New Journal of Chemistry

Supporting information

Co-vacancy $Co_{1-x}S$@C flower-like nanosheets derived from MOF for high current density cycle performance and stable sodium-ion storage

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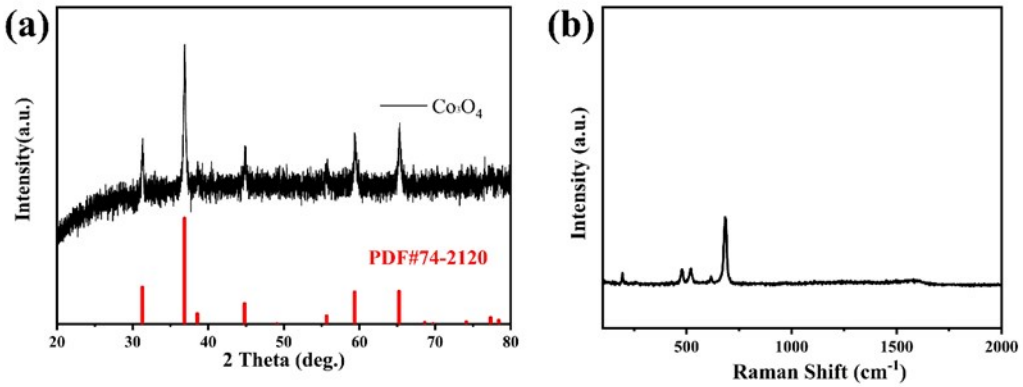

Figure S1. (a) XRD pattern (b) Raman spectrum of Co_3O_4

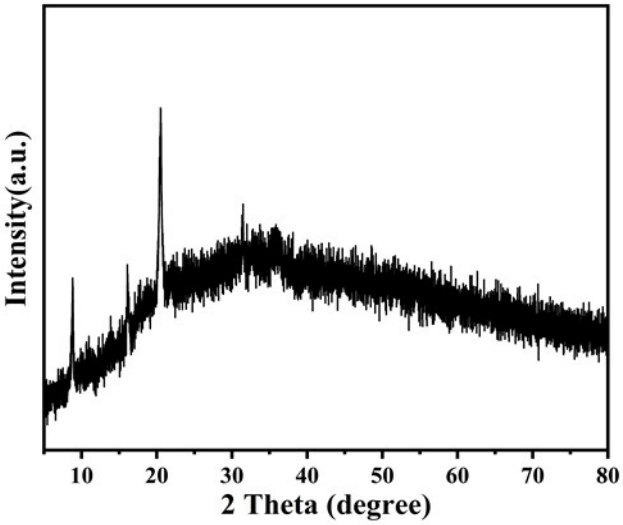

Figure S2. XRD pattern of ZIF-9 nanosheets

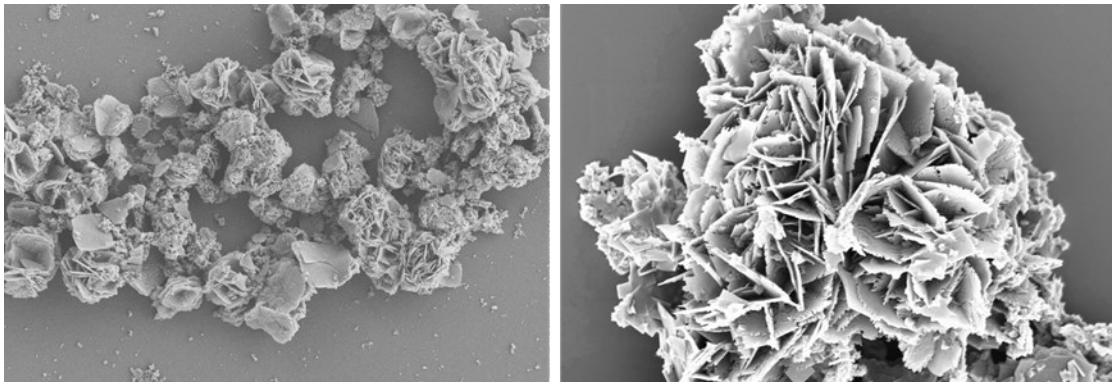

Figure S3. SEM images of $Co_{1-x}S$@C

Element	Mass percentage (%)	Atomic percentage (%)
C K	78.43	92.78
N K	0.00	0.00
S K	10.00	4.43
Co K	11.58	2.79
Total	100.00	100

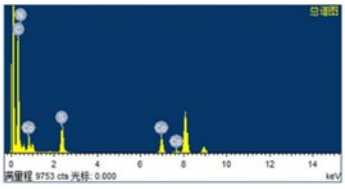

Figure S4. The EDS result of Co1-xS@C

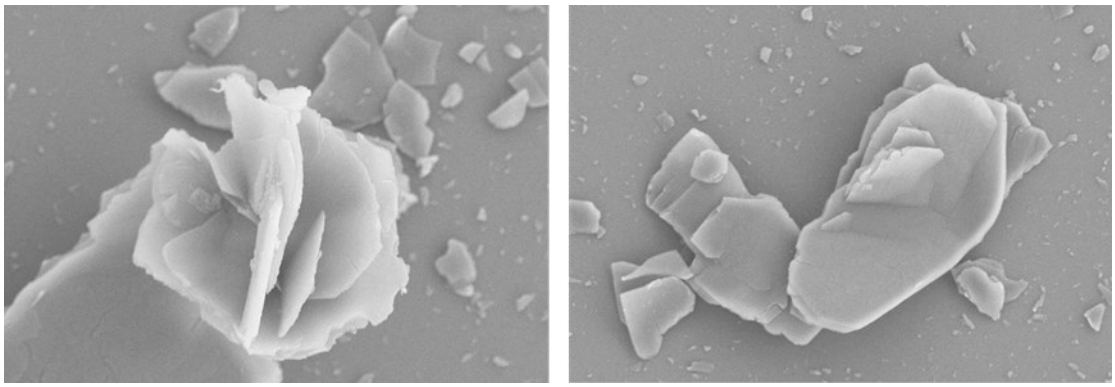

Figure S5. SEM image of ZIF-9 nanosheets

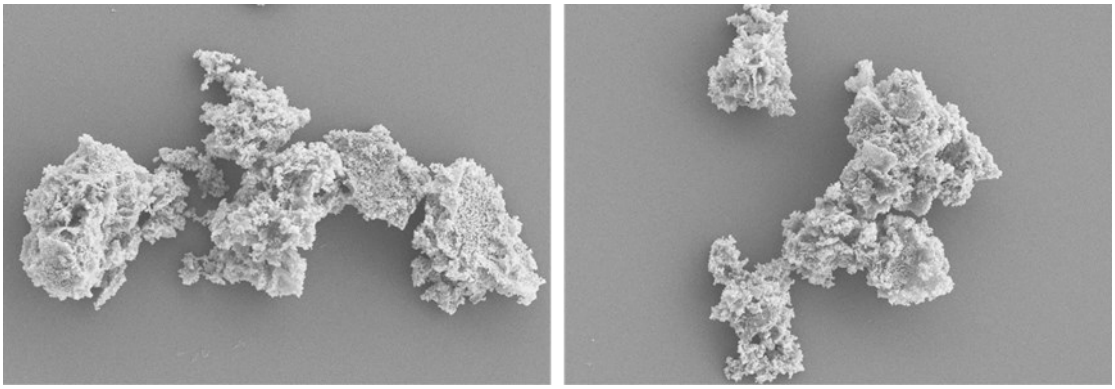

Figure S6. SEM images of prepared pure $Co_{1-x}S$

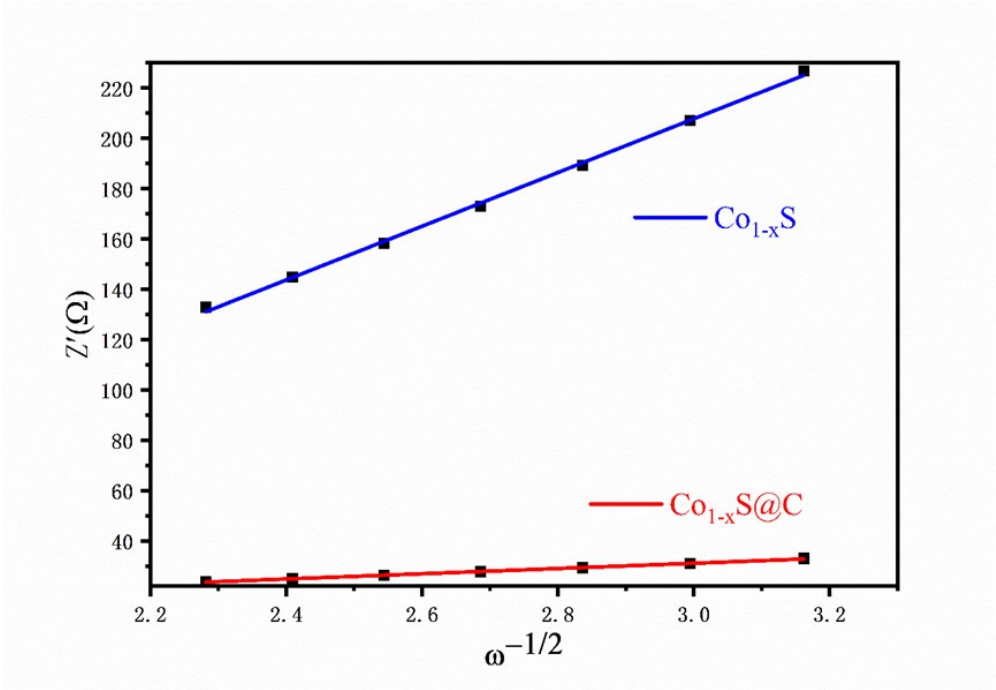

Figure S7. liner fits of Z´ *vs* $w^{-1/2}$ curves of $Co_{1-x}S$@C and $Co_{1-x}S$

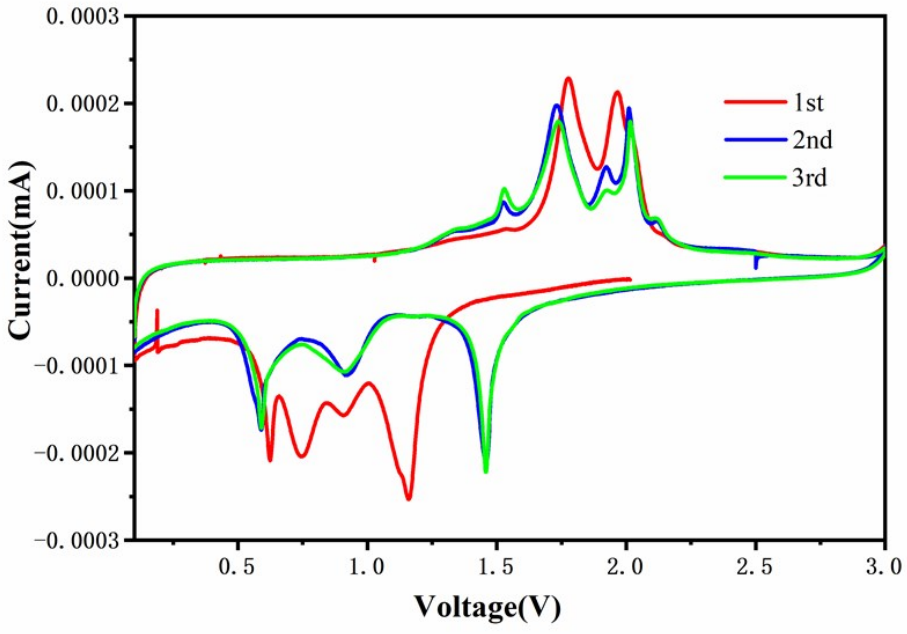

Figure S8. CV curves of $Co_{1-x}S$

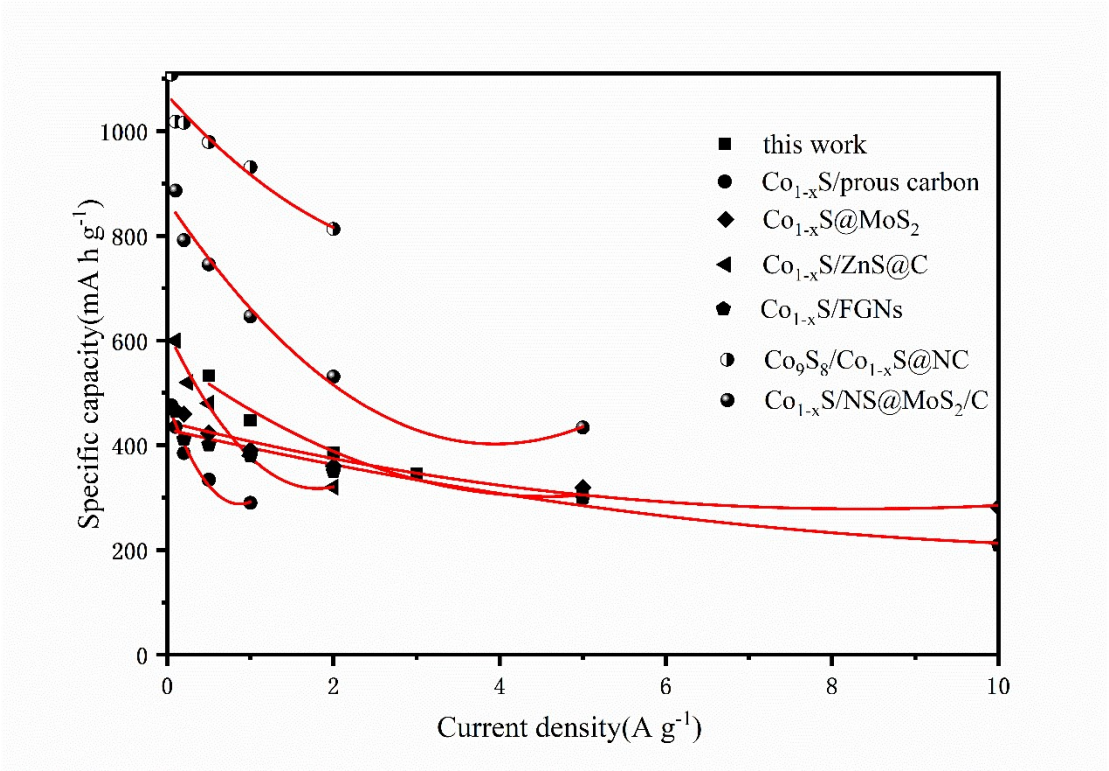

Figure S9. liner fits of Current density *vs* Specific capacity curves of $Co_{1-x}S$@C and $Co_{1-x}S$

Number	Formula
1	$i=av^b$
2	$\ln i=b \ln v + \ln a$
3	$i=k_1v+k_2v^{0.5}$

Table S1. Equation to the contributions degree of capacitive effect ·

Materials	Performance		References
	Cycling [Capacity(mA h g^{-1})/Current density(A g^{-1})/Cycles]	Rate [Capacity(mA h g^{-1})/Current density(A g^{-1})]	
$Co_{1-x}S$@C nanosheets	390/1/100	300/5	This work
$Co_{1-x}S$/ Porous carbon	408/0.1/100	308/1	[27]
$Co_{1-x}S@MoS_2$	378/1/100	218.6/5	S1

$Co_{1-x}S$/ZnS@C	580/0.3/100	389/1	S2
$Co_{1-x}S$/FGNs	251/1/200	211/10	S3
Co_9S_8/$Co_{1-x}S$@NC	1230/0.05/110		S4
$Co_{1-x}S$/NC@MoS_2/C	636/0.1/150	407/1	S5

Table S2. Performance comparison diagram of similar anode materials

References:

S1. P. Li, Y. Yang, S. Gong, F. Lv, W. Wang, Y. Li, M. Luo, Y. Xing, Q. Wang and S. Guo, *Nano Research*, 2019, **12**, 2218-2223.

S2. X. Zhu, J. Li, R. N. Ali, M. Huang, P. Liu and B. Xiang, Materials & Design, 2018, 160, 636-641.

S3. T. Chen, Y. Ma, Q. Guo, M. Yang and H. Xia, Journal of Materials Chemistry A, 2017, 5, 3179-3185.

S4. J. Wang, F. Bai, X. Chen, Y. Lu and W. Yang, Journal of Materials Chemistry A, 2017, 5, 3628-3637.

S5. Y. Wang, W. Xie, D. Li, P. Han, L. Shi, Y. Luo, G. Cong, C. Li, J. Yu, C. Zhu and J. Xu, Science Bulletin, 2020, 65, 1460-1469.