

Supporting Information

Boosting oxygen evolution with electrodes composed of metal sulfides and hydrogen bonded organic frameworks

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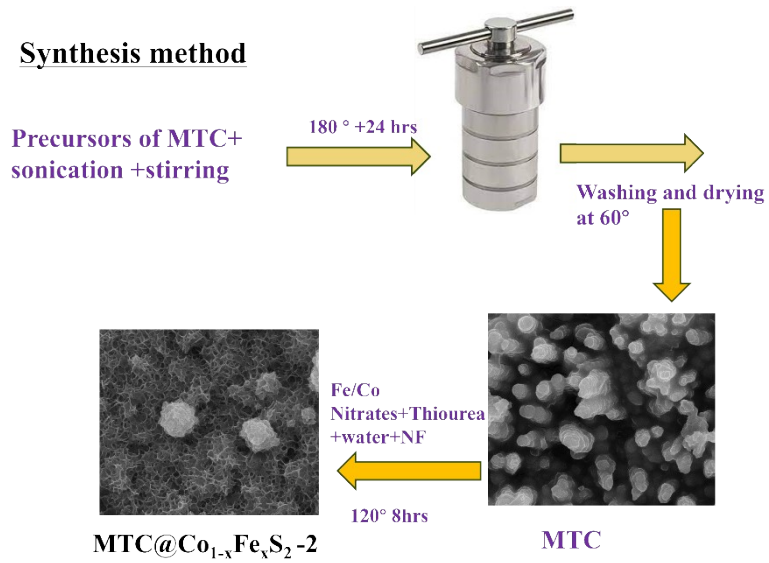


Figure S1: Schematic illustration of formation of MTC@Co_{1-x}Fe_xS₂-2

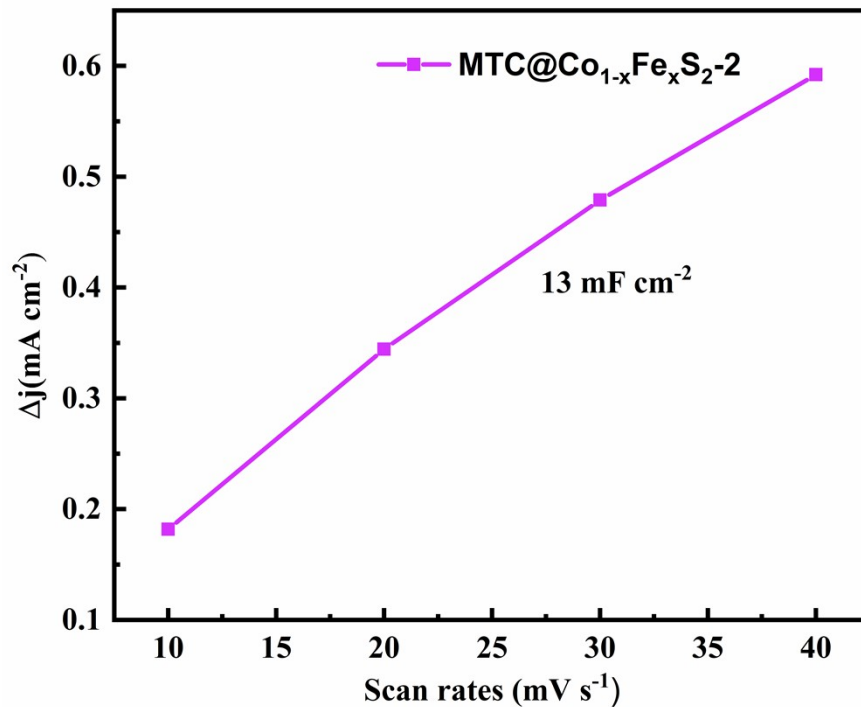


Figure S2: Estimation of double-layer capacitance (C_{dl}) of MTC@Co_{1-x}Fe_xS₂-2.

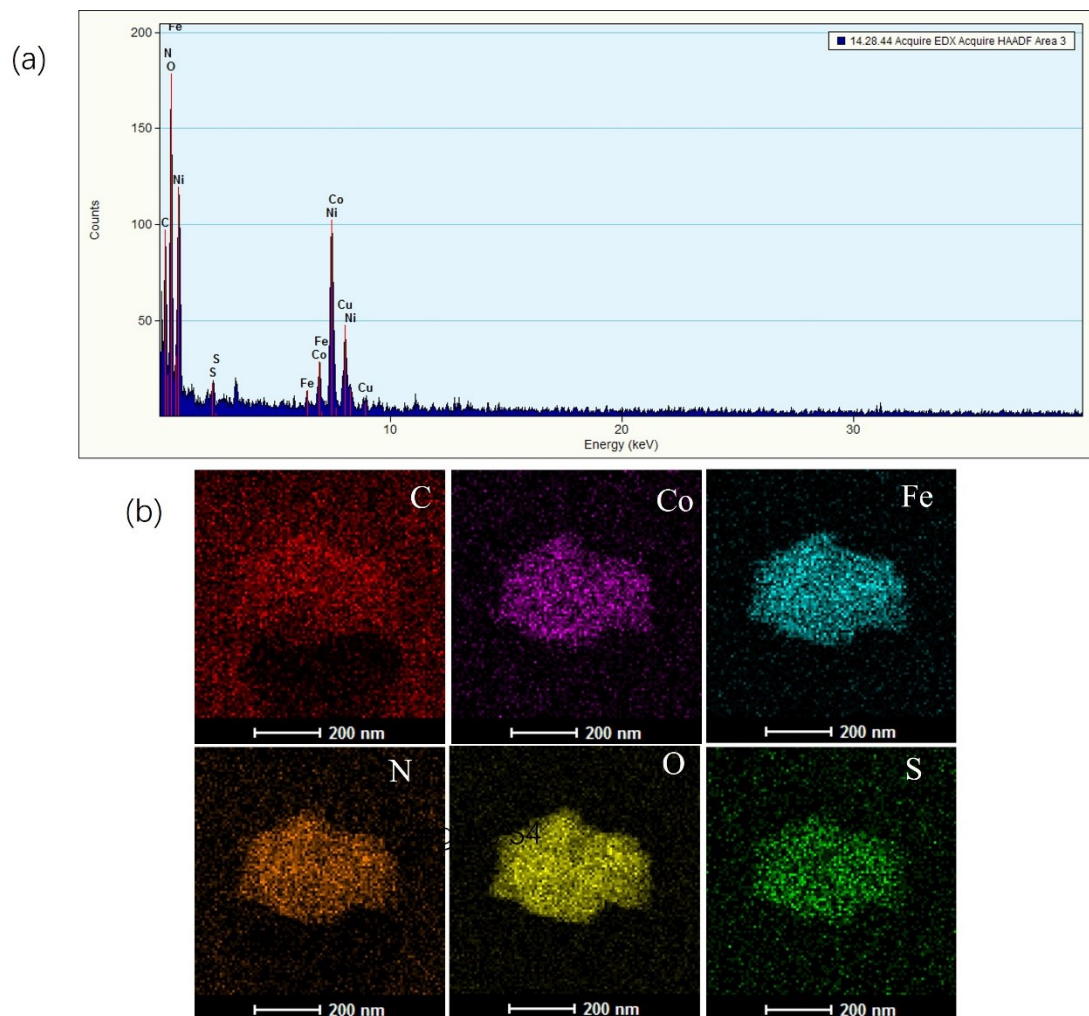


Figure S3. (a) EDS spectrum of $MTC@Co_{1-x}Fe_xS_2-2$ (b) The corresponding elemental mapping images of C, Co, Fe, N, O, and S.

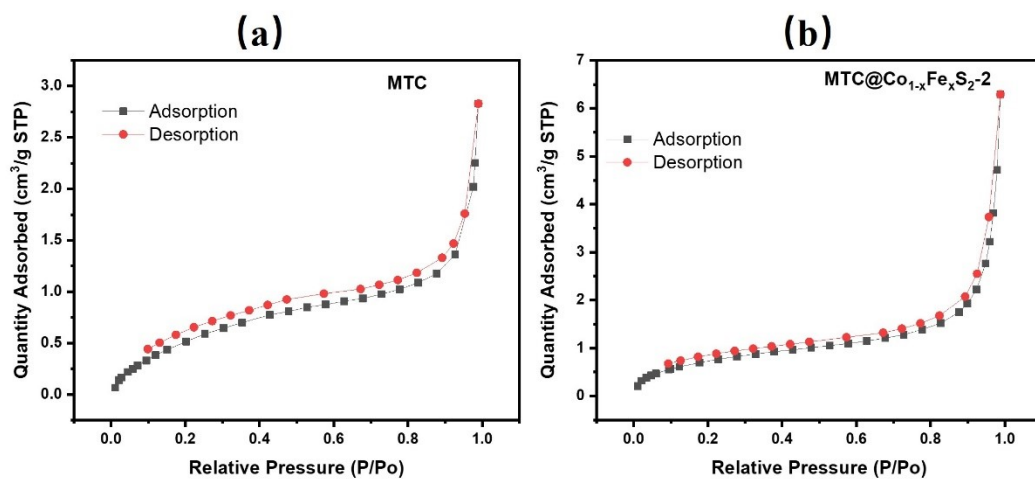


Figure S4: BET plots for (a) MTC (b) MTC@Co_{1-x}Fe_xS₂-2

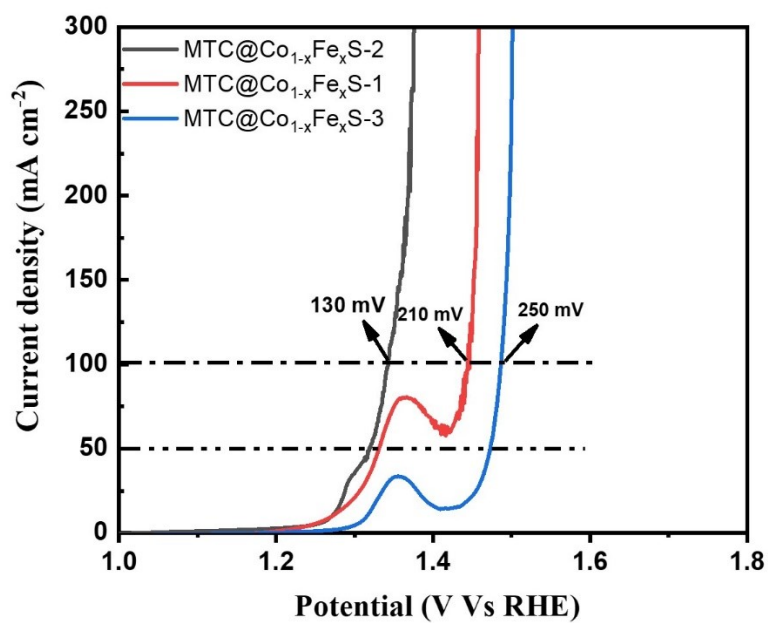


Figure S5: Polarization curves at scan rates of 5 mV s⁻¹ of three concentrations of the composite material

Catalysts	Electrolyte (KOH)	Current density (mA cm ⁻²)	Overpotential (mV)	reference
MTC@Co_{1-x}Fe_x S₂-2	1 M	100	130	This work
(Fe, Ni) ₉ S ₈ @SNC	1 M	10	207	[1]
Co ₈ FeS ₈ MXene / NF	1 M	10	170	[2]
(CoFe-MS/MOF	1 M	10	261	[3]
MoS ₂ /CoFe@NC	1 M	10	337	[4]
Se-(CoFe)S	1 M	10	281	[5]
NiCoOx	1 M	10	281	[6]
Co ₈ FeS ₈ @CoFe-MOF/NF	1 M	10	213	[7]
CoS _{1.097} /Fe _{1-x} S/Ni ₃ S ₂ /NF	1 M	50	229	[8]

Table S1: Comparison of OER performance of MTC@Co_{1-x}Fe_x S₂-2 with some representative bimetallic sulfides OER electrocatalysts from literature.

References:

1. Ma, Z., et al., *Construction of binary metal sulphides via lignosulfonate as sulphur source for efficient oxygen evolution reaction*. 2023. **48**(26): p. 9636-9646.
2. Li, M., et al., *Hierarchical electronic coupling engineering of bimetallic sulfide driven by CoFe bimetal MOFs anchored on MXene promotes efficient overall water splitting*. 2024. **358**: p. 130256.
3. Yu, R., et al., *Bimetallic sulfide particles incorporated in Fe/Co-based metal-organic framework ultrathin nanosheets toward boosted electrocatalysis of the oxygen evolution reaction*. 2022. **9**(13): p. 3130-3137.
4. Ma, W., et al., *N-doped carbon wrapped CoFe alloy nanoparticles with MoS₂ nanosheets as electrocatalyst for hydrogen and oxygen evolution reactions*. 2023. **48**(58): p. 22032-22043.
5. Song, Y., X. Zhao, and Z.-H.J.E.A. Liu, *Surface selenium doped hollow heterostructure/defects Co-Fe sulfide nanoboxes for enhancing oxygen*

- evolution reaction and supercapacitors*. 2021. **374**: p. 137962.
6. Xue, Y., et al., *Bimetallic hollow tubular NiCoO_x as a bifunctional electrocatalyst for enhanced oxygen reduction and evolution reaction*. 2021. **13**(6): p. 7334-7342.
 7. Zhao, T., et al., *Constructing abundant phase interfaces of the sulfides/metal-organic frameworks pp heterojunction array for efficient overall water splitting and urea electrolysis*. 2023. **634**: p. 630-641.
 8. Wen, Y., et al., *Polymetallic sulfide nanosheet arrays with composite structure as a highly efficient oxygen evolution electrocatalyst*. 2023. **635**: p. 494-502.