

Supplementary Information

Soybean-derived hierarchical porous carbon with large sulfur loading and sulfur content for high-performance lithium-sulfur batteries

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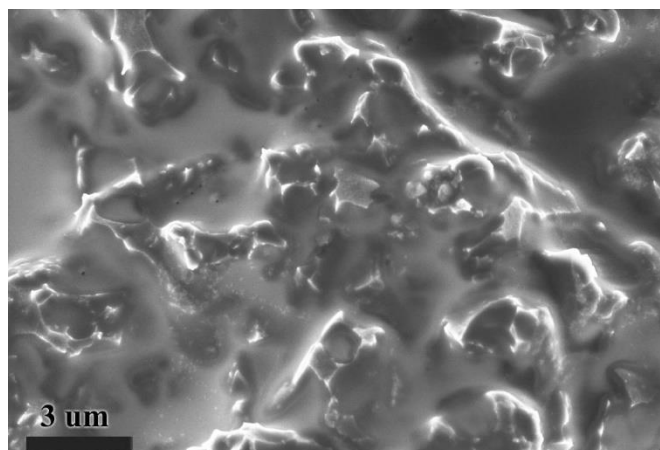


Figure S1. SEM image of carbonaceous intermediates, derived from soybean treated at 180 °C for 20 h in an autoclave. These carbonaceous intermediates appeared as a thick oil-like paste.

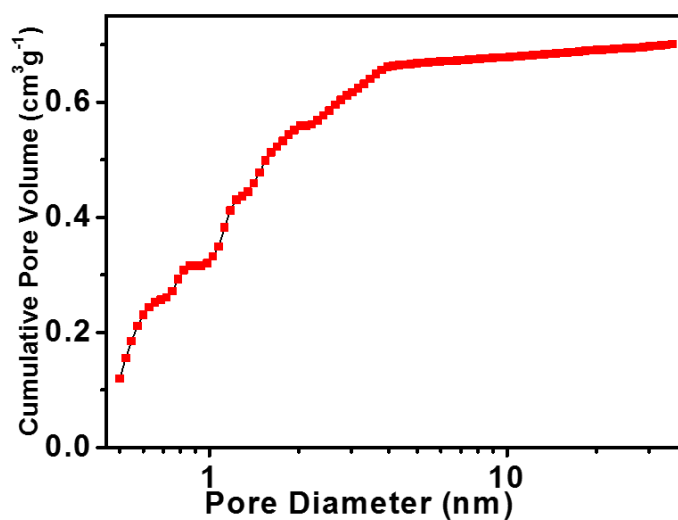


Figure S2. Plot of the cumulative pore volume of the soybean-derived hierarchical porous carbon, showing the contribution from pores with different diameters to the total pore volume in the porous carbon. From this plot it is observed that micropores with pore diameter smaller than 2 nm contribute most of the total pore volume of ca. 0.7 cm³ g⁻¹.

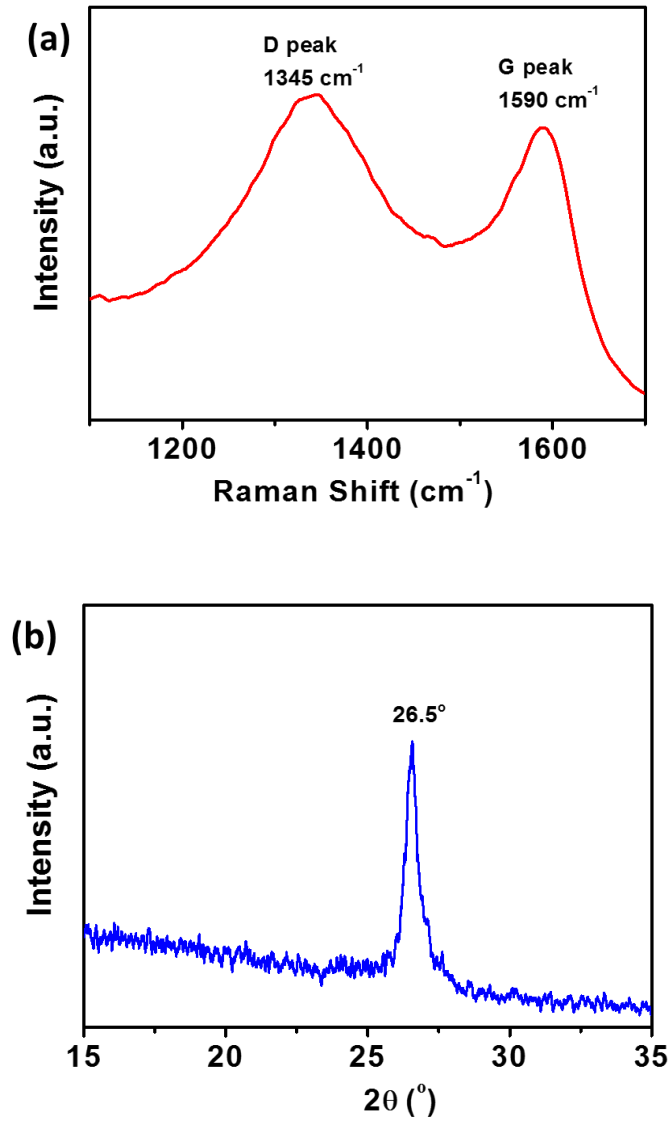


Figure S3. Raman spectrum (a) and XRD pattern (b) of the soybean-derived hierarchical porous carbon. Two Raman peaks at ca. 1345 cm⁻¹ and ca. 1590 cm⁻¹, and the broad XRD peak at 26.5 ° are the characteristics of carbonaceous material.

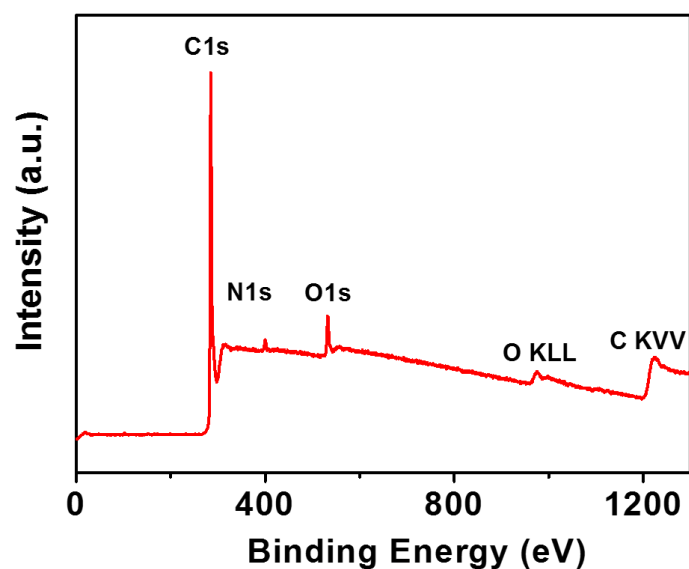


Figure S4. Survey XPS spectrum of the soybean-derived hierarchical porous carbon indicating the presence of O and N as intrinsic dopants in the carbonaceous material.

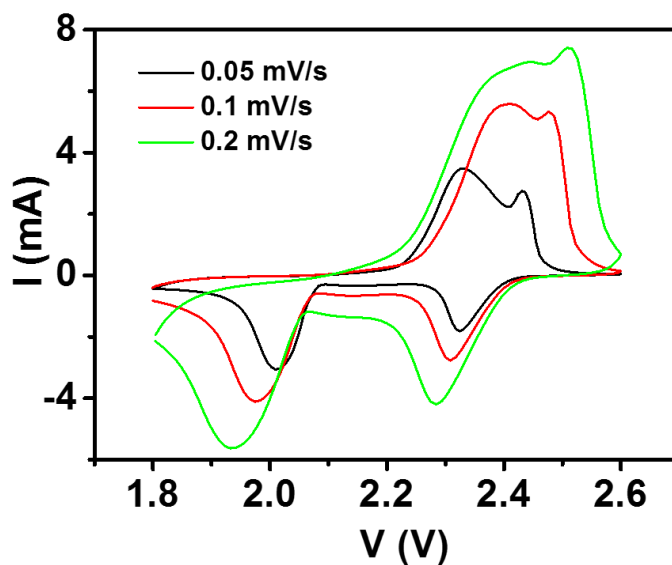


Figure S5. C-V curves of a cell at different scan rates of 0.05 mV/s, 0.1 mV/s and 0.2 mV/s that show two well-separated cathodic peaks and two closely-spaced anodic peaks, with the cathodic and anodic peaks shift due to polarization at higher scan rates. These cathodic and anodic peaks correspond to the potential plateaus in the C-D curves of Figure 3d.

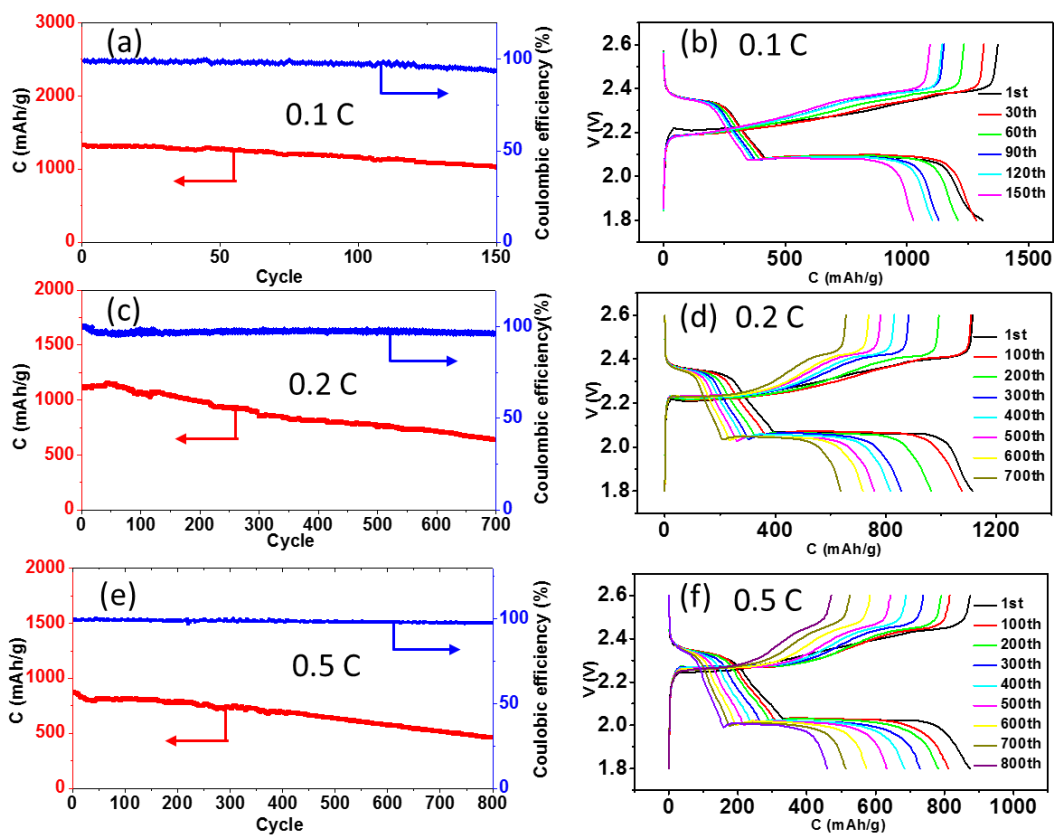


Figure S6. Cycling test of the cells with a sulfur loading of 2 mg cm^{-2} at different C-D rates, and the representative C-D profiles. Three cells were cycled at 0.1 C for 150 cycles (a, b), 0.2 C for 700 cycles (c, d), 0.5 C for 800 cycles (e, f).

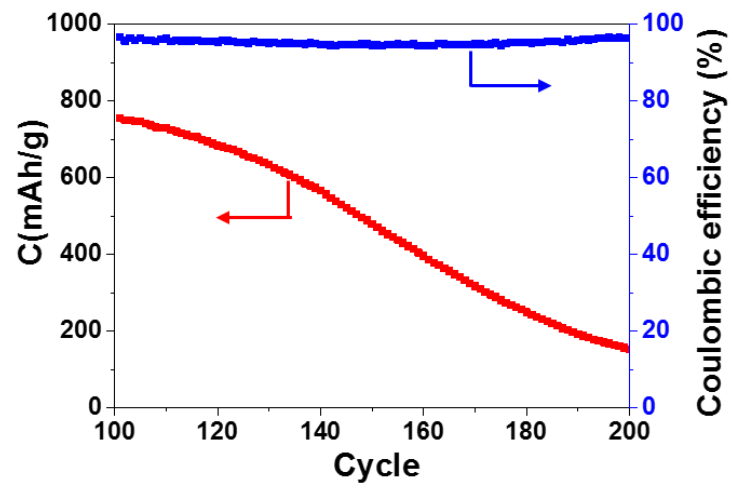


Figure S7. Cycling test of the cells with a sulfur loading of 5.5 mg cm^{-2} up to 200 cycles at 0.2 C. The capacity decreased dramatically after 120 cycles.

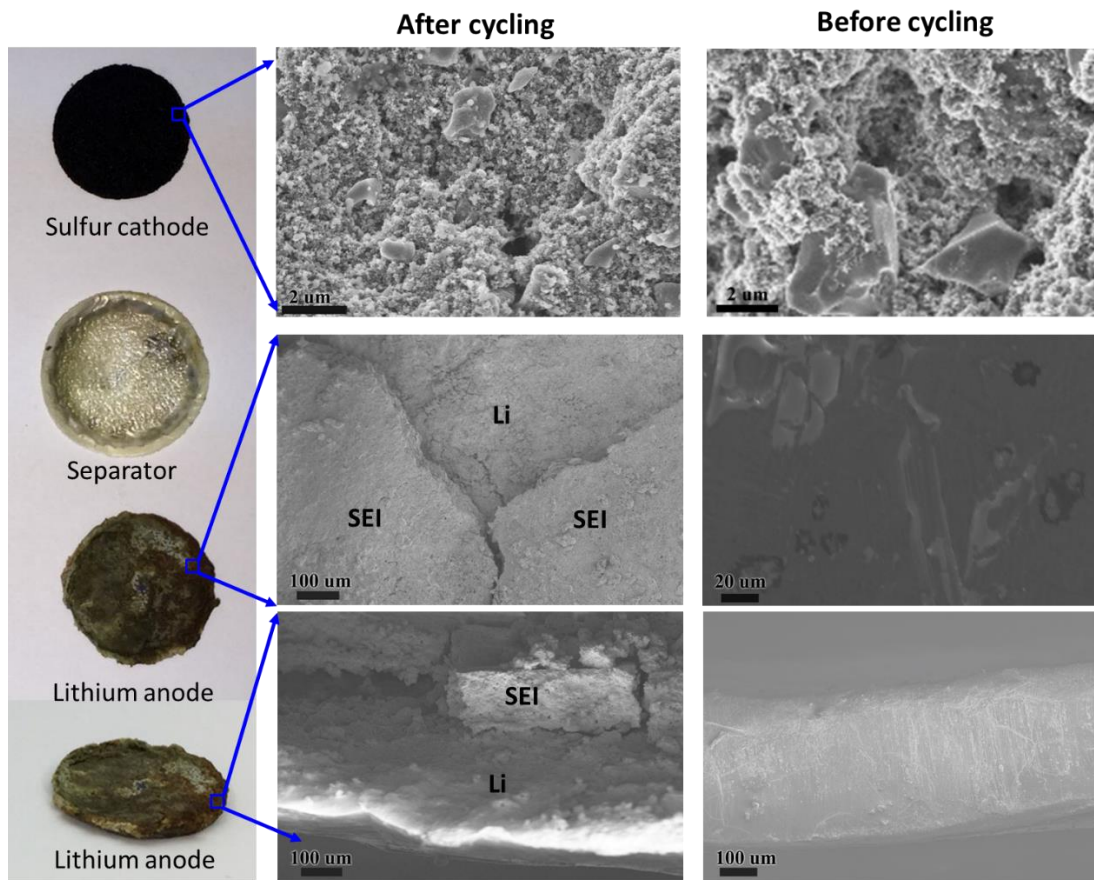


Figure S8: The postmortem analysis of the failed battery through the photograph and SEM imaging. The sulfur cathode does not show obvious signature of failure, while the lithium anode was severely eroded and a thick SEI layer was formed on the surface. This SEI layer is probably unstable. These observations suggest erosion of lithium anode was the main failure mechanism for LSBs.