Electronic Supplementary Material (ESI) for Nanoscale.

Supporting Information

A Simple Melting-Diffusing-Reacting Strategy to Fabricate S/NiS_2-C for Lithium-Sulfur Batteries

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The mass ratio of the added sulfur and Ni-C is:

$$r = \frac{m_S}{m_1} = \frac{w_2}{M_{Ni}(1 - w_2)} [2M_s(1 - w_1)(2 - w_2) + M_{Ni}w_1]$$

m_S…… the mass of sulfur powders
m_1…… the mass of Ni-C
M_{Ni}…… the molar mass of Ni
M_s…… the molar mass of S
w_1…… the mass percentage of C in Ni-C
w_2…… the mass percentage of S in S/NiS_2-C composite

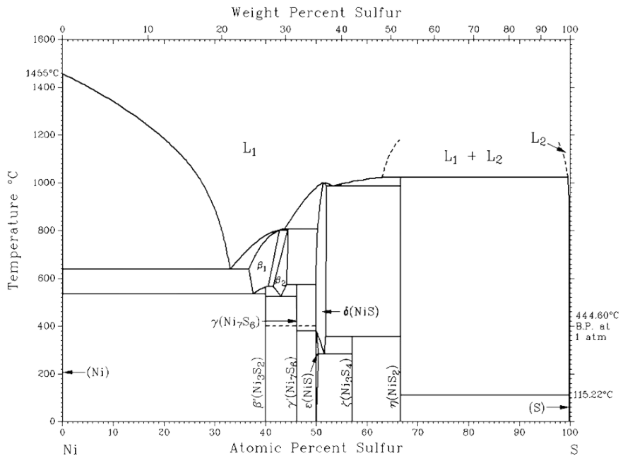

Figure S1. Phase diagram of nickel-sulfur binary system.

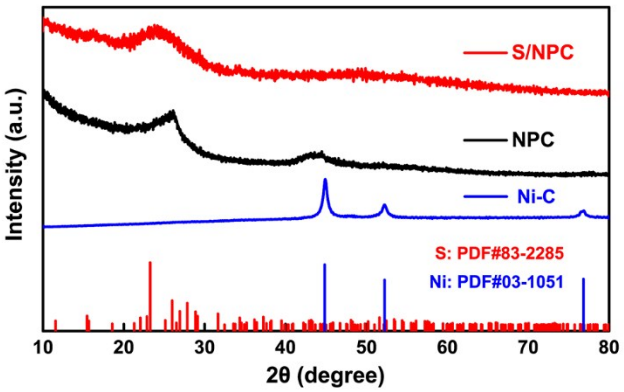

Figure S2. XRD patterns of Ni-C, NPC, S/NPC and the standard patterns of Ni and S.

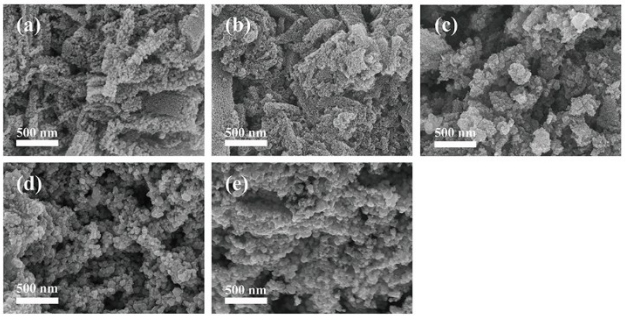

Figure S3. SEM images of (a) Ni-C, (b) NPC, (c) S/NPC, (d) 70S/NiS_2-C and (e) 80S/NiS_2-C.

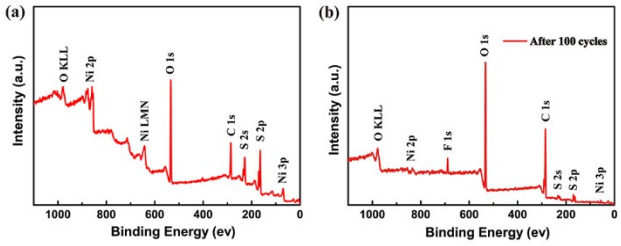

Figure S4. The XPS spectrum of S/NiS_2-C (a) before cycling; (b) after discharge/charge at 0.5 C for 100 cycles.

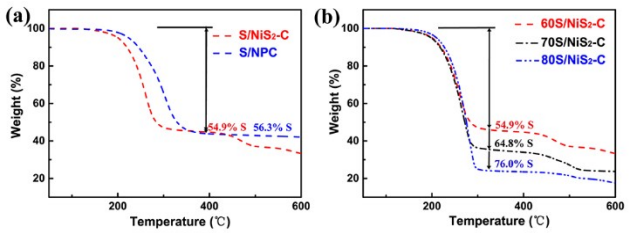

Figure S5. (a) Thermogravimetric (TG) curves of S/NiS_2-C and S/NPC composites; (b) Thermogravimetric (TG) curves of S/NiS_2-C with different sulfur content.

Table S1. The cathodic and anodic peaks from the first CV scan

Electrode	**$E1_{pa}$ (V)**	**$E1_{pc}$ (V)**	**$\Delta E1_p$ (V)**	**$E2_{pa}$(V)**	**$E2_{pc}$ (V)**	**$\Delta E2_p$ (V)**
S/NiS_2-C	2.29	2.04	**0.25**	2.37	2.31	**0.06**
S/NPC	2.32	2.01	0.31	2.38	2.27	0.11

Table S2. The fitting results of EIS

Electrode	**R_1 (Ω)**	**R_2 (Ω)**	**R_3 (Ω)**
S/NiS_2-C	1.40	7.00	3.00
S/NPC	1.00	50.00	12.00

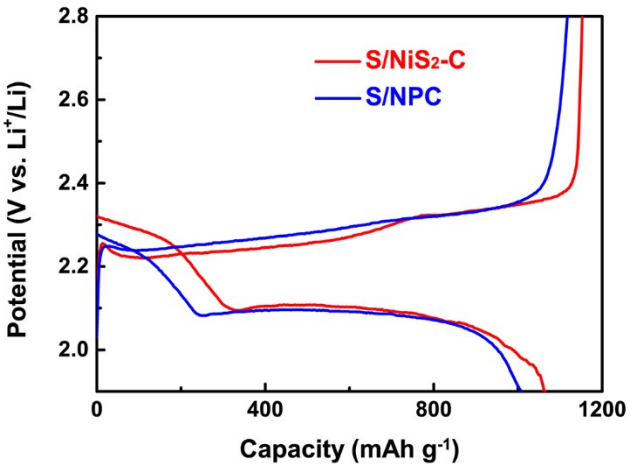

Figure S6. Initial discharge/charge profiles of S/NiS_2-C and S/NPC in the voltage range of 1.9–2.8 V at 0.2 C.