

Supplementary Information

Ni-Co Sulfide Nanoboxes with Tunable Compositions for High-performance Electrochemical Pseudocapacitors

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Table S1. Electrochemical performance of hollow NiCo₂S₄ nanobox electrode compared with reported NiCo₂S₄ electrodes.

Electrode structure	Specific capacitance	Capacitance degradation	Capacitance retention	Reference
Hollow NiCo₂S₄ nanoboxes	1588 F g⁻¹ at 2 A g⁻¹	11.8% after 4000 cycles at 5 A g⁻¹	64% from 1 to 20 A g⁻¹	Our work
NiCo ₂ S ₄ nanotube arrays	1430 F g ⁻¹ at 2 A g ⁻¹	4% after 2000 cycles at 5 A g ⁻¹	84% from 2 to 10 A g ⁻¹	1
NiCo ₂ S ₄ hollow nanoprism	895.2 F g ⁻¹ at 1 A g ⁻¹	14.3% after 1500 cycles at 5 A g ⁻¹	65.3% from 1 to 20 A g ⁻¹	2
NiCo ₂ S ₄ ball-in-ball hollow spheres	1036 F g ⁻¹ at 1 A g ⁻¹	13% after 2000 cycles at 5 A g ⁻¹	68.1% from 1 to 20 A g ⁻¹	3
NiCo ₂ S ₄ -RGO	1161 F g ⁻¹ at 5 A g ⁻¹	4.5% after 2000 cycles at 5 A g ⁻¹	52.4% from 1 to 20 A g ⁻¹	4
NiCo ₂ S ₄ NS/NCF	1138 F g ⁻¹ at 5 A g ⁻¹	9.6% after 2000 cycles at 10 A g ⁻¹	71.2% from 2 to 20 A g ⁻¹	5
NiCo ₂ S ₄ nanosheets	1084 F g ⁻¹ at 1 A g ⁻¹	8% after 1500 cycles at 2 A g ⁻¹	40.3% from 1 to 8 A g ⁻¹	6
NiCo ₂ S ₄ @MnO ₂	1337.8 F g ⁻¹ at 2 A g ⁻¹	18% after 2000 cycles at 5 A g ⁻¹	44.9% from 2 to 20 A g ⁻¹	7
NiCo ₂ S ₄ nanotubes	1181.8 F g ⁻¹ at 2 A g ⁻¹	80.1% after 5000 cycles at 4 A g ⁻¹	58.6% from 1 to 10 A g ⁻¹	8
CoS@NiCo ₂ S ₄ NWSAs	7.62 F cm ⁻² at 5 mA cm ⁻²	28% after 3000 cycles at 5 mA cm ⁻²	72.4% from 5 to 30 mA cm ⁻²	9
NiCo ₂ S ₄ /Ni _x Co _{9-x} S ₈	680 F g ⁻¹ at 5 A g ⁻¹	24.6% after 2000 cycles at 10 A g ⁻¹	69.8% from 4 to 9 A g ⁻¹	10

Table S2. Electrochemical performance of hollow Ni₂CoS₄ nanobox electrode compared with reported Ni₂CoS₄ electrodes.

Electrode structure	Specific capacitance	Capacitance degradation	Capacitance retention	Reference
Ni₂CoS₄ nanoboxes	1200 F g⁻¹ at 2 A g⁻¹	9.5% after 4000 cycles at 5 A g⁻¹	81.2% from 1 to 20 A g⁻¹	Our work
Ni ₂ CoS ₄ nanosheet arrays	26.39 F cm ⁻² at 5 mA cm ⁻²	22.1% after 3000 cycles at 30 mA cm ⁻²	78% from 5 to 50 mA cm ⁻²	11
Ni ₂ CoS ₄ nanoparticles	916.7 F g ⁻¹ at 5 A g ⁻¹	51.5% after 2000 cycles at 4 A g ⁻¹	36.1% from 1 to 20 A g ⁻¹	12
Mushroom-like Ni ₂ CoS ₄ arrays	5.71 F cm ⁻² at 20 mA cm ⁻²	19.1% after 3000 cycles at 20 mA cm ⁻²	82% from 5 to 50 mA cm ⁻²	13
Ni ₂ CoS ₄ nanowires	990 F g ⁻¹ at 10 A g ⁻¹	28% after 5000 cycles at 2.5 A g ⁻¹	72% from 2.5 to 25 A g ⁻¹	14
Ni ₂ CoS ₄ nanoparticles	617.8 F g ⁻¹ at 50 A g ⁻¹	11% after 1000 cycles at 10 A g ⁻¹	82% from 1 to 5 A g ⁻¹	15

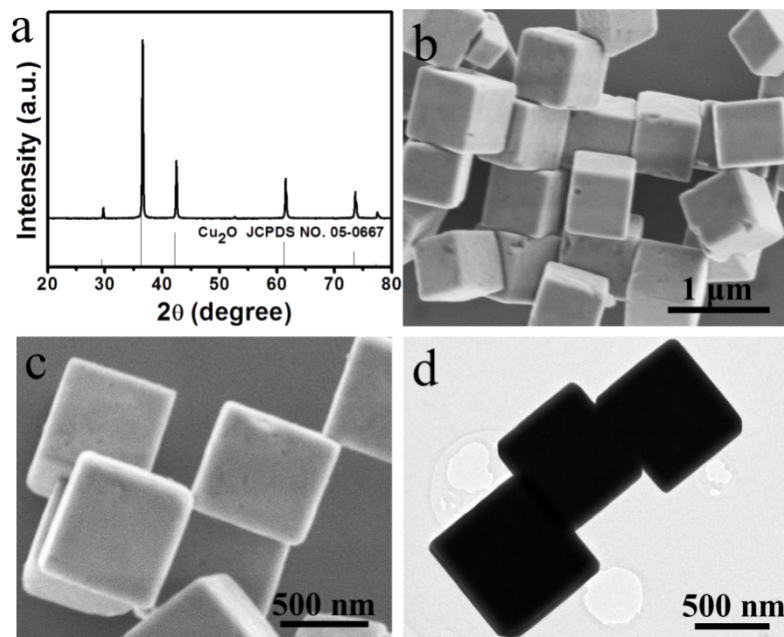


Fig. S1. (a) XRD pattern, (b and c) FESEM, and (d) TEM images of Cu₂O nanocubes.

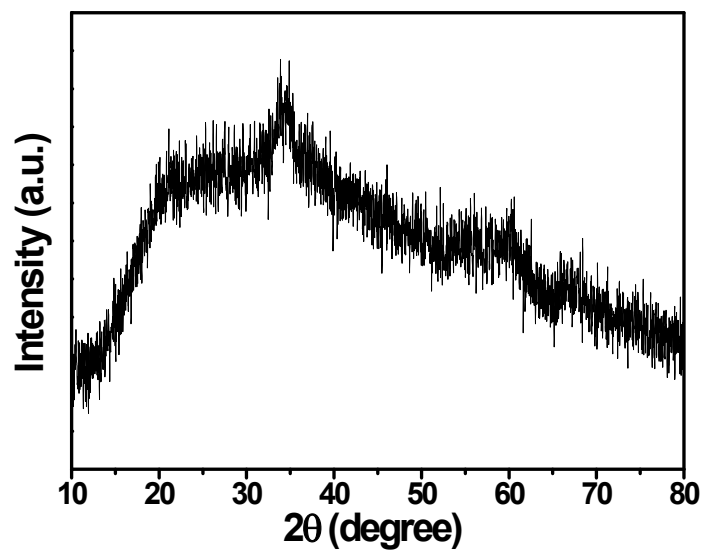


Fig. S2. XRD pattern of Ni-Co precursor.

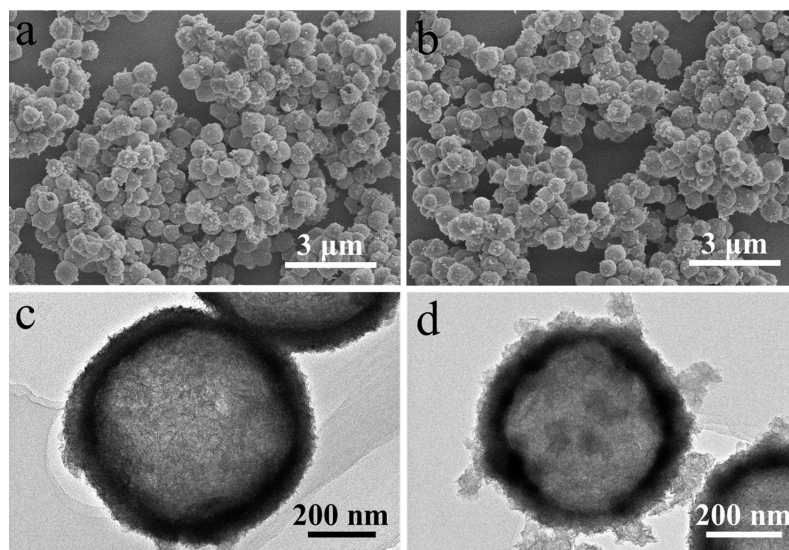


Fig. S3. (a and c) FESEM and TEM images of hollow Ni-Co₂ precursor. (b and d) FESEM and TEM images of hollow Ni₂-Co precursor.

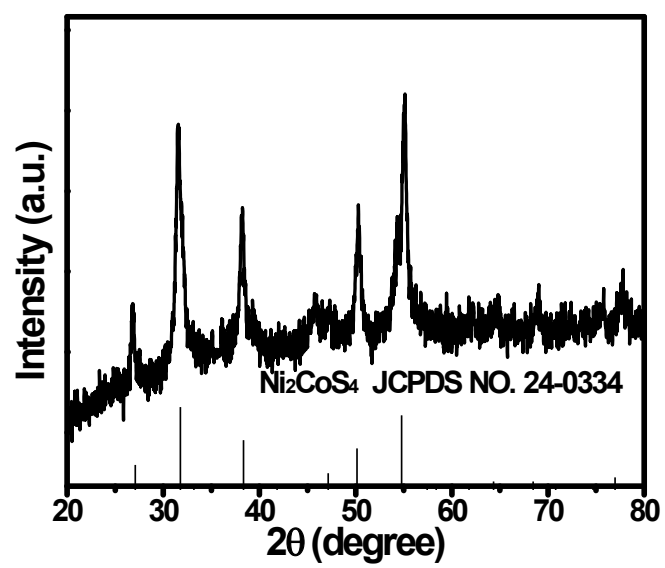


Fig. S4. XRD pattern of Ni_2CoS_4 .

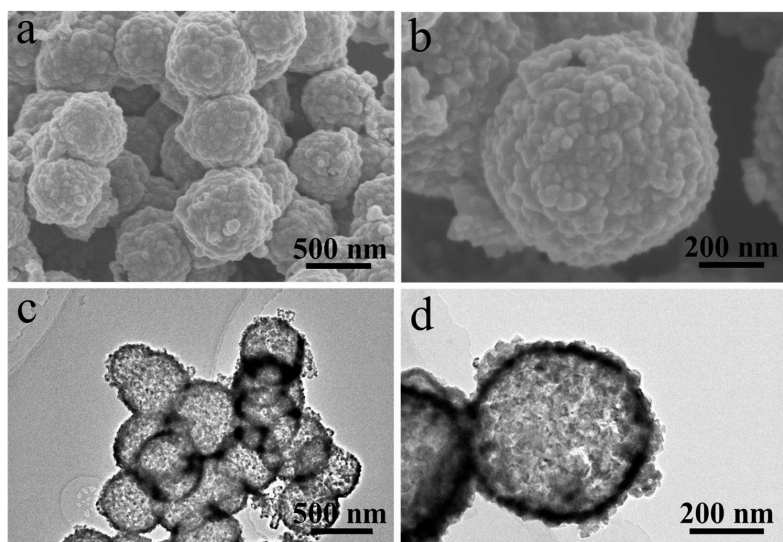


Fig. S5. (a and b) FESEM and (c and d) TEM images of Ni_2CoS_4 nanoboxes.

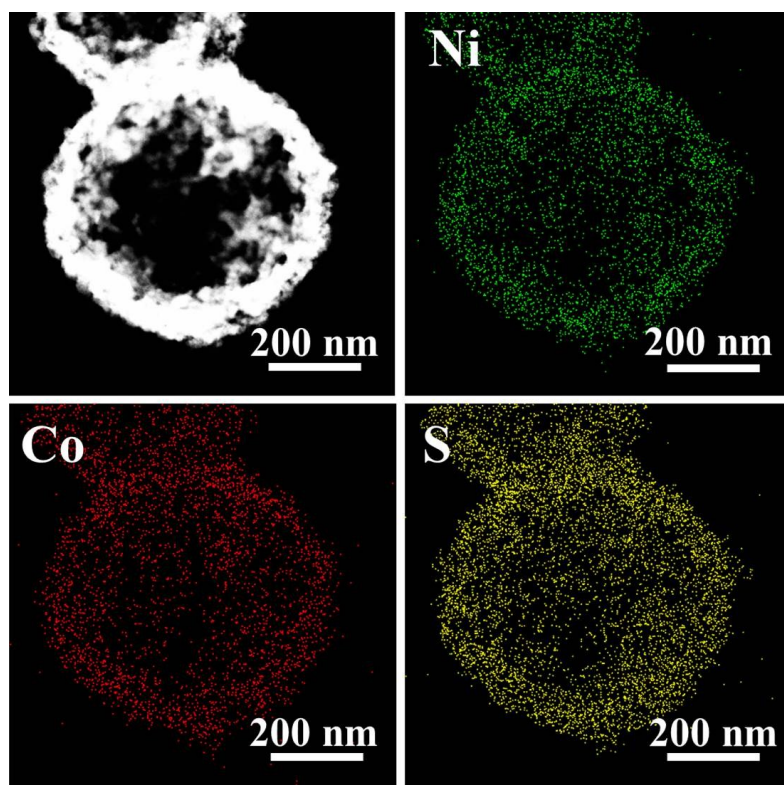


Fig. S6. EDX mapping results of NiCo_2S_4 .

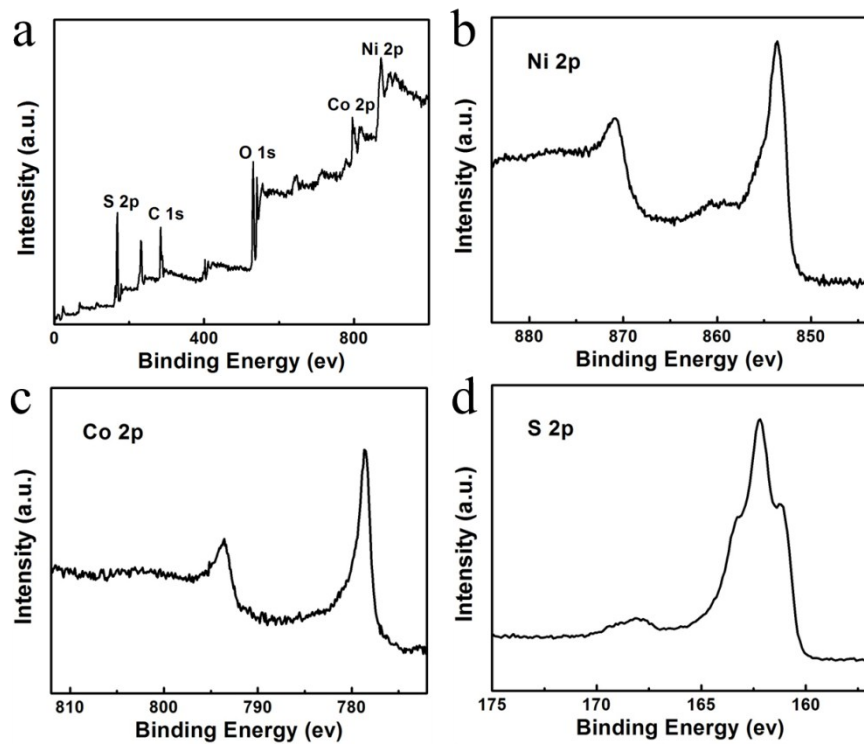


Fig. S7. (a) XPS survey of NiCo₂S₄ and high-resolution XPS of (b) Ni 2p, (c) Co 2p, and (d) S 2p.

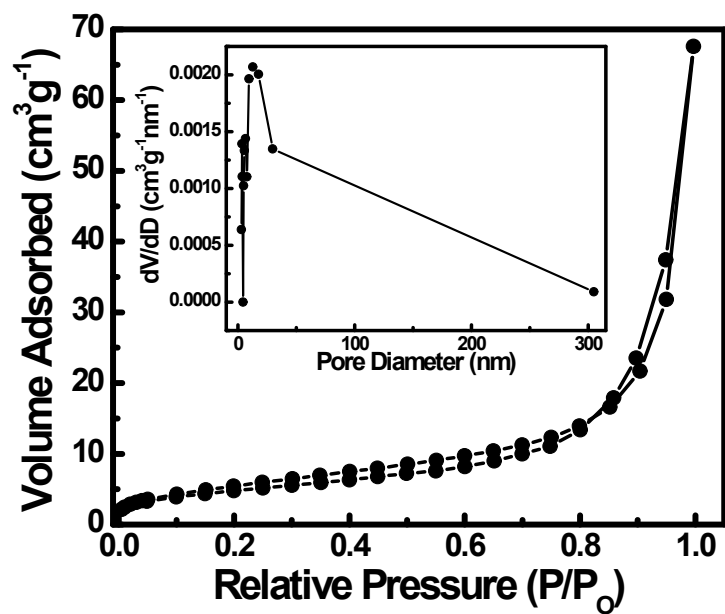


Fig. S8. N₂ adsorption-desorption isotherm and pore-size distribution curves of NiCo₂S₄.

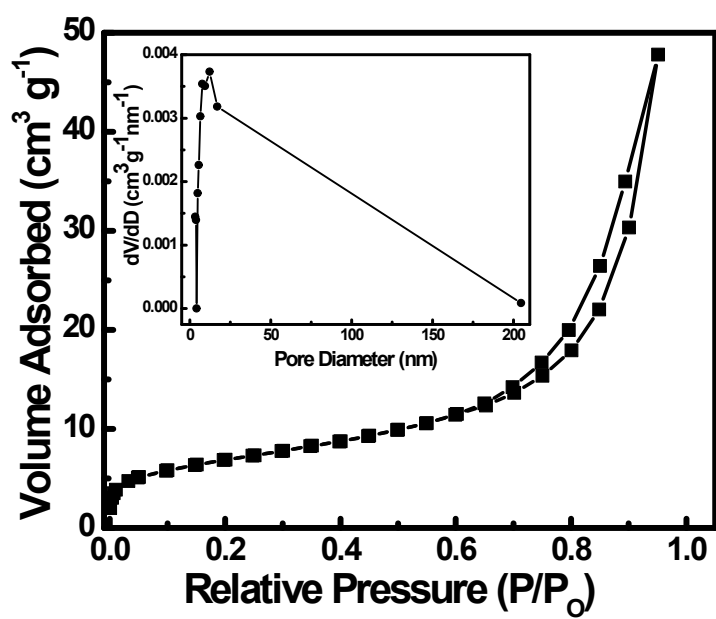


Fig. S9. N₂ adsorption-desorption isotherm and pore-size distribution curves of Ni₂CoS₄ nanoboxes.

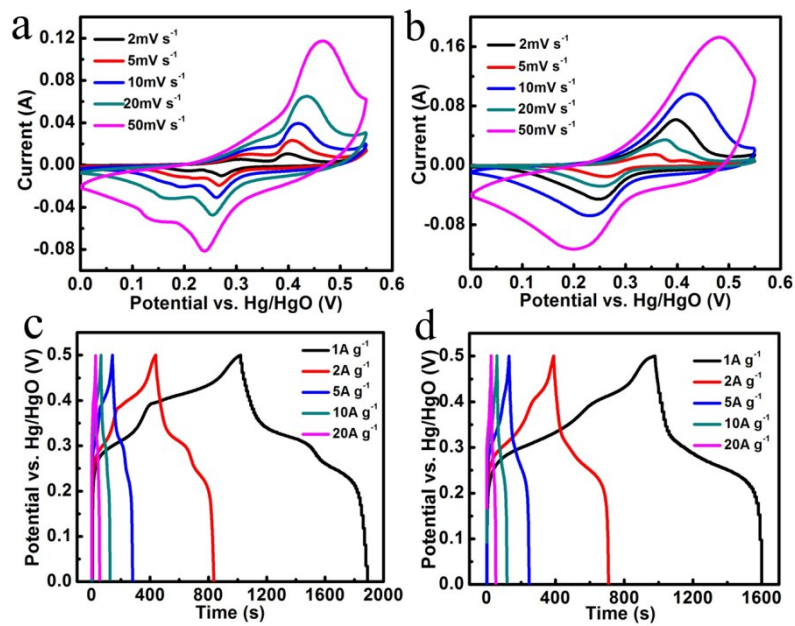


Fig. S10. (a and b) CV curves at various scan rates ranging from 2 to 50 mV s⁻¹ of the NiCo₂S₄ and Ni₂CoS₄ electrodes. (c and d) Charge-discharge voltage profiles at different current densities of the NiCo₂S₄ and Ni₂CoS₄ electrodes.

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