

Supporting Information

Shale-like Co_3O_4 for high performance lithium/sodium ion batteries

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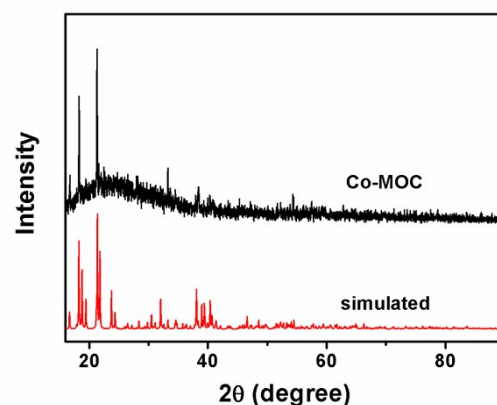


Figure S1. The XRD patterns for Co-MOC: the simulated (red line) and the as-synthesized (black line).

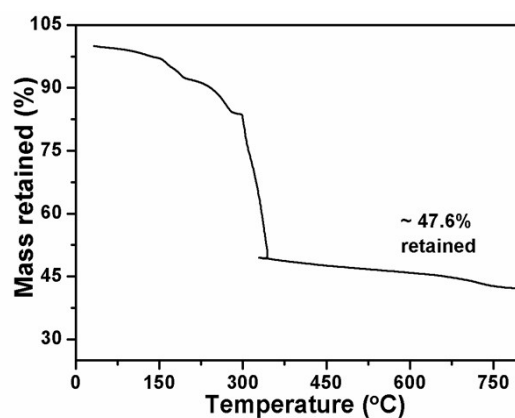


Figure S2. TG curve of the prepared Co-MOC under air atmosphere.

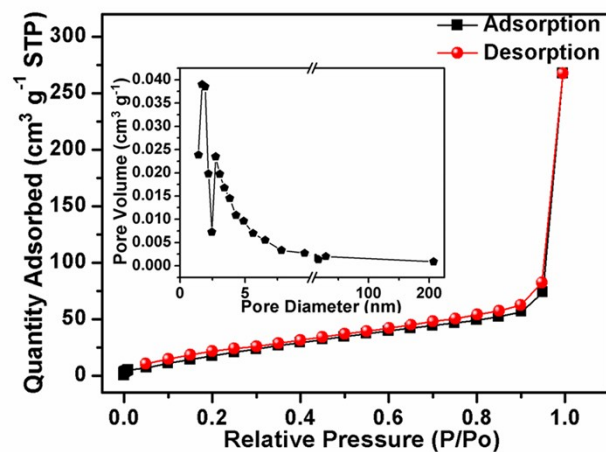


Figure S3. Nitrogen adsorption isotherms at -196°C for prepared $\text{S-Co}_3\text{O}_4$, the inset shows the BJH pore size distribution.

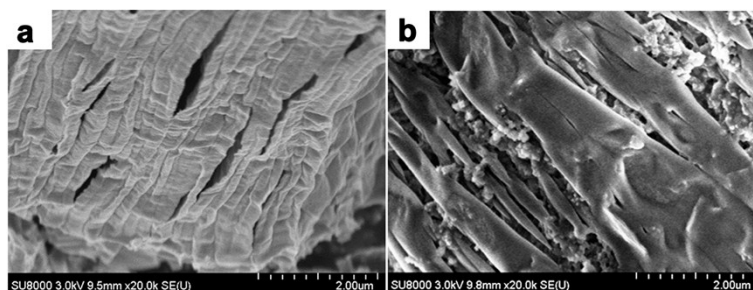


Figure S4. SEM images of $\text{S-Co}_3\text{O}_4$ (a) before and (b) after 50 cycles.

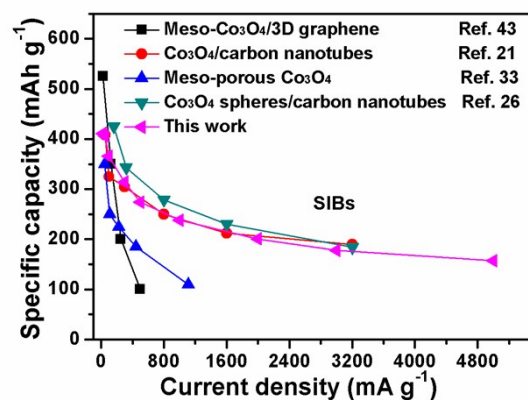


Figure S5. Comparison of specific capacities of the $\text{S-Co}_3\text{O}_4$ electrode with Co_3O_4 -based electrodes reported in the literature for SIBs.

Table S1. The crystallographic data for Co-MOC.

	Co-MOC
formula	$\text{Co}_3\text{C}_8\text{O}_7\text{N}_6\text{H}_2\text{Na}$
fw	467.90
space group	<i>Pnma</i>
crystal system	Orthorhombic
<i>a</i> /Å	23.085
<i>b</i> /Å	7.491
<i>c</i> /Å	9.934
<i>a</i> /°	90
<i>β</i> /°	90
<i>γ</i> /°	90
<i>V</i> /Å ³	1717.88
<i>Z</i>	4
calculated density (g.cm ⁻³)	1.902
absorption coefficient (μ,mm ⁻¹)	2.930
crystal size (mm)	0.31 x 0.12 x 0.08
<i>R</i> ₁ [<i>I</i> > 2σ(<i>I</i>)] ^a	0.0458
<i>wR</i> ₂ [<i>I</i> > 2σ(<i>I</i>)] ^b	0.1589
GOF on <i>F</i> ²	1.117

$$^a R_1 = \sum(|F_0| - |F_c|)/\sum|F_0|, ^b wR_2 = [\sum w(|F_0|^2 - |F_c|^2)^2/\sum w(F_0^2)^2]^{1/2}$$

Table S2. Surface area, pore volume and mean pore diameter of S-Co₃O₄.

Sample	Surface area (m ² g ⁻¹)	Pore volume (cm ³ g ⁻¹)	Average pore diameter (nm)
S-Co ₃ O ₄	208.8	0.45	2.06

Table S3. Comparison of specific capacities of the S-Co₃O₄ electrode with Co₃O₄-based electrodes reported in the literatures.

Material	Capacity after 100 cycles	Rate performance	Ref.
Co ₃ O ₄ hollow-structured nanoparticles	770 mAh g ⁻¹ @100 mA g ⁻¹ after 50 cycles	850, 750, 600, and 450 mAh g ⁻¹ @0.1, 0.5, 1 and 2 A g ⁻¹	ACS NANO. 2015, 9,1775
Co ₃ O ₄ /N-doped porous carbon hybrid	892 mAh g ⁻¹ @100 mA g ⁻¹	1026, 947, 839, 627 and 560 mAh g ⁻¹ @1, 2, 5, 9 and 10 A g ⁻¹	Nano Energy. 2015, 12, 1
Co ₃ O ₄ /nitrogen modified graphene	900 mAh g ⁻¹ @100 mA g ⁻¹	~800, 780, and 600 mAh g ⁻¹ @0.188, 0.313, and 0.625 A g ⁻¹	Nano Energy. 2014, 3, 134
Mesoporous nanostructured Co ₃ O ₄	913 mAh g ⁻¹ @100 mA g ⁻¹	~800, 742.5, 442.1 and 100 mAh g ⁻¹ @0.4, 0.5, 1 and 2 A g ⁻¹	J. Mater. Chem. A, 2015, 3, 5585
Co ₃ O ₄ /CuO nanocomposite	838.9 mAh g ⁻¹ @100 mA g ⁻¹ after 150 cycles	770, 710, and 640 mAh g ⁻¹ @0.2, 0.3, 1 and 0.5 A g ⁻¹	ChemSusChem 2015, 8,1435
Mesoporous hexagonal Co ₃ O ₄	909 mAh g ⁻¹ @100 mA g ⁻¹	1054, 916, 650, and 571 mAh g ⁻¹ @0.2, 0.5, 1 and 2 A g ⁻¹	ScientificReports. 2014, 4, 6519
flower-like Co ₃ O ₄ /carbon nanofiber	911 mAh g ⁻¹ @200 mA g ⁻¹ after 50 cycles	760, 575, and 323 mAh g ⁻¹ @0.4, 0.6 and 1 A g ⁻¹	CARBON 2015, 89, 197
Co ₃ O ₄ @MnO ₂ hierarchical porous nanoneedle array	924 mAh g ⁻¹ @120 mA g ⁻¹	982, 675, and 387.5 mAh g ⁻¹ @0.24, 0.48 and 0.96 A g ⁻¹	Adv.Funct.Mater. 2014, 24, 3815
Peapod-like Co ₃ O ₄ @Carbon	862 mAh g ⁻¹ @100 mA g ⁻¹ after 60 cycles	~700, 500, 453, and 408 mAh g ⁻¹ @0.2, 0.5, 1 and 5 A g ⁻¹	Angew.Chem.Int. Ed. 2015,54,7060
Mesoporous hollow spheres	~700 mAh g ⁻¹ @1000 mA g ⁻¹	929, 610, 321, and 181 mAh g ⁻¹ @1, 2.5, 5 and 10 A g ⁻¹	NAT COMMUN. 2014.5.4526
Shale-like Co ₃ O ₄	1045.3 mAh g ⁻¹ @200 mA g ⁻¹	902.5, 784.1, 522.4, and 414.5 mAh g ⁻¹ @0.4, 1.6, 6.4, and 10 A g ⁻¹	This work

Table S4. Impedance parameters of S-Co₃O₄ calculated from equivalent circuit.

Sample	R_e (ohm)	R_{ct} (ohm)	Chi-squared
S-Co ₃ O ₄	1.85	83.68	0.072%
error%	+2.099%	+1.007%	—