Electronic Supplementary Information (ESI)

Pomegranate-Structured Sulfur Cathode Material with Triple Confinement of Lithium Polysulfides for High-Performance Lithium-Sulfur Batteries

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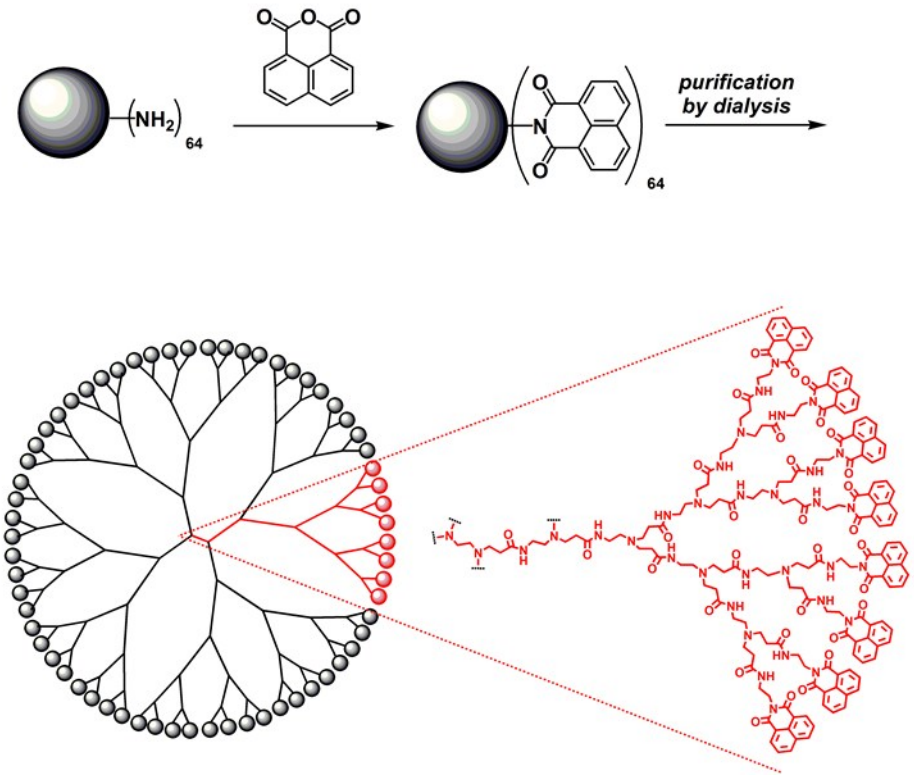

Fig. S1 Schematic illustration of naphthalimide functionalization of PAMAM .

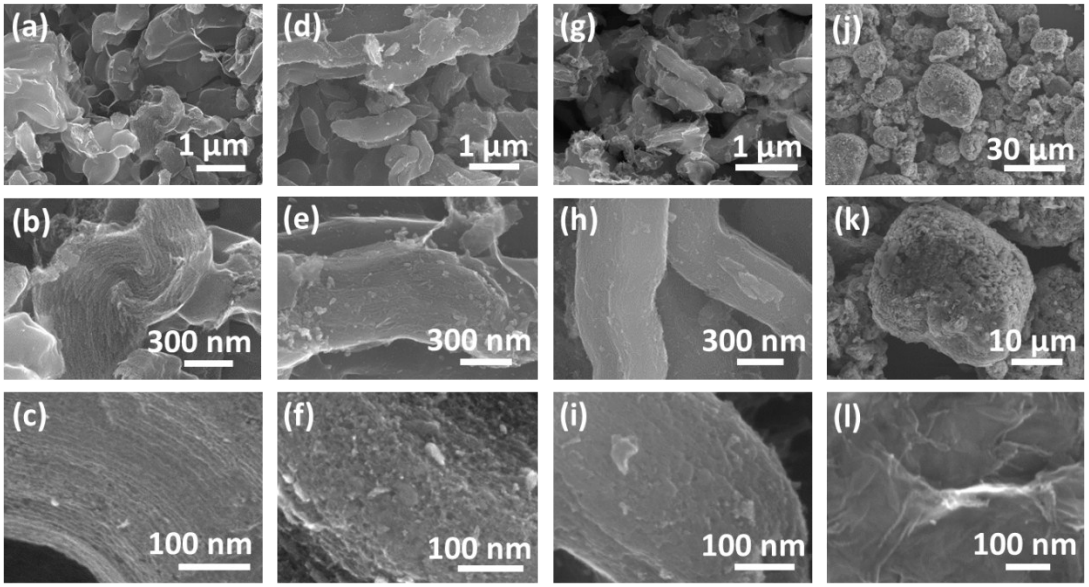

Fig. S2 SEM images of (a, b, c) CMK-3, (d, e, f) Fc-CMK, (g, h, i) Fc-CMK@S, and (j, k, l) Fc-CMK@S@Den-GO.

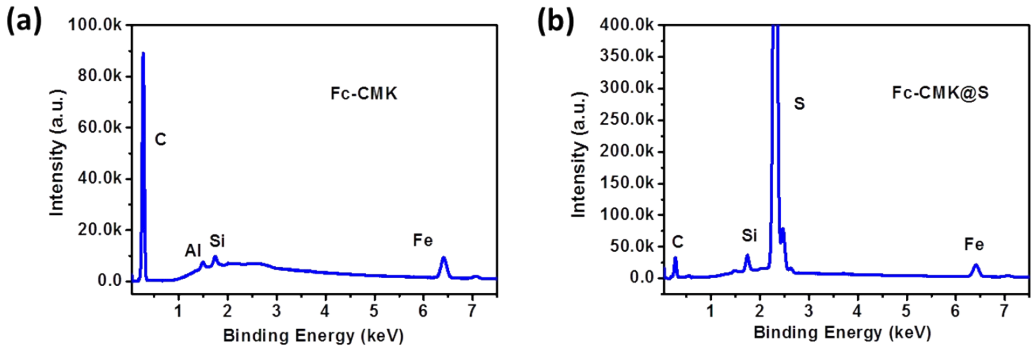

Fig. S3 EDX spectra of (a) Fc-CMK and (b) Fc-CMK@S.

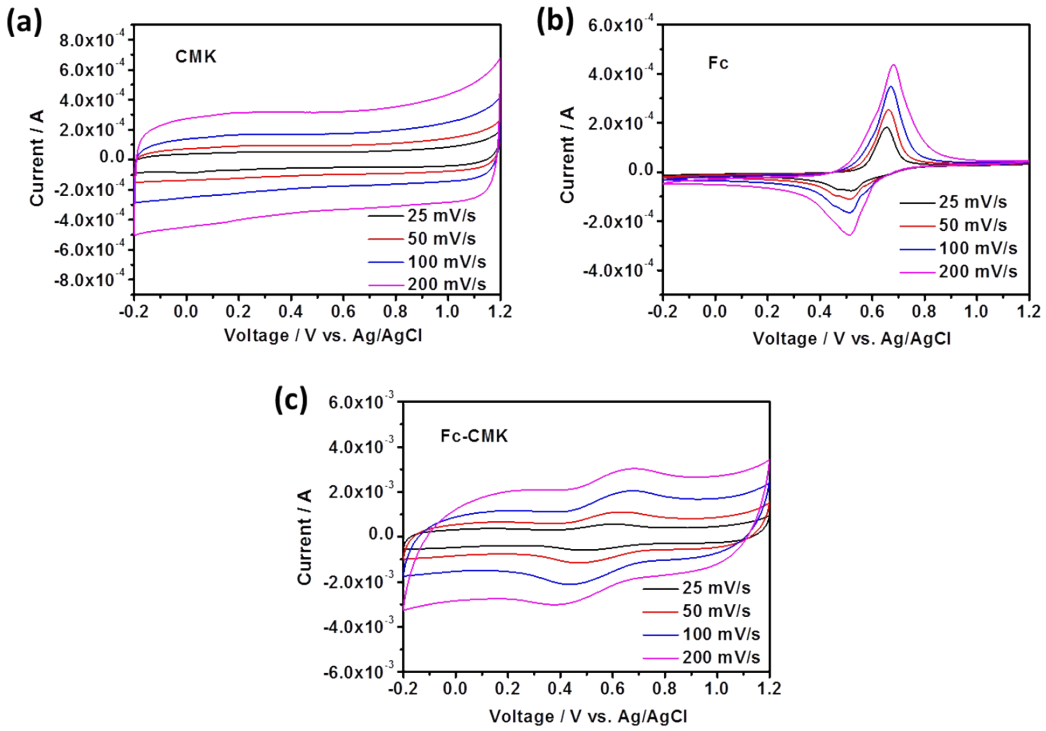

Fig. S4 CV curves of (a) CMK-3, (b) Fc, and (c) Fc-CMK in 0.1 M PBS.

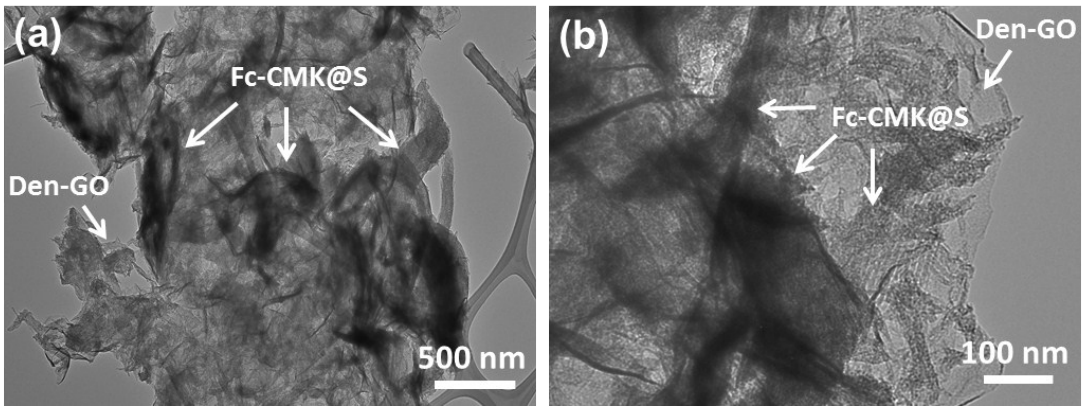

Fig. S5 TEM images of Fc-CMK@S@Den-GO.

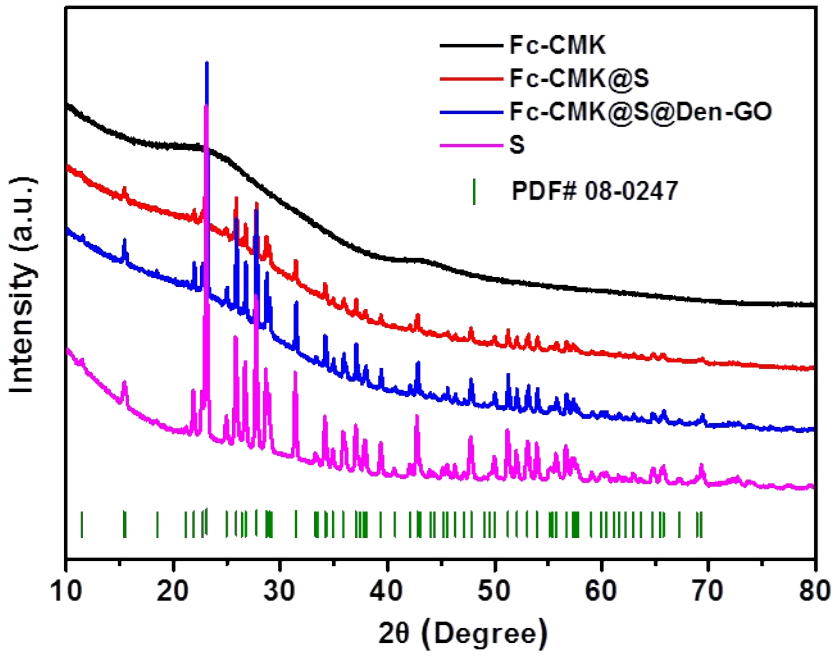

Fig. S6 XRD patterns of Fc-CMK, Fc-CMK@S, Fc-CMK@S@Den-GO, and S (PDF#08-0247).

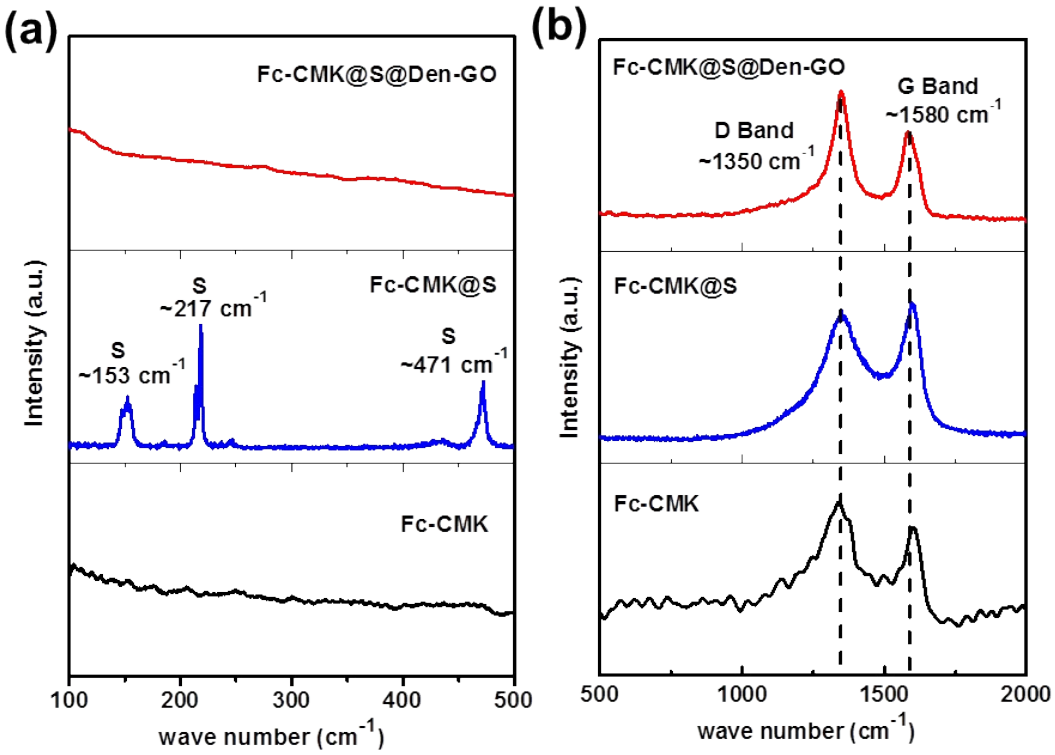

Fig. S7 Raman spectroscopy of Fc-CMK, Fc-CMK@S, and Fc-CMK@S@Den-GO.

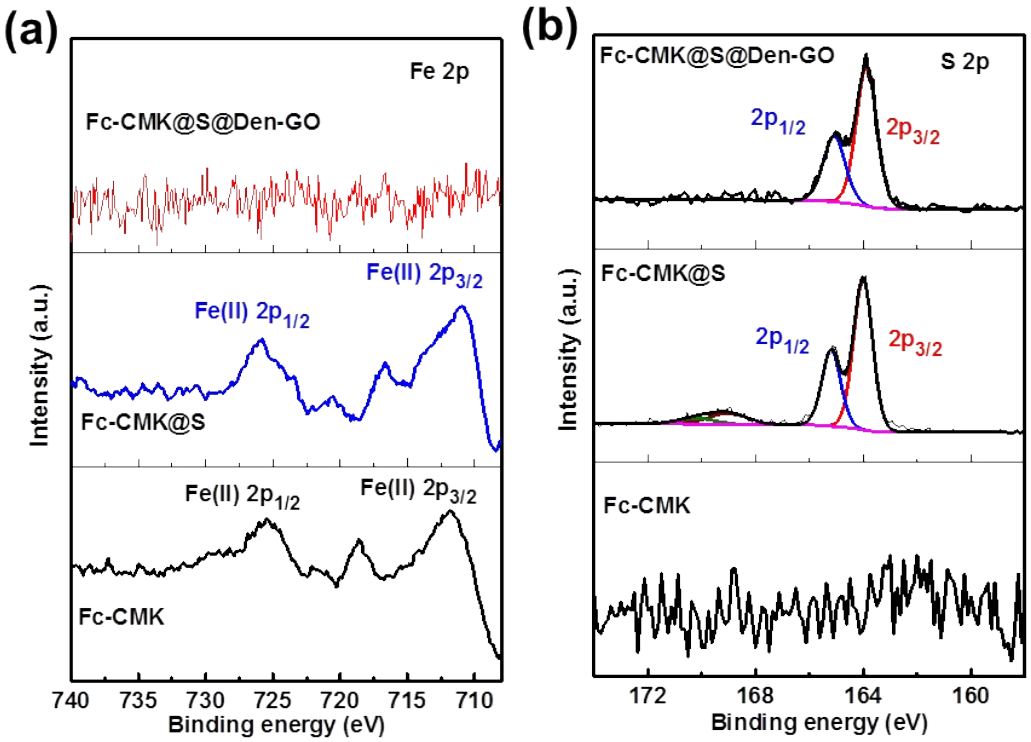

Fig. S8 XPS analysis of Fc-CMK, Fc-CMK@S, and Fc-CMK@S@Den-GO.

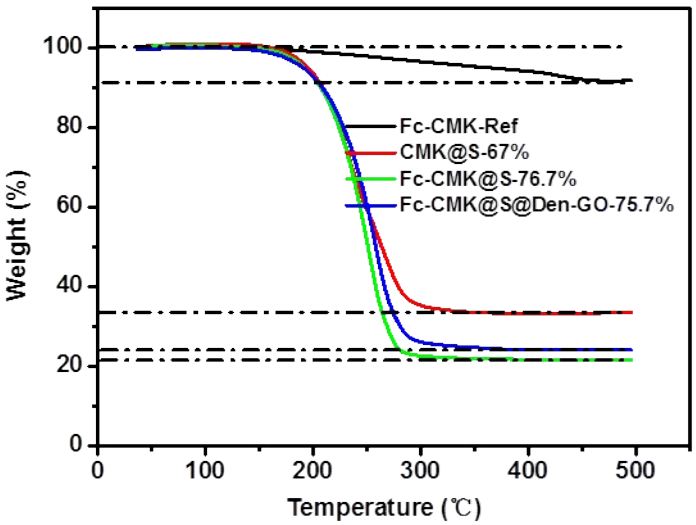

Fig. S9 The TGA curves of Fc-CMK, CMK@S, Fc-CMK@S, and Fc-CMK@S@Den-GO. The weight loss for Fc-CMK (10%) is due to the evaporation of Fc. Therefore in Fc-CMK, m_{CMK}: m_{Fc} = 9: 1. The weight losses for Fc-CMK@S (79%) and Fc-CMK@S@Den-GO (78%) are caused by removal of both S and Fc. Thus, the S content of Fc-CMK@S can be calculated as $\frac{79\%X - 21\%X/9}{X}$ =76.7%, where X is the mass of Fc-CMK@S. Then the composition of Fc-CMK@S is 76.7 wt% S, 2.3 wt% Fc, and 21.0 wt% CMK-3. The composition of Fc-CMK@S@Den-GO was calculated to be 75.7 wt% S, 2.3 wt% Fc, 20.7 wt% CMK-3, and 1.3 wt% Den-GO in the same way.

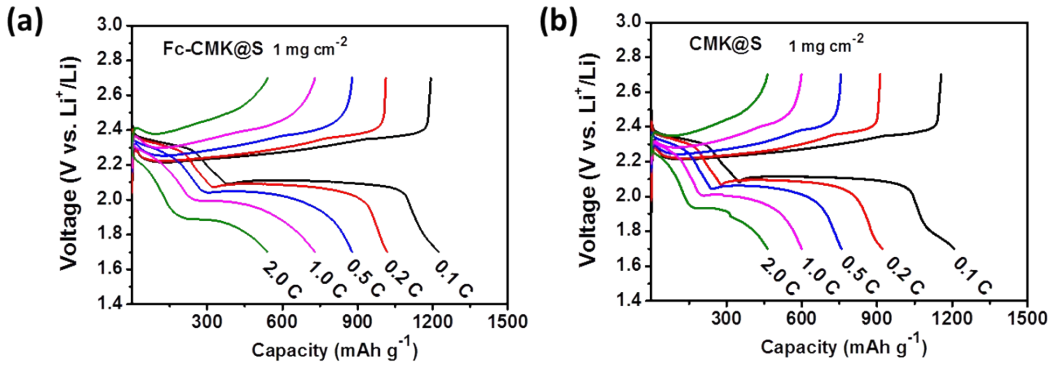

Fig. S10 Discharging/charging voltage profiles of (a) Fc-CMK@S and (b) CMK@S. The S content of the materials are 76.7 wt% and 67.0 wt% for Fc-CMK@S and CMK@S, respectively. The S mass loading on the electrodes is ~1 mg cm^{-2}.

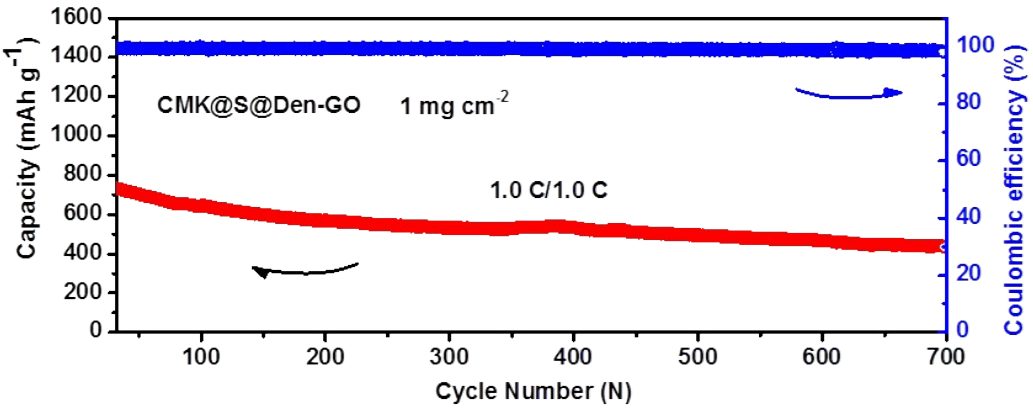

Fig. S11 Long-term cycling stability of CMK@S@Den-GO at 1.0 C. The S mass loading on the electrodes is ~1 mg cm^{-2}.

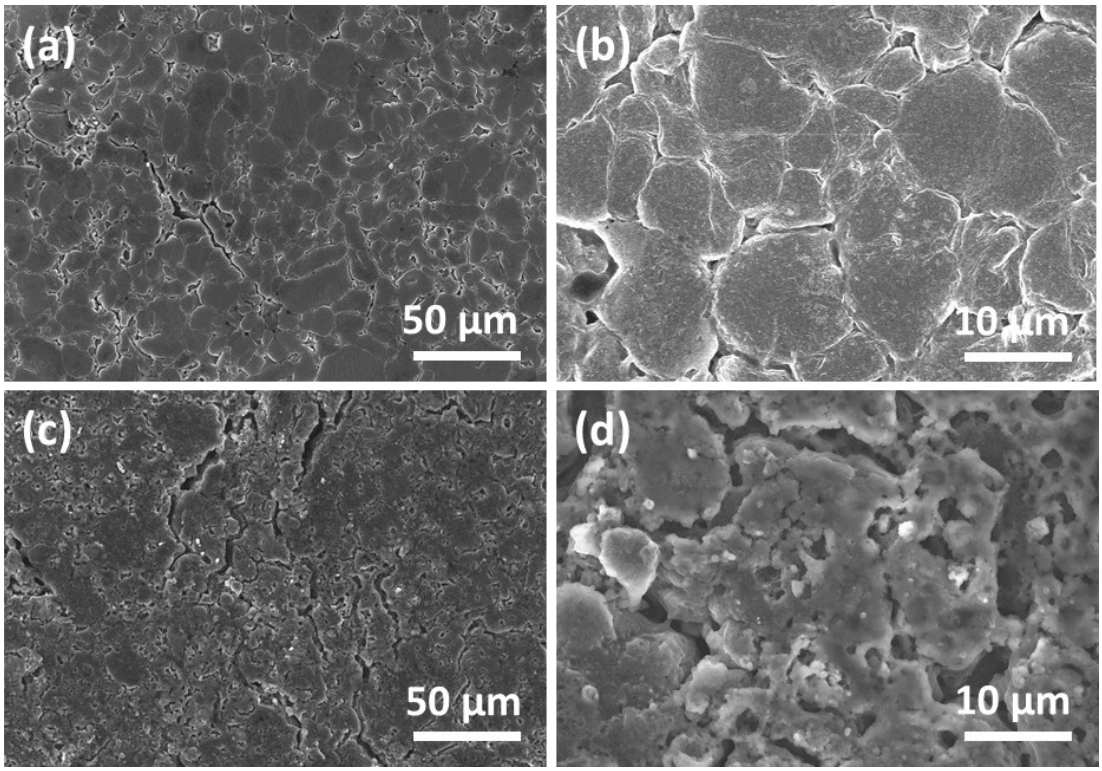

Fig. S12 SEM images of the Li anodes paired with the (a, b) Fc-CMK@S@Den-GO and (c, d) Fc-CMK@S electrodes after 750 cycles.

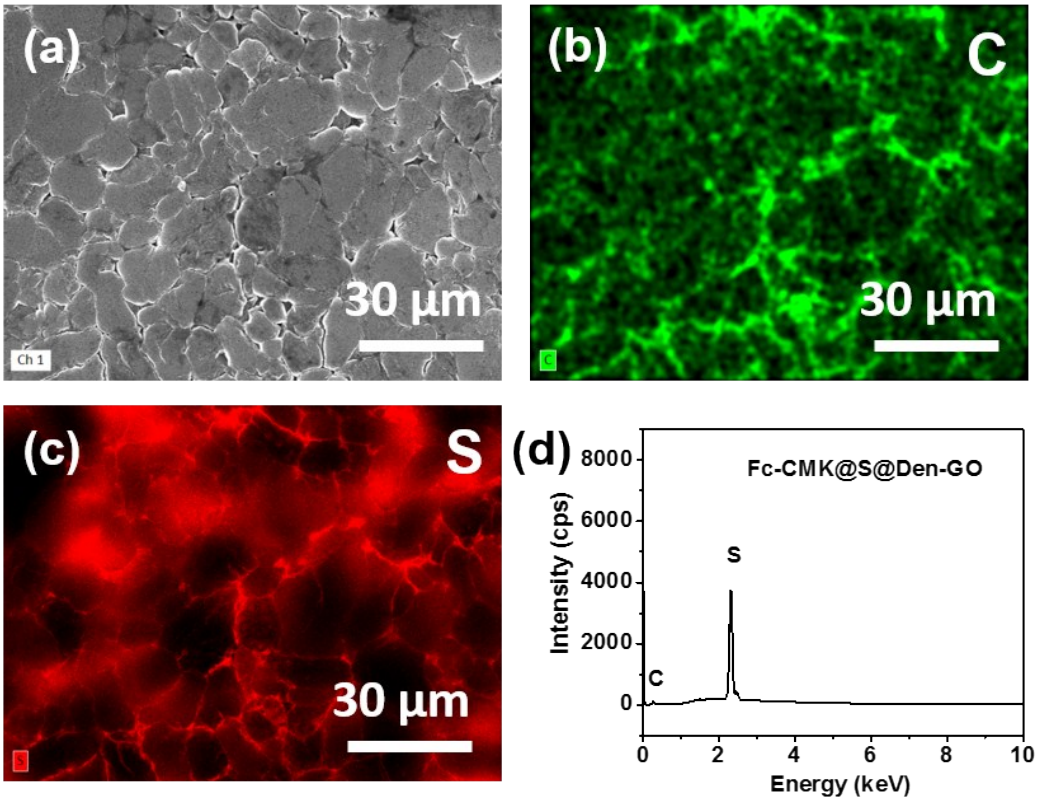

Fig. S13 SEM-EDX analysis of the cycled Li anode paired with the Fc-CMK@S@Den-GO cathode. (a) SEM image; elemental maps of (b) C and (c) S; (d) the corresponding EDX spectrum.

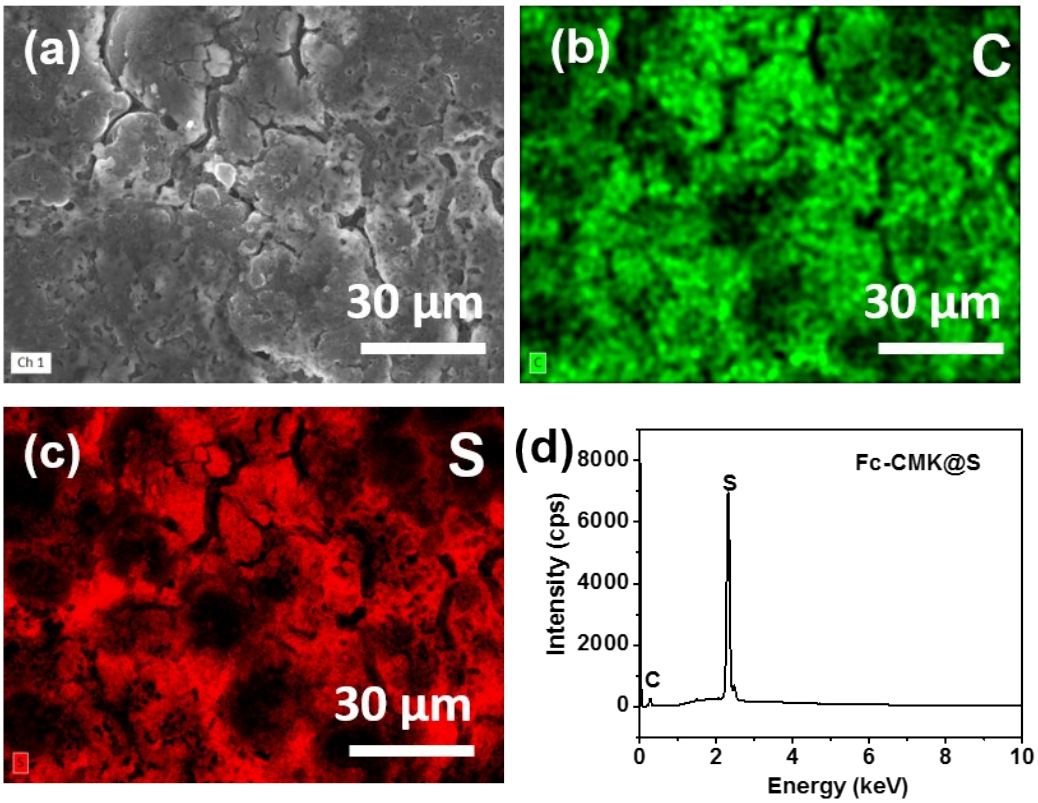

Fig. S14 SEM-EDX analysis of the cycled Li anode paired with the Fc-CMK@S cathode. (a) SEM image; elemental maps of (b) C and (c) S; (d) the corresponding EDX spectrum.

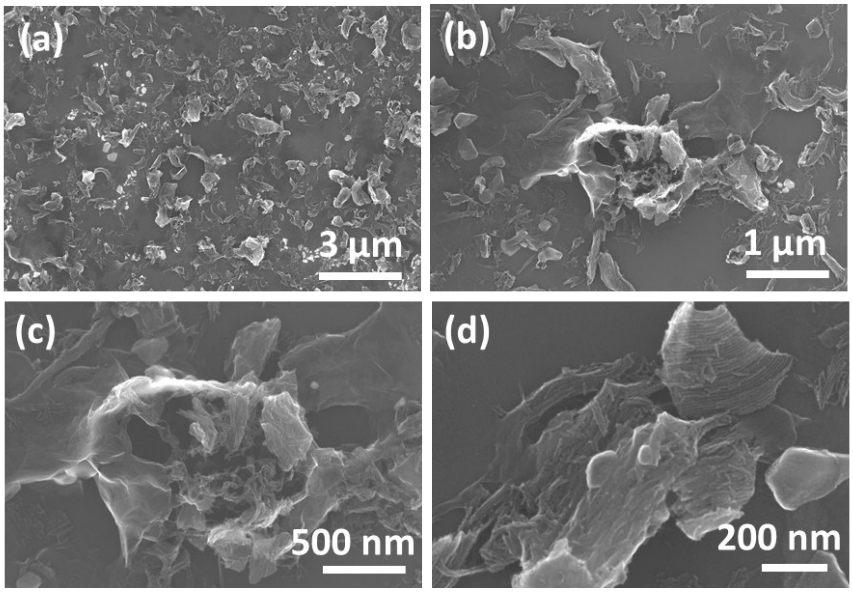

Fig. S15 SEM images of Fc-CMK@S@GO.

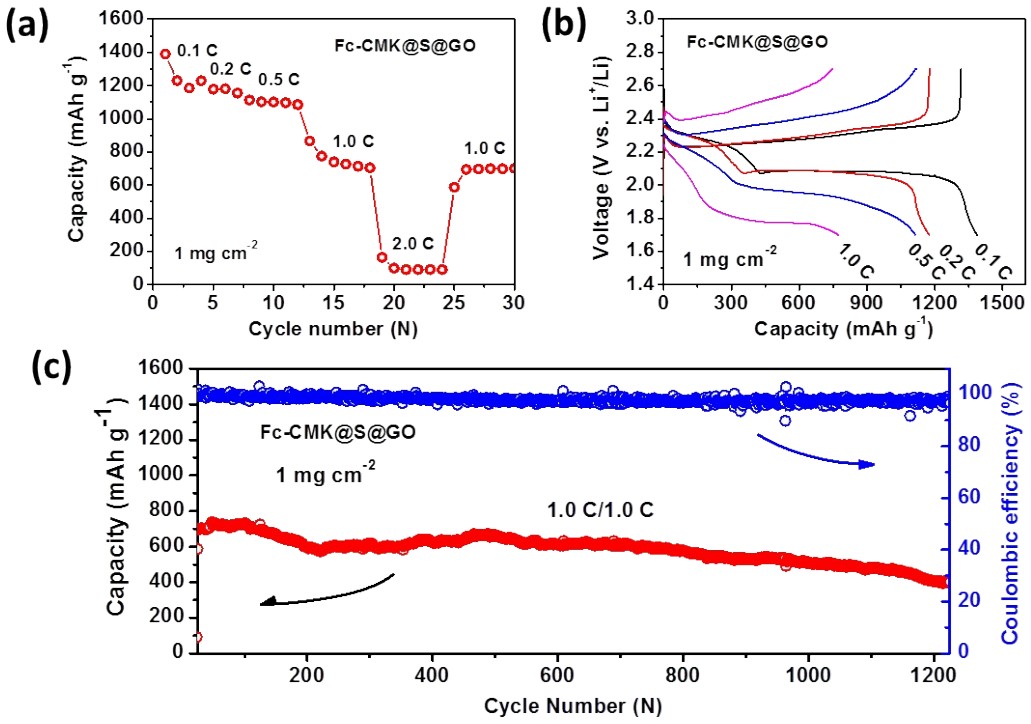

Fig. S16 Electrochemical performance of a Li-S cell with the Fc-CMK@S@GO material as the cathode.

(a) Specific capacities and (b) the corresponding discharging/charging voltage profiles at various rates.

(c) Long-term cycling stability with Coulombic efficiency at 1.0 C.

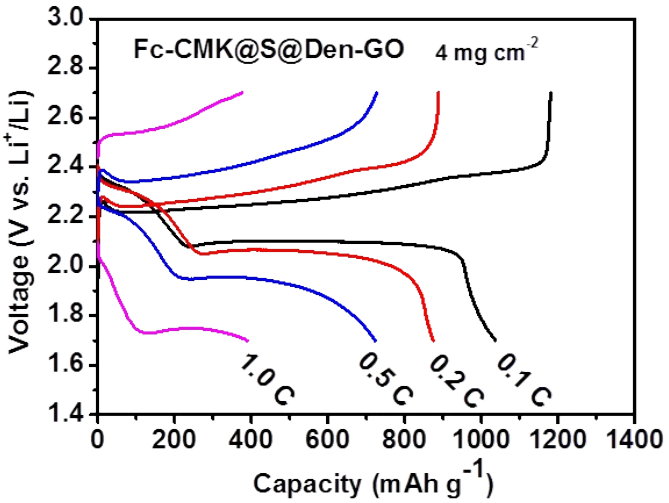

Fig. S17 Discharging/charging voltage profiles of Fc-CMK@S@Den-GO with S mass loading of 4 mg cm^{-2} on the electrode.