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Two-dimension Sulfide Anodes for Sodium-ion Batteries

Two-dimension (2D) materials, such as molybdenum disulfide (MoS_2), iron disulfide (FeS_2), have received widely interest in electrode materials for rechargeable batteries owing to their 2D structure, low cost, natural abundance and high theoretical capacity. Here, we report the application of MoS_2[1], FeS_2[2] as the anodes of sodium-ion batteries. Based on the selected compatible ether-based electrolyte and the tuned cut-off voltage, both of two sulfides show an intercalation mechanism rather than a conversion reaction, refraining from the huge volume change caused by phase conversion. MoS_2 nanoflower with expanded interlayer shows high discharge capacities of 350 mAh g^{-1} at 0.05 A g^{-1}, and 195 mAh g^{-1} at 10 A g^{-1}. FeS_2 microsphere exhibits high-rate capability (170 mAh g^{-1} at 20 A g^{-1}) and long-term cycling (~90% capacity retention for 20000 cycles) The superior electrochemical performance of the two sulfides demonstrates the feasibility for their practical application.

References

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[2] Z. Hu, Z. Zhu, F. Cheng, K. Zhang, J. Wang, C. Chen, J. Chen, *Energy Environ. Sci.*, 8(2015), 1309–1316.
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Figures

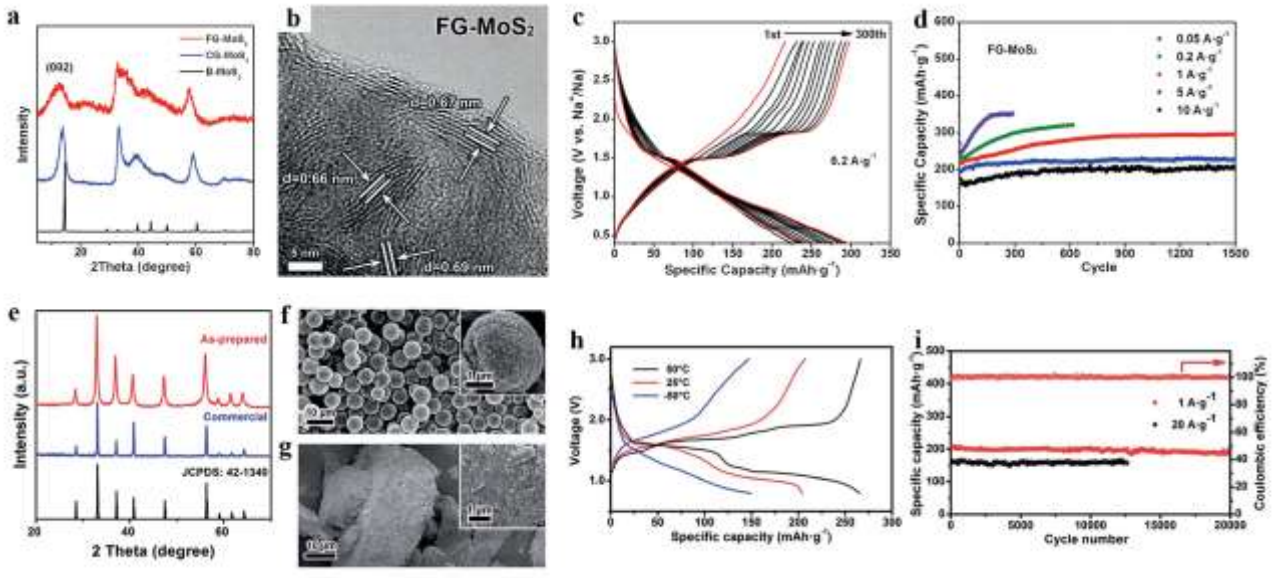

Figure 1: (a) XRD patterns of the MoS_2 samples and (b) HRTEM images of FG-MoS_2. (c) The charge-discharge curves from 1st to 300th cycle and (d) the cyclic properties at different rates of FG-MoS_2. (e) XRD patterns and (f,g) SEM images of FeS_2 microspheres and commercial FeS_2. (h) Charge-discharge profiles at 1 A g^{-1} at different temperatures. (d) Cycling performance of FeS_2 microspheres.