Supporting Information

Interconnected NiCo$_2$O$_4$ nanosheet arrays grown on carbon cloth as host, adsorber and catalyst for sulfur species enabling high-performance Li-S batteries

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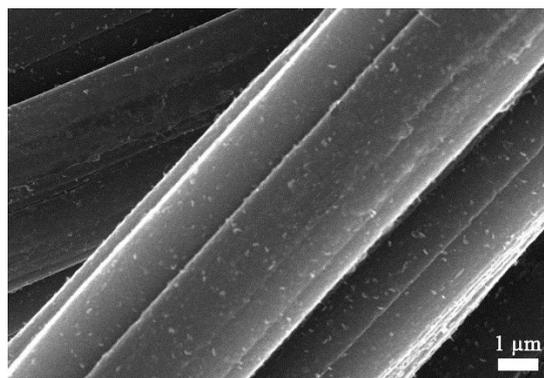E-mail addresses: gych@gdut.edu.cn (Lin Yu); panyuede@tyut.edu.cn (Yuede Pan)
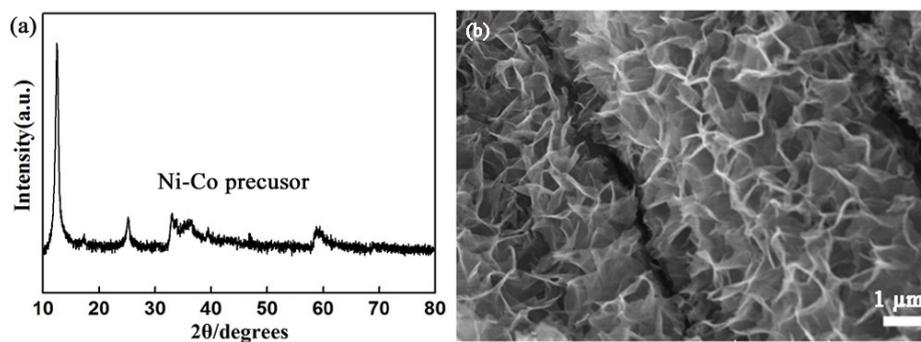
Figure S1. SEM image of bare CC.

Figure S2. XRD pattern (a) and SEM image (b) of the precursor of $NiCo_2O_4$/CC, with a composition of $(Ni_xCo_y)(OH)_a(CO_3)_b(H_2O)_c$.
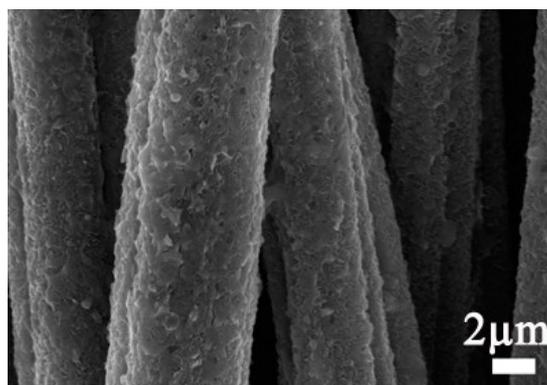

Figure S3. FESEM images of S/CC with sulfur loading of 1.15 mg cm^{-2}.
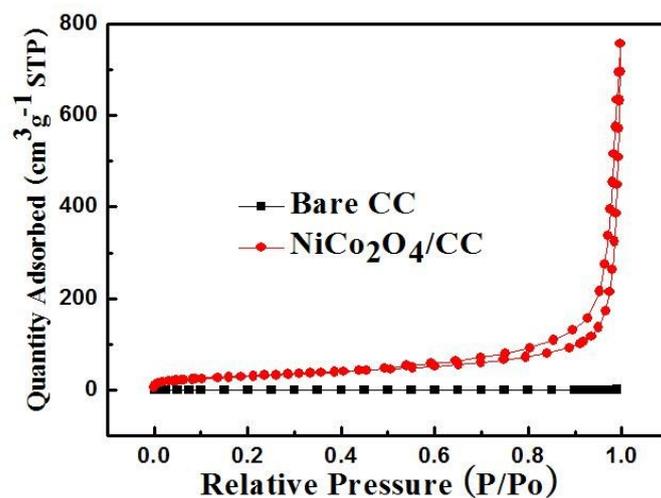
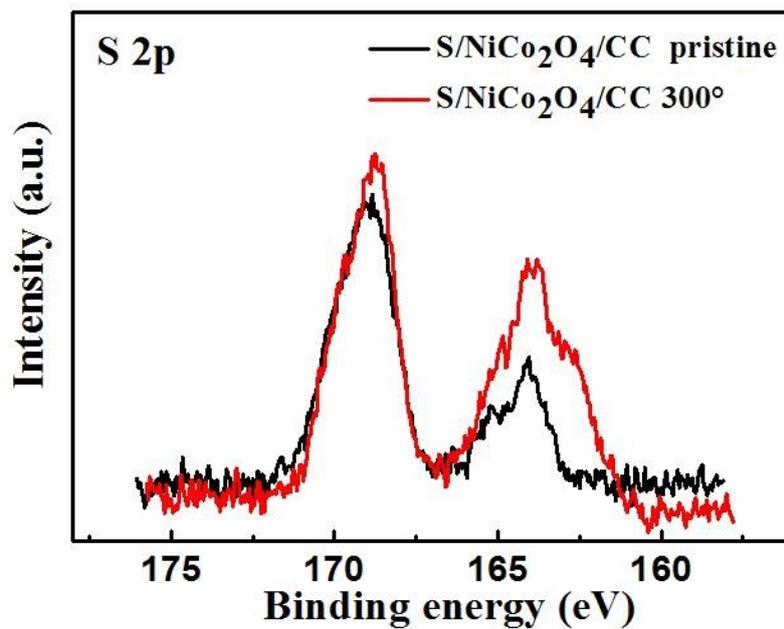Figure S4. N$_2$ adsorption-desorption isotherms of bare CC and NiCo$_2$O$_4$/CC.

Figure S5. High-resolution S 2p XPS spectra of S/NiCo$_2$O$_4$/CC before and after 300°C
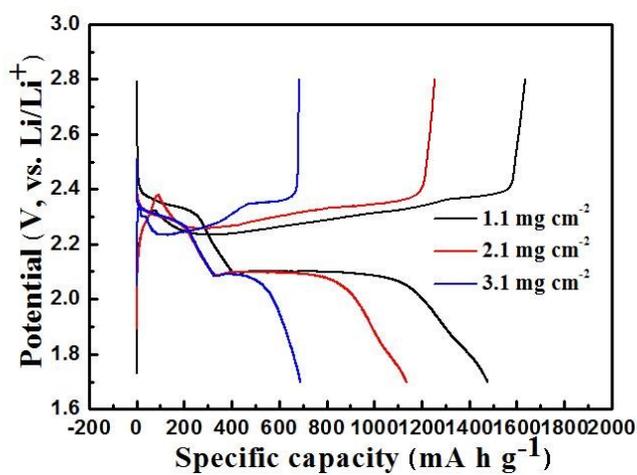
treatment.

Figure S6. The first charge-discharge profiles at 0.1 C for S/NiCo$_2$O$_4$/CC cathodes with varied
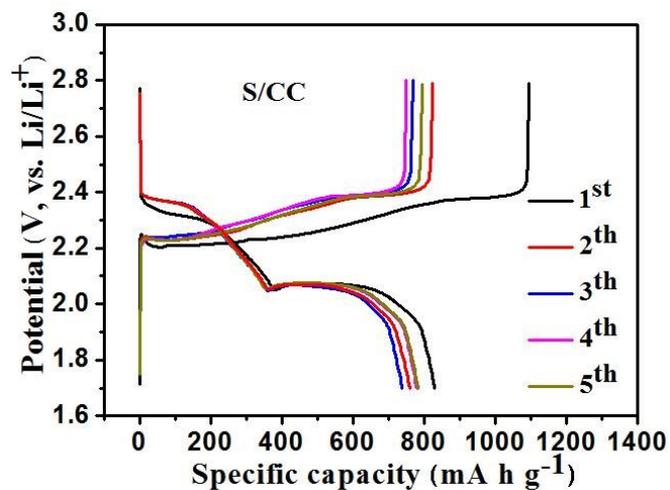
sulfur loading.

Figure S7. Charge-discharge profiles for the first five cycles at 0.5 C for S/CC. The initial

Coulombic efficiency is lower than 80%.

$$I_p=(2.69\times10^5)n^{1.5}AD^{0.5}Cv^{0.5}(25\ ^{\circ}C)$$

Randles-Sevcik equation for lithium ion diffusion process, where I_p is the peak current (A), n is charge transfer number, A is the electrode area (cm^2), D is the lithium ion diffusion coefficient (cm^2 s^{-1}), C is the concentration of Li ions (mol cm^{-3}), and v is the scan rate (V s^{-1}).
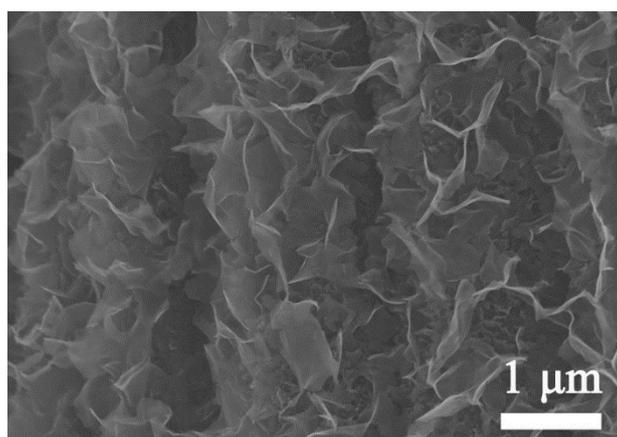

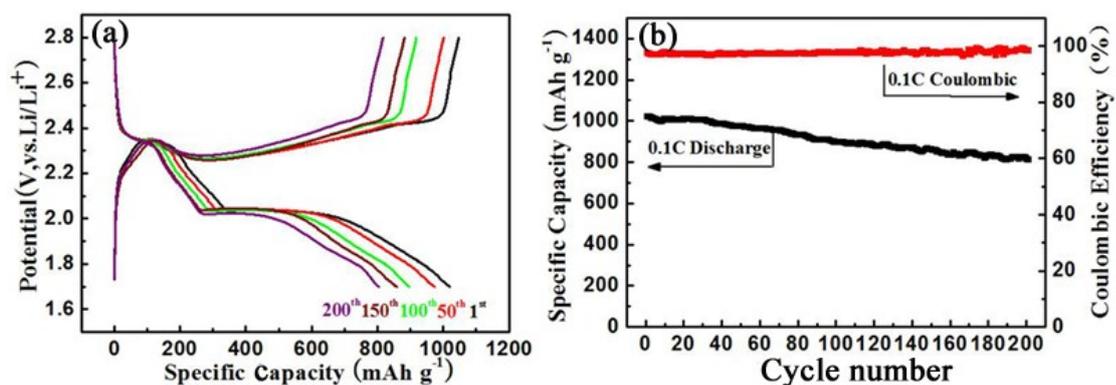Figure S8. SEM image of S/NiCo$_2$O$_4$/CC electrode after 400 cycles.

Figure S9. (a) Charge-discharge profiles during cycling at 0.1 C for S/NiCo$_2$O$_4$/CC (sulfur loading: 2.73 mg cm^{-2}) at the 1st, 50th, 100th, 150th and 200 cycles. (b) Cycling performances and Coulombic efficiencies of S/NiCo$_2$O$_4$/CC (sulfur loading: 2.73 mg cm^{-2}) at 0.1 C.
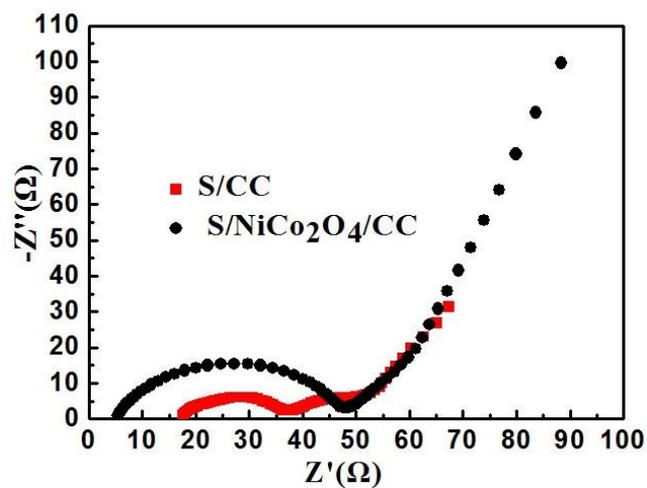
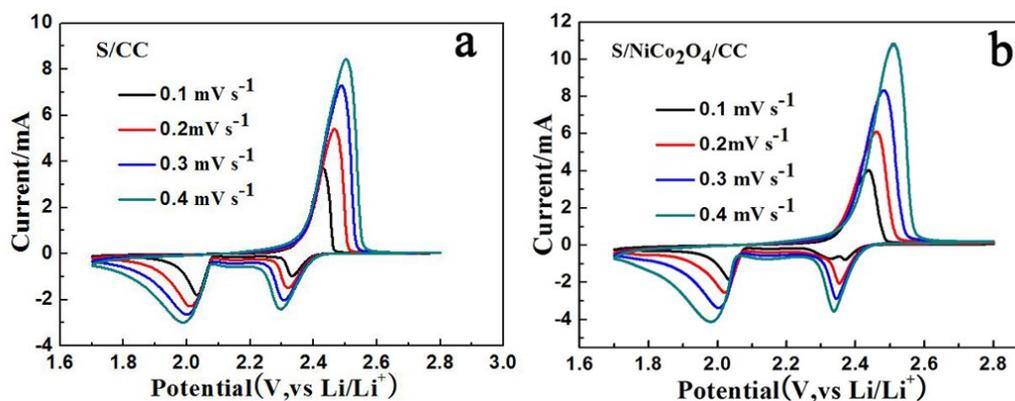Figure S10. EIS measurements for S/CC and S/NiCo$_2$O$_4$/CC after cycling at 100% of charge state.

Figure S11. CV curves for (a) S/CC and (b) S/NiCo$_2$O$_4$/CC composites at different scan rates from 0.1 to 0.4 mV s^{-1}.
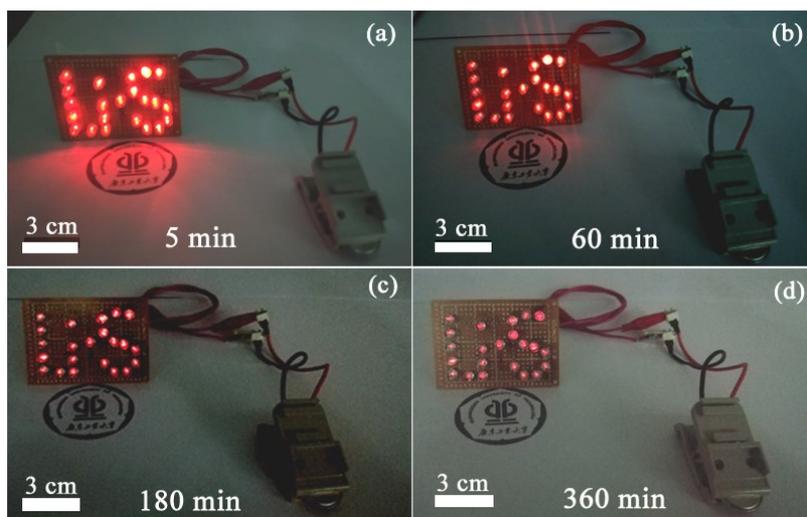
Figure S12. Demonstration of a Li-S coin cell with the S/NiCo$_2$O$_4$/CC electrode in illuminating red LED for (a) 5 min, (b) 60 min, (c) 180 min, (d) 360 min.