

Mechanism of capacity fade in sodium storage and the strategies of improvement for FeS₂ anode

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Supporting Information

Supplementary data: **Figure S1.** Particle size distribution of FeS₂ microparticles. **Figure S2.** Ex-situ XRD patterns of FeS₂ electrodes in different sodiation/desodiation process. **Figure S3.** In-situ XAFS of FeS₂. **Figure S4.** Ex-situ EDX of FeS₂ electrode during cycling. **Figure S5.** TEM images of the FeS₂ electrodes after 30 cycles. **Figure S6.** EIS data and equivalent circuit model of FeS₂ electrodes. **Figure S7.** The energy density and power density contrast of recent work about FeS₂. **Table S1.** The R_{ct} of different FeS₂ electrodes before and after 30 cycles.

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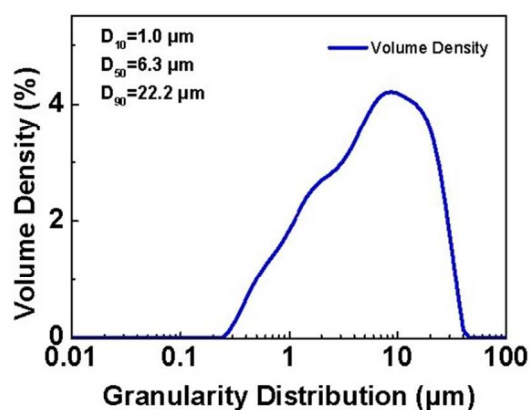


Figure S1. Particle size distribution of FeS₂ microparticles.

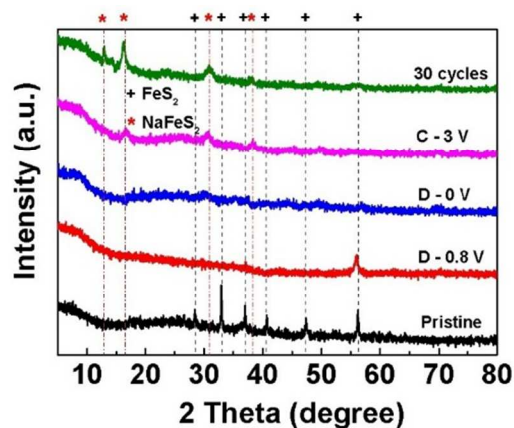


Figure S2. *Ex-situ* XRD patterns of FeS₂ electrodes in different sodiation/desodiation process.

Supporting Information

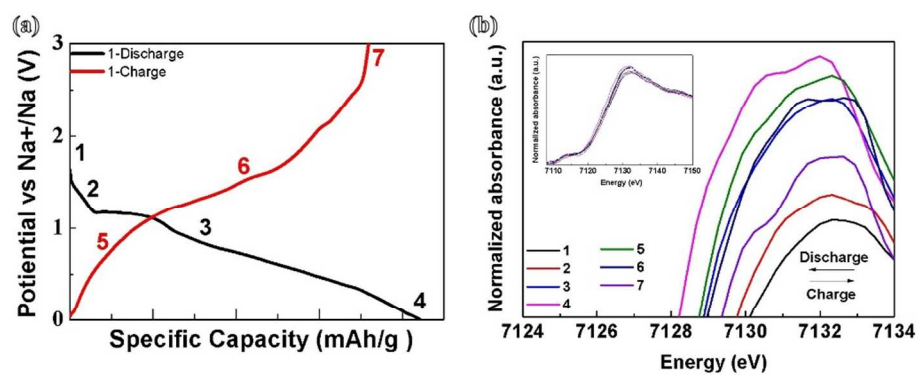


Figure S3. In-situ XAFS of FeS₂ (a) charge/discharge profiles (b) in-situ XAFS spectra of Fe K-edge.

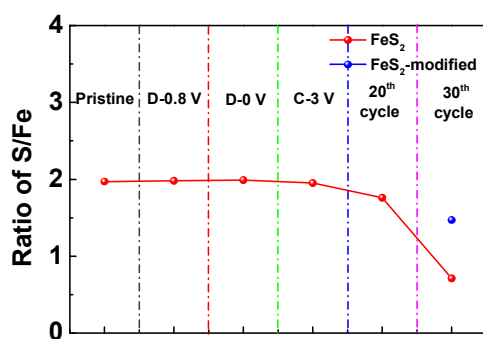


Figure S4. The ratio of S/Fe in bare FeS₂ electrode and FeS₂-graphene electrode during cycling by EDX test.

Supporting Information

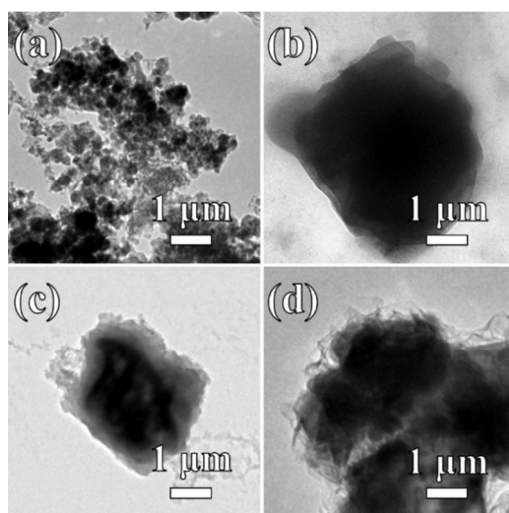


Figure S5. TEM images of the FeS_2 electrodes after 30 cycles. (a) PVDF binder (0-3 V); (b) PVDF binder (0.5-3 V); (c) PAA-Na binder (0-3 V); (d) PVDF binder and graphene coating (0-3 V).

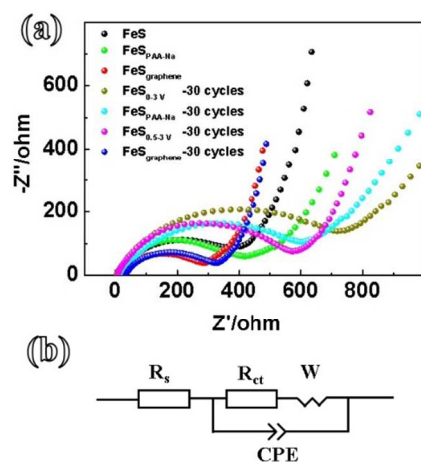


Figure S6. (a) EIS data of the different FeS_2 electrodes before and after 30 cycles; (b) equivalent circuit model of FeS_2 electrodes (R_s corresponds to the solid-state diffusion impedance, R_{ct} and CPE corresponds to the charge transfer impedance and capacitance, W corresponds to the Warburg impedance during diffusion process).

Supporting Information

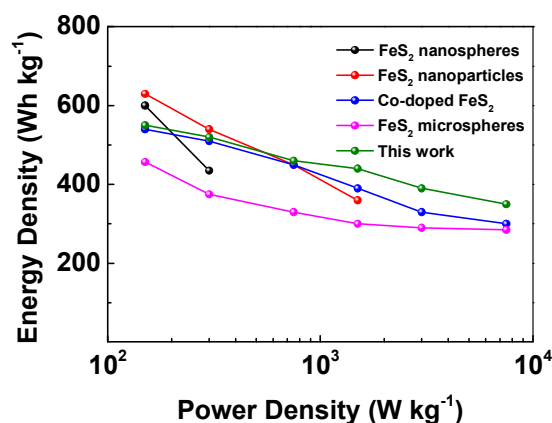


Figure S7. Energy density and power density contrast of recent work on FeS₂ materials in sodium batteries (Based on the mass of FeS₂-graphene composite).¹⁻⁴

Table S1. The R_{ct} of different FeS₂ electrodes before and after 30 cycles.

Name	Pristine/ohm	30 cycles/ohm
FeS ₀₋₃ V	321	587
FeS _{0.5-3} V	321	490
FeS _{PAA-Na}	314	470
FeS _{graphene}	210	249

References

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- (3) Zhang, K.; Park, M.; Zhou, L.; Lee, G.-H.; Shin, J.; Hu, Z.; Chou, S.-L.; Chen, J.; Kang, Y.-M. Cobalt-Doped FeS₂ Nanospheres with Complete Solid Solubility as a High-Performance Anode Material for Sodium-Ion Batteries. *Angew. Chem. Int. Ed.* **2016**, 55, 12822-12826.
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