. S2 X-ray diffraction study of bare  $\text{CoS}_x$ .



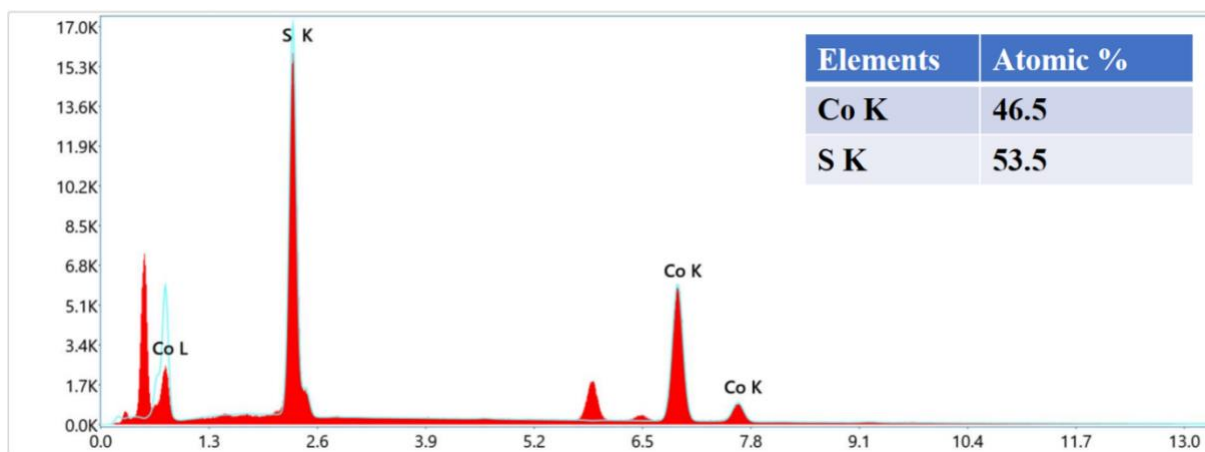
**Fig. S3** FESEM images of Co-MOF at lower to higher magnifications.



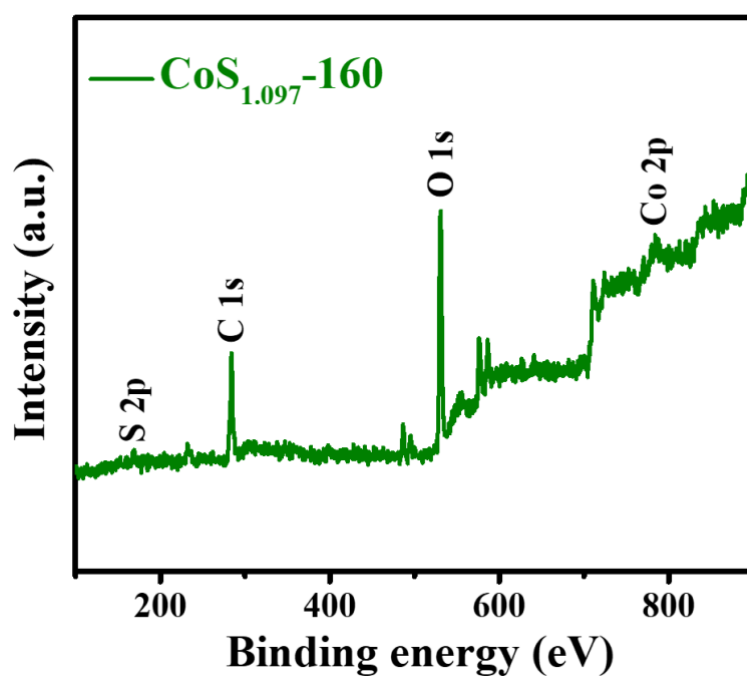
**Fig. S4** FESEM study of CoS<sub>1.097-140</sub> at varied magnifications.



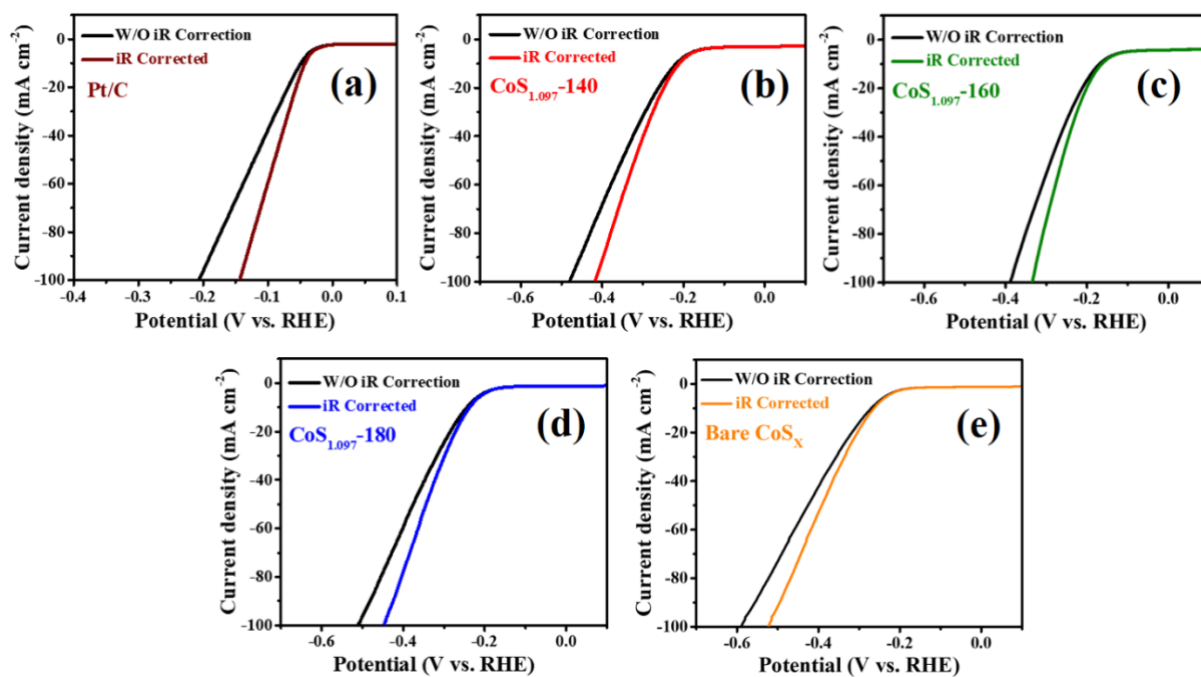
**Fig. S5** FESEM pictures of CoS<sub>1.097-180</sub> at different magnifications.



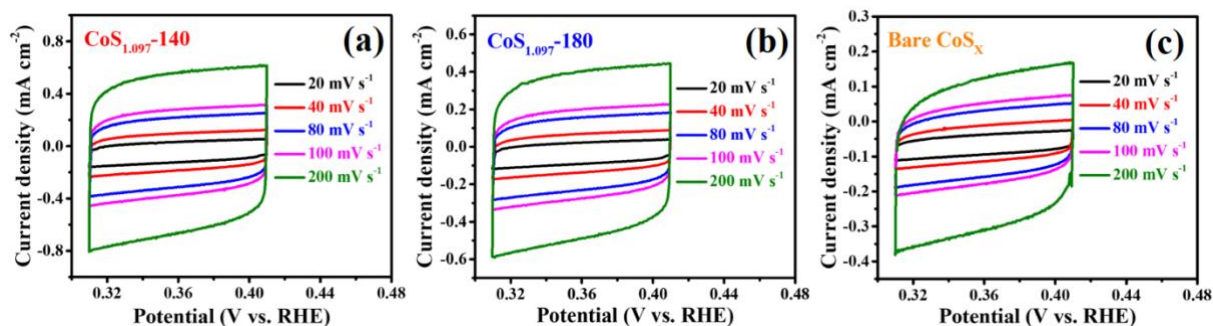
**Fig. S6** EDX spectrum of optimized  $\text{CoS}_{1.097-160}$  showing the presence and percentage of elements Co and S.



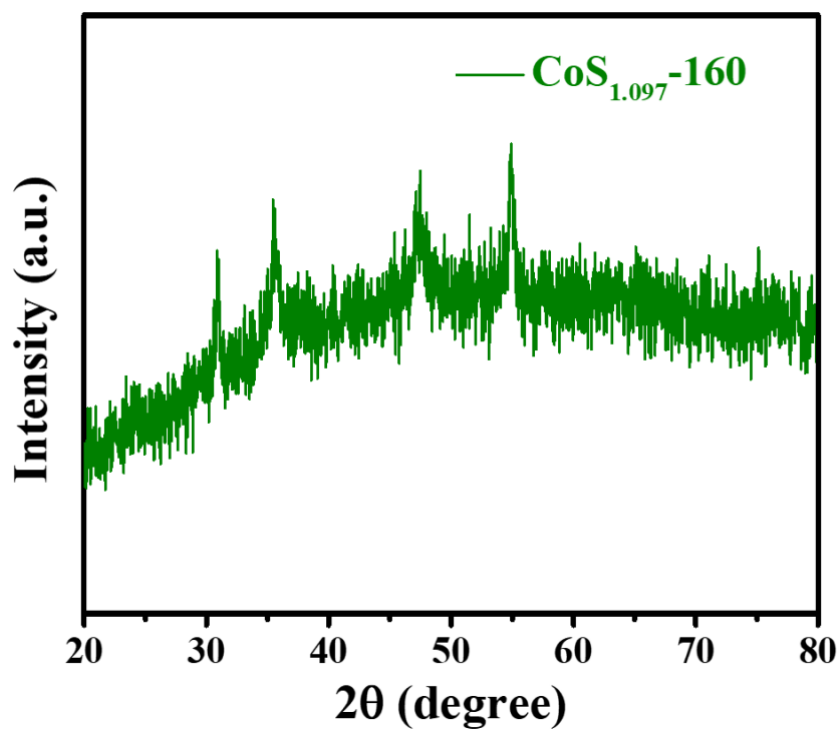
**Fig. S7** Full scan X-ray photoelectron survey spectrum of  $\text{CoS}_{1.097-160}$ .



**Fig. S8** Polarization curves of CoS<sub>1.097</sub>-T products, Pt/C and bare CoS<sub>x</sub> before and after iR compensation.



**Fig. S9** Cyclic voltammograms (CVs) of CoS<sub>1.097</sub>-140 (a), CoS<sub>1.097</sub>-180 (b) and bare CoS<sub>x</sub> (c) in a non-faradaic potential region of 0.31 V vs. RHE to 0.41 V vs. RHE.



**Fig. S10** PXRD study of CoS<sub>1.097</sub>-160 after chronopotentiometry measurement of 25 h at 10 mA cm<sup>-2</sup> current density under acidic electrolytic conditions.

**Table S1.** Hydrogen evolution reaction (HER) comparison of cobalt sulfide-based electrocatalysts.

<b>Electrocatalyst</b>	<b>Overpotential at 10 mA cm<sup>-2</sup> (mV)</b>	<b>Tafel slope (mV dec<sup>-1</sup>)</b>	<b>Electrolyte</b>	<b>References</b>
CoS <sub>1.097</sub> /MoS <sub>2</sub>	228	59.7	0.5 M H <sub>2</sub> SO <sub>4</sub>	ACS Appl. Energy Mater. 2019, 2, 10, 7504–7511
CoP-CoS composite nanorods	156	74	0.5 M H <sub>2</sub> SO <sub>4</sub>	ChemCatChem 2019, 11, 6099– 6104
MoS <sub>2</sub> /Co <sub>3</sub> S <sub>4</sub>	175	55.6	0.5 M H <sub>2</sub> SO <sub>4</sub>	Electrochim. Acta 2018, 269, 262–273
CoS <sub>2</sub>	192	52	0.5 M H <sub>2</sub> SO <sub>4</sub>	J. Phys. Chem. C. 2014, 118, 21347–21356.
CoS <sub>2</sub>	165	86.57	0.5 M H <sub>2</sub> SO <sub>4</sub>	ACS Appl. Mater. Interfaces 2021, 13, 41573–41583
Ni-doped CoS <sub>2</sub>	156	52	0.5 M H <sub>2</sub> SO <sub>4</sub>	Electrochim. Acta, 2017, 228, 428-435
CoS <sub>2</sub> /CC	288	210.7	0.5 M H <sub>2</sub> SO <sub>4</sub>	J. Mater. Chem. A, 2015, 3, 22886-22891
CoS <sub>2</sub> microwires	158	58	0.5 M H <sub>2</sub> SO <sub>4</sub>	J. Am. Chem. Soc., 2014, 136,10053-10061
Co <sub>x</sub> S <sub>y</sub>	188	96	0.5 M H <sub>2</sub> SO <sub>4</sub>	ChemElectroChem 2018, 5, 3639–3644
CoS-MoS <sub>2</sub>	270	74	0.5 M H <sub>2</sub> SO <sub>4</sub>	J. Solid State Electrochem. 2017, 21, 409–417
<b>CoS<sub>1.097</sub>-160</b>	<b>163</b>	<b>53</b>	<b>0.5 M H<sub>2</sub>SO<sub>4</sub></b>	<b>This Work</b>