

Supporting Information

rGO-CNT aero gel covalently bonded with a nitrogen-rich polymer as a polysulfide adsorptive cathode for high sulfur loading lithium sulfur battery

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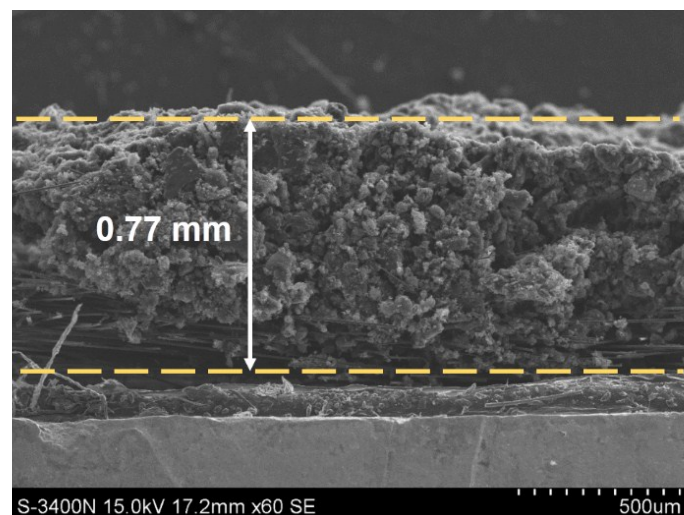


Figure S1. SEM of the cross section of the PEI-GC cathode with a sulfur loading of 6 mg/cm²

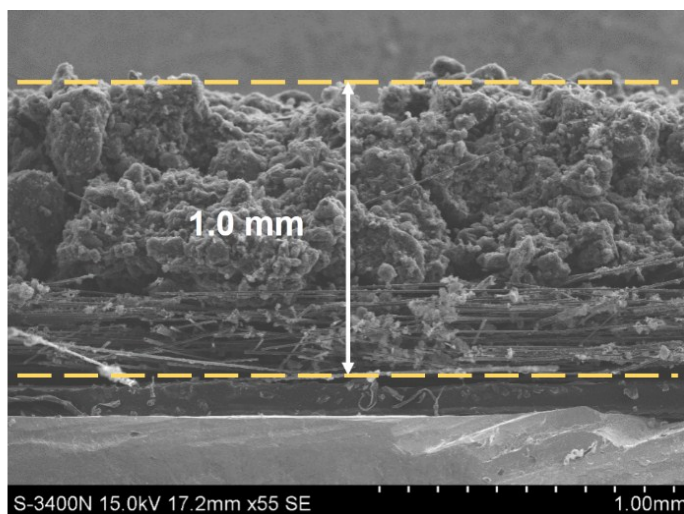


Figure S2. SEM of the cross section of the PEI-GC cathode with a sulfur loading of 10 mg/cm²

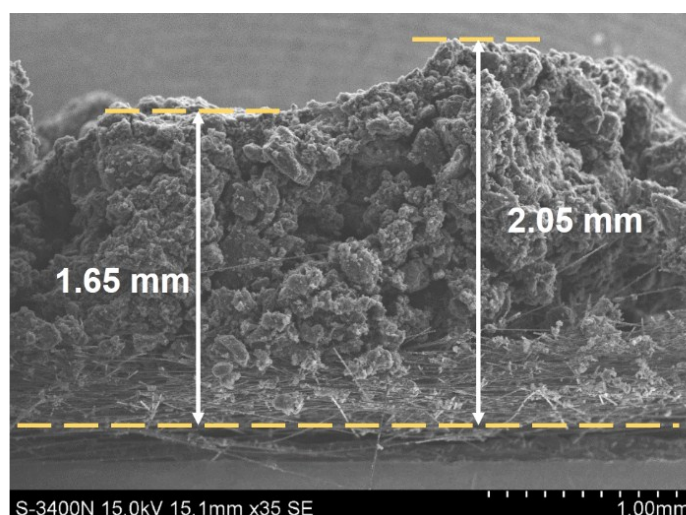


Figure S3. SEM of the cross section of the PEI-GC cathode with a sulfur loading of 18 mg/cm²

Sulfur loading (mg/cm ²)	Cathode radius (cm)	Thickness (cm)	Volume (cm ³)
6	0.6	0.077	0.087
10	0.6	0.10	0.11
18	0.6	0.185	0.209

Table S1. The volumes of the high sulfur loading PEI-GC cathodes

GO/PEI (w/w)	Nitrogen content (wt%, parallel 1)	Nitrogen content (wt%, parallel 2)	Nitrogen content (wt%, average)
0.5	13.63	13.75	13.69
1	12.14	12.04	12.09
2	8.77	8.74	8.755
4	5.14	5.08	5.11
8	3.05	2.97	3.01

Table S2. Quantitative analysis of nitrogen content in PEI-G with incremental PEI weight ratio.

Sulfur loading (mg/cm ²)	Weight of sulfur (mg)	Weight of cathode disc (mg)	Weight of PEI-GC (mg)	Areal PEI-GC loading (mg/cm ²)	Sulfur content
1	1.1	1.0	0.5	0.44	68%
6	6.8	5.2	4.7	4.16	59%
10	11.3	9.0	8.5	7.52	57%
18	20.3	16.3	15.8	13.98	56%

Table S3. The areal PEI-GC loading and sulfur content of each experiment. In order to know the weight of PEI-GC aerogel on each cathode disc, the average weight of bare carbon fiber paper disc was measured to be 0.5 mg. Based on this, the amount of aerogel (mg/cm²) and the relevant figures are calculated.

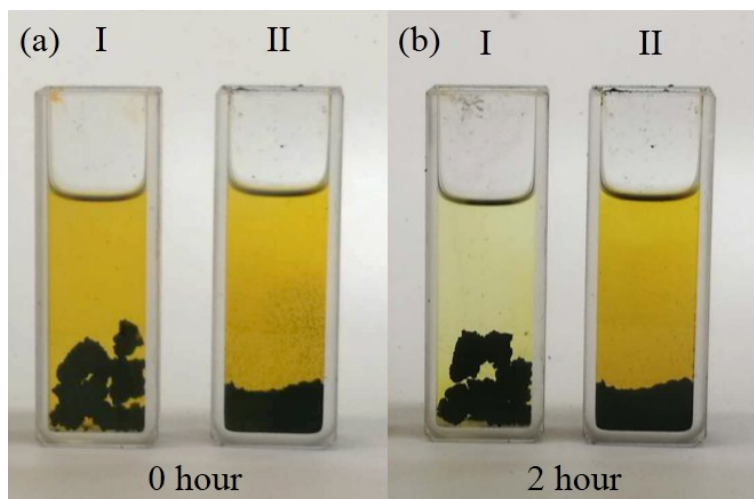


Figure S4 (a) I: PEI-GC with Li_2S_6 solution, II: GC with Li_2S_6 solution. The photo was taken at the beginning of the adsorption test. (b) I: PEI-GC with Li_2S_6 solution, II: GC with Li_2S_6 solution. 2 mg of PEI-GC and GC, respectively, were used to adsorb 2 ml of 1 mmol/L Li_2S_6 dissolved in DOL/DME. The thickness of the liquid in the cuvettes is 5 mm. The photo was taken 2 hours after the test.

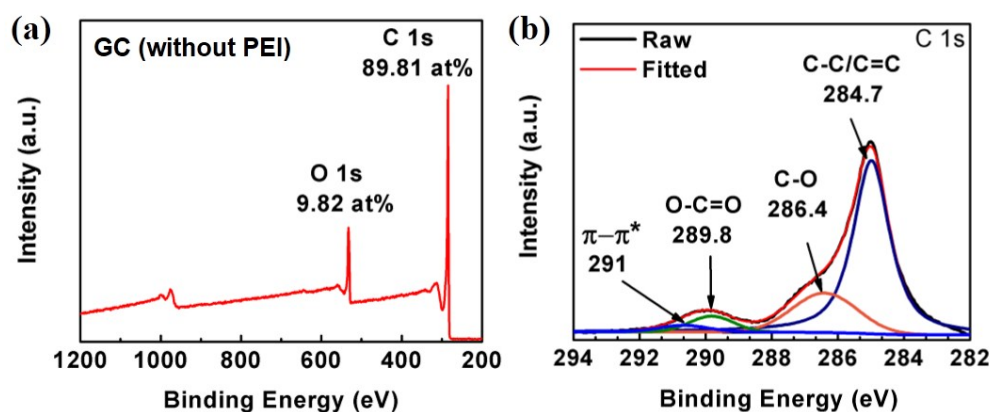


Figure S5. (a) XPS spectra of GC; (b) XPS C1s spectrum of GC and the split Lorentzian peaks.

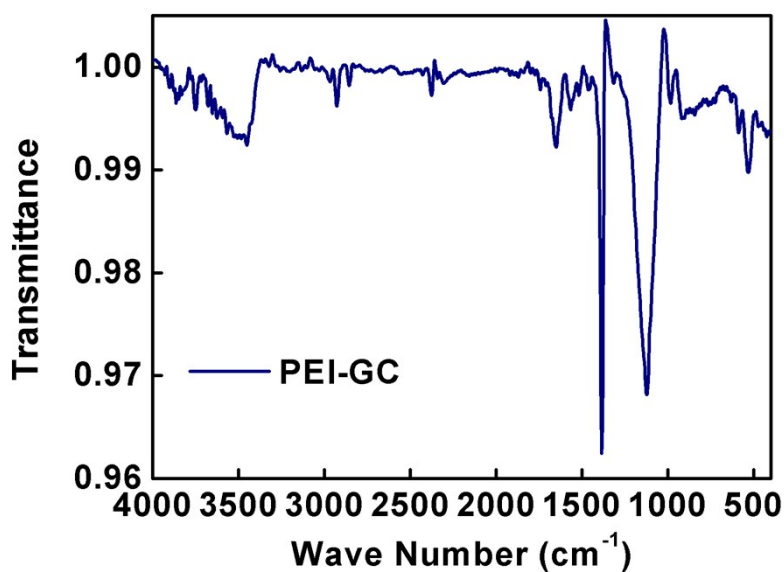


Figure S6. FTIR analysis of PEI-GC.

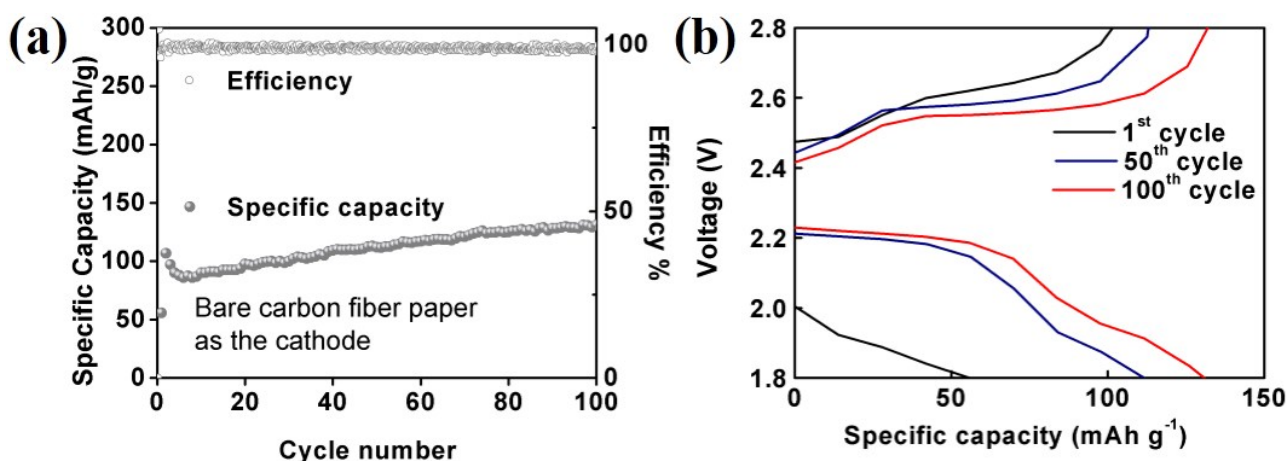


Figure S7. (a) Cycling results of bare carbon fiber paper as the cathode; (b) charge-discharge profile of the cell. Here the bare carbon fiber paper is tested as the cathode to demonstrate that it contributes little to the capacity when is used as the current collector. The sulfur areal loading here is 1 mg cm^{-2} . $2 \text{ M Li}_2\text{S}_6$ catholyte was used as the electrolyte and the sulfur source. The average mass of a 12 mm diameter carbon fiber paper is around 0.3~0.5 mg.

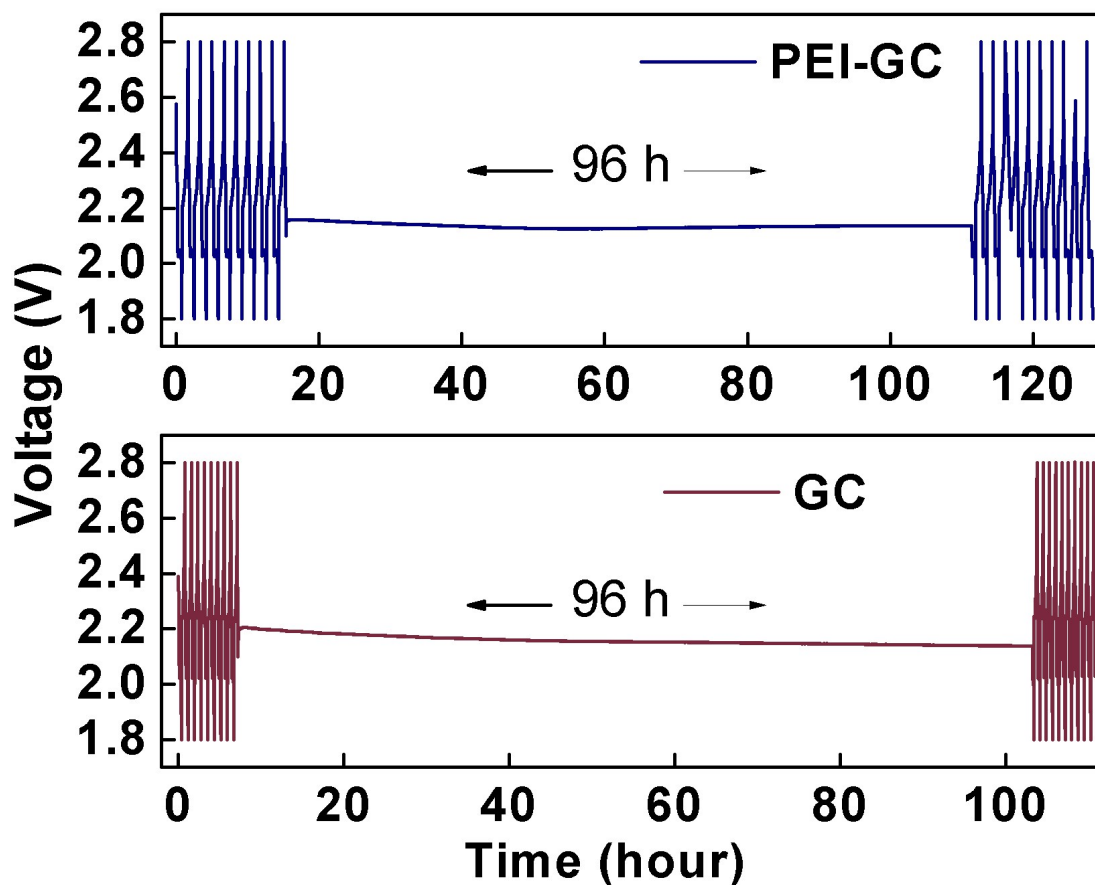


Figure S8. the voltage-time plots of the PEI-GC and GC cells, respectively, for the self discharge tests.

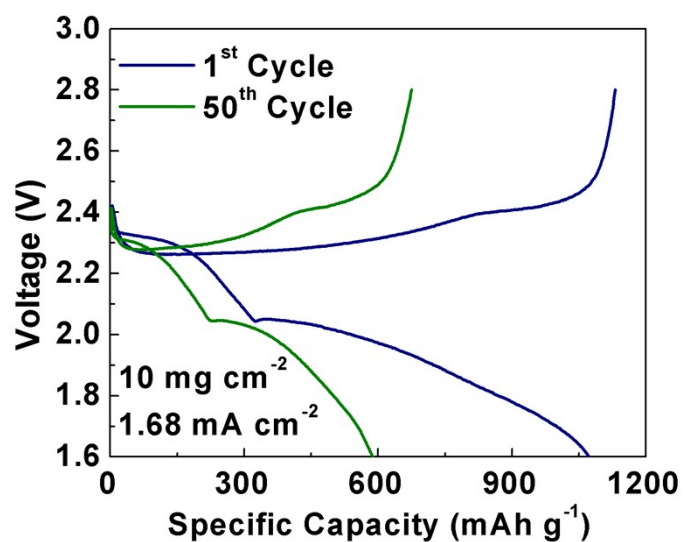


Figure S9. The charge-discharge profile of the PEI-GC cell of 10 mg cm^{-2} areal sulfur loading.

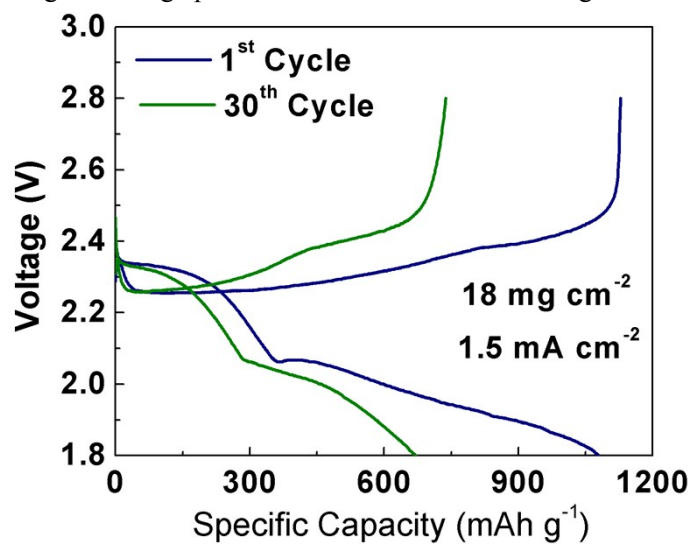


Figure S10. The charge-discharge profile of the PEI-GC cell of 18 mg cm^{-2} areal sulfur loading.