

Supporting Information

A bimetallic sulfide $\text{Co}_9\text{S}_8/\text{MoS}_2/\text{C}$ heterojunction in a three-dimensional carbon structure for increasing sodium ion storage

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NEW CARBON MATERIALS

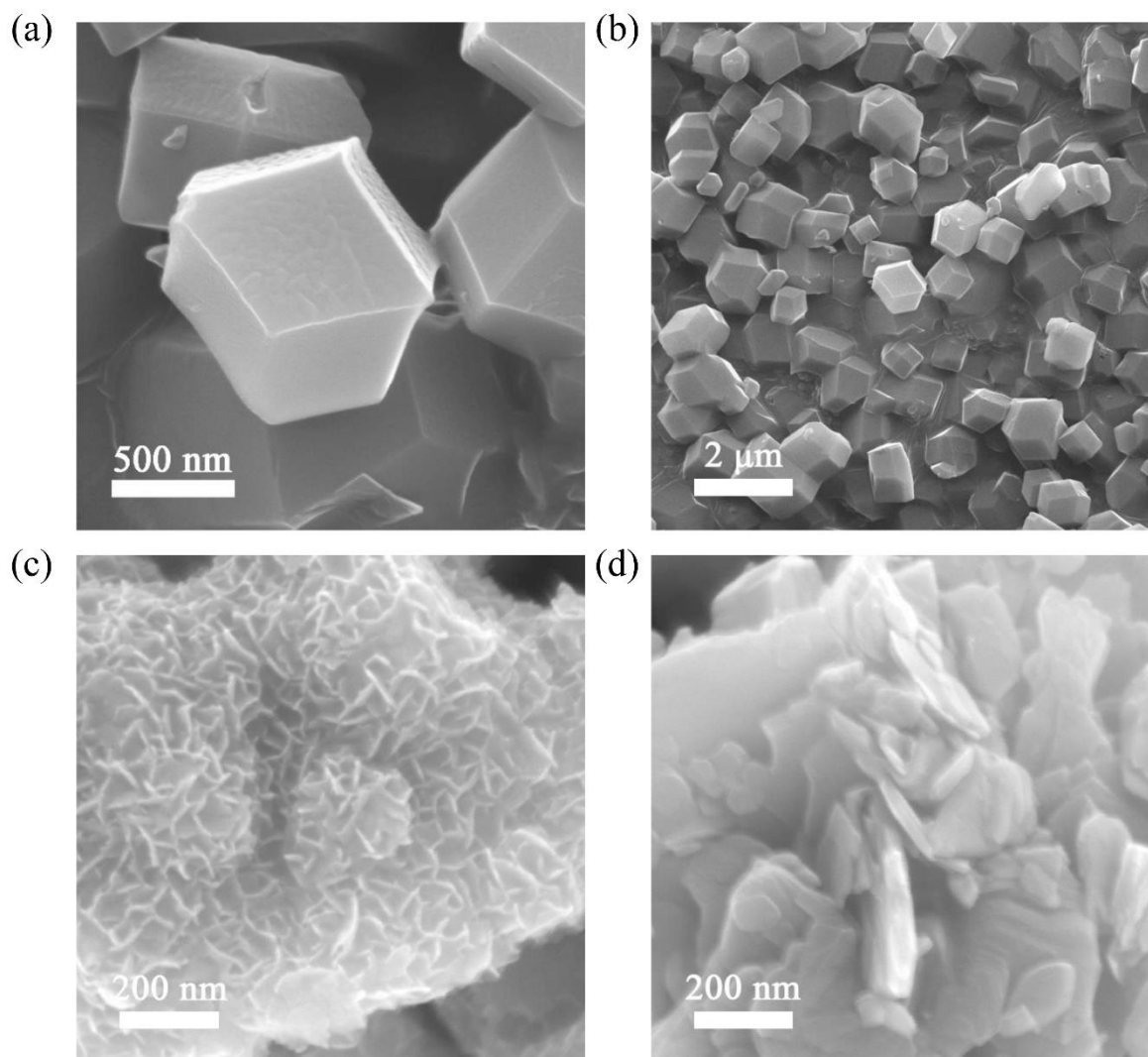


Figure S1 Typical SEM of (a) single ZIF-67 precursor showing the regular shape. (b) Large scale ZIF-67 precursor. (c) Co₉S₈/MoS₂-600, (d) Co₉S₈/MoS₂-800.

NEW CARBON

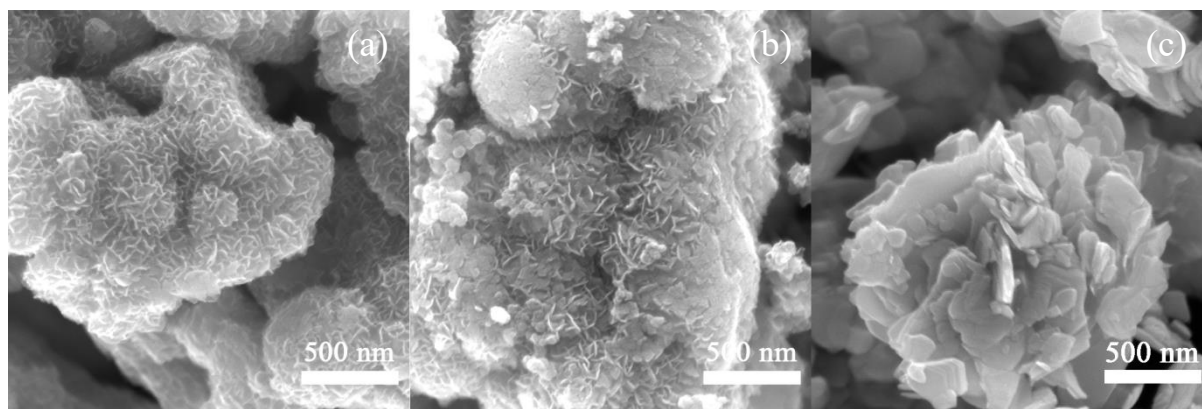


Figure S2 Typical SEM of (a) $\text{Co}_9\text{S}_8/\text{MoS}_2\text{-600}$, (b) $\text{Co}_9\text{S}_8/\text{MoS}_2\text{-700}$ and (c) $\text{Co}_9\text{S}_8/\text{MoS}_2\text{-800}$ heterostructure.

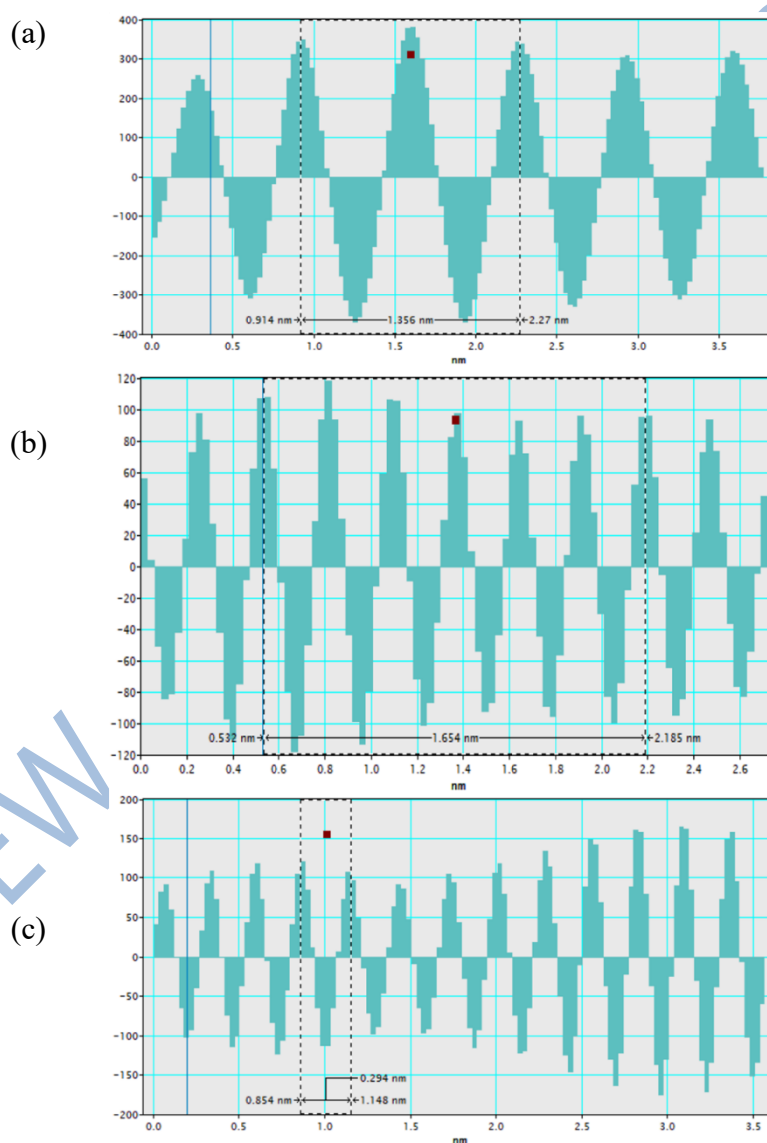
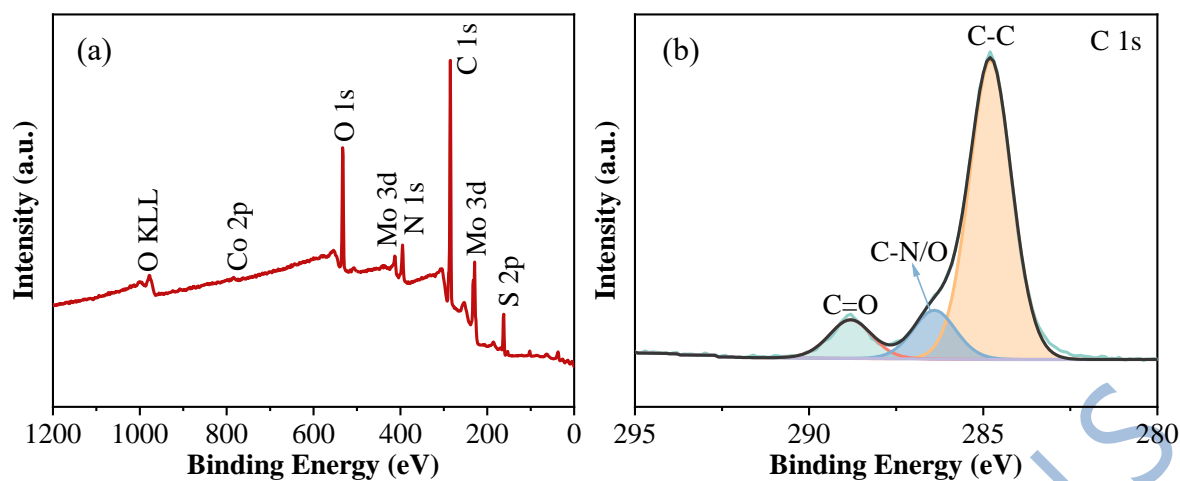
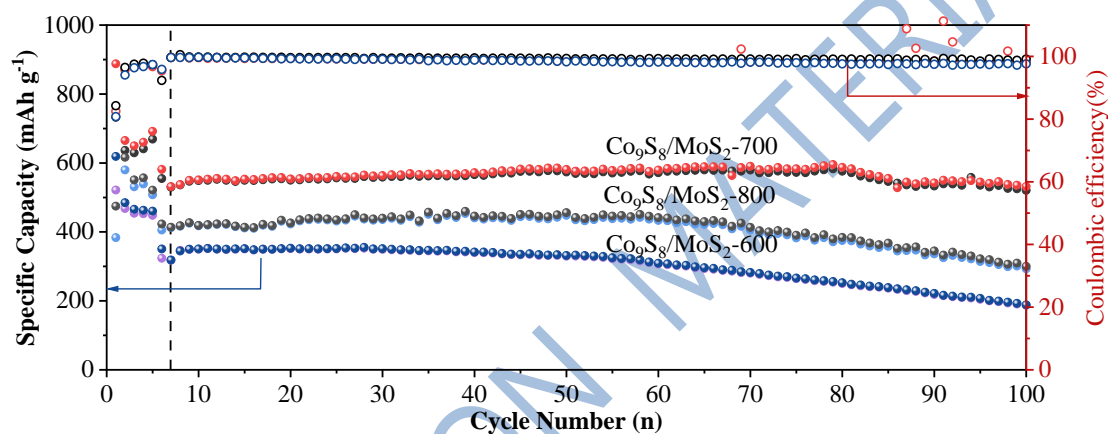
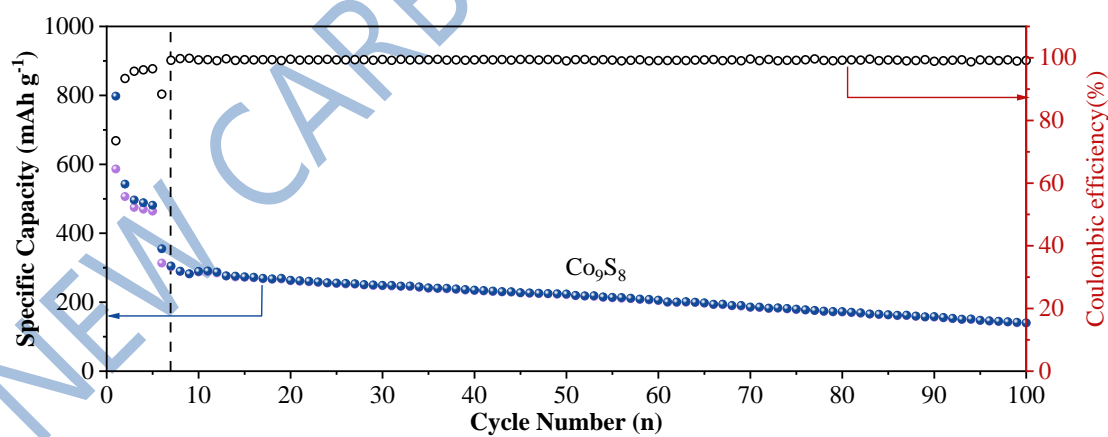


Figure S3 The measured lattice distances of (a) MoS_2 (002), (b) MoS_2 (103) and (c) Co_9S_8 (311) lattice plane.

Figure S4 XPS spectra of the $\text{Co}_9\text{S}_8/\text{MoS}_2$ -700: (a) survey spectra, (b) C 1s spectra.Figure S5 Cycling performance of the $\text{Co}_9\text{S}_8/\text{MoS}_2$ electrode at 800 mA g^{-1} .Figure S6 Cycling performance of the Co_9S_8 electrode at 800 mA g^{-1} .

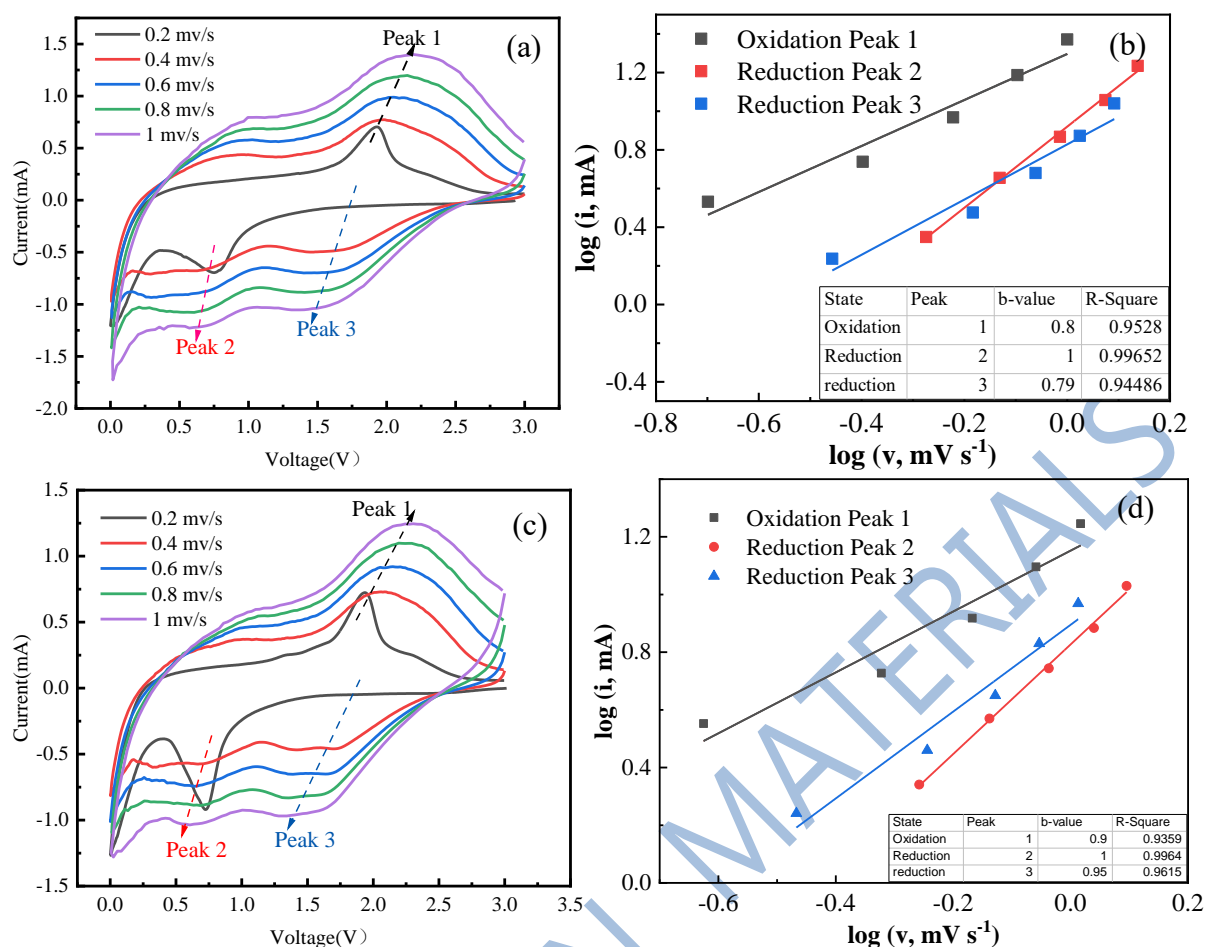


Figure S7 (a, c) CV curves of $\text{Co}_9\text{S}_8/\text{MoS}_2\text{-600}$ and of $\text{Co}_9\text{S}_8/\text{MoS}_2\text{-800}$ at different scan rates, (b, d) $\log(i)$ versus $\log(v)$ plots at various redox peaks for $\text{Co}_9\text{S}_8/\text{MoS}_2\text{-600}$ and $\text{Co}_9\text{S}_8/\text{MoS}_2\text{-800}$.

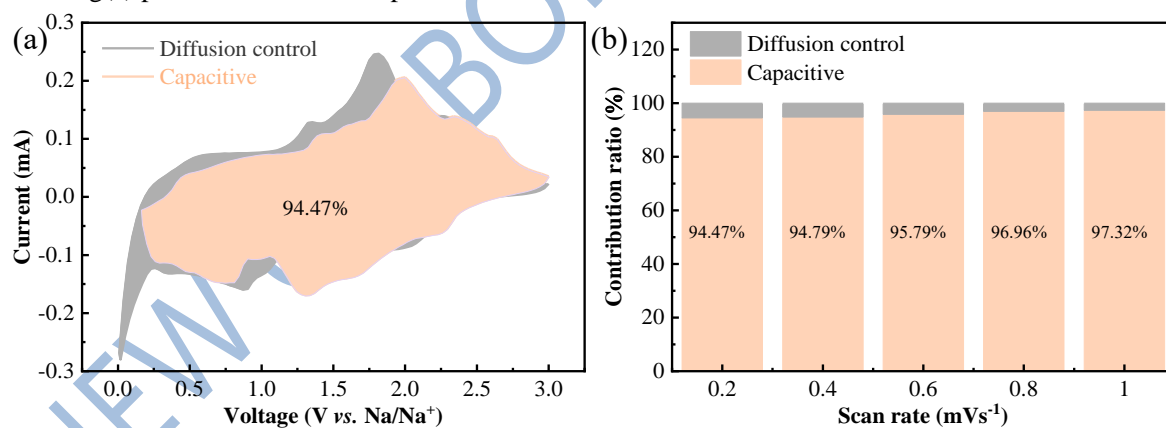


Figure S8 Kinetic analysis of sodium storage behavior of the $\text{Co}_9\text{S}_8/\text{MoS}_2\text{-700}$ electrode: (a). The percentage of capacitive contribution to charge storage at 0.2 mV s^{-1} (b) Capacitive contribution at various scan rates.

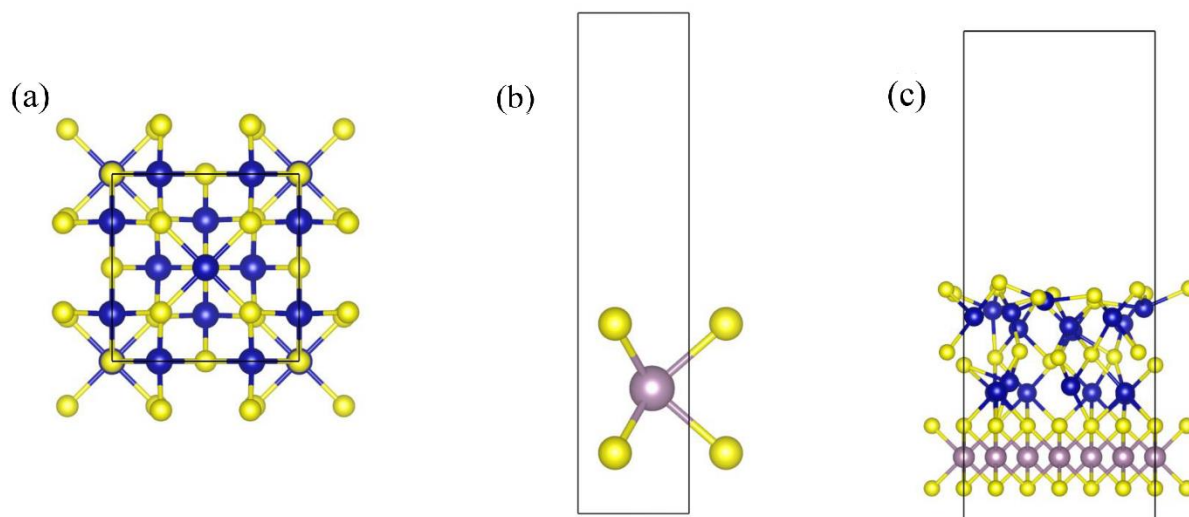


Figure S9 The optimized crystal structures of Co_9S_8 , MoS_2 and $\text{Co}_9\text{S}_8(001)/\text{MoS}_2$.

NEW CARBON MATERIALS

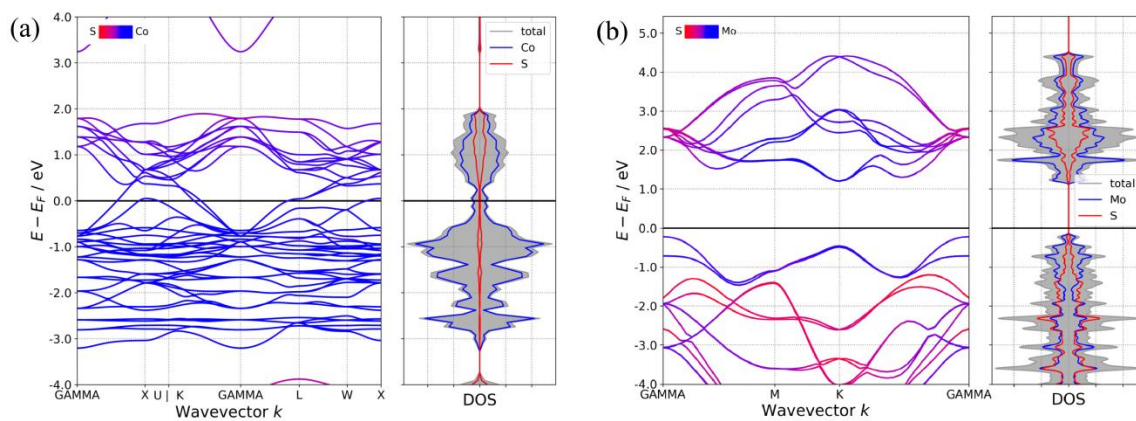


Figure S10 Band structures, calculated for Co_9S_8 (a), MoS_2 (b). The Fermi level is set to 0.0 eV

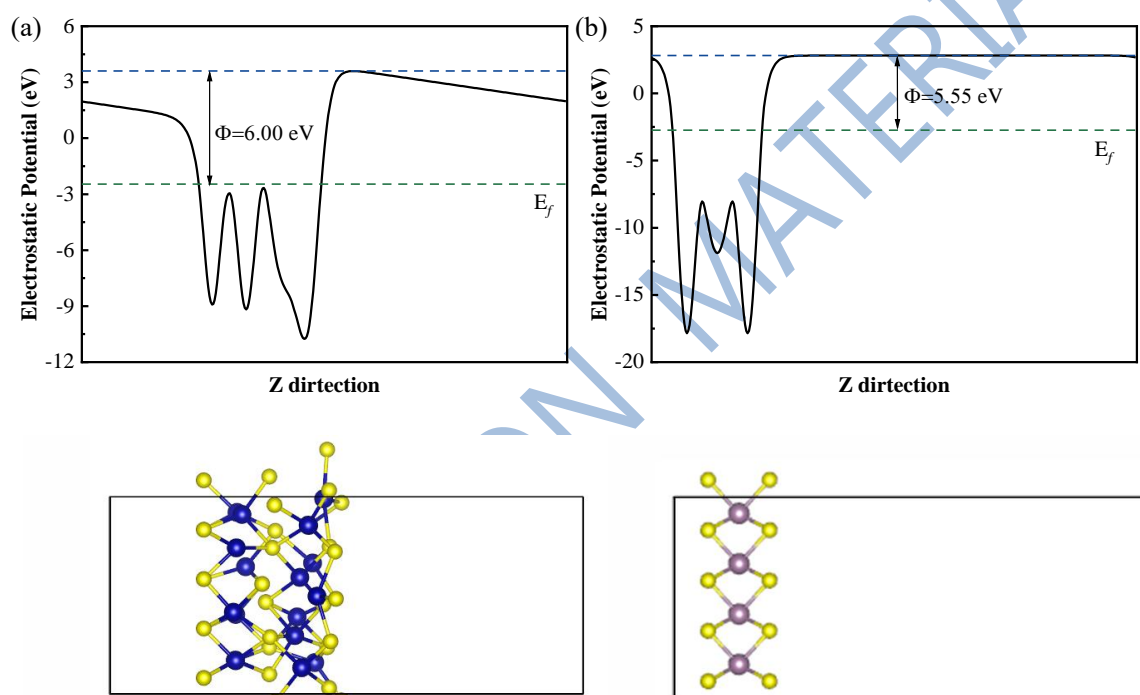


Figure S11 Calculated electrostatic potentials for (a) Co_9S_8 (001) surface, and (b) MoS_2 (001) surface. The green and blue dashed lines denote Fermi level and the vacuum energy level, respectively.

Table S1 Comparisons of cycling stability of Co₉S₈/MoS₂ with other Mo-based and Co-based transition metal sulfides.

No.	Samples	Current density (mA g ⁻¹)	No. of cycles	Capacity (mAh g ⁻¹)	Refs.
1	MoS ₂ /RGO Sponge	50	100	372	[1]
2	MoS ₂ @CNFs	50	50	380	[2]
3	MoS ₂ @SnO ₂ @C	100	150	396	[3]
4	Exfoliated MoS ₂ /G	324	100	100	[4]
5	Graphene@MoS ₂ @porous graphene	100	100	290	[5]
6	MoS ₂ embedded in N-doped carbon fibers	100	100	480	[6]
7	BG-C@MoS ₂	100	100	155	[7]
8	MoS ₂ @SnO ₂ @C	100	150	396	[8]
9	MoS ₂ @CNFs	50	50	380	[9]
10	Co ₉ S ₈ @carbon yolk-shell	1000	400	426	[10]
11	MoS ₂ /C	1000	550	340	[11]
12	Co ₉ S ₈ @C	500	100	406.5	[12]
13	MWCNTs/Co ₉ S ₈	500	80	444	[13]
14	Co ₉ S ₈ -HB	500	100	520	[14]
15	Co₉S₈/MoS₂-700	80	100	535	This
		2000	120	464	work

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