

Supplementary Information

Self-sacrificing strategy to fabricate fluorine-modified integrated silicon/carbon anode for high-performance lithium-ion batteries

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Figure Captions

Fig. S1 XPS spectra of F-SC: (a) survey scanning spectrum, (b) C 1 s, (c) Si 2 p and (d) F 1 s.

Fig. S2 O 1s XPS spectra of F-SC

Fig. S3 SEM and TEM of Si NPs

Fig. S4 CV curves of SSC at scanning rate of 0.1 mV s^{-1} between 0.01 and 1.5 V (vs Li/Li⁺)

Fig. S5 Comparison of ICE with reported studies in literature

Fig. S6. The equivalent circuit diagrams (a) before and (b) after the cycle

Fig. S7. Representative lithiation/delithiation voltage profiles of F-SC at 0.5 A g^{-1}

Fig. S8. high magnification surface morphology of F-SC electrode before (a), after 100 cycles (b) and after 200 cycles (c) at 0.5 A g^{-1}

Fig. S9. Microscopic morphology before and after electrode cycling. Surface morphology of SSC electrode before (a) and after 200 cycles (b) at 0.5 A g^{-1} . Cross-sectional SEM images of SSC electrode before (c) and after 200 cycles (d) at 0.5 A g^{-1} . Variation of electrode thickness

Table Captions

Table S1 Atomic percentage of each element in XPS spectra.

Table S2 Kinetic parameters of Si NPs, F-SC and SSC composites electrodes.

Table S3 Comparison of performances of Si@void@C composites for lithium-ion batteries.

Table S1. Atomic percentage of each element in XPS spectra

		Binding Energy (eV)	Atomic (%)
F-SC	Si 2p	103~	11.07
	C 1s	285~	78.54
	O 1s	533~	9.71
	F 1s	687~	0.68
SSC	Si 2p	103~	14.51
	C 1s	285~	73.22
	O 1s	533~	11.82
	F 1s	687~	0.45

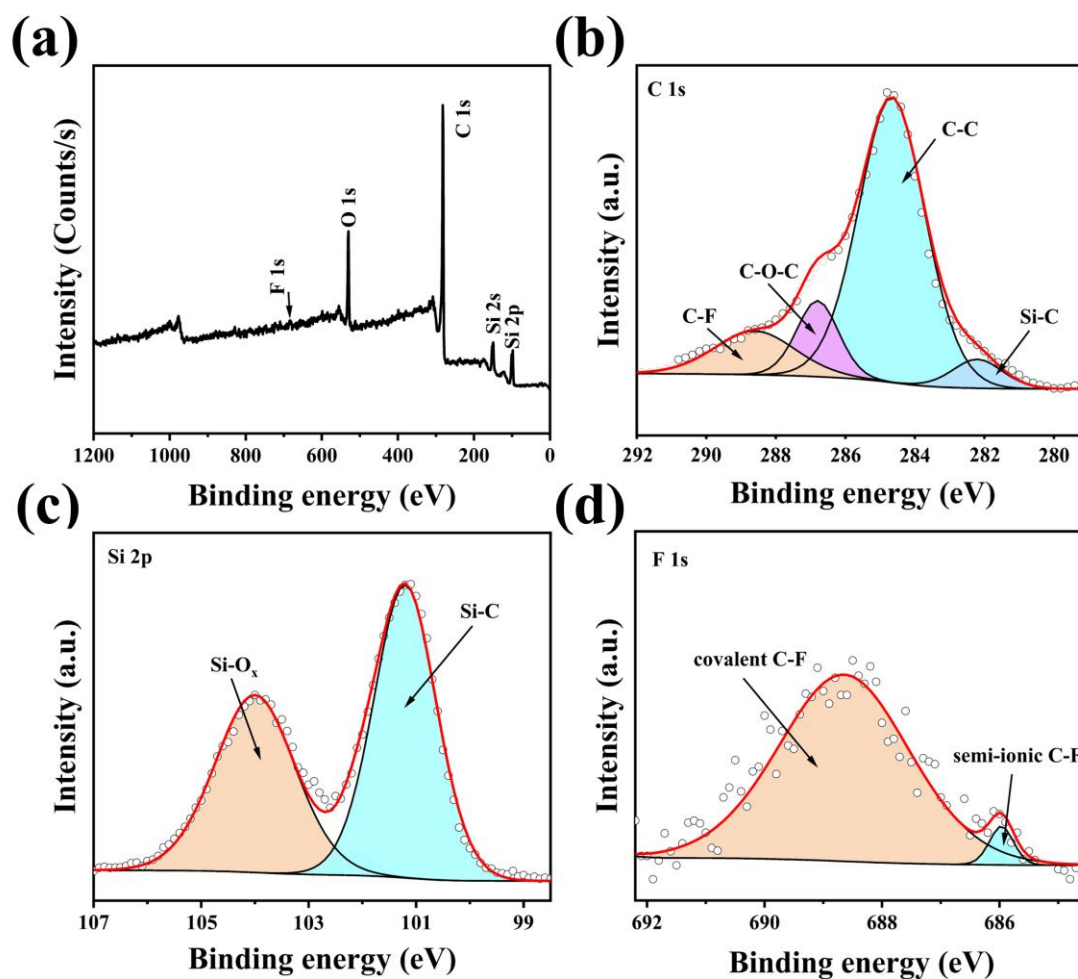


Fig. S1 XPS spectra of F-SC: (a) survey scanning spectrum, (b) C 1 s, (c) Si 2 p and (d) F 1 s

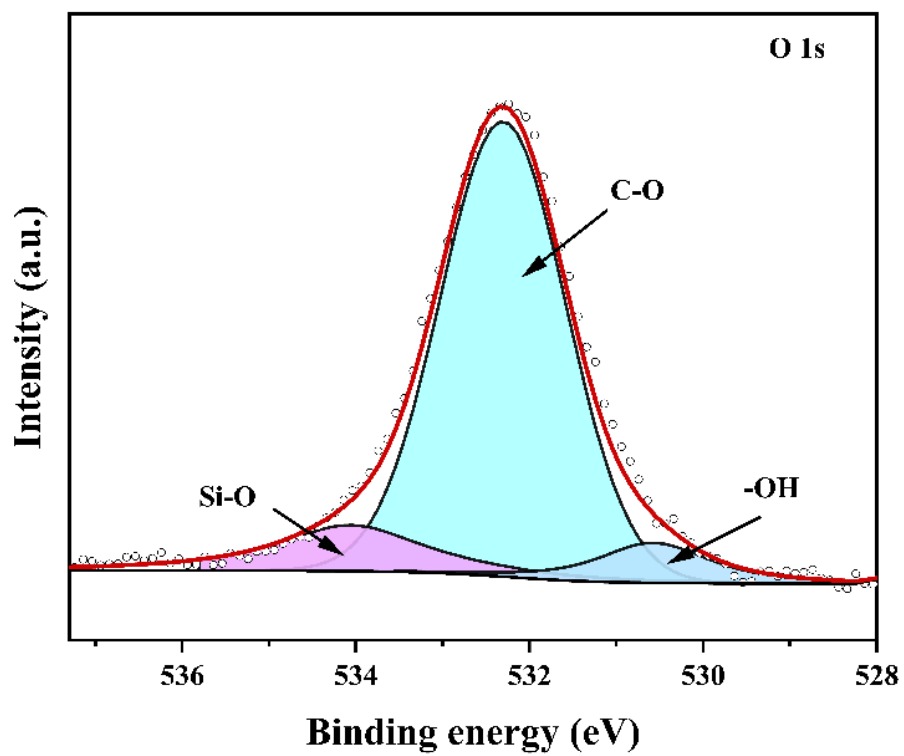


Fig. S2 O 1s XPS spectra of F-SC

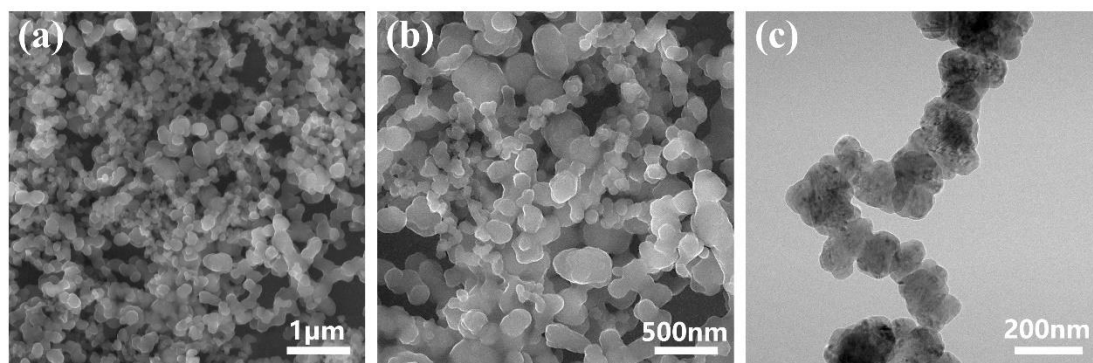


Fig. S3 (a)、(b) SEM and (c) TEM of Si NPs

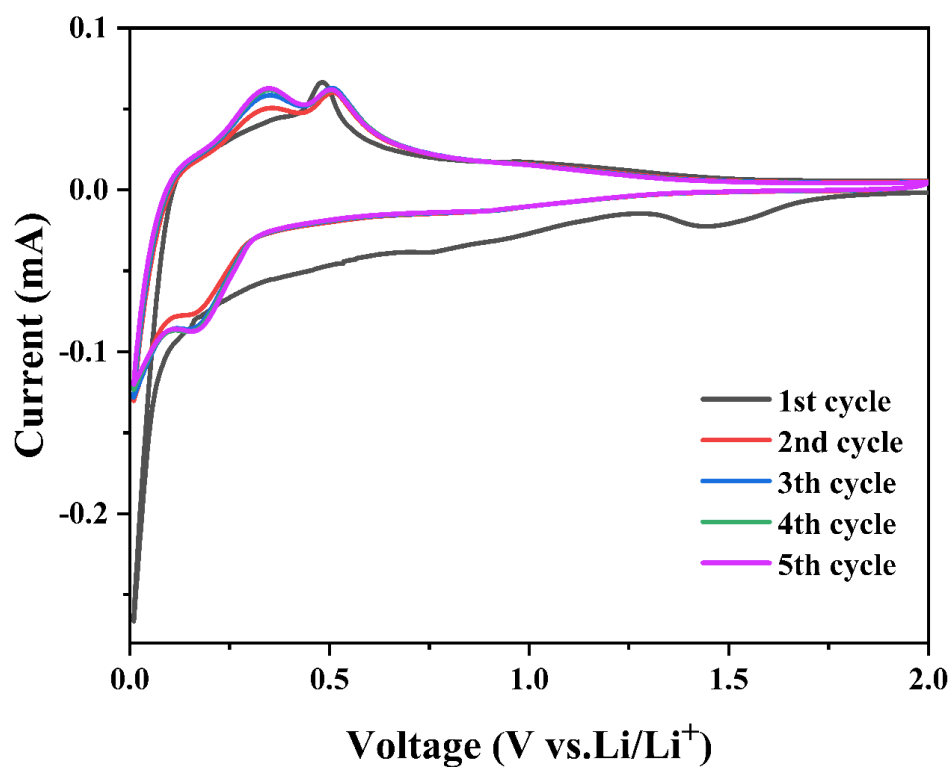


Fig. S4 CV curves of SSC at scanning rate of 0.1 mV s^{-1} between 0.01 and 1.5 V (vs Li/Li⁺)

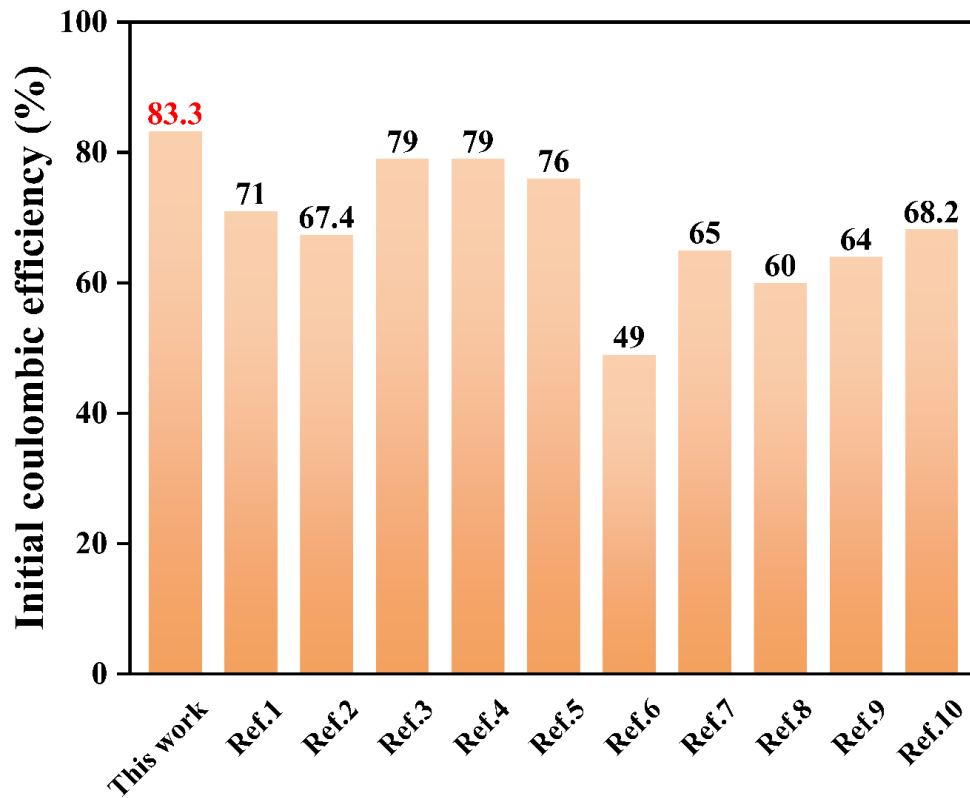


Fig. S5 Comparison of ICE with reported studies in literature¹⁻¹⁰

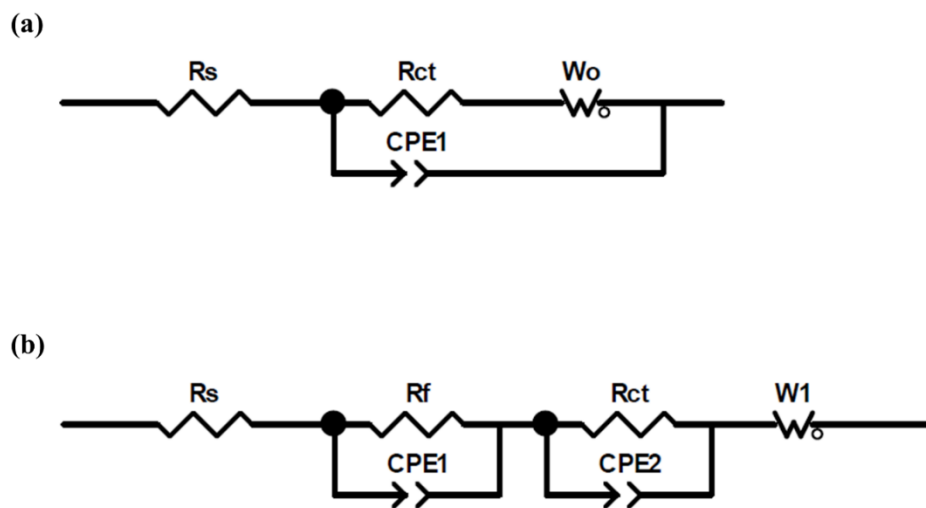
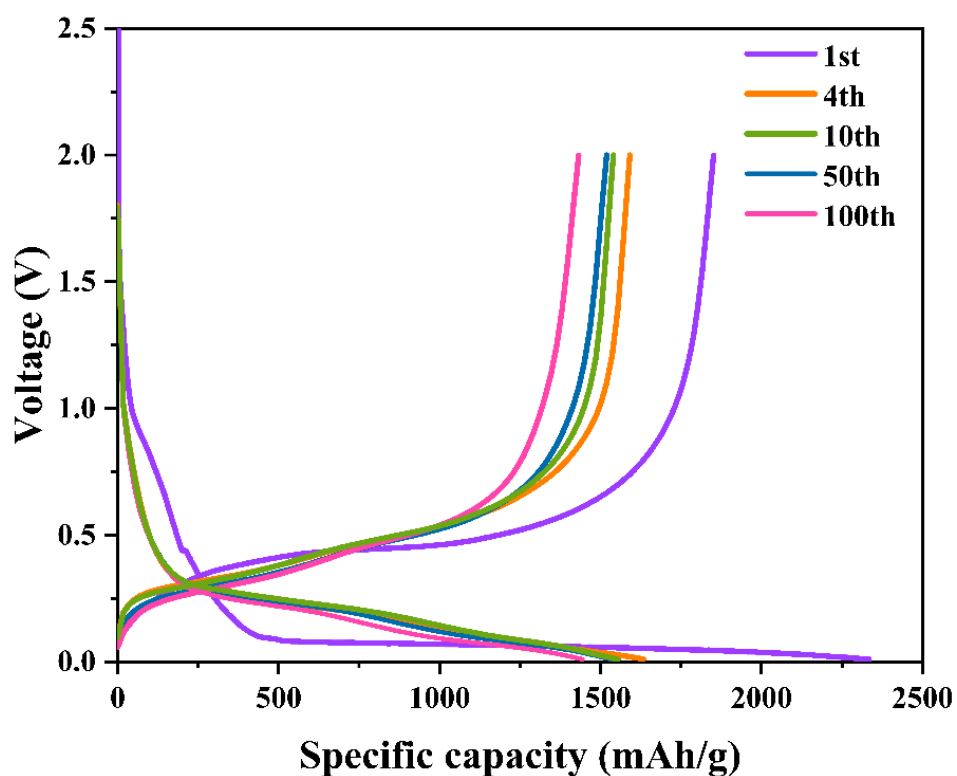


Fig. S6. The equivalent circuit diagrams (a) before and (b) after the cycle

Table S2. Kinetic parameters of Si NPs、 F-SC and SSC composites electrodes.

Materials	Cycle number	Rs (Ω)	Rf (Ω)	Rct (Ω)
Si NPs	0 th	1.182	—	175.5
	100 th	3.454	25.98	101.8
SSC	0 th	1.255	—	138.3
	100 th	6.158	41.71	46.17
F-SC	0 th	1.225	—	90.42
	100 th	1.899	68.58	39.85

**Fig. S7.** Representative lithiation/delithiation voltage profiles of F-SC at 0.5 A g⁻¹

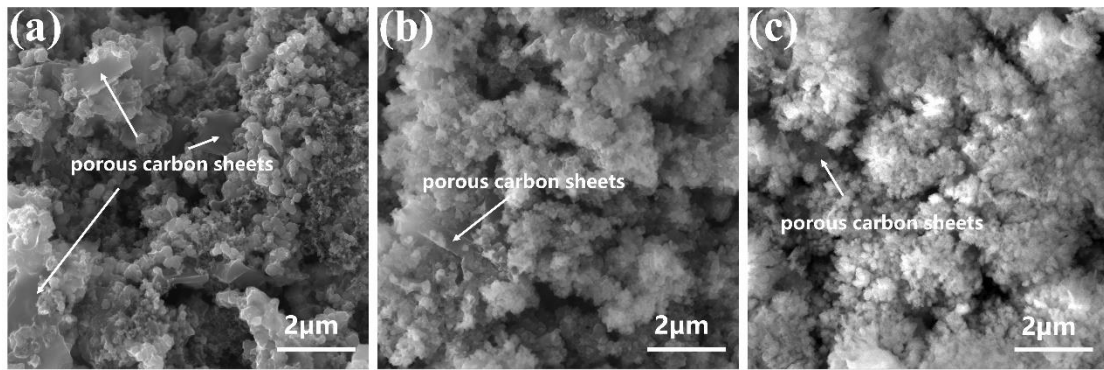


Fig. S8. high magnification surface morphology of F-SC electrode before (a), after 100 cycles (b) and after 200 cycles (c) at 0.5 A g^{-1}

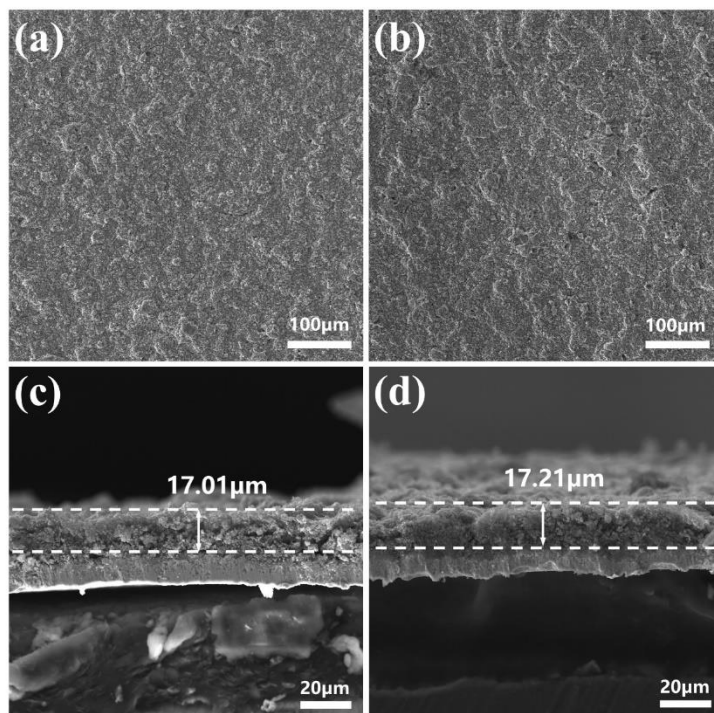


Fig. S9. Microscopic morphology before and after electrode cycling. Surface morphology of SSC electrode before (a) and after 200 cycles (b) at 0.5 A g^{-1} . Cross-sectional SEM images of SSC electrode before (c) and after 200 cycles (d) at 0.5 A g^{-1} .

Variation of electrode thickness

Table S3. Comparison of performances of Si@void@C composites for lithium-ion batteries.

Template	Etching	Cycle Performance				Ref.
		Current Density (mA·g ⁻¹)	Cycle Number	Discharge Capacity (mAh·g ⁻¹)	initial coulombic efficiency (%)	
SiO ₂	Yes	100	200	1113	71	1
SiO ₂	Yes	500	500	972	67.4	2
SiO ₂	Yes	100	300	705	79	3
PEI	No	200	200	854	--	11
SiO ₂	Yes	200	300	587	79	4
SiO ₂	Yes	100	100	767	--	12
Colloidal	No	100	200	749	49	6
SiO ₂	Yes	1000	100	940	65	7
PS	No	200	100	710	60	8
SiO ₂	Yes	200	200	1129	64	9
SiO ₂	Yes	1000	200	1020	68.2	10
CTAB	No	500	100	1444	83.3	This work
		1000	400	1013		

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