Electronic Supplementary Material (ESI) for RSC Advances.

Supporting Information

Facile synthesis of mesoporous $Ni_xCo_{9-x}S_8$ hollow spheres for high-performance supercapacitor and aqueous Ni/Co-Zn battery

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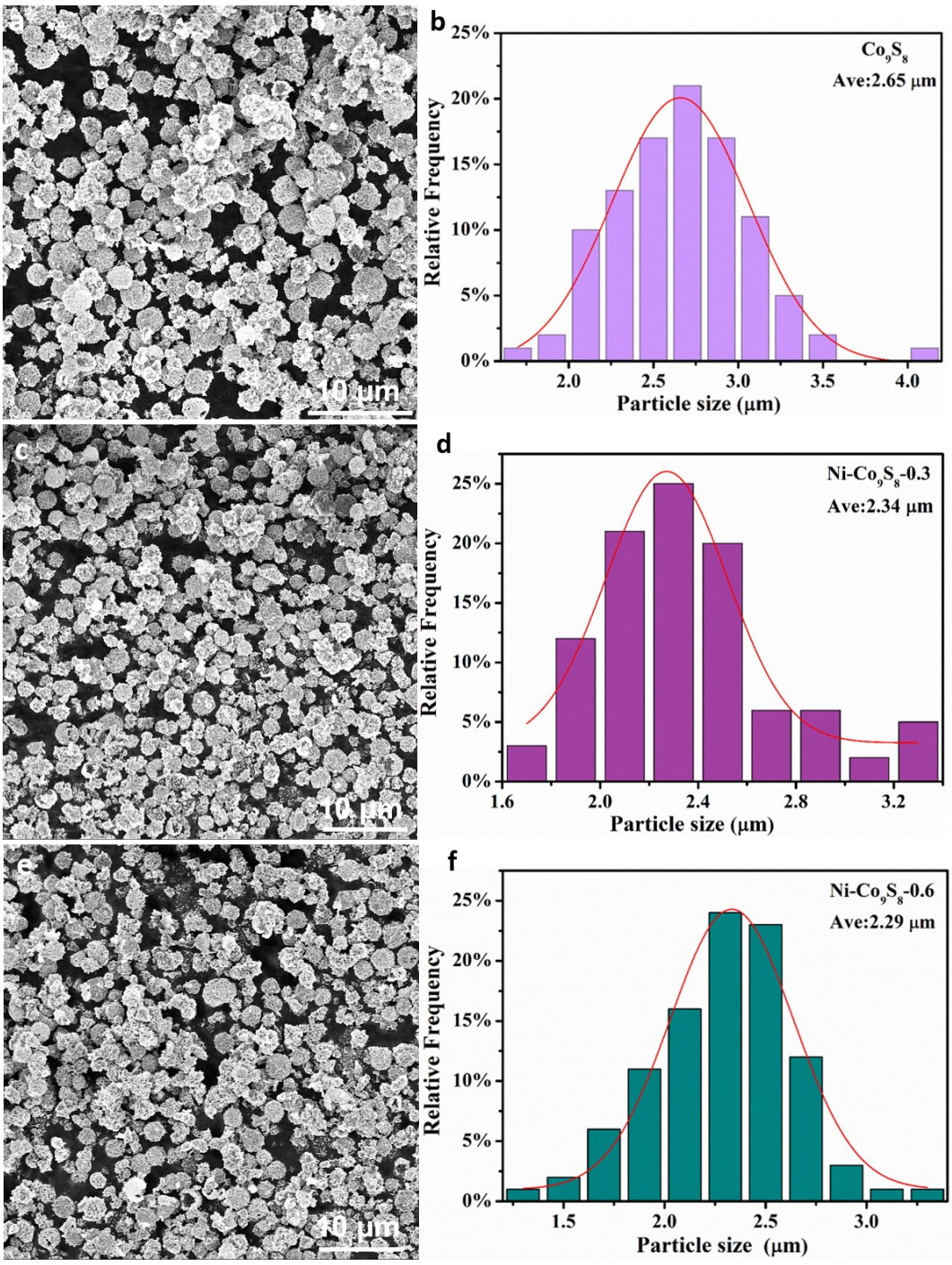

Fig.S1 The SEM images and size distribution of (a-b) Co_9S_8, (c-d) Ni-Co_9S_8-0.3, and (e-f) Ni-Co_9S_8-0.6 hollow spheres.

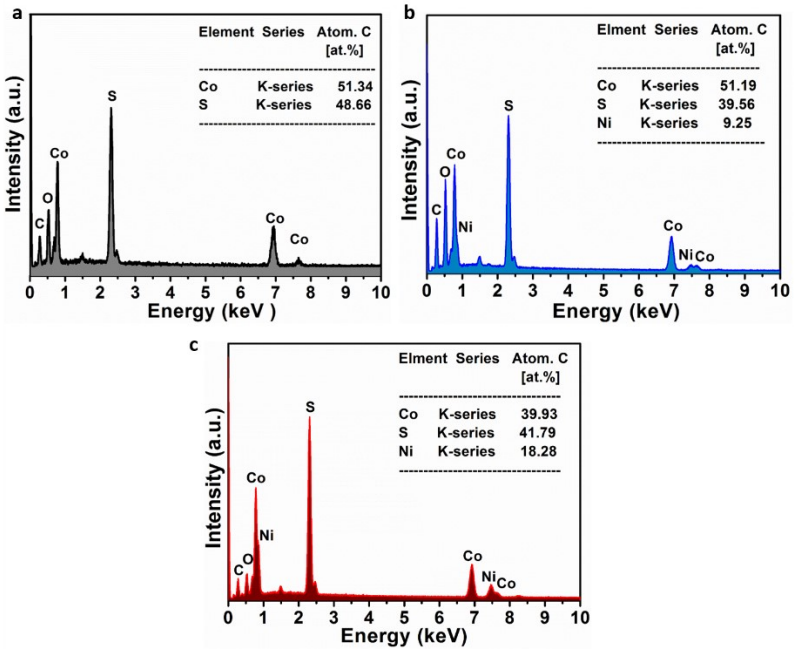

Fig.S2 EDS of (a) Co_9S_8, (b) Ni-Co_9S_8-0.3, and (c) Ni-Co_9S_8-0.6 hollow spheres.

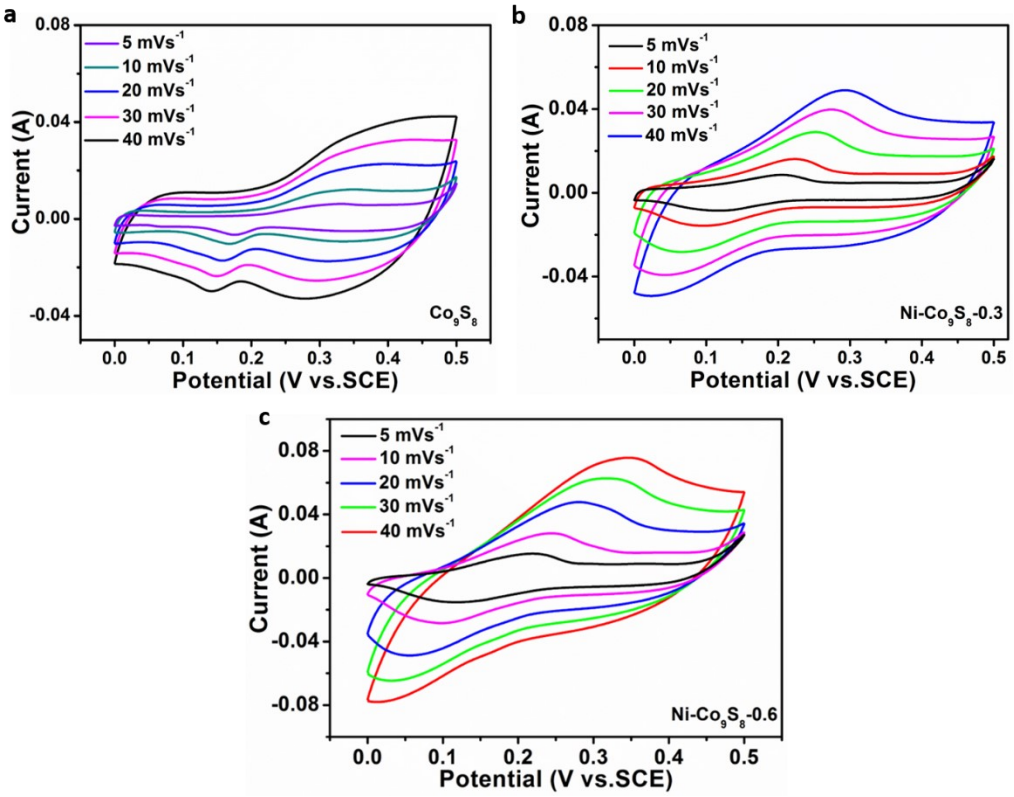

Fig.S3 CV curves of (a) Co_9S_8, (b) Ni-Co_9S_8-0.3, and (c) Ni-Co_9S_8-0.6 hollow spheres.

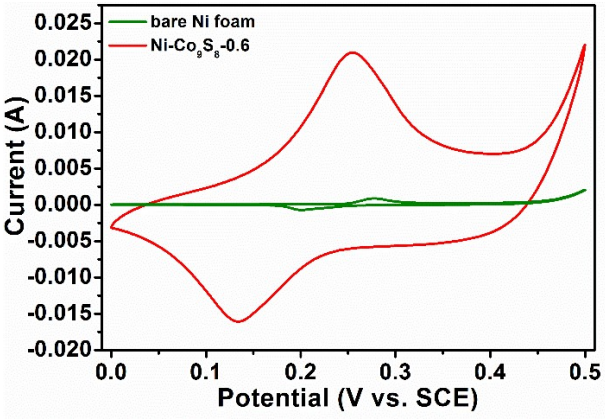

Fig.S4 The comparison of CV curves of bare Ni foam and Ni-Co_9S_8-0.6 hollow spheres at the scan rate of 5 mV s^{-1}.

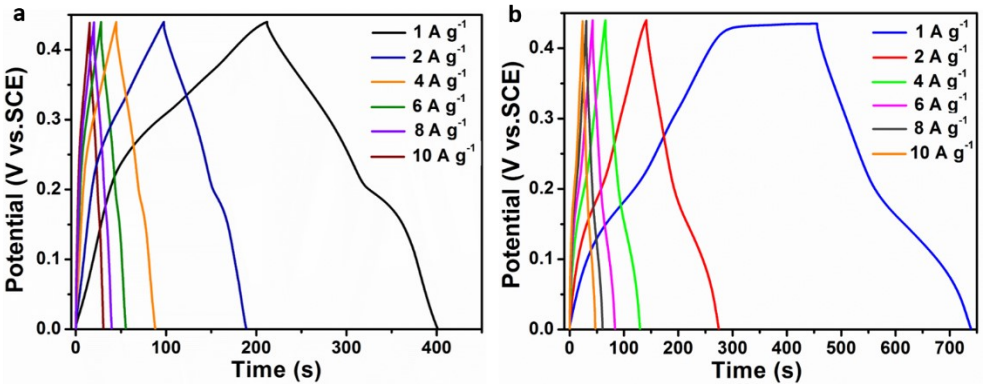

Fig.S5 GCD curves of (a) Co_9S_8 and (b) Ni-Co_9S_8-0.3 electrodes.

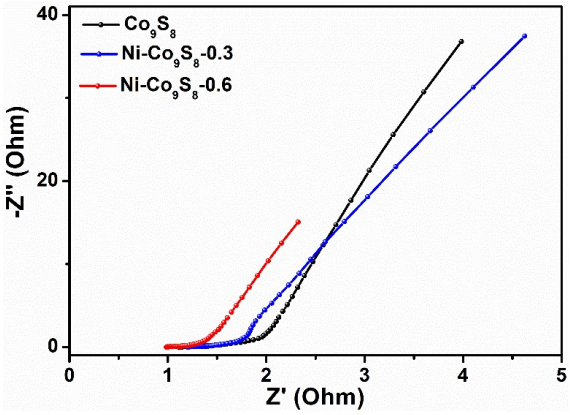

Fig.S6 The Nyquist plots of Co_9S_8, Ni-Co_9S_8-0.3, and Ni-Co_9S_8-0.6 hollow spheres.

Table S1 The peak area ratio of $Co^{3+}/Co^{2+}$and Ni^{3+}/Ni^{2+} in $Ni_xCo_{9-x}S_8$ series microspheres.

Sample	**Co^{3+}/Co^{2+}**	**Ni^{3+}/Ni^{2+}**
Co_9S_8	0.3248	0
Ni-Co_9S_8-30	0.3127	1.8803
Ni-Co_9S_8-60	0.3529	2.3823

Table S2 Comparison of the performance of the $Ni_xCo_{9-x}S_8$ mesoporous hollow microspheres electrode with other reported Co-based and suflides electrode.

Materials	Morphology	Electrolyte (KOH)	Specific capacity (F g^{-1})	Rate capability	Capacity retention (%)	Ref
Co_9S_8@N–C@MoS_2	core–shell structured nanocubes	3 M	410.0 (10 A g^{-1})	79.8% (0.5-10 A g^{-1})	101.7% (20000, 10 A g^{-1})	ACS Appl. Energy Mater. 2018, 1, 3513–3520
rGO/Co_9S_8	hollow particles	1 M	575.9 (2 A g^{-1})	77.7% (2-10 A g^{-1})	92% (9000, 4 A g^{-1})	Chin. Chem. Lett. 2018, 29, 612–615
NiCo-MOF NSHS	nanosheet-assembled hollow spheres	3 M	1126.7 (0.5 A g^{-1})	65% (0.5-10 A g^{-1})	93% (3000, 10 A g^{-1})	Inorg. Chem. 2020, 59, 11385−11395
Co_9S_8-X@CN	octahedral nanoparticles / carbon matrix	6 M	471.1 (0.5 A g^{-1})	59.0% (0.5-10 A g^{-1})	79.2% (1000, 10 A g^{-1})	Chem Asian J. 2021, 16, 1-8
Co_9S_8/GPs	nanotube arrays / graphene paper	2 M	653 (0.5 A g^{-1})	71.8 % (0.5-10A g^{-1})	91.8 % (2500, 10 A g^{-1})	Chem. Eur. J. 2018, 24, 2339 –2343
NiS@CoS	core-shell		1210 (1 A g^{-1})	82% (1-10A g^{-1})	80.94% (2000, 10 A g^{-1})	Adv. Mater. Interfaces 2019, 7, 1901618
Co_9S_8@C	hollow microspheres	1 M	514 (1 A g^{-1})	77% (1-16A g^{-1})	88% (1000, 8 A g^{-1})	ChemElectro Chem, 2018, 2, 137-143
P-$CoS_{1.097}$-6	dandelion-like		536 C g^{-1} (5 A g^{-1})	94% (5-20A g^{-1})	97% (5000, 10 A g^{-1})	J. Electro-anal.Chem.2021, 889, 115231

CoS_2 HNs	nanocuboids	3 M	703.3 ± 0.5 (0.5 A g^{-1})	72.5% (0.5-10 A g^{-1})	---	J. Colloid Interface Sci. 2021, 599, 577–585
CoS_x/C	Hierarchical hollow nanocages	1 M	618 (2 A g^{-1})	83.6% (2-50 A g^{-1})	ca.100% (10000, 4 Ag^{-1})	RSC Adv., 2019, 9, 11253
Co-S-P	Nanoflowers	6 M	969.5 (1 A g^{-1})	79.9% (1-20A g^{-1})	105% (30 000, 10 A g^{-1})	ACS Sustain. Chem. Eng., 2019, 7, 11448 –11454
Ni-Co_9S_8-0.6	Mesoporous hollow microspheres	2 M	1300 (1 A g^{-1})	80.6% (1-10A g^{-1})	74.5% (5000 , 4 A g^{-1})	This work