Electronic Supplementary Material (ESI) for Journal of Materials Chemistry A.

Supporting Information

Sodium Trithiocarbonate Cathode for High-performance Sodium-sulfur Batteries

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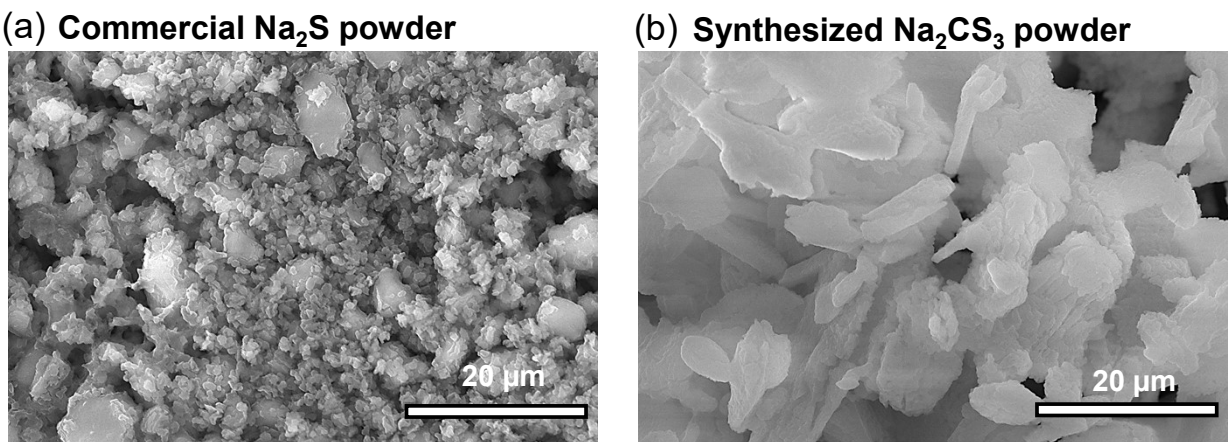


Figure S1. SEM images of (a) commercial Na_2S powder and (b) synthesized Na_2CS_3 powder.

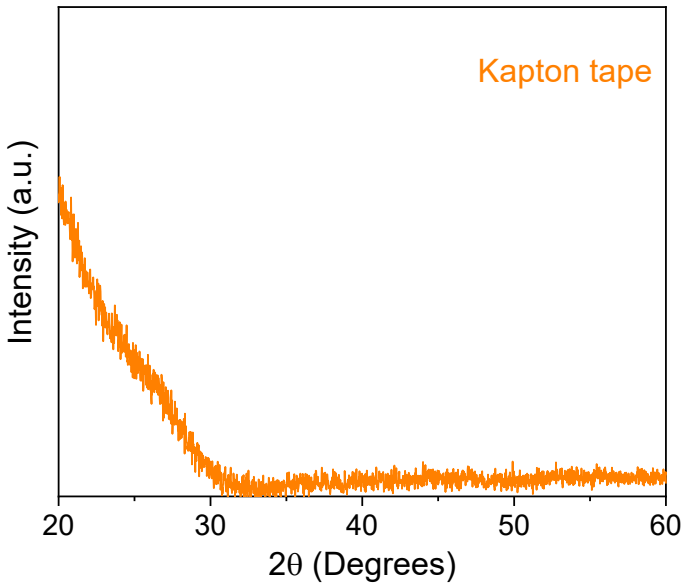


Figure S2. XRD patterns of Kapton tape only.

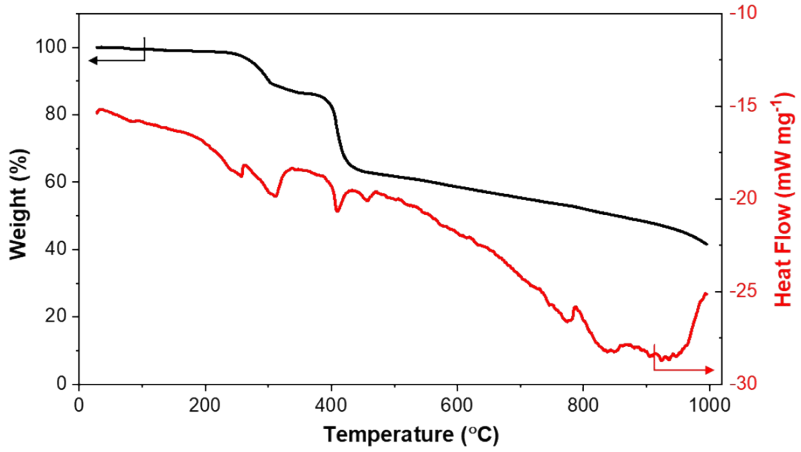


Figure S3. TGA and DSC curves of Na_2CS_3 in Ar atmosphere. Na_2CS_3 undergoes a three-step thermal decomposition at 250 - 300 °C, 390 - 420 °C, and > 420°C.

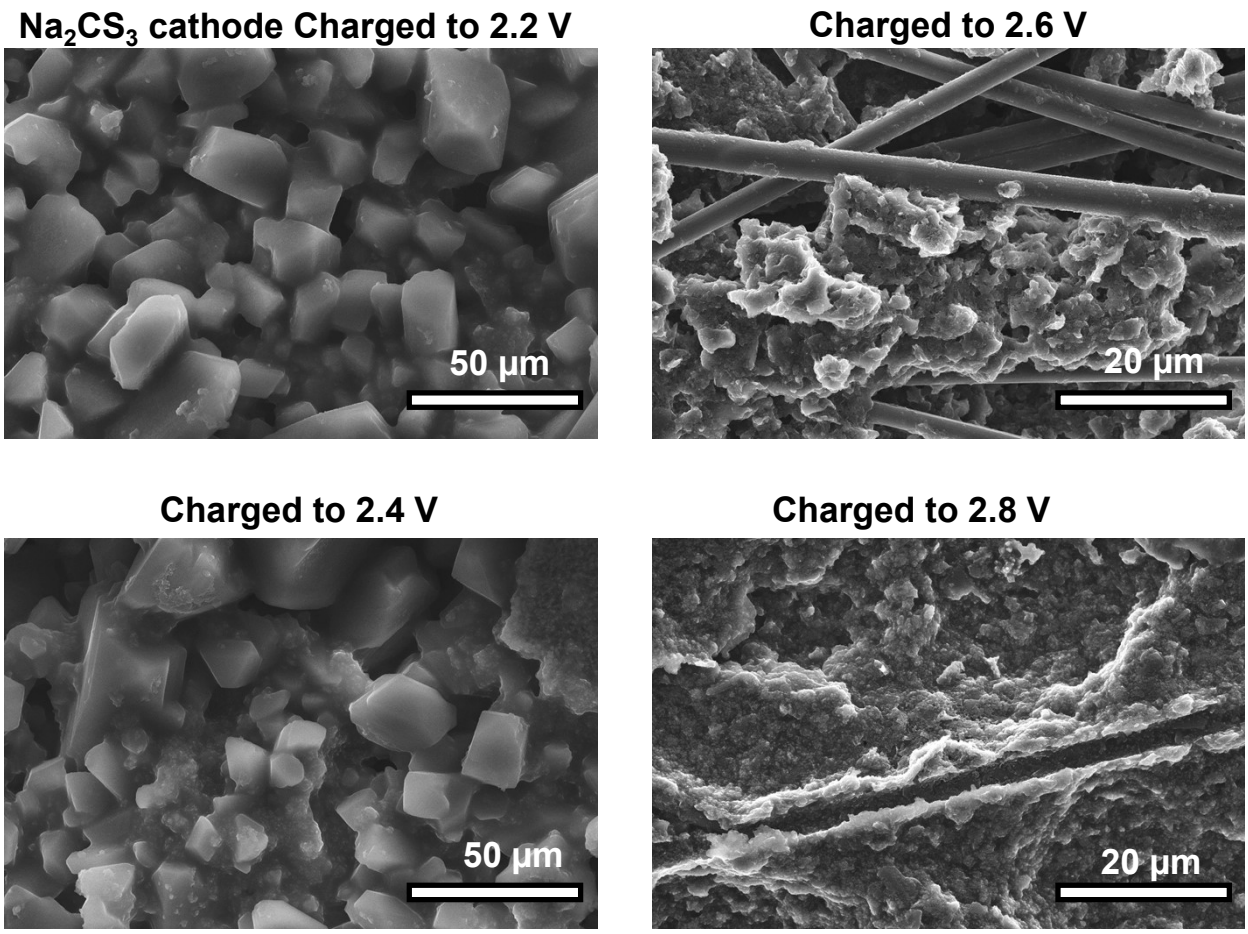


Figure S4. SEM images of Na_2CS_3 cathode at different charge states (2.2, 2.4, 2.6, and 2.8 V).

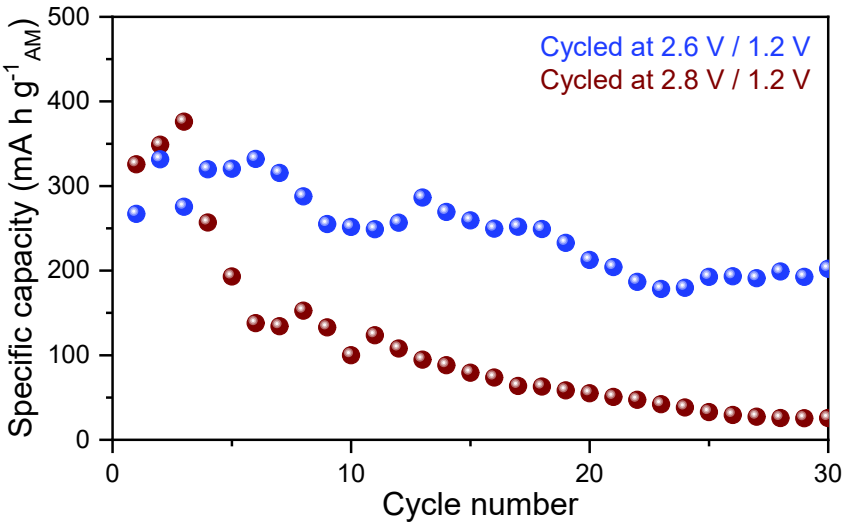


Figure S5. Cycling stability comparison of the Na || Na_2CS_3 cells when cycled at 2.6 – 1.2 V (blue) and 2.8 – 1.2 V (brown). The active material loading is 1.5 mg cm^{-2} and the electrolyte to active material loading is 25 µL mg^{-1}.

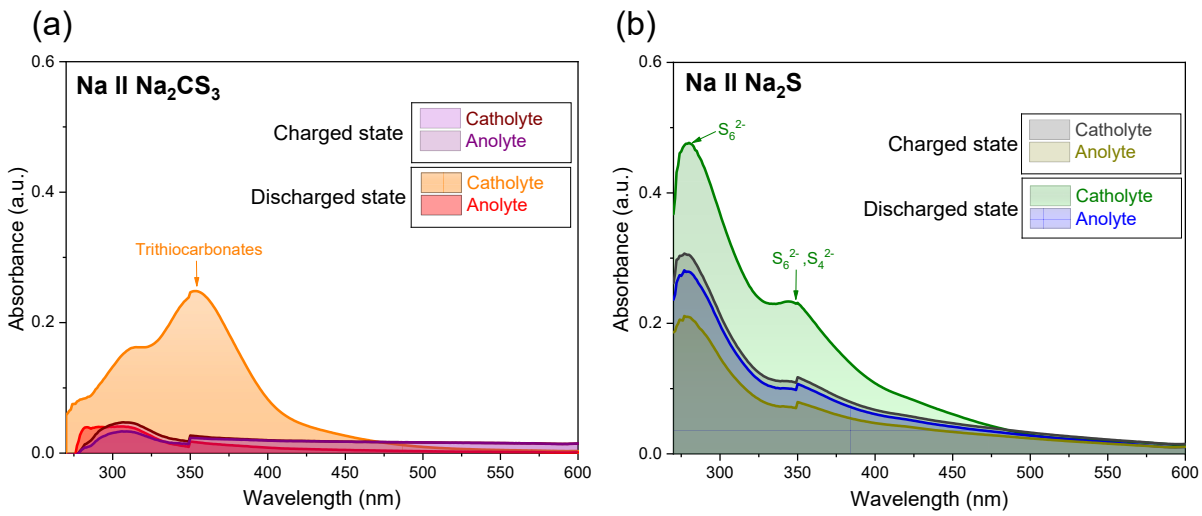


Figure S6. UV-Vis spectra of the catholytes and anolytes from the optical H-cell at charged and discharged states. The optical cell was initially charged and subsequently discharged: (a) Na || Na_2CS_3 and (b) Na || Na_2S cells.

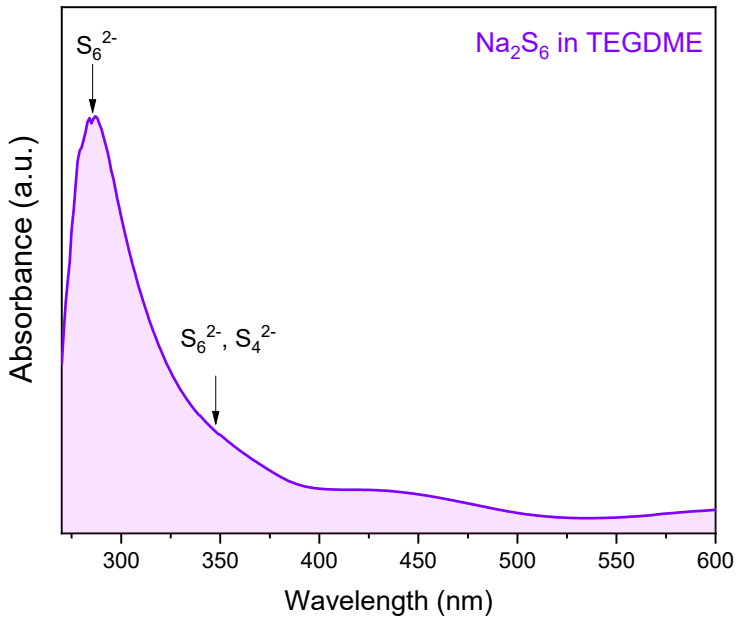


Figure S7. UV-Vis spectra of Na_2S_6 in TEGDME.

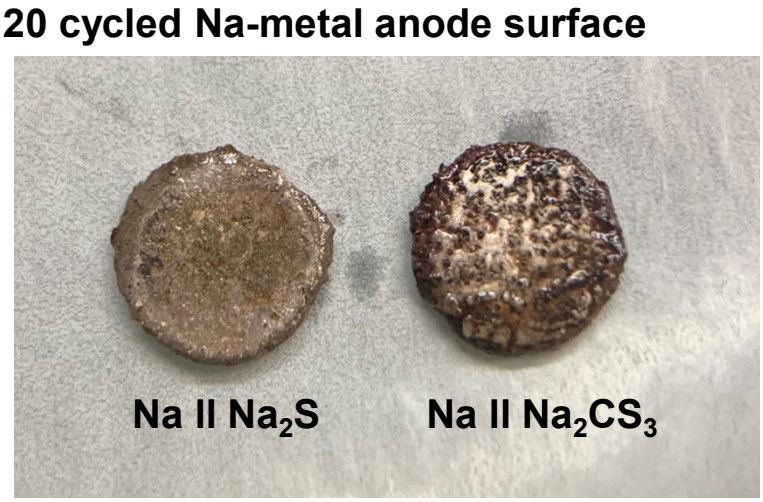


Figure S8. Optical photograph of Na-metal anodes after 20 cycles from the Na || Na_2S (left) and Na || Na_2CS_3 (right) cells.

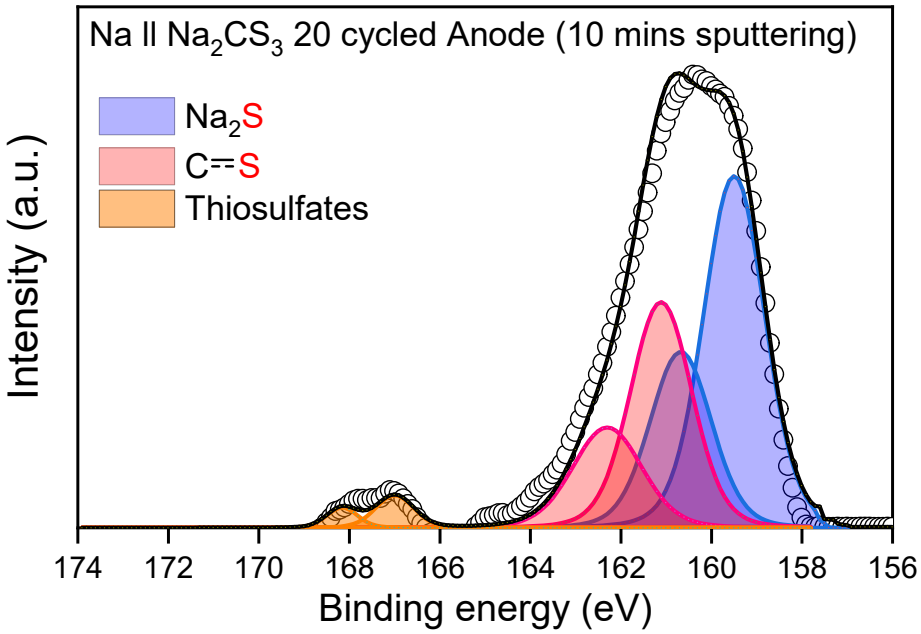
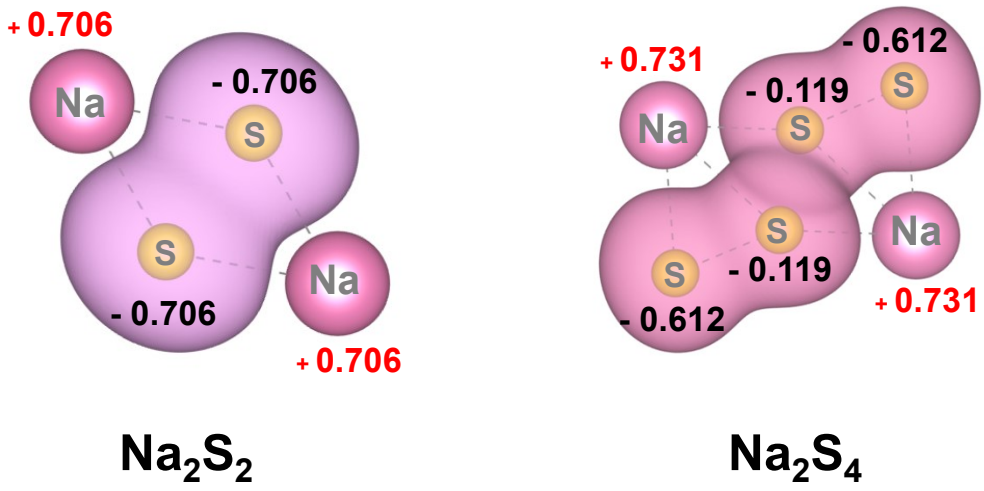


Figure S9. S 2p XPS data of the 20 cycled Na-metal anode of the Na ‖ Na_2CS_3 cell after 10 mins of Ar^+ sputtering.



Na_2S_2 Na_2S_4

Figure S10. Bader charge analysis of Na_2S_2 and Na_2S_4.