

Supplementary Information

Control of Cyclic Stability and Volume Expansion on Graphite-SiO_x-C Hierarchical Structure for Li-Ion Battery Anodes

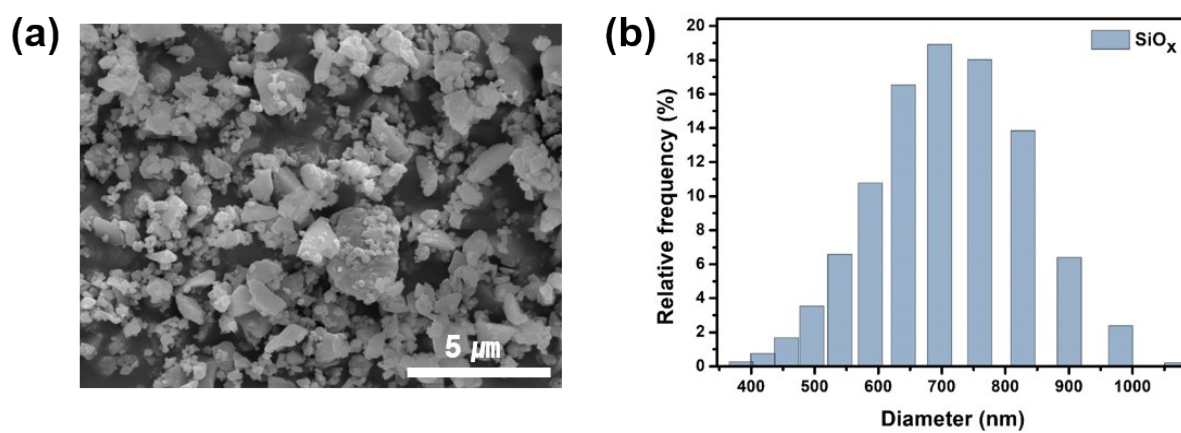


Fig. S1 (a) SEM image of SiO_x particles. (b) Particle sized distribution of SiO_x particles.

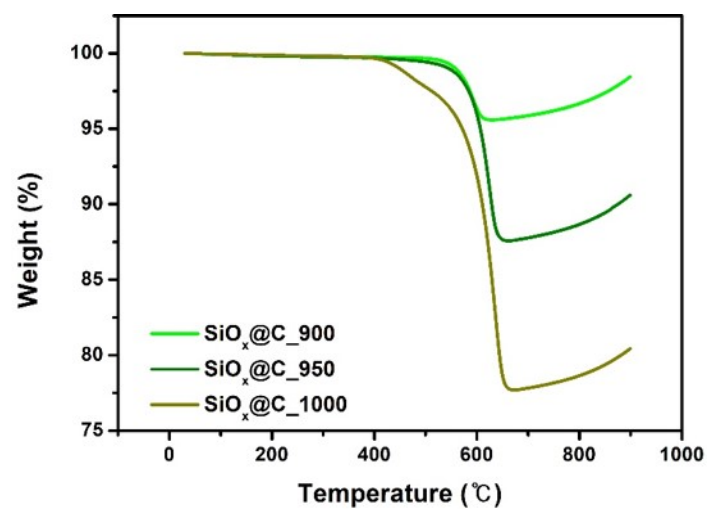


Fig. S2 TG curves of SiO_x@C_900, SiO_x@C_950, SiO_x@C_1000.

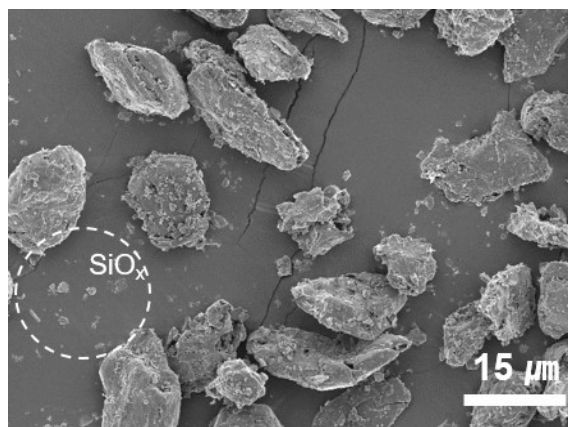


Fig. S3 SEM image of $\text{SiO}_x@G$ without acid treatment.

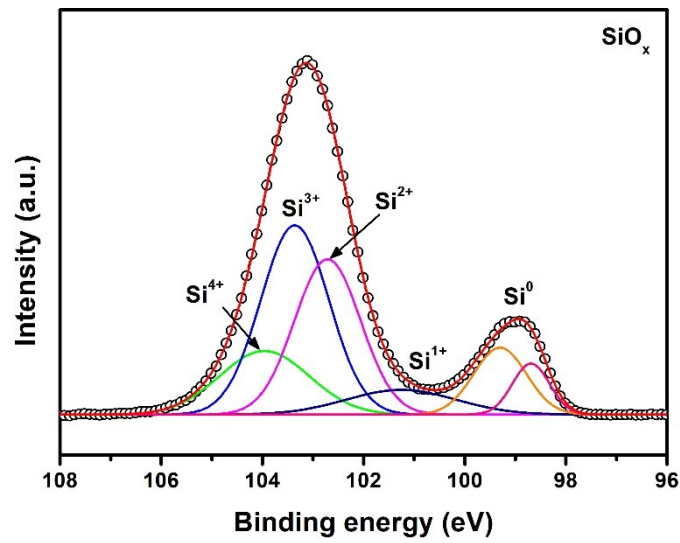


Fig. S4 Si 2p XPS spectra of SiO_x , deconvoluted to the individual silicon oxidated state.

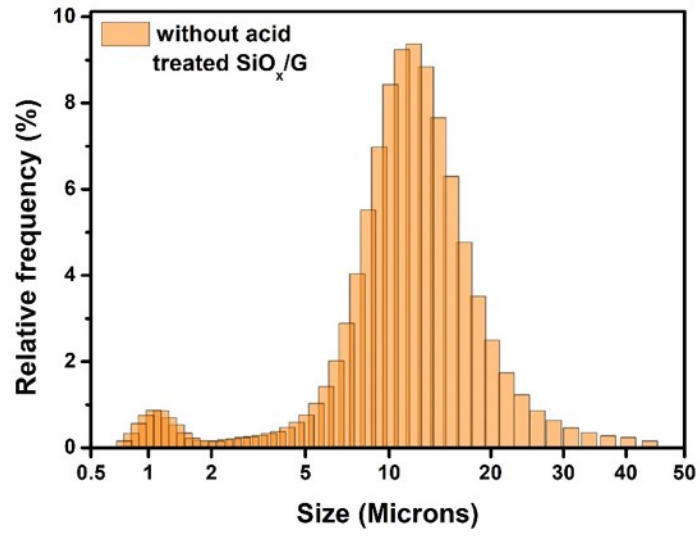


Fig. S5 PSD curve of SiO_x/G without acid treatment.

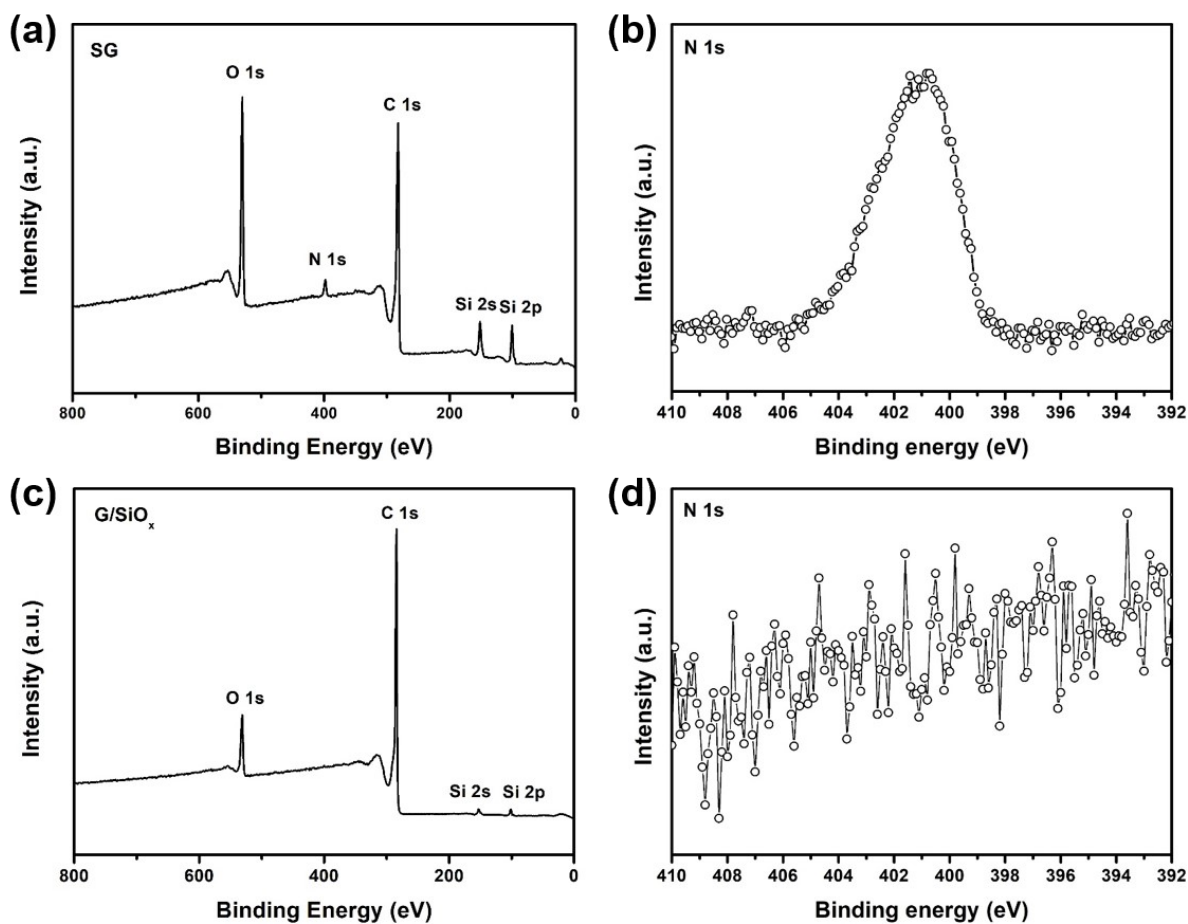


Fig. S6 XPS spectra of SG, G/SiO_x. (a) full survey of SG and (b) branched N 1s, (c) full survey of G/SiO_x and (d) branched XPS spectra of N 1s.

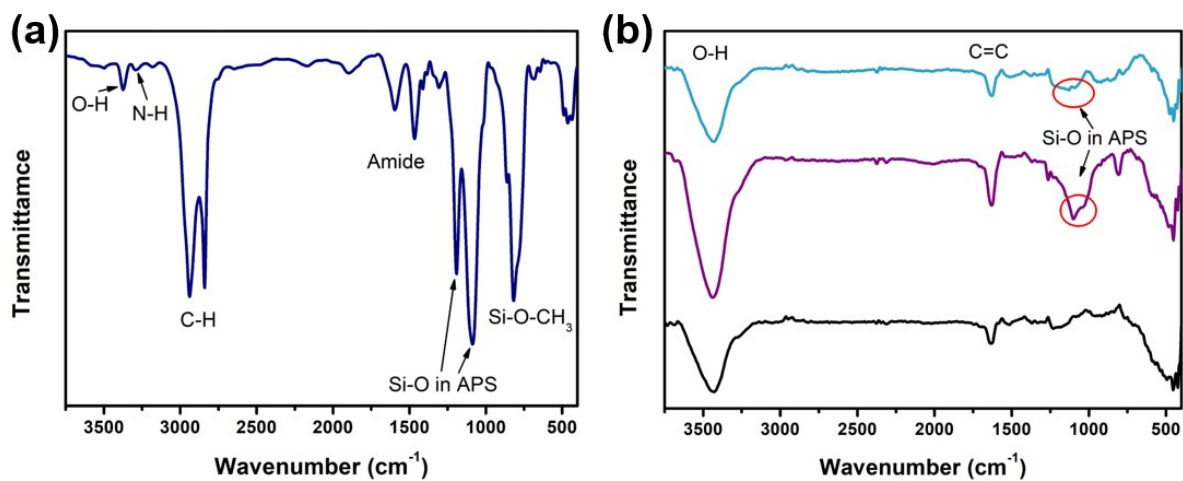


Fig. S7 FT-IR spectra of (a) APS and (b) G, SG, and MSG.

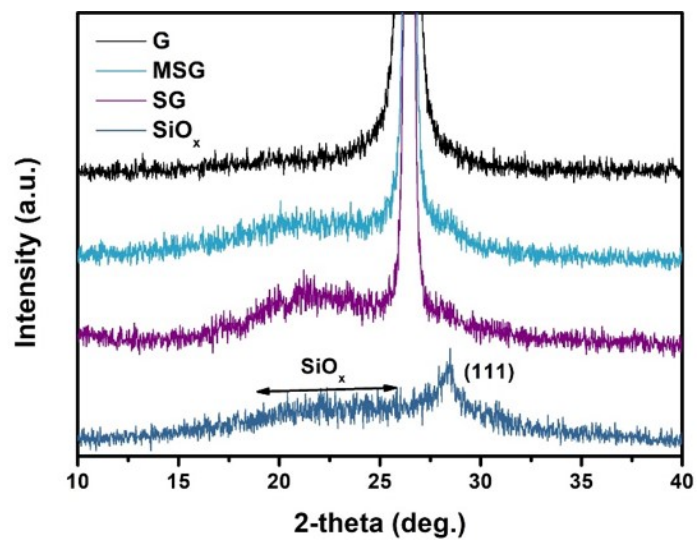


Fig. S8 XRD patterns of G, G/SiO_x, SG, MSG.

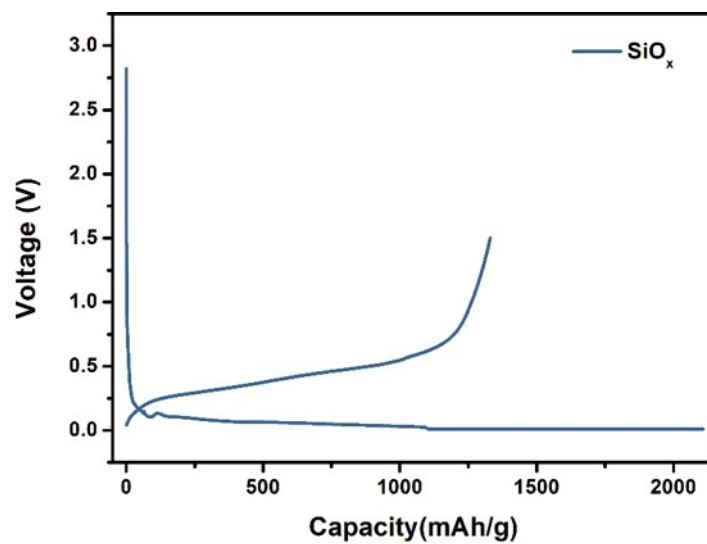


Fig. S9 1st cycle charge/discharge profile of pristine SiO_x

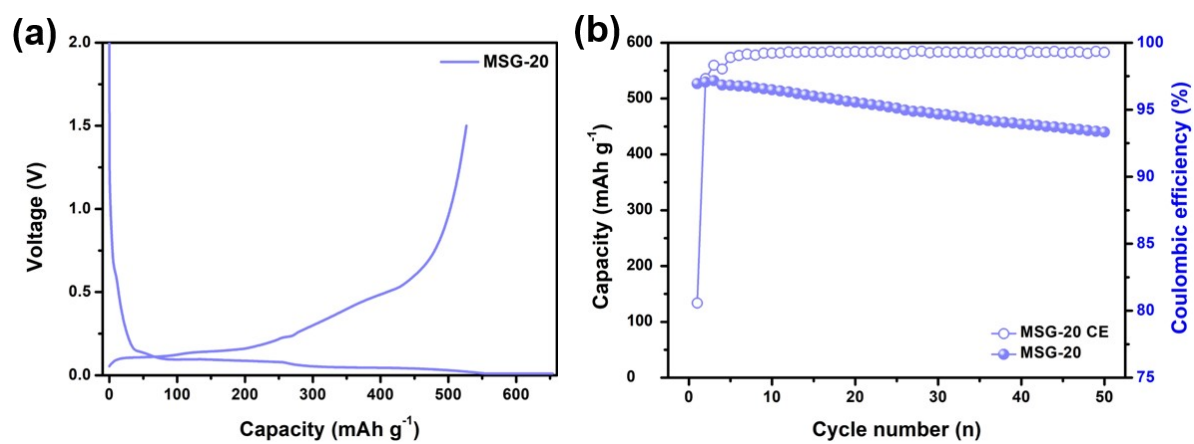


Fig. S10 (a) Galvanostatic charge/discharge voltage profile of MSG-20. (b) Discharge capacity

of 50 cycles at current density of 0.5C with coulombic efficiency.

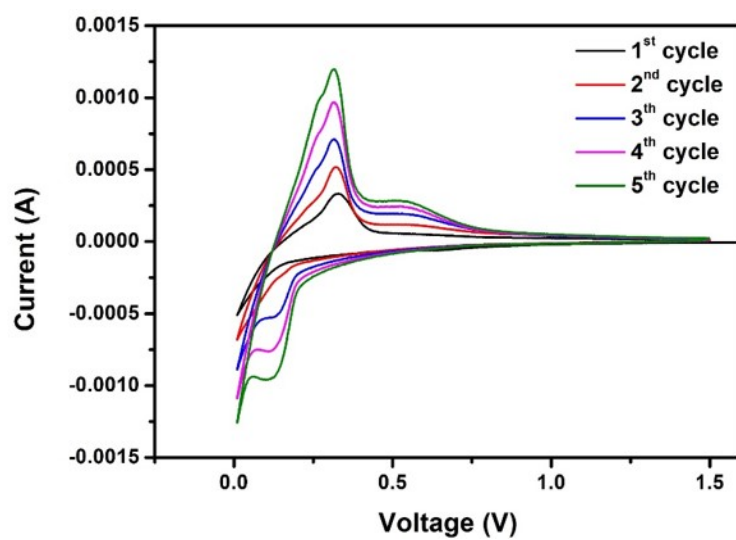


Fig. S11 CV curves of SG at a scan rate of 0.1 mV s⁻¹

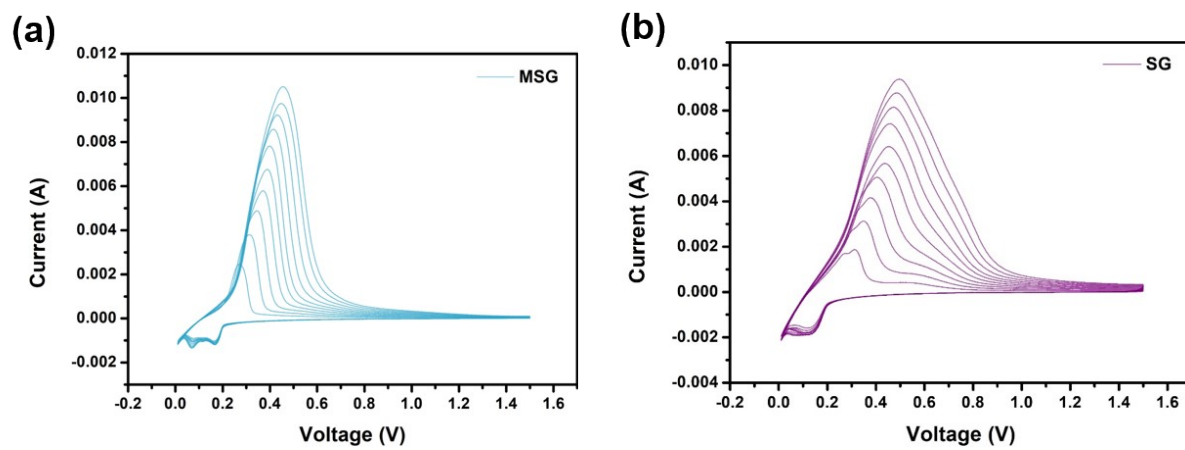


Fig. S12 CV curves of (a) MSG, (b) SG at scan rates of 0.1-1.0 mV s^{-1}

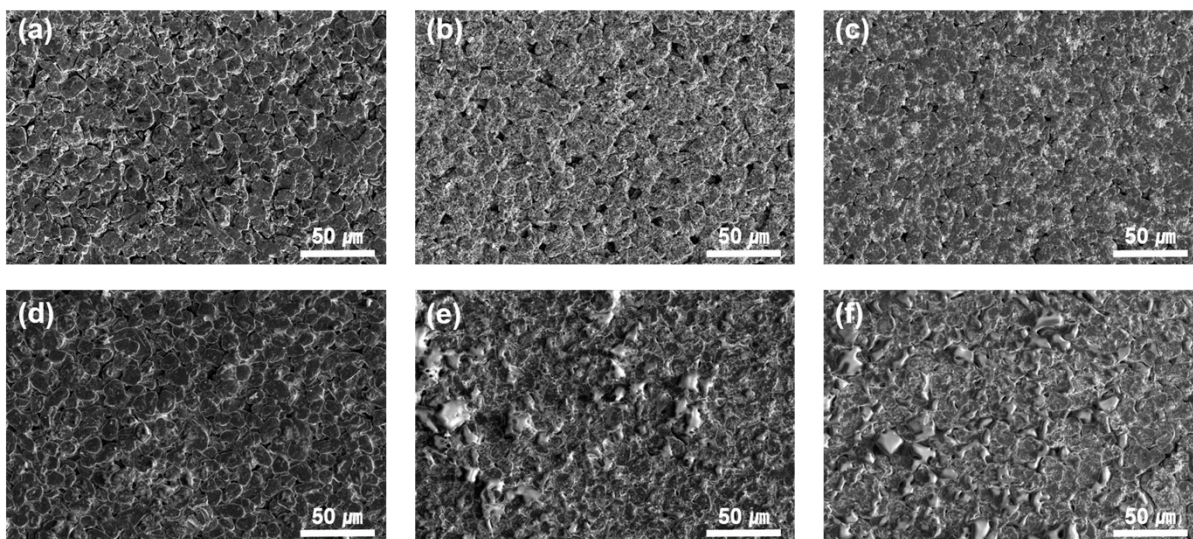


Fig. S13 Top SEM images of the (a and d) G, (b and e) SG, (c and f) MSG electrodes (a-c) before cycling and (d-f) after 50th cycles, respectively .

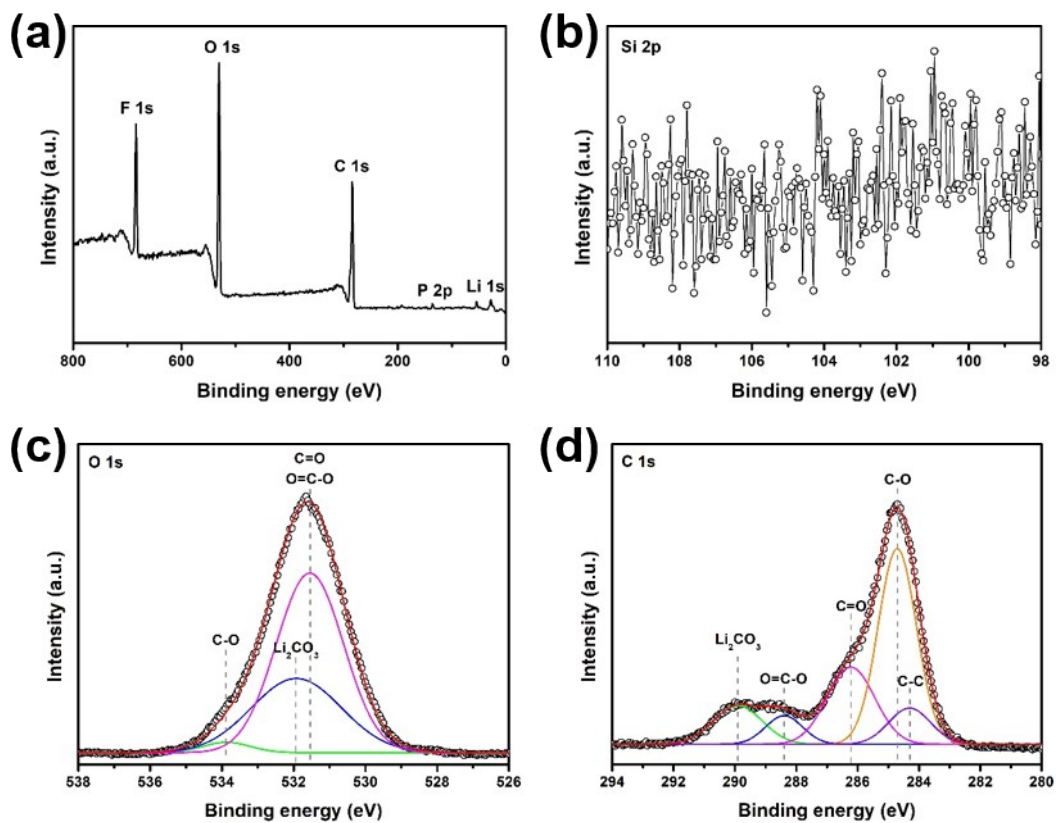


Fig. S14 XPS spectra of SG electrodes after 50 cycles. (a) overall XPS spectra and branched XPS spectra of (b) Si 2p, (c) O 1s and (d) C 1s.

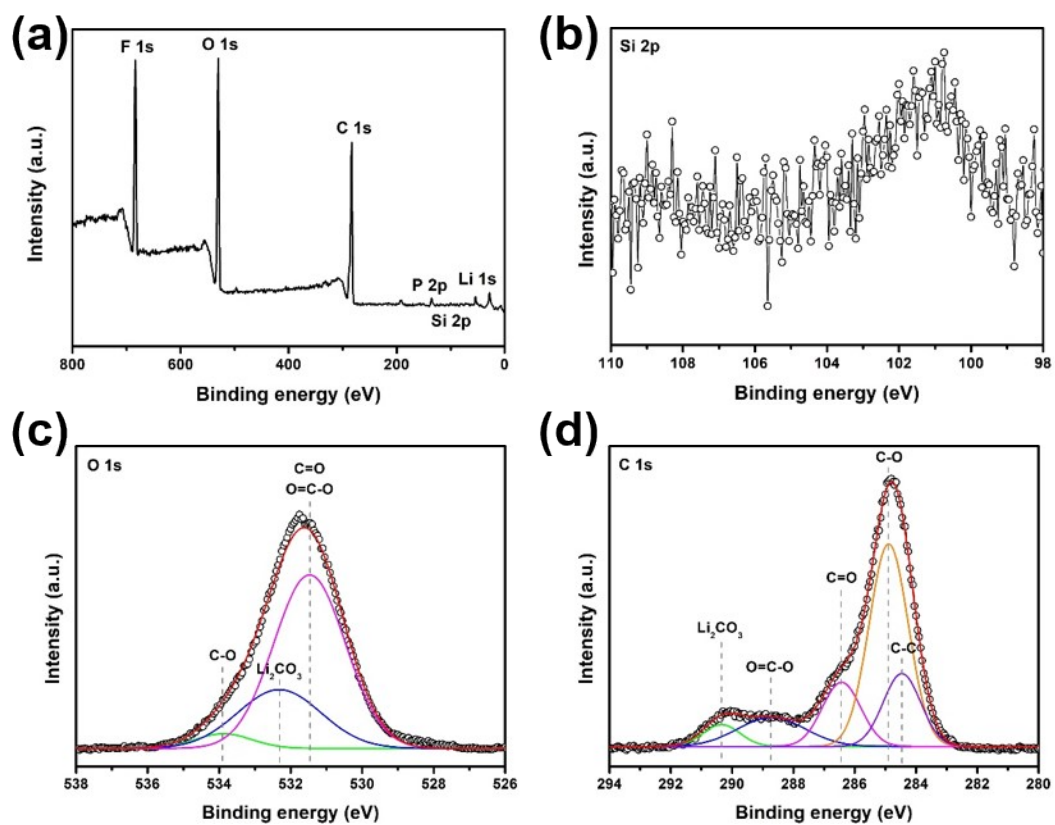


Fig. S15 XPS spectra of MSG electrodes after 50 cycles. (a) overall XPS spectra and branched XPS spectra of (b) Si 2p, (c) O 1s and (d) C 1s.

Table S1. (a) Estimated areal ratio of SiO_x and (b) oxygen content of SiO_x.

(a)

Oxidation state	Si ⁴⁺	Si ³⁺	Si ²⁺	Si ¹⁺	Si ⁰
Areal ratio (%)	15.42	34.87	27.71	7.32	14.67

(b)

Oxygen content	SiO _x
x in SiO _x	1.14

Table S2. The measured resistance and Li diffusion coefficient of SG and MSG electrodes.

Sample	R_b (Ω)	R_{SEI} (Ω)	R_{ct} (Ω)	D_{Li^+} ($cm^2 s^{-1}$)
SG	2.16	3.00	12.57	1.04×10^{-9}
MSG	1.90	2.61	8.30	3.63×10^{-9}