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Supporting Information

Self-Sacrificial Template-Directed Synthesis of Metal–Organic Framework-Derived Porous Carbon for Energy-Storage Devices

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Supporting Information

Experiment Sections

Preparation of ZnO spheres. ZnO spheres were synthesized through hydrolysis of zinc acetate dihydrate in diethylene glycol as described in previous report.^[S1] Typically, 1.97 g of zinc acetate dihydrate was added in 90 mL of diethylene glycol. The mixture was heated to 160 °C at a rapid heating of about 10 °C min⁻¹ and then reflux at this temperature for 16 h. The product was collected by centrifuged and washed by ethanol several times. Then the white product was annealed at 400 °C for 1 h in air.

Preparation of hollow ZIF-8 derived carbon sphere. 204 mg ZnO nanosheets was added to 80 mL N,N-dimethylformamide/H₂O mixed solvent (v/v ratio of 3:1) and stirred for 1 h. Then 206 mg 2-methylimidazole (MeIM) was added to the dispersion under magnetic stirring. After 10 min stirring, the homogeneous dispersion was added to Teflon-lined stainless-steel autoclave (100 mL). The autoclave was transferred to an oven preheated to 70 °C. After the mixture reacted for 12 h, the white product was collected by centrifugation and washed by fresh DMF and ethanol for five times. The as-prepared ZnO@ZIF-8 composite was put into a ceramic boat and transferred into a temperature-programmed furnace, then heated to 200 °C for 6 h at a heating rate of 5 °C min⁻¹. The further pyrolysis treatment was performed at 950 °C for 10 h.

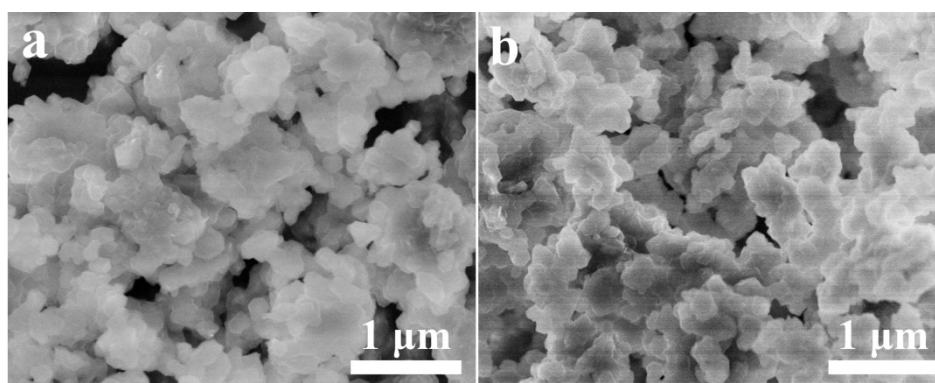


Figure S1. SEM images of ZnO@ZIF-8 composites prepared with (a) 4 h and (b) 12 h.

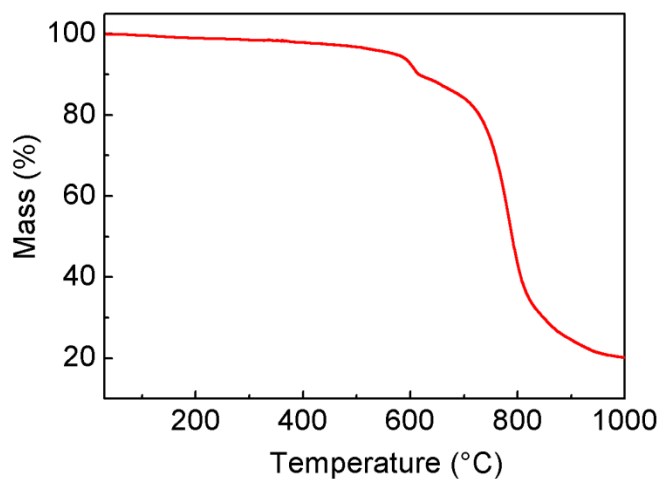


Figure S2. TGA curve of ZnO@ZIF-8 composite under N₂ conditions at a heating rate of 5 °C min⁻¹ (ZnO@ZIF-8 composite was prepared at 4 h).

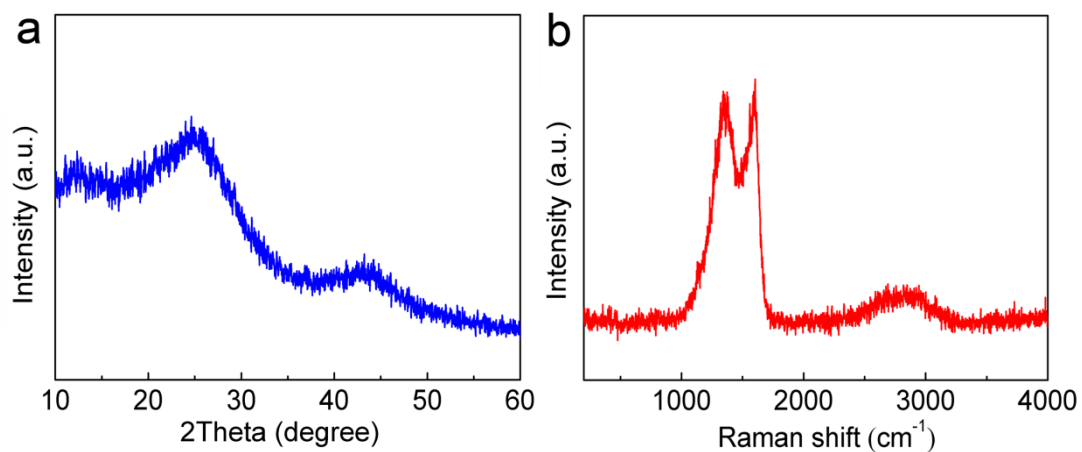


Figure S3. (a) XRD pattern and (b) Raman spectrum of ZCNs-4.

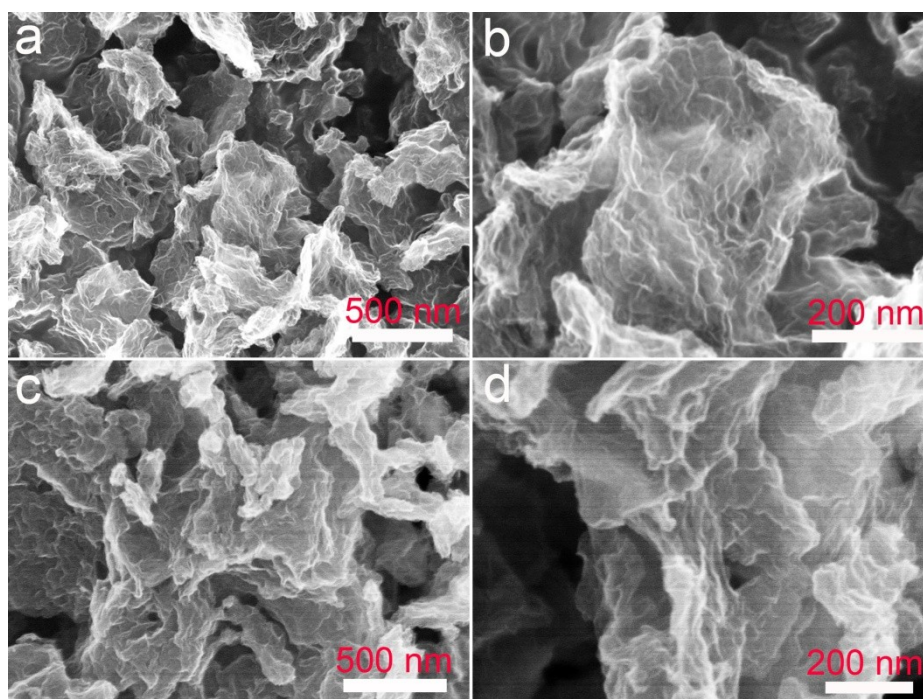


Figure S4. SEM images of (a, b) ZCNs-4 and (c, d) ZCNs-12.

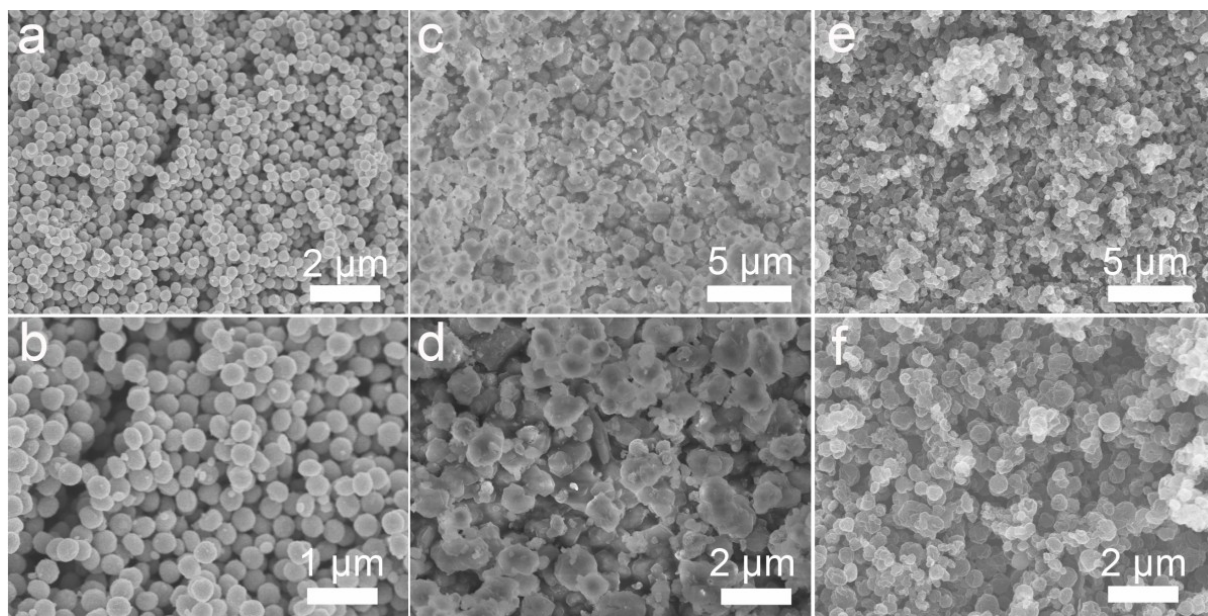


Figure S5. SEM images of (a, b) ZnO sphere, (c, d) core-shell nanostructured ZnO@ZIF-8 composite and (e, f) ZIF-8-derived hollow carbon sphere.

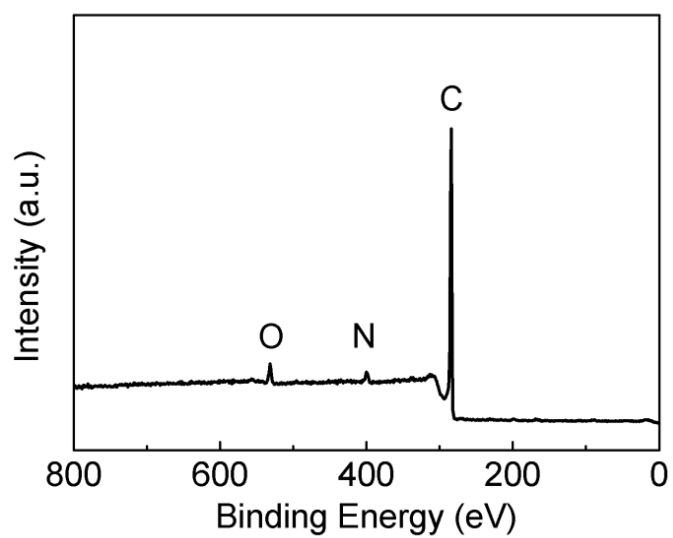


Figure S6. Typical survey scanned XPS spectrum of ZCNs-4.

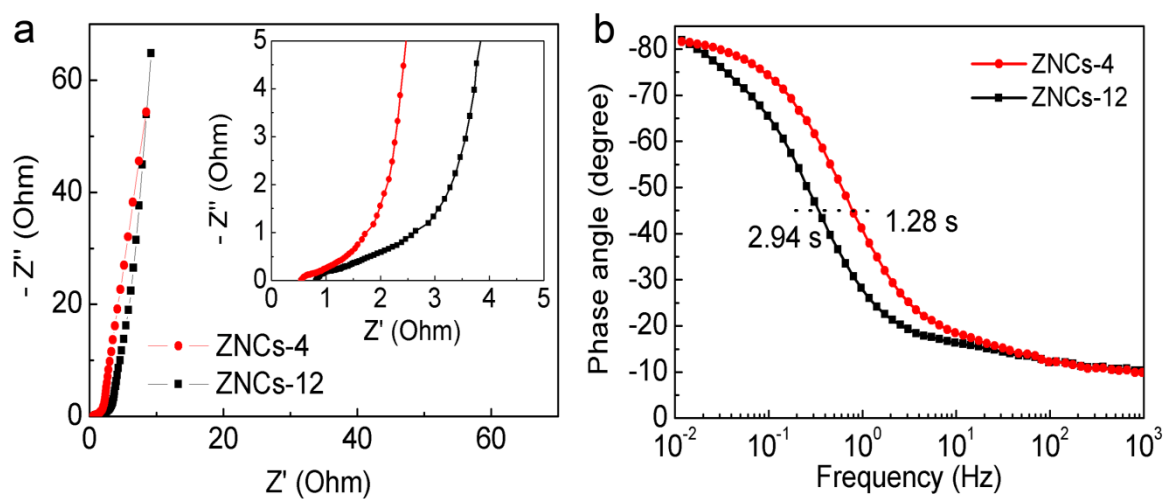


Figure S7. (a) Nyquist plots and (b) bode plots of ZCNs-4 and ZCNs-12-based cell.

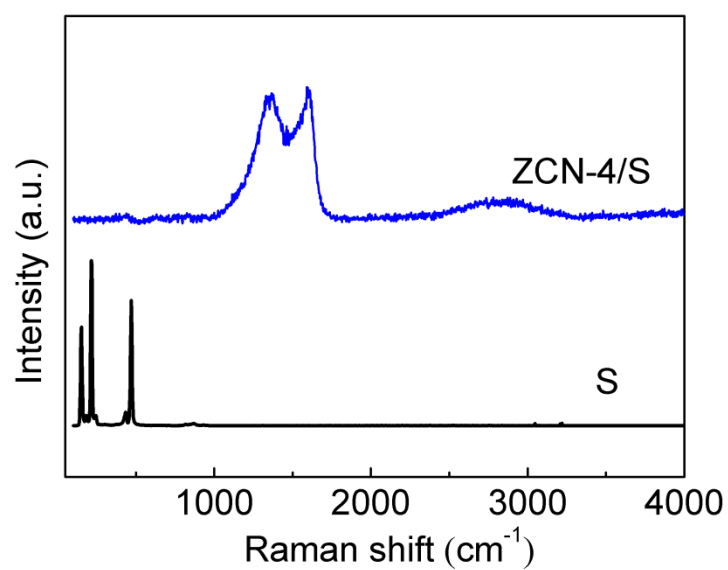


Figure S8. Raman spectra of elemental sulfur and ZCNs-4/S composite.

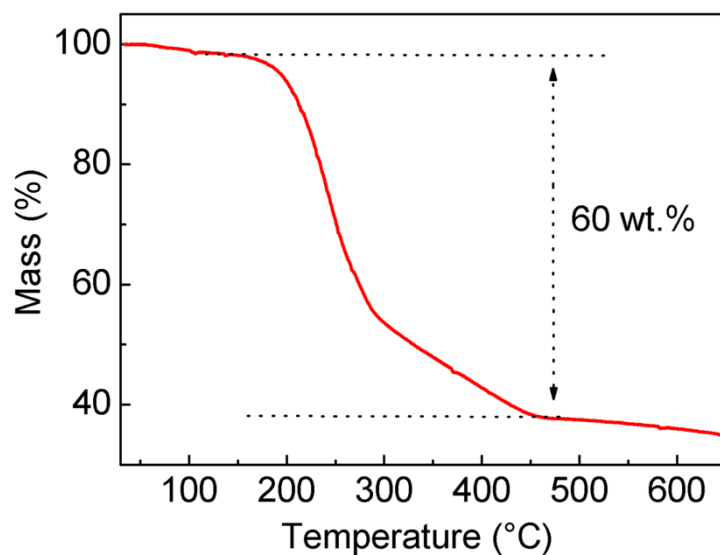


Figure S9. TG curves of elemental sulfur and ZCNs-4/S composite.

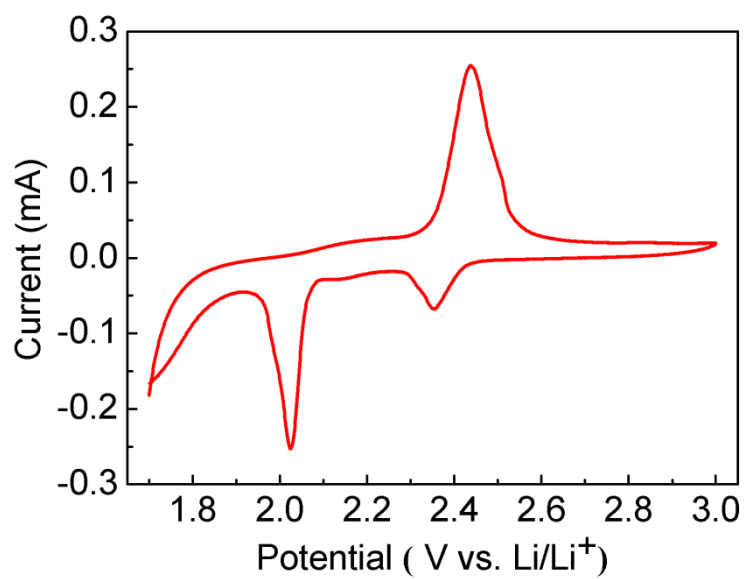


Figure S10. CV curve of ZCNs-4/S electrode.

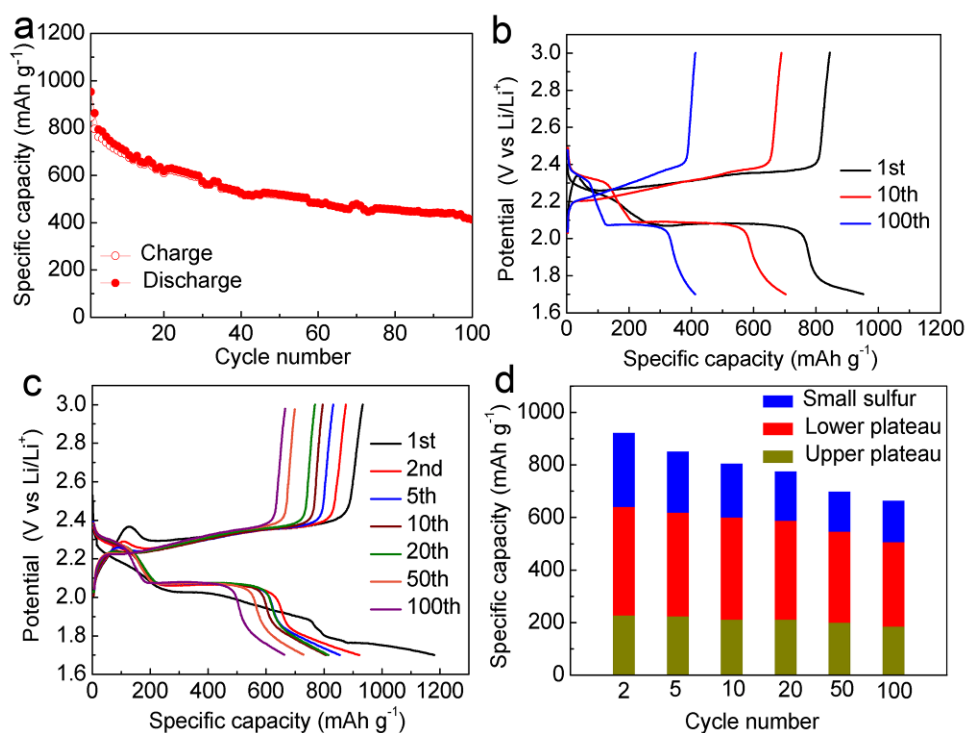


Figure S11. (a) Cycling performance and (b) potential profiles of ZCNs-12/S electrode at 0.5 C. (c) Potential profiles of ZCNs-4/S electrode at 0.5 C. (d) Capacity contribution from higher plateau, lower plateau and small sulfur molecule of ZCNs-4/S electrode.

Table S1. Porous characterizations of ZCNs-4 and ZCNs-12.

Samples	S_{BET} ($\text{m}^2 \text{g}^{-1}$)	Micro-SSA ($\text{m}^2 \text{g}^{-1}$)	Pore volume ($\text{cm}^3 \text{g}^{-1}$)	Micro volume (cm^3 g^{-1})	$\frac{\text{Meso+Macro}}{\text{Micro}}$
ZCNs-4	1228	639	0.80	0.26	2.46
ZCNs-12	1023	565	0.74	0.23	2.22

References

- [S1] Q. Zhang, T. P. Chou, B. Russo, S. A. Jenekhe, G. Z. Cao, *Adv. Funct. Mater.* **2008**, *18*, 1654.