

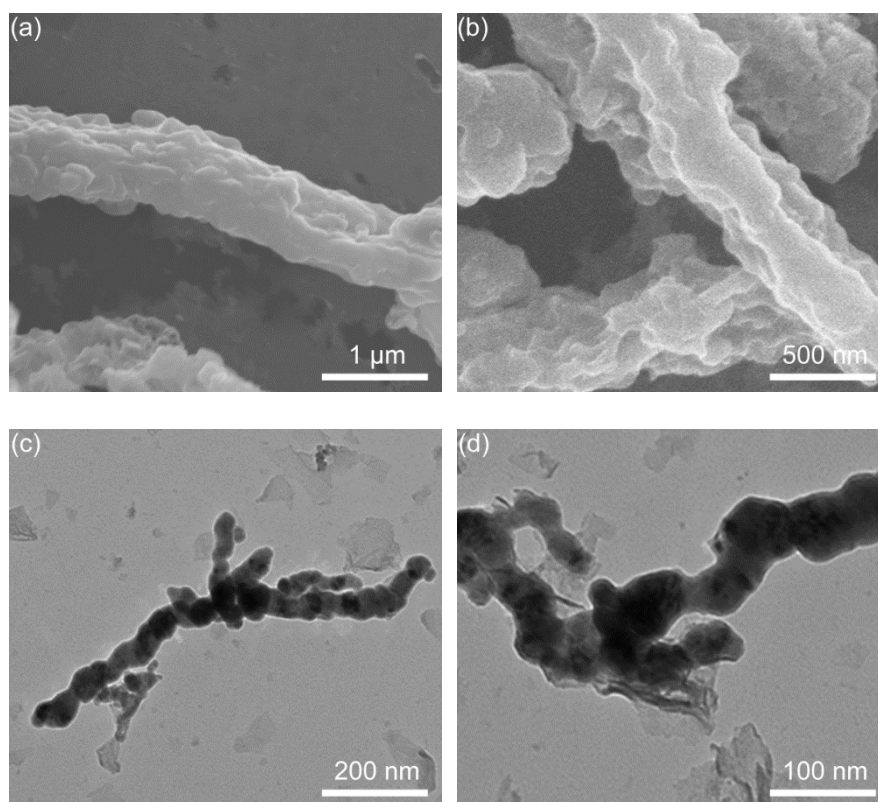
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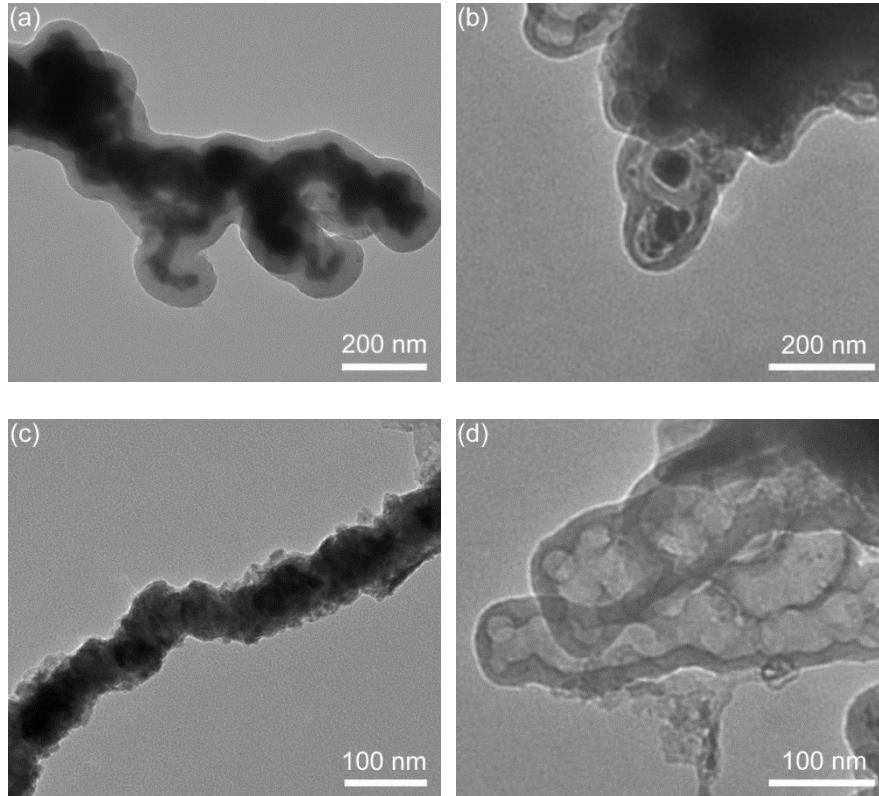
**A Yolk-Shell  $\text{Fe}_3\text{O}_4@$ Void@Carbon Nanochain as Shuttle Effect  
Suppressive and Volume-Change Accommodable Sulfur Host for  
Long-Life Lithium-Sulfur Batteries**

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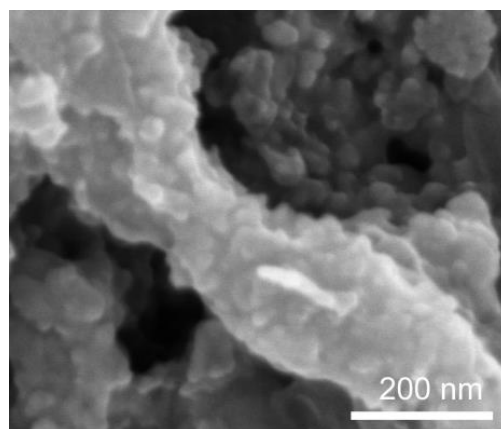
Huigang Zhang,<sup>\*,b</sup> Jinyun Liu<sup>\*,a</sup>



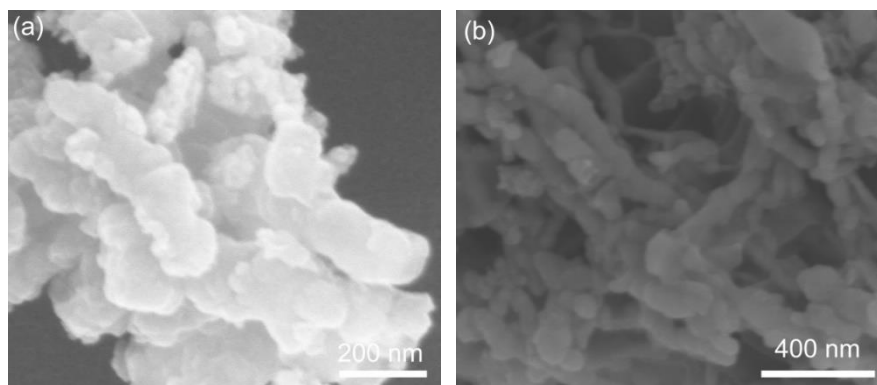
**Fig. S1** (a, b) SEM and (c, d) TEM images of the carbon-coated  $\text{Fe}_3\text{O}_4$  nanochain.



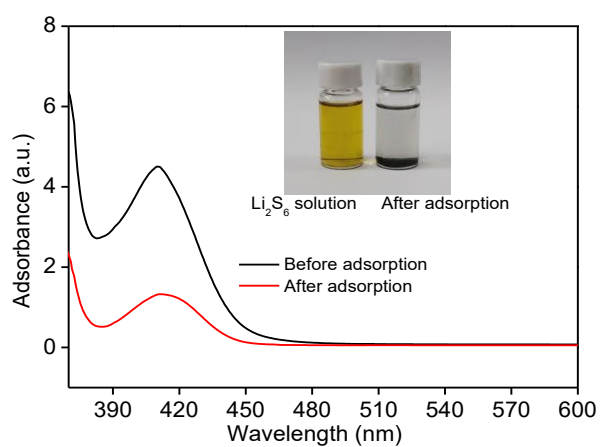
**Fig. S2** TEM images of the  $\text{Fe}_3\text{O}_4@\text{C}$  after etching by 0.2 M HCl solution for (a, b) 30 min, (c) 20 min, and (d) 60 min.



**Fig. S3** SEM image of the  $\text{Fe}_3\text{O}_4@\text{S}@\text{C}$  nanochain after 500 cycles at 0.2C.



**Fig. S4** (a, b) SEM images of the Fe<sub>3</sub>O<sub>4</sub>@S prepared by directly coating sulfur onto the Fe<sub>3</sub>O<sub>4</sub> nanochains.



**Fig. S5** UV-vis spectra of the Li<sub>2</sub>S<sub>6</sub> solution before and after adsorption by the Fe<sub>3</sub>O<sub>4</sub>@void@C nanochain host. Inset shows the photo of the initial Li<sub>2</sub>S<sub>6</sub> solution and the one after adsorption.

**Table S1.** Comparison on the electrochemical performance of some sulfur cathodes.

| Cathode materials   | Preparation method                | Cycling rate | Cycling number | Capacity (mAh g <sup>-1</sup> ) | Ref.      |
|---|-----------------------------------|--------------|----------------|---------------------------------|-----------|
| S@TiO <sub>2</sub> @HCNBs                                 | Templated synthesis               | 0.5C         | 50             | 773                             | 1         |
| Carbon nanotube/S   | Thermal treatment                 | 0.1C         | 300            | 669                             | 2         |
| S/PPy-MnO <sub>2</sub>                                    | In situ polymerization            | 0.2C         | 200            | 985                             | 3         |
| S@CNTs/CoS  | Hydrothermal approach             | 0.2C         | 100            | 762                             | 4         |
| Yolk-shell Co-V@C/S                                       | Template-free solvothermal method | 0.2C         | 100            | 830                             | 5         |
| Yolk-shell S@Co-N-C/CNTs                                  | Hydrothermal method               | 0.5C         | 110            | 572                             | 6         |
| Yolk-shell NiS <sub>2</sub> /C-S                          | Hydrothermal method               | 0.2C         | 50             | 600                             | 7         |
| TiO <sub>2</sub> @TiN@S                                   | Hydrothermal method               | 0.2C         | 500            | 533                             | 8         |
| Au@MCNSs/S  | Self-crosslinking procedure       | 0.1C         | 40             | 664                             | 9         |
| Yolk-shell Fe <sub>3</sub> O <sub>4</sub> @S@C nanochains | Hydrothermal method               | 0.2C         | 500            | 625                             | This work |

## References

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