

Supporting Information

Engineered Self-Supported Electrocatalytic Cathode and Dendrite-Free Composite Anode Based on 3D Double-Carbon Hosts for Advanced Li-SeS₂ Batteries

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Section SI. Supporting Figures

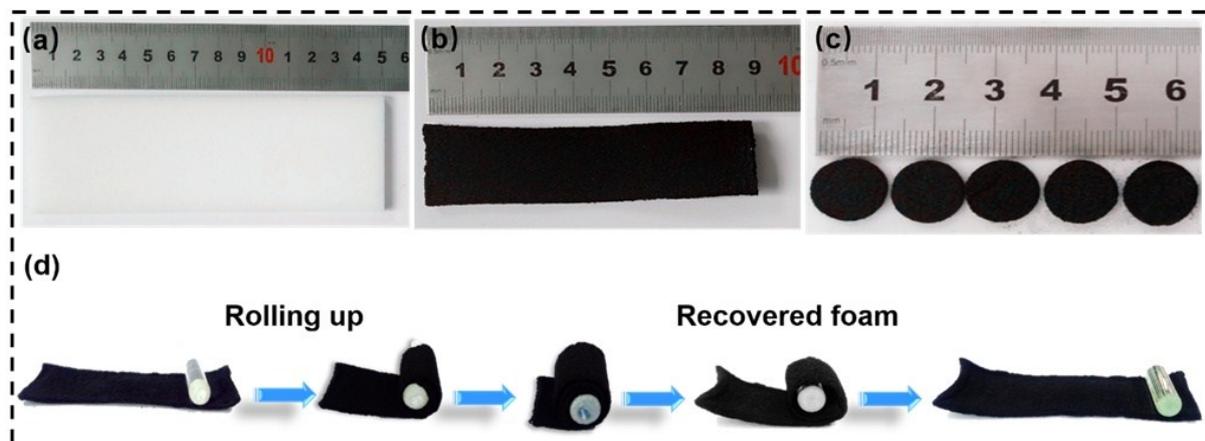


Figure S1 (a-c) Digital images of commercial MF (a), as-prepared CF@CNTs (b) and CF@CNTs/CoS₂ hybrid (c). (d) Digital images of the rolling up process of the 3D flexible CF@CNTs/CoS₂-SeS₂ electrode, which still maintains an integral morphology without any structural cracking.

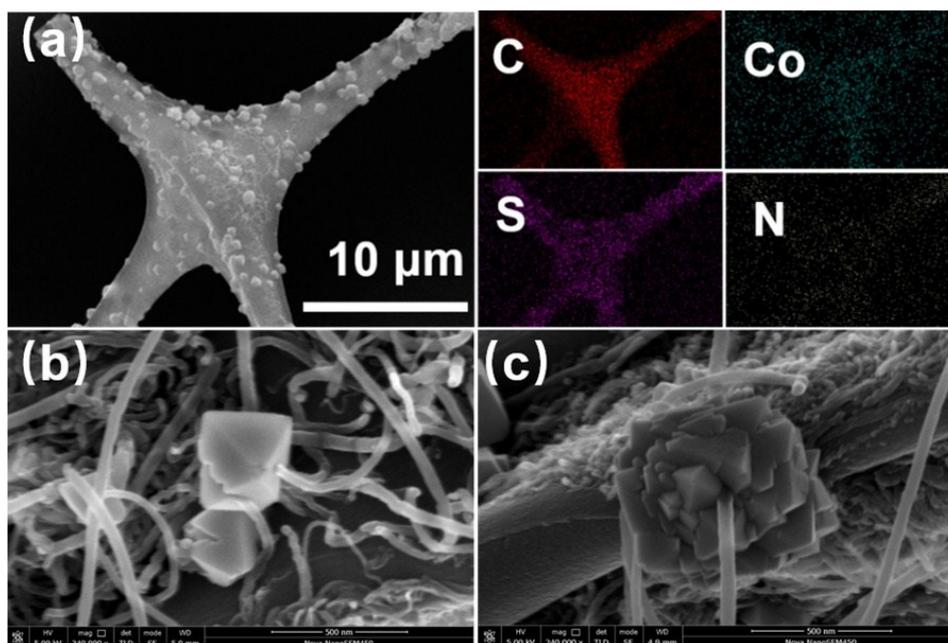


Figure S2 (a) EDS mappings of C, Co, S, and N elements of CF@CNTs/CoS₂. (b, c) FESEM images of CF@CNTs/CoS₂.

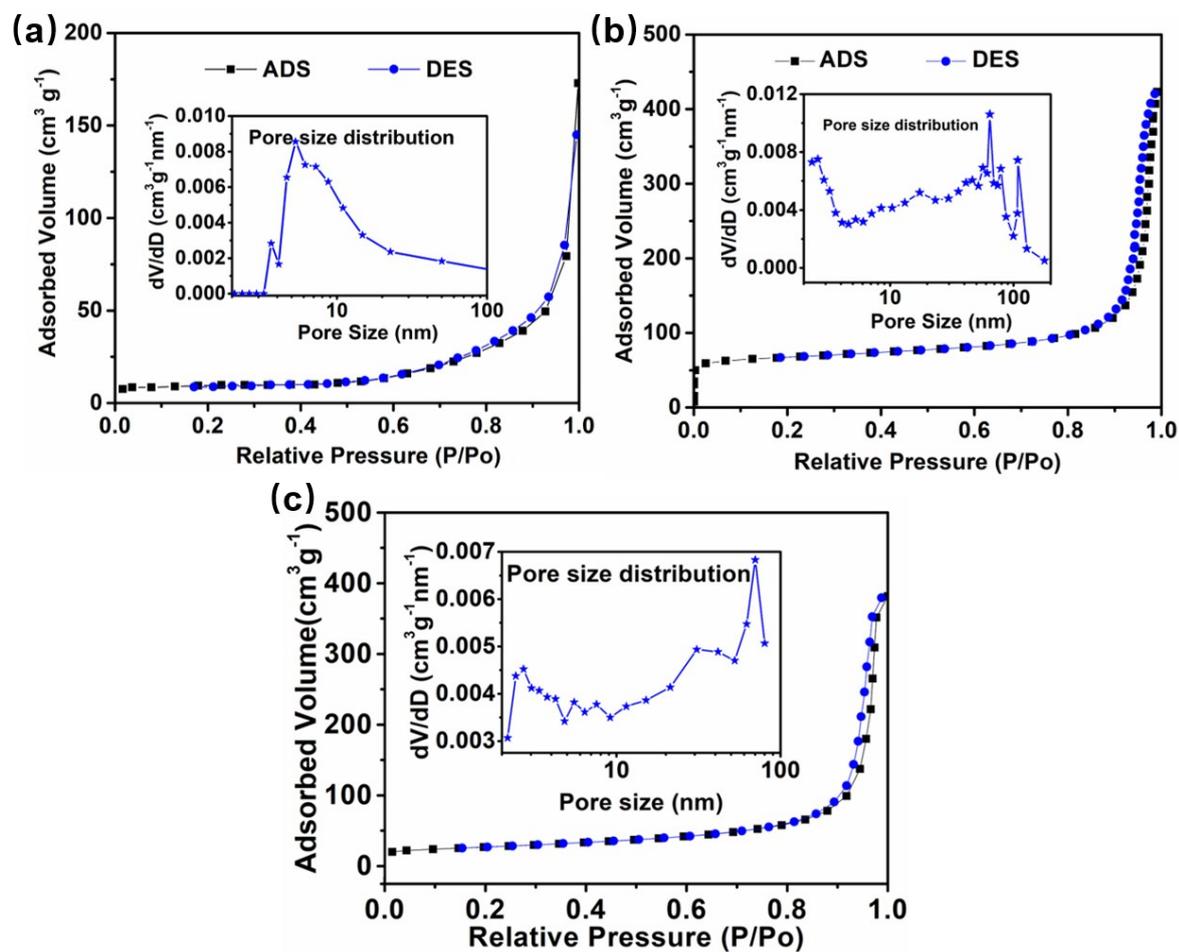


Figure S3 Nitrogen adsorption/desorption isotherms and pore-size distributions (inset) of CF, CF@CNTs and CF@CNTs/CoS₂ with the BET and BJH methods.

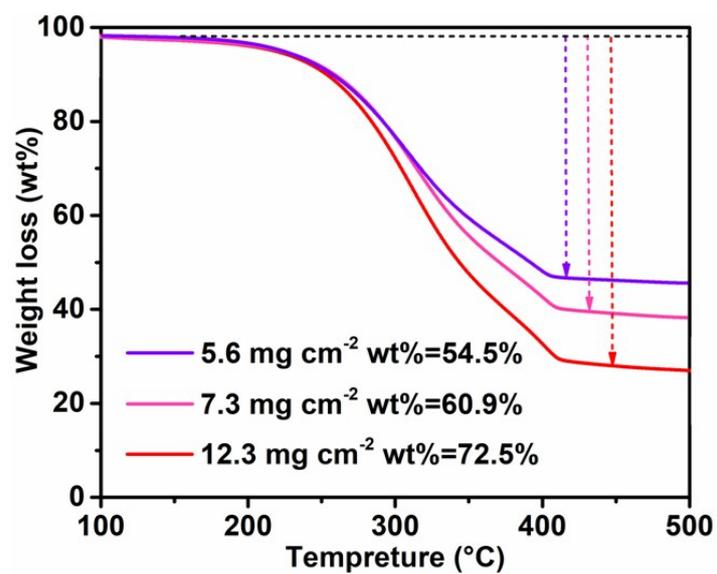


Figure S4 TGA curves of CF@CNTs/CoS₂@SeS₂ electrode materials with different areal SeS₂ loadings of 5.6, 7.3 and 12.3 mg cm⁻², respectively.

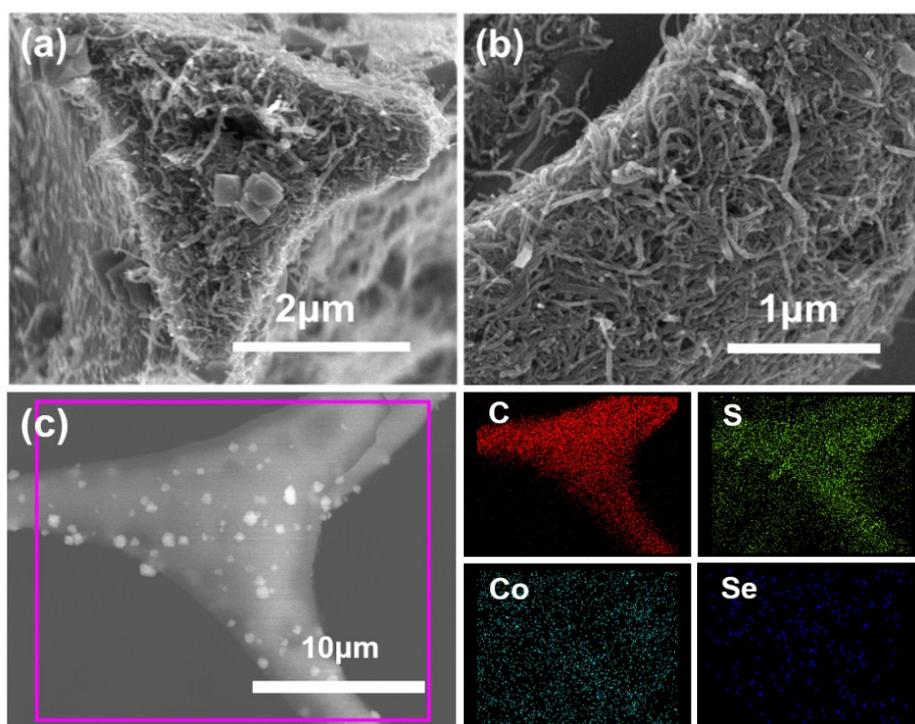


Figure S5 (a, b) Typical FESEM images of CF@CNTs/CoS₂@SeS₂ electrode with the areal SeS₂ loading of 5.6 mg cm⁻² and (c) EDS mappings of C, Co, S, and Se elements of CF@CNTs/CoS₂@SeS₂.

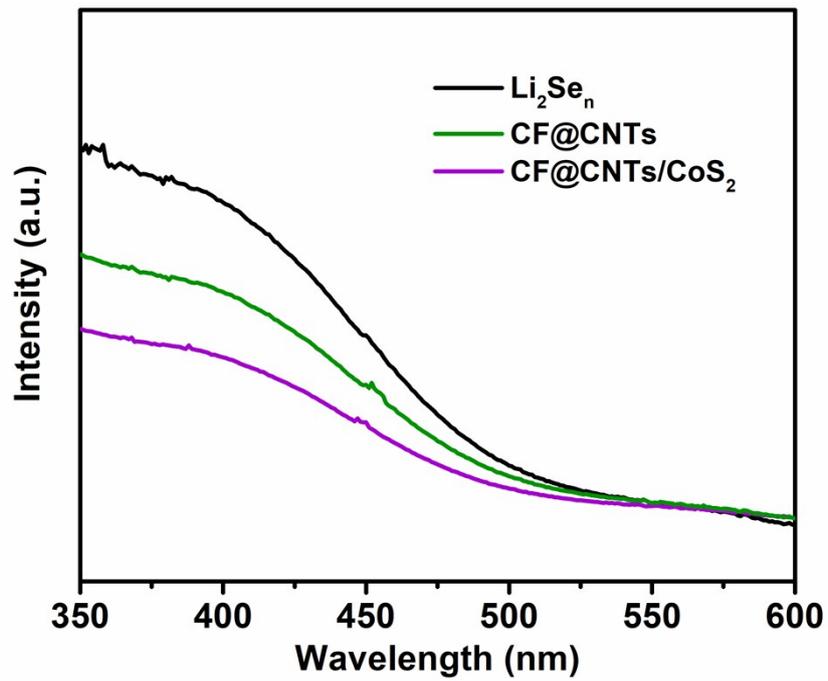


Figure S6 UV-vis absorption spectra of Li_2Se_n ($4 \leq n \leq 8$) solutions with exposure to CF@CNTs/CoS_2 and CF@CNTs

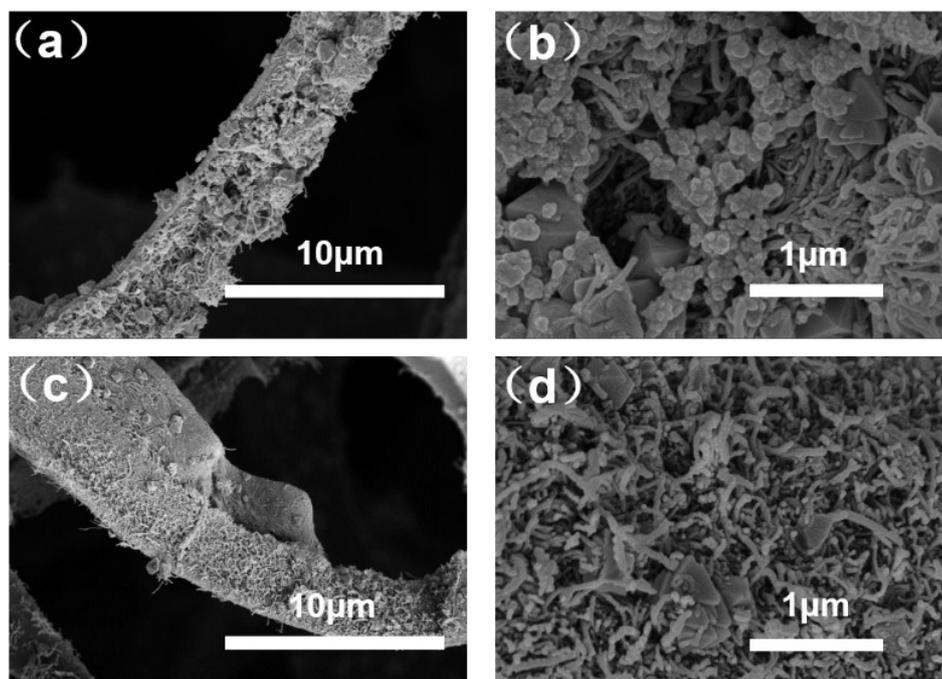


Figure S7 FESEM images of CF@CNTs/CoS₂ after adsorption of Li₂Se_n (a-b) and Li₂S_n (c-d).

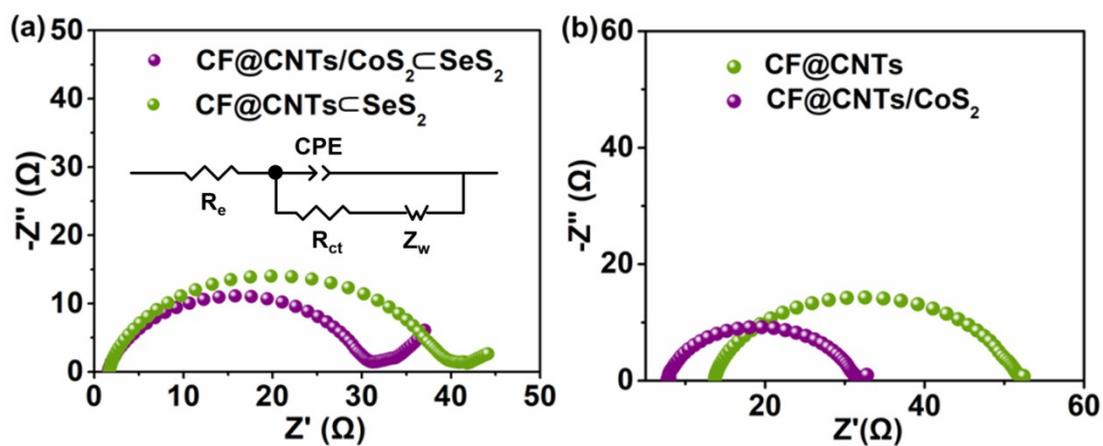


Figure S8 (a) Nyquist plots of CF@CNTs@SeS₂ and CF@CNTs/CoS₂@SeS₂ as cathode coupled with Li anode. (b) Nyquist plots of the symmetric cells with CF@CNTs or CF@CNTs/CoS₂ as both the working and counter electrodes.

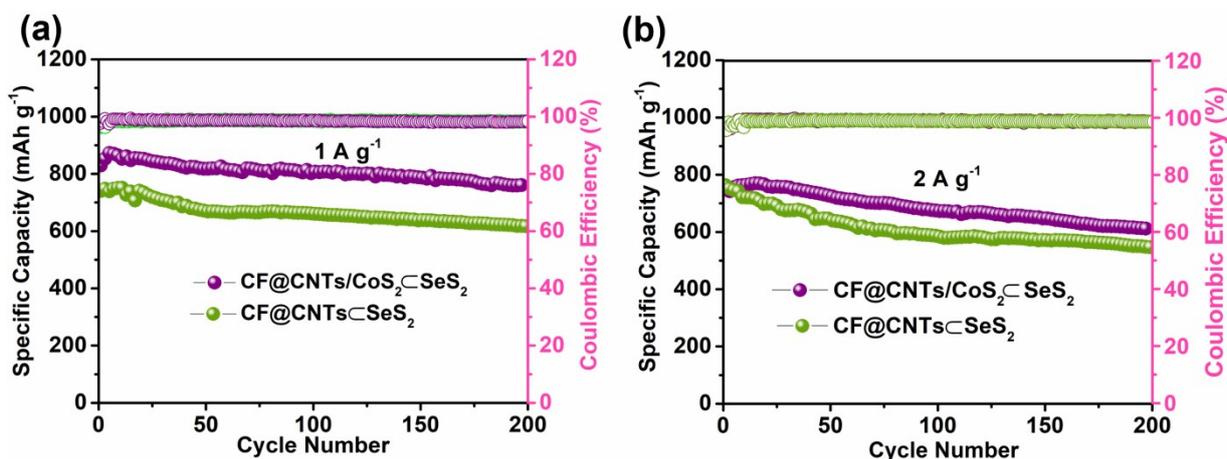


Figure S9 Comparison of the cycling stabilities of CF@CNTs/CoS₂/SeS₂ and CF@CNTs/SeS₂ electrodes at 1.0 A g⁻¹ for 200 cycles.



Figure S10 (a) Schematic diagram of soft-packaged Li-SeS₂ battery; (b, c) Vivid photographs demonstration of the flexibility of the as-fabricated soft-packaged Li-SeS₂ battery based on the CF@CNTs/CoS₂/SeS₂ cathode bending at 180° and after nearly 180°. The soft-packaged Li-SeS₂ battery can light up 33 red LEDs (nominal voltage of 2.0-2.2 V) in the flat and bent states.

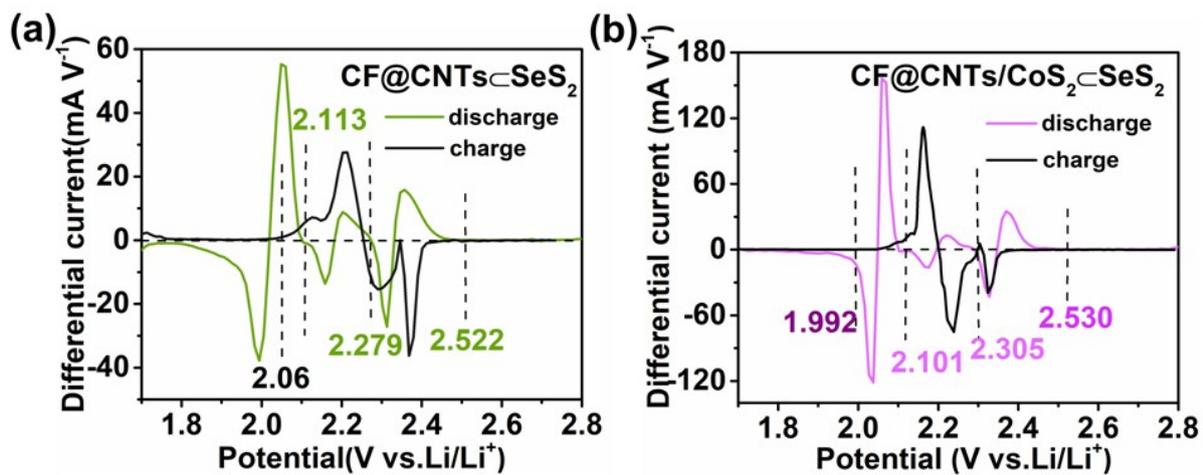


Figure S11 Electrocatalytic effects of electrode materials verified from the CV profiles: differential CV curves of (a) CF@CNTs/SeS₂ and CF@CNTs/CoS₂/SeS₂; The baseline potentials and baseline current densities in (a, b) are defined as the values before the redox peaks, where the variation on current density is the smallest, namely $dl/dV = 0$.

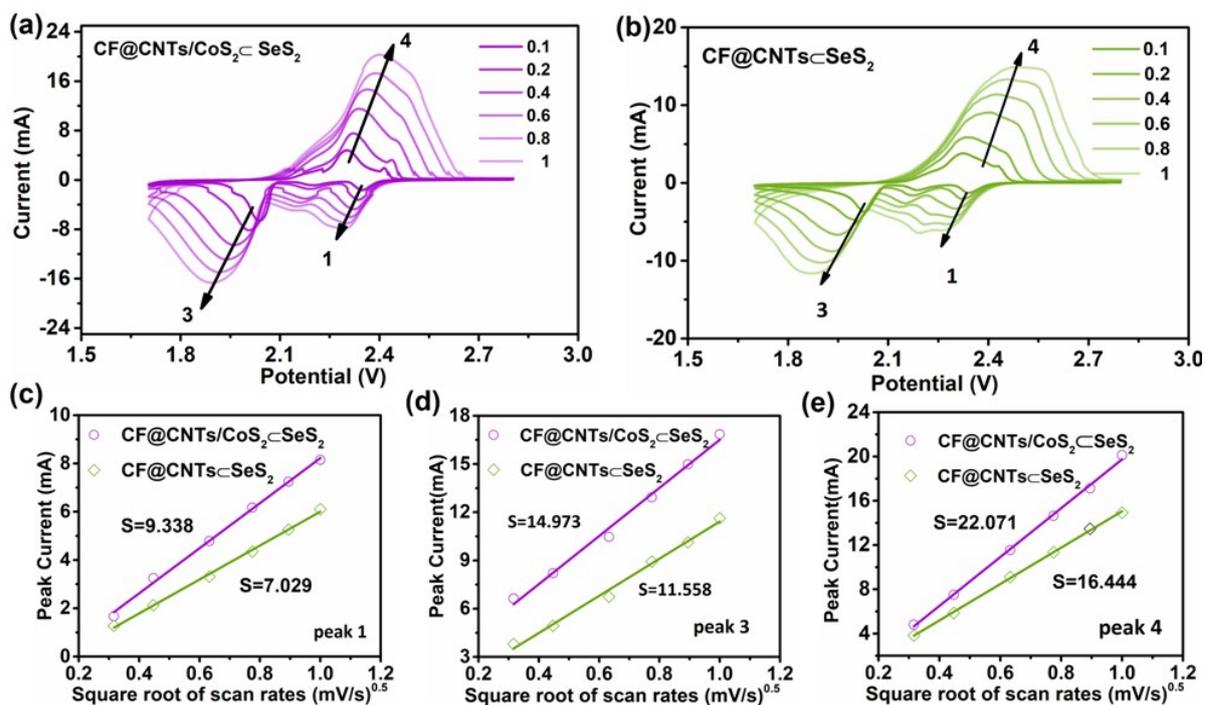


Figure S12 CV curves of the (a) CF@CNTs/CoS₂-SeS₂ and (b) CF@CNTs-SeS₂ electrodes at various scan rates. (c-d) Plots of the CV peak current intensities of (c) peak 1 (S₈→Li₂S₄), (d) peak 3 (Li₂S₄→Li₂S; Li₂Se₄→Li₂Se), and (e) peak 4 (Li₂S→Li₂S₈) versus the square root of scan rates.

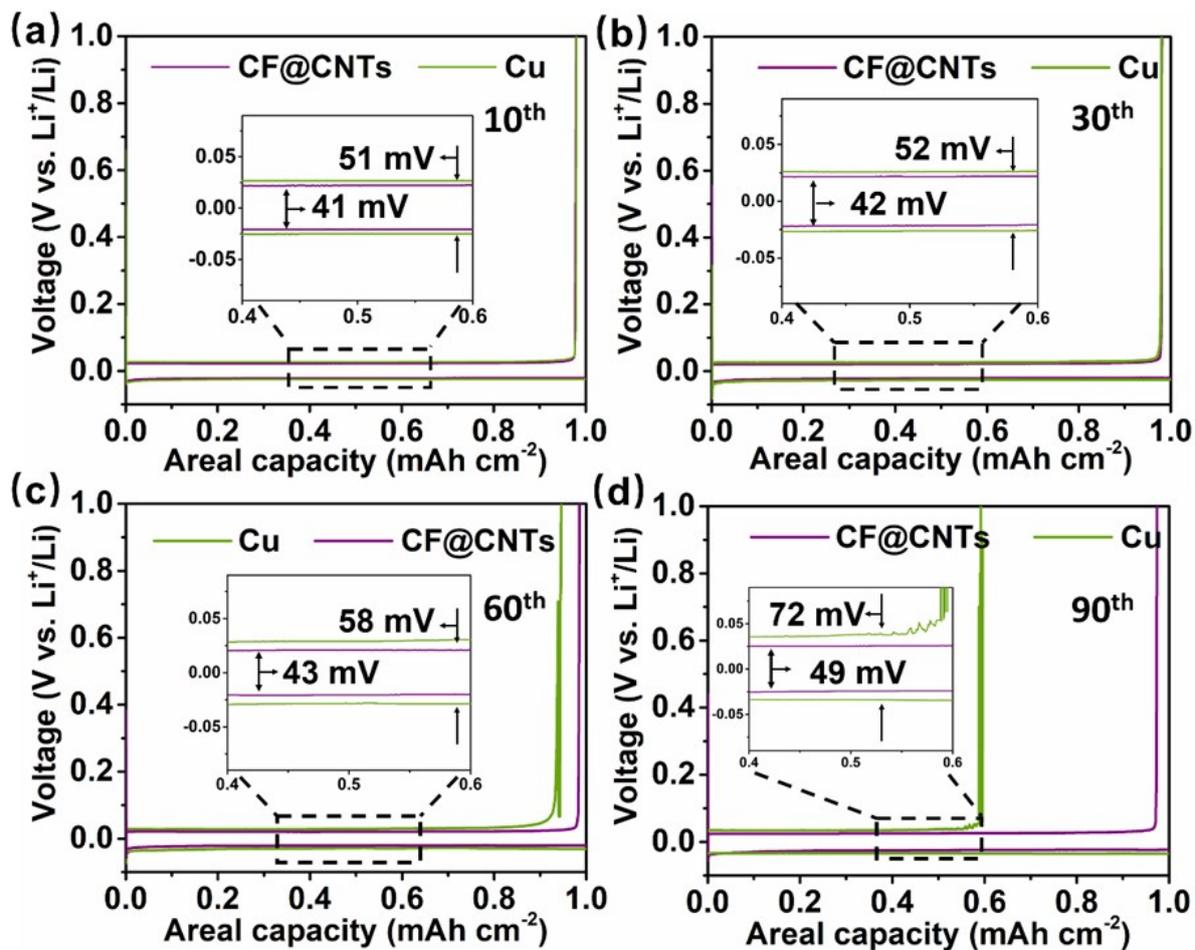


Figure S13 The typical voltage profiles of Cu foil and CF@CNTs electrodes at a current density of 1.0 mA cm^{-2} with a cycling capacity of 1.0 mAh cm^{-2} after 10 (a), 30 (b), 60 (c), and 90 (d) cycles.

Section SII. Supporting Tables

Table S1 Elemental analysis results of MF and CF@CNTs.

Samples	Element (wt.%)		
	C	N	H
MF	32.16	41.86	25.98
CF@CNTs	94.84	5.16	---

Table S2 Square resistance of samples.

Samples	CF	CF@CNTs	CF@CNTs/CoS ₂
Resistance (Ω/\square)	24.88	0.65	0.38

Supplementary References

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