

## **Supporting Information**

### **Recovery from Self-Assembly: A Composite Material for Lithium-Sulfur Batteries**

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**Table S1. BET specific surface area, pore volume, electric conductivity of AICMK, AICMK/S composites and sulfur content in composites**

Sample	Specific surface area [m <sup>2</sup> g <sup>-1</sup> ]	Pore volume [cm <sup>3</sup> g <sup>-1</sup> ]	Sulfur content [wt.%]	Electric conductivity [10 <sup>-2</sup> S cm <sup>-1</sup> ] <sup>a</sup>	Sulfur loading in cathodes [mg cm <sup>-2</sup> ]
AICMK	1812	2.91	ND <sup>b</sup>	9.6	/
AICMK/S-0-0	ND	ND	70.0	ND	1.0
AICMK/S-20-0	37.51	0.082	60.8	4.6	0.7
AICMK/S-20-1	41.17	0.092	49.8	5.6	0.7
AICMK/S-20-3	45.68	0.183	47.2	5.7	0.7
AICMK/S-20-20	51.72	0.203	43.8	6.0	0.6

<sup>a</sup>Samples were pressed at a pressure of 1 MPa; <sup>b</sup>Not determined.

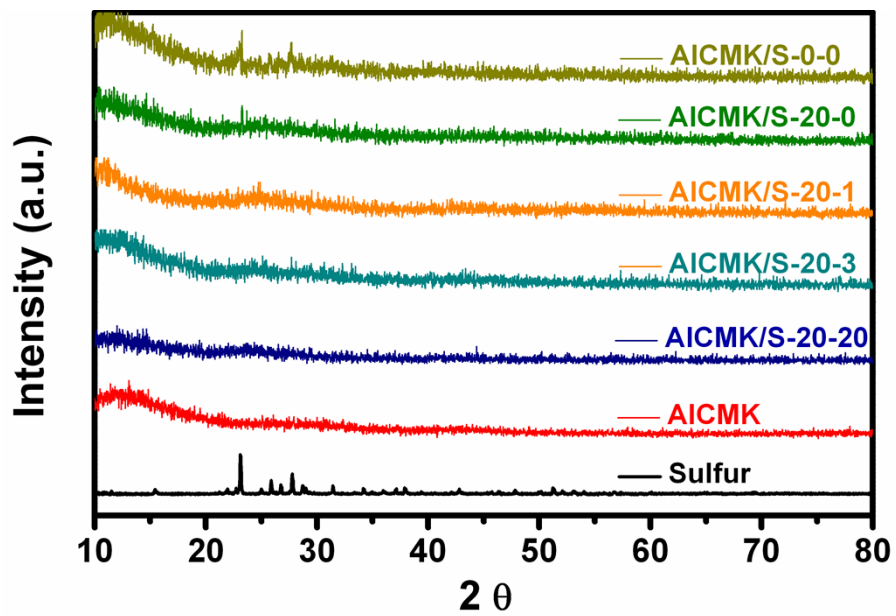
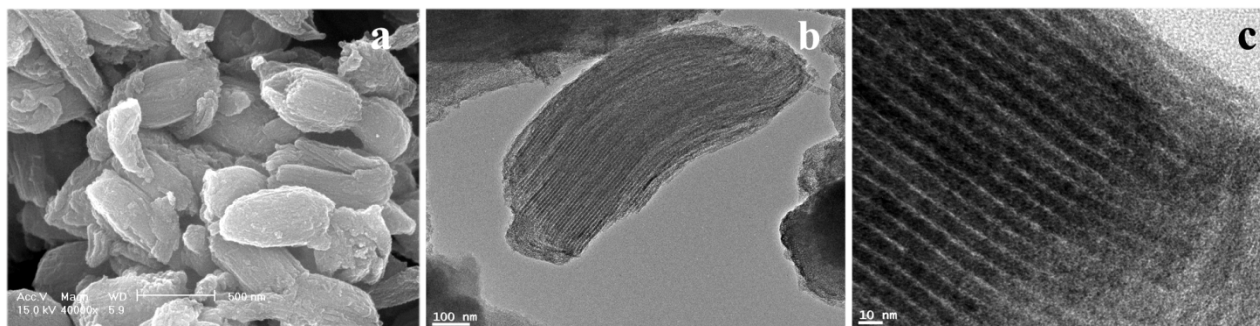
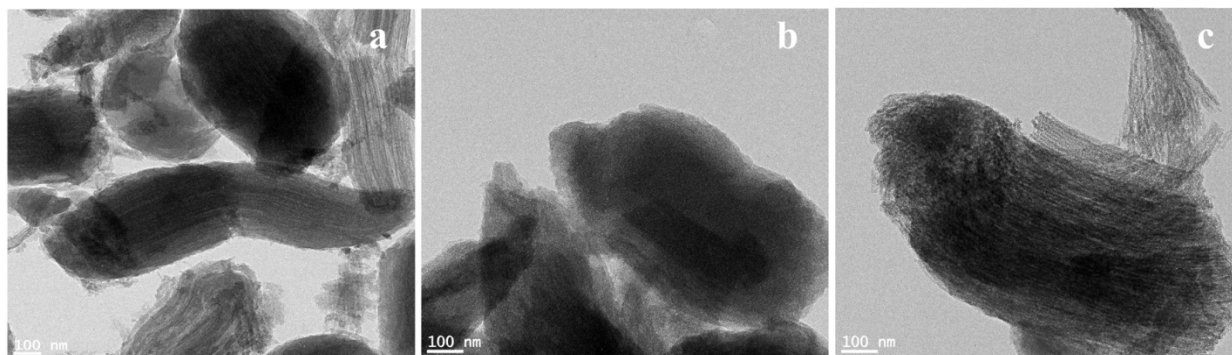


Fig. S1. XRD patterns of sulfur, AICMK and AICMK/S composites.



**Fig. S2.** a) FESEM and b,c) TEM images of AlCMK/S-20-20 composite.



**Fig. S3.** TEM images of AlCMK/S composites, a) AlCMK/S-20-0, b) AlCMK/S-20-1 and c) AlCMK/S-20-3. A trait of Sulfur can be observed to cover the surface of AlCMK or not uniformed dispersed in the carbon matrix.

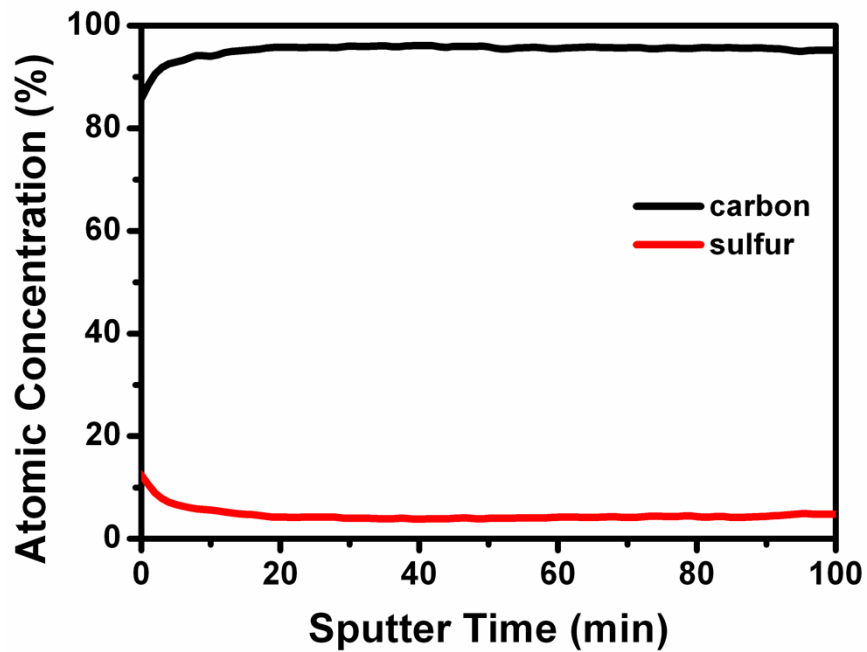
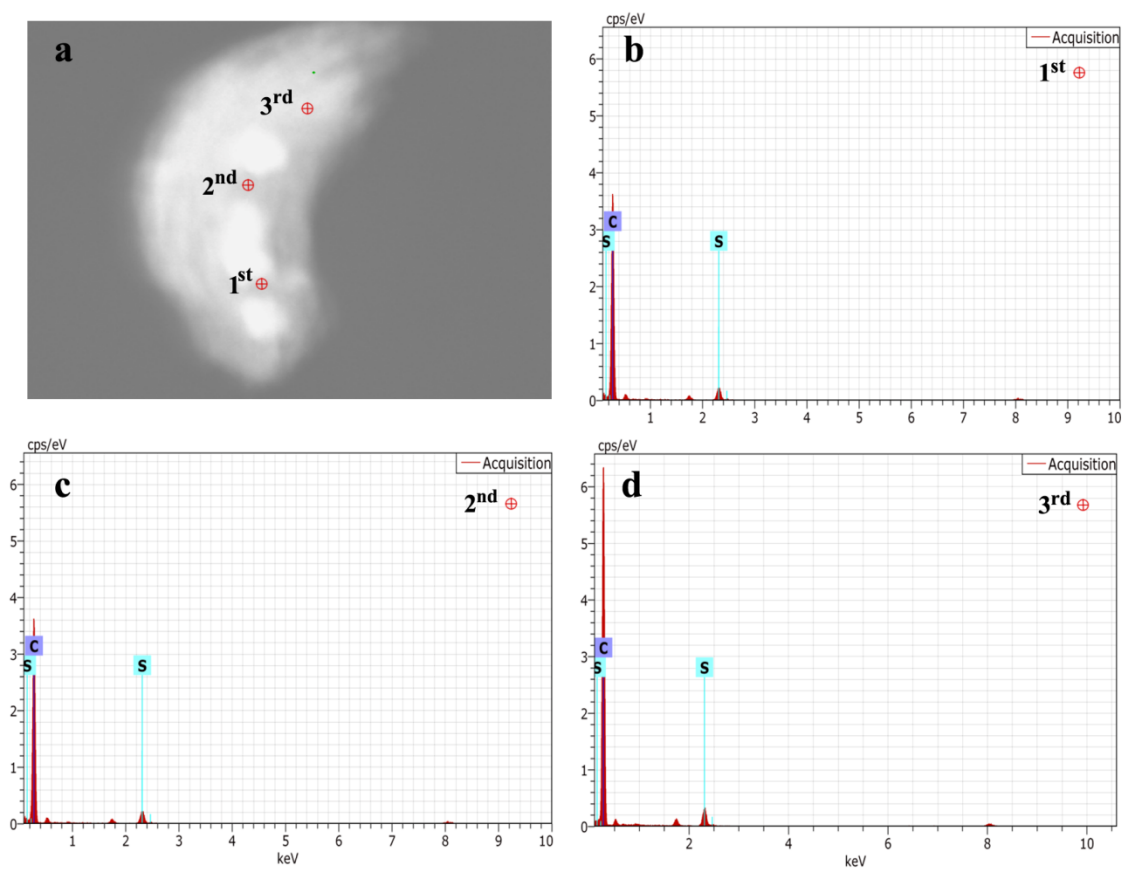
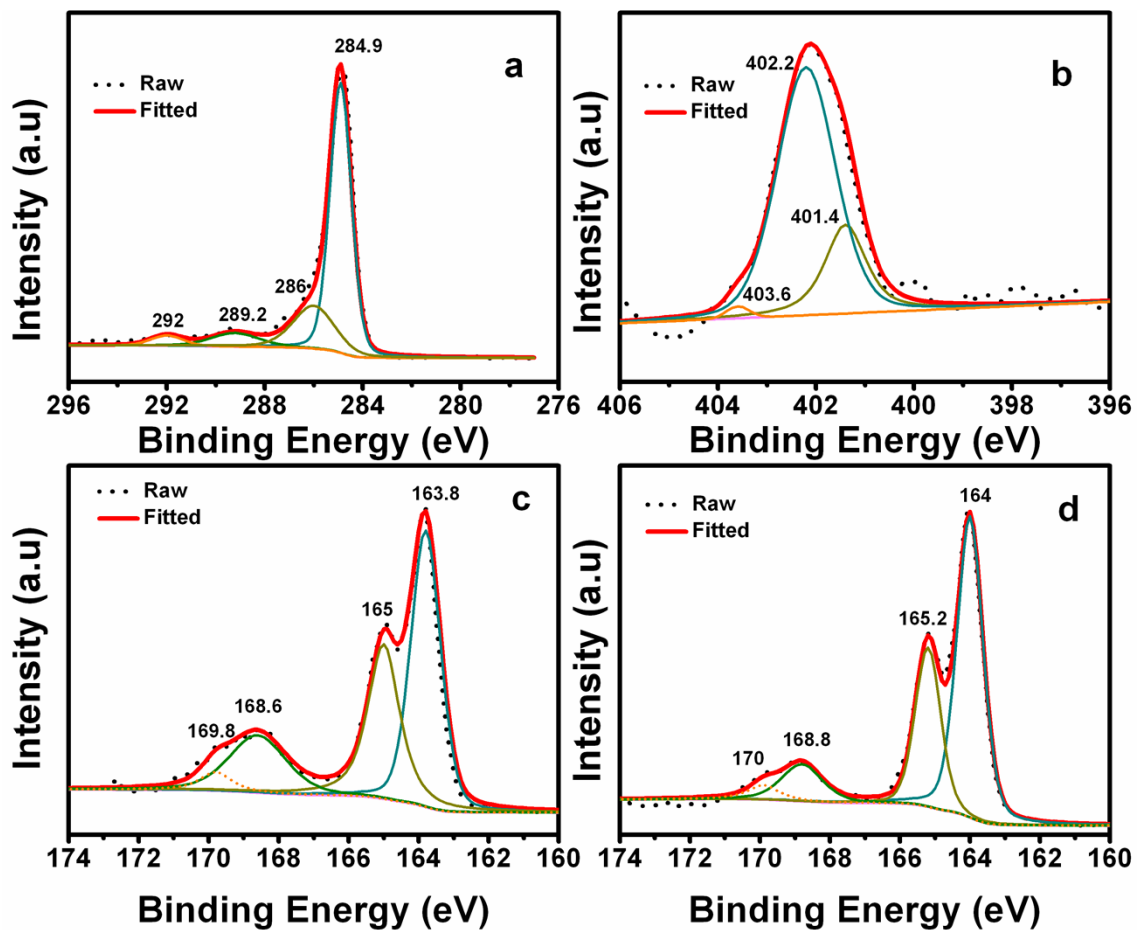


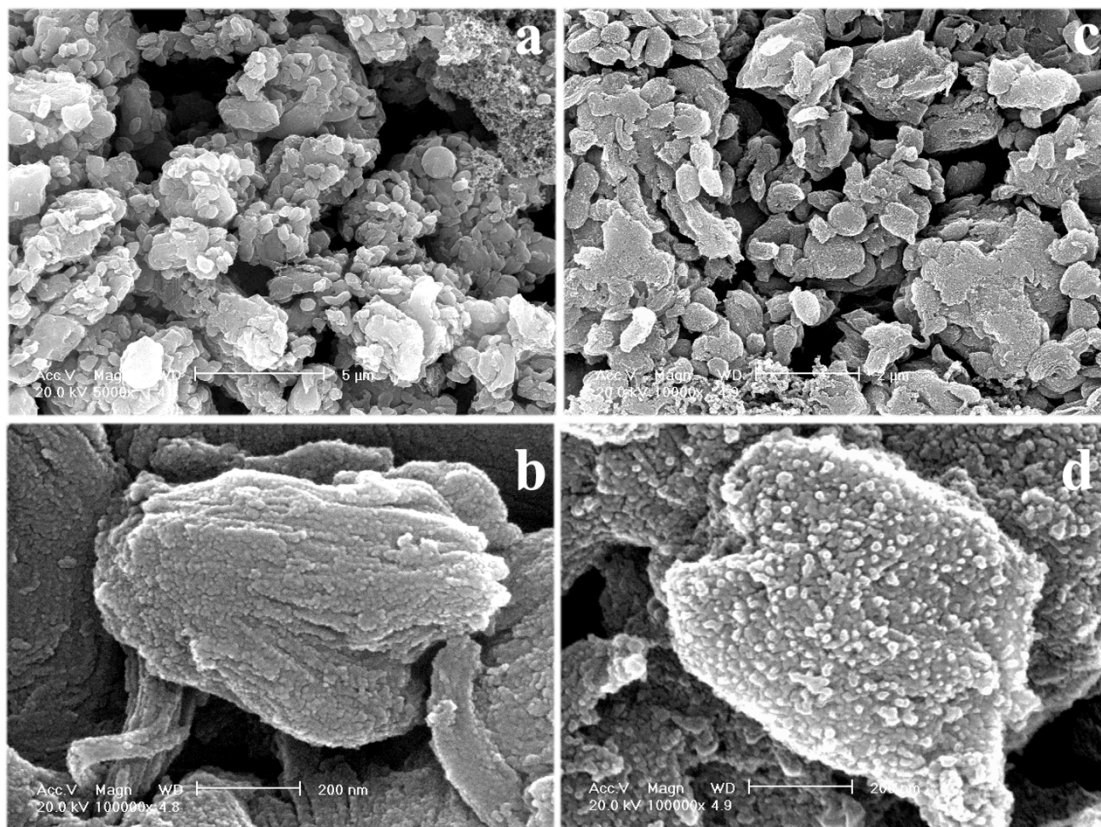
Fig. S4. AES spectrum of AlCMK/S-20-20 composite with sputtering depth.



**Fig. S5.** Elemental analysis of different locations in AlCMK/S-20-20 composite. Sulfur and carbon content at the three points are almost the same, which indicates the uniform distribution of sulfur in AlCMK/S-20-20 composite.

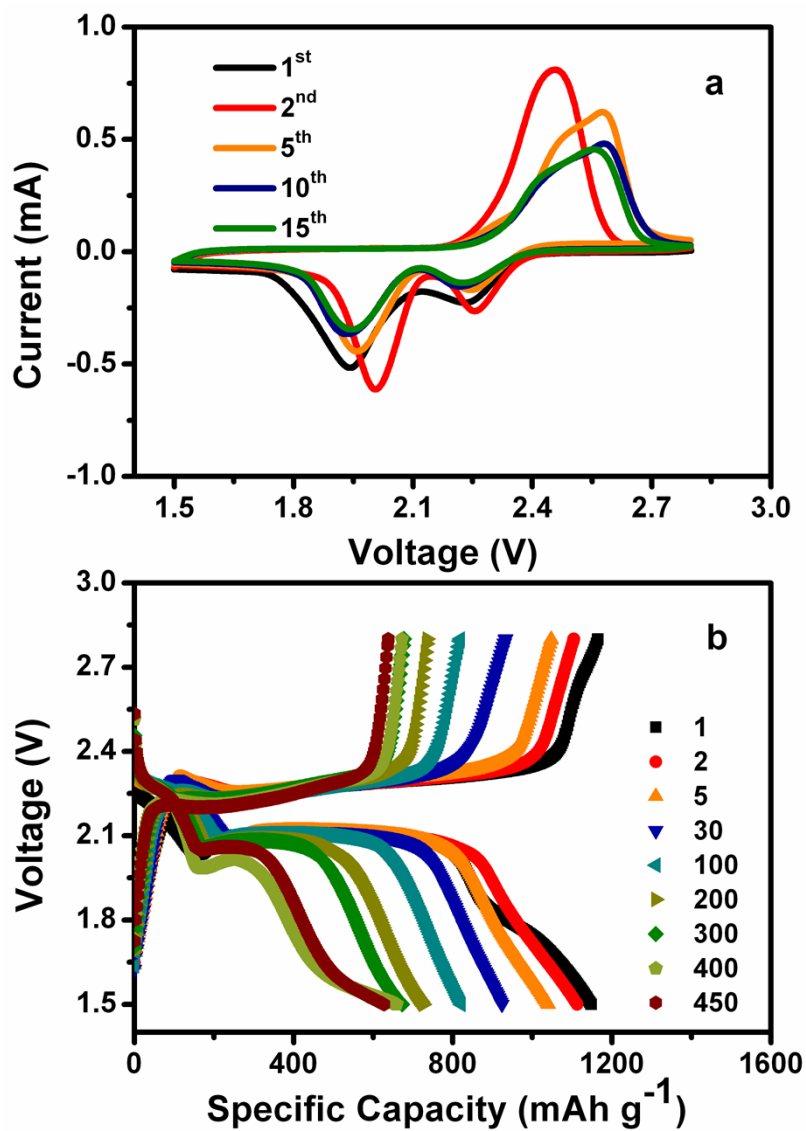


**Fig. S6.** XPS spectra of a) C 1s and b) N 1s in AICMK/S-20-20 composite; XPS spectra of S 2p spectra in c) AICMK/S-20-0 and d) AICMK/S-20-3.



**Fig. S7.** FESEM of AlCMK/S-20-20 cathodes: a,b) fresh cathode and c,d) cathode after 450 cycles at 0.1 C.





**Fig. S8.** a) Cyclic voltammogram and b) discharge-charge capacity vs. voltage profiles of Li-S cells with AICMK/S-20-20 cathode.

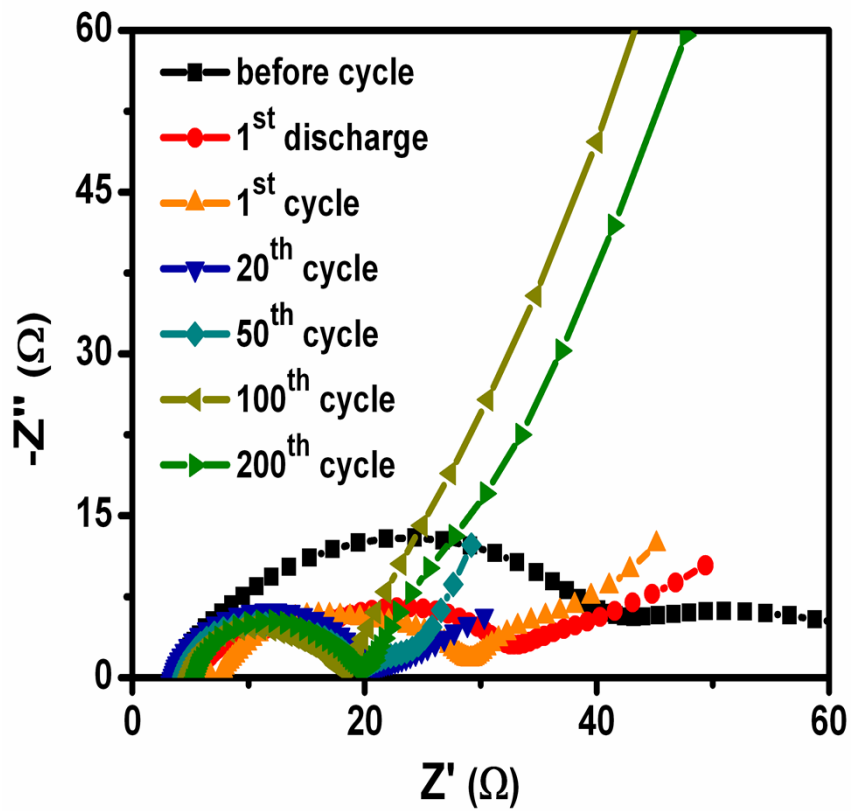


Fig. S9. EIS plots of the Li-S cell with AlCMK/S-20-20 cathode before and after cycles.