Supplemental information

Freestanding and Flexible Nitrogen-doped Carbon Foam/Sulfur Cathode Composited with Reduced Graphene Oxide for High Sulfur Loading Lithium-sulfur Batteries

Mingwu Xiang, Li Yang, Yifeng Zheng, Ju Huang, Peng Jing, Hao Wu, Yun Zhang, Heng Liu*

Department of Advanced Energy Materials, College of Materials Science and Engineering, Sichuan University Chengdu, 610064, P. R. China.

Corresponding author

E-mail: h_liu@scu.edu.cn; Tel: +86-28-85410272; Fax: +86-28-85416050

Table S1 Impedance parameters calculated based on the *Z*-view software simulations.

NCF-S@rGO composites		Impedance parameters			
		R_e (Ω)	R_{ct}(Ω)	R_{st}(Ω)	R_{total}(Ω)
3.2 mg cm^{-2}	before	2.07	37.37	18.27	57.71
	after cycling	4.72	16.62	7.32	28.66
4.3 mg cm^{-2}	before	2.63	45.87	35.49	83.99
	after cycling	5.35	21.39	9.28	36.02
5.1 mg cm^{-2}	before	3.06	55.03	44.51	102.6
	after cycling	5.00	30.91	7.14	43.05

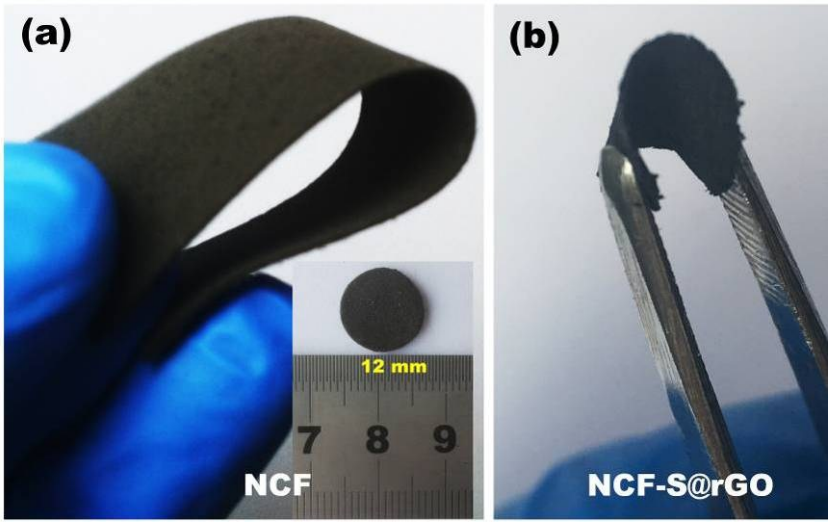

Fig. S1 Digital photographs of (a) NCF and (b) NCF-S@rGO composite with an enhanced flexibility.

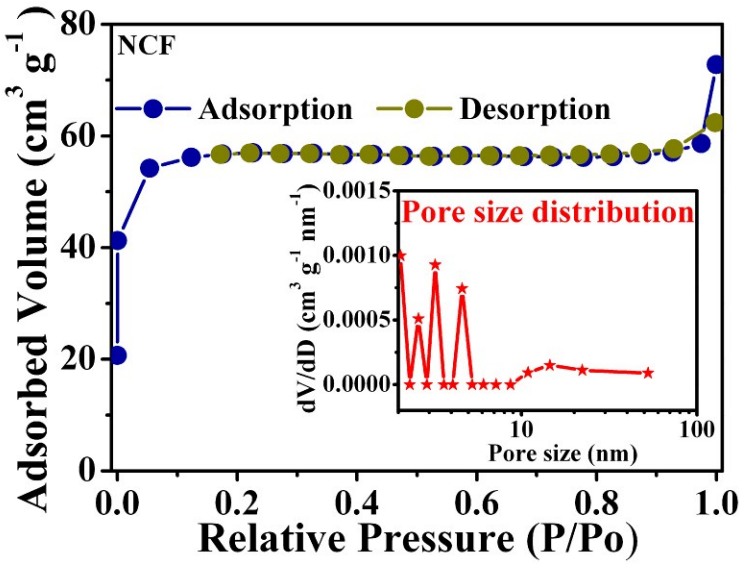

Fig. S2 N_2 dsorption/desorption isotherms and pore-size distribution (inset) of NCF sample obtained by BET and BJH methods.

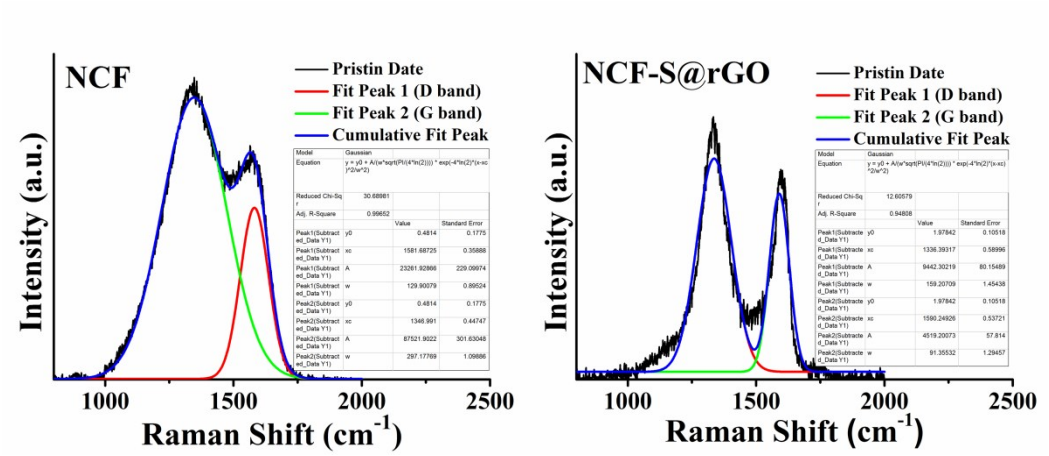

Fig. S3 The fitting results of Raman spectra of NCF and NCF-S@rGO. The intensity ratio of IG/ID based on the peak area was 0.26 and 0.48 for the NCF and NCF-S@rGO, respectively.

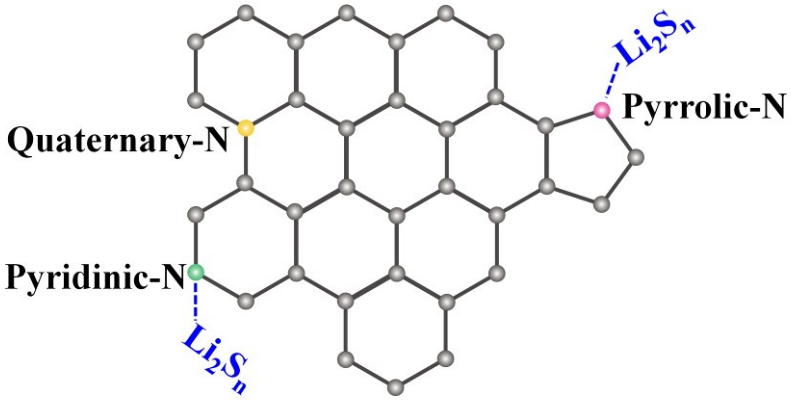

Fig. S4 Schematic illustration of the interaction between Li_2S_n and nitrogen atoms in the NCF-S@rGO composite.

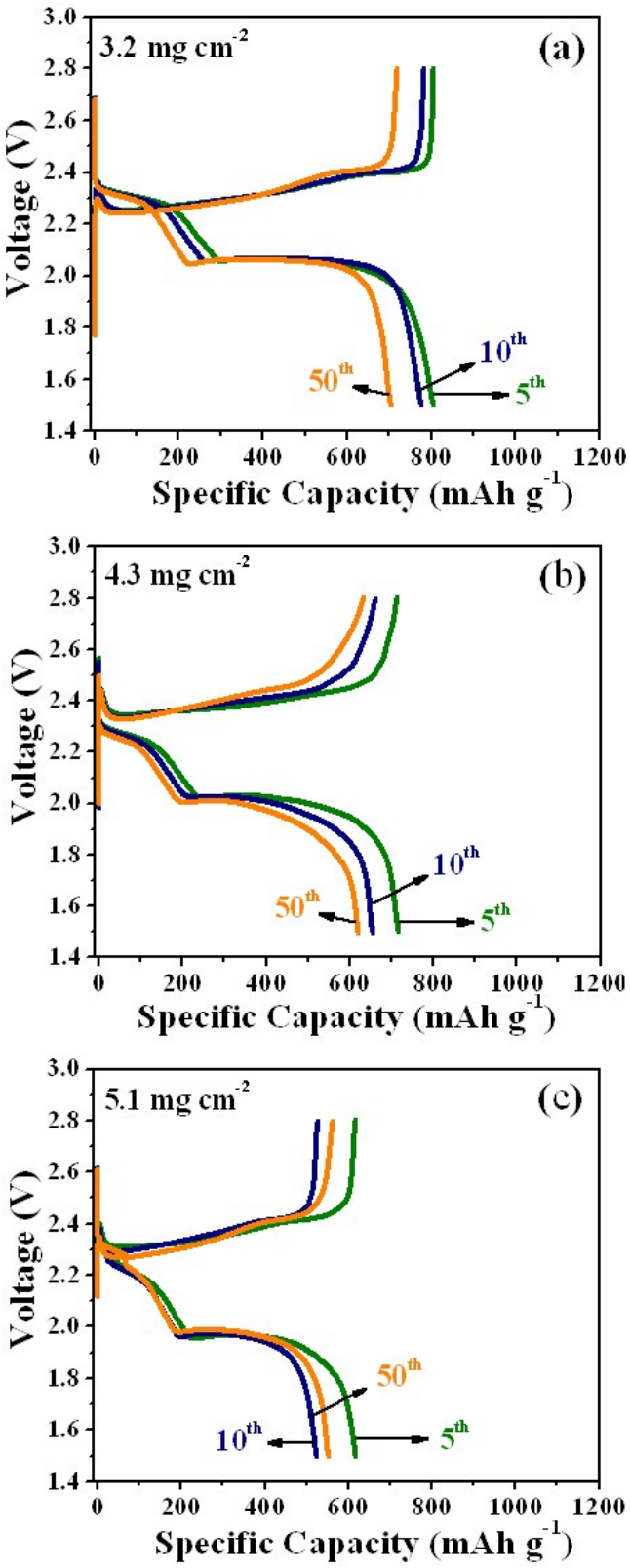

Fig. S5 The 5th, 10th, and 50th charge/discharge curves of the three NCF-S@rGO electrodes with sulfur loadings of 3.2, 4.3, and 5.1 mg cm^{-2} at 0.2 C, respectively.

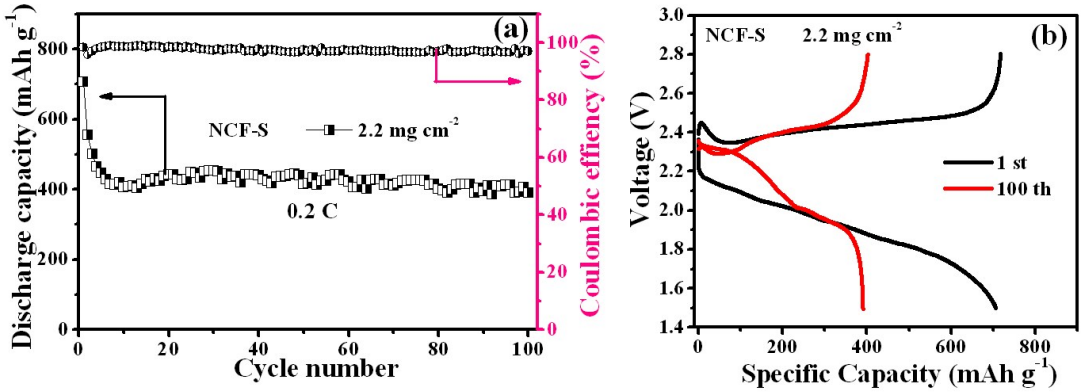

Fig. S6 (a) Cycling performance and (b) charge/ discharge profiles of the NCF-S with low sulfur loading of 2.2 mg cm^{-2} at 0.2 C.

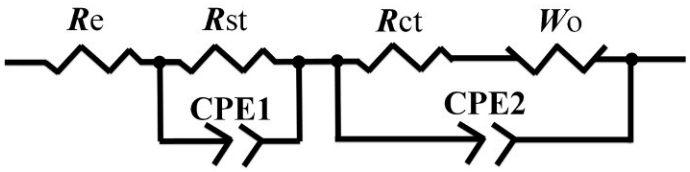

Fig. S7 Equivalent circuit based on the Z-view software simulations.

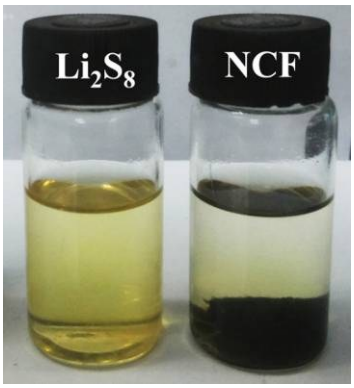

Fig. S8 Digital photographs of lithium polysulfides (Li_2S_8) solutions before and after 12 h adsorption with the pristine NCF. Owing to the in-situ N-dopped carbon skeleton, the NCF shows a favorable chemisorption capability of lithium polysulfides.

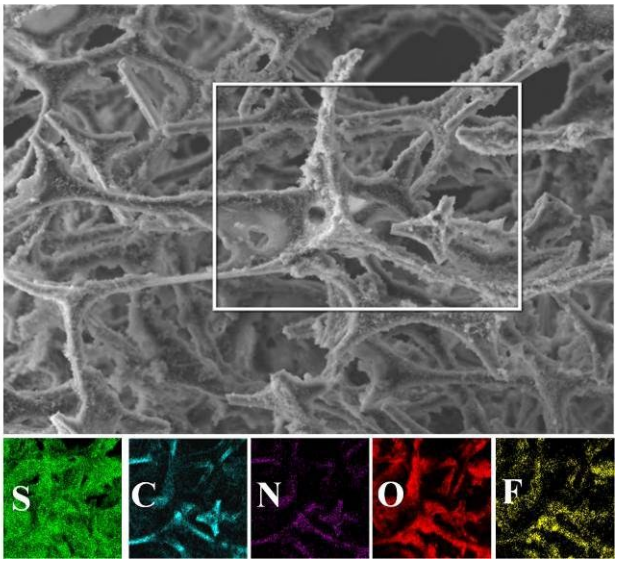

Fig. S9 SEM images and corresponding elemental mapping of the NCF-S@rGO cathode with the sulfur loading of 3.2 mg cm^{-2} after 250 cycles at 0.5 C.