

Supporting information

A facile surface preservation strategy on the lithium anode for high performance Li-O₂ batteries

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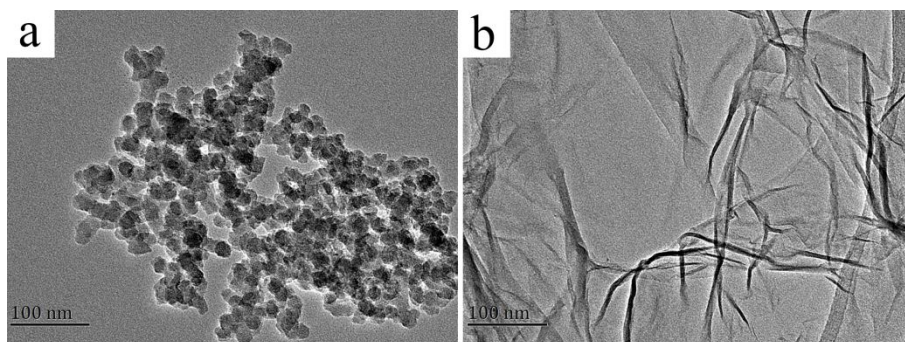


Figure S1 TEM images of (a) SiO_2 and (b) GO

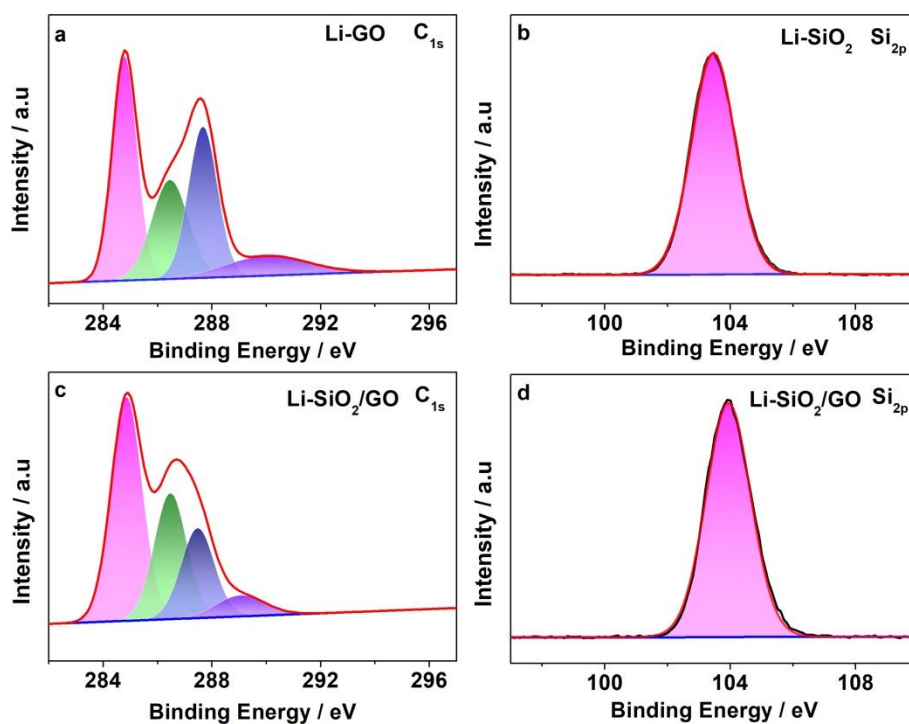


Figure S2 XPS analysis of coating layers: C_{1s} spectrum of GO layer (a), Si_{2p} spectrum of SiO_2 layer (b), C_{1s} and Si_{2p} spectra of SiO_2/GO (c, d) layers

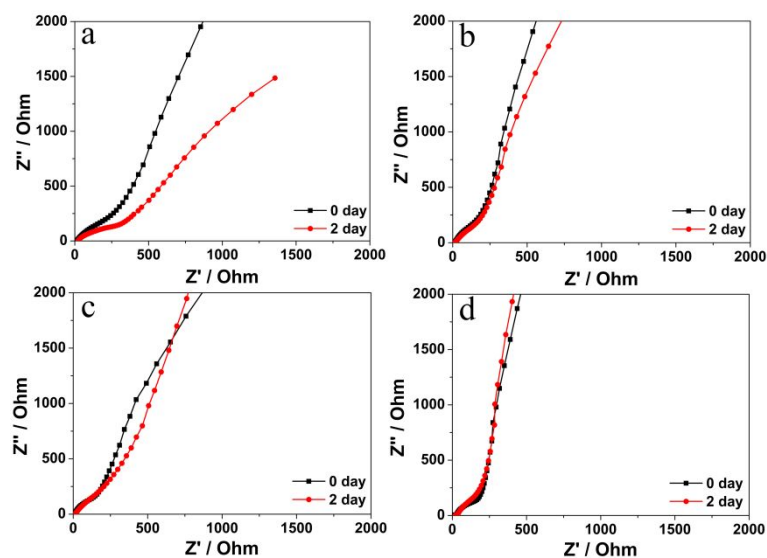


Figure S3 Nyquist Plots of Li|SS foam cells in O_2 atmosphere: pristine Li (a), Li-GO (b), Li-SiO₂ (c) and Li-SiO₂/GO (d)

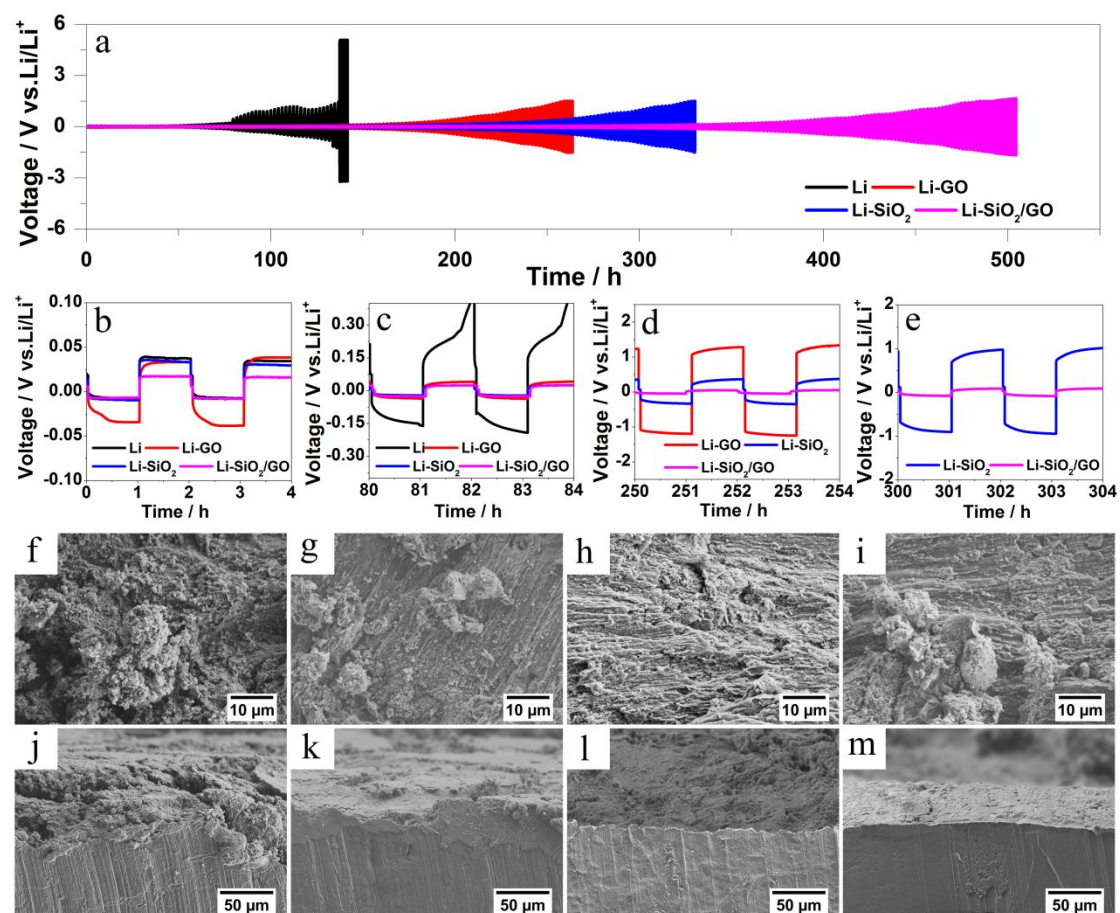


Figure S4 (a) Li stripping/plating curves in Li|Li symmetric cells with pristine Li, Li-GO, Li-SiO₂ and Li-SiO₂/GO at $0.1 \text{ mA} \cdot \text{cm}^{-2}$ in O_2 atmosphere. The selected voltage profiles in the

ranges from (b) 0 h to 4 h, (c) 80 h to 84 h, (d) 250 h to 254 h, and (e) 300 h to 304 h. Surface morphology and cross-section images of (f, j) Li after 80 h, (g, k) Li-GO, (h, l) Li-SiO₂ and (i, m) Li-SiO₂/GO after 200 h

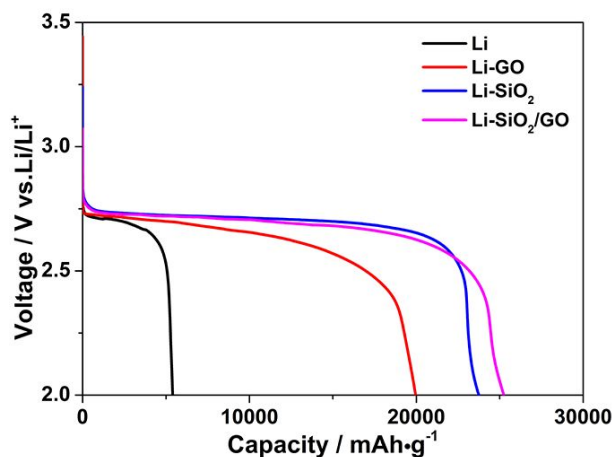


Figure S5 Ultimate capacities of the LOBs with the pristine Li, Li-GO, Li-SiO₂ and Li-SiO₂/GO anodes

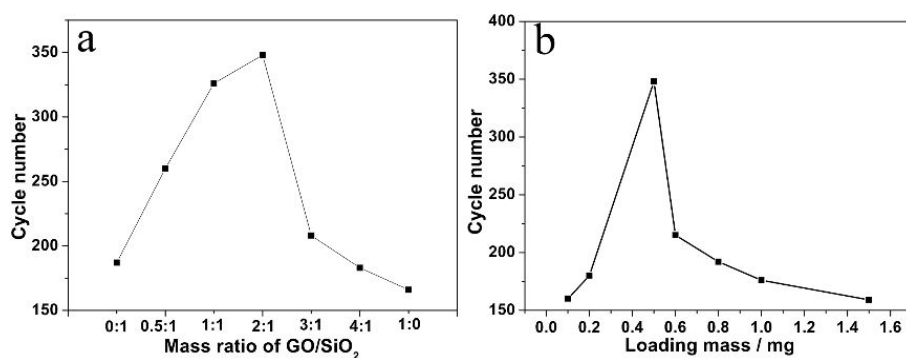


Figure S6 The (a) mass ratio and (b) loading amount of the SiO₂/GO coatings dependence of the cyclic performance of the LOBs.

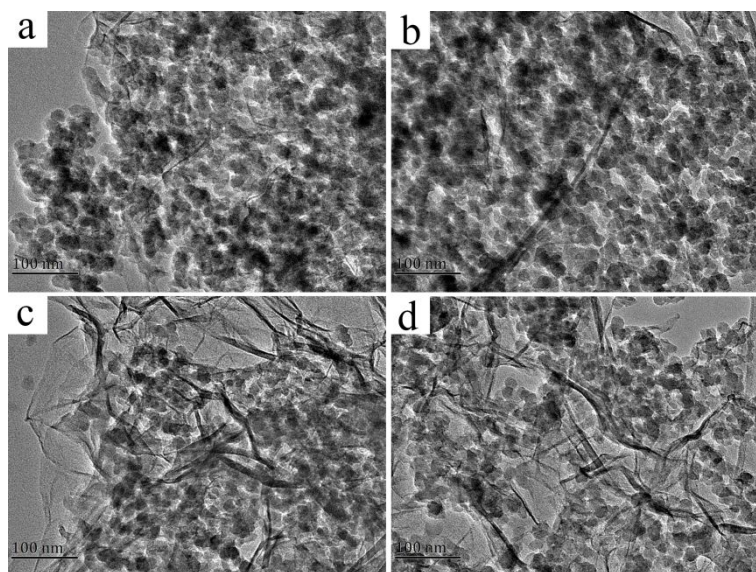


Figure S7 TEM images of GO/SiO₂ with different mass ratio: a— 0.5:1; b— 1:1; c—3:1; d— 4:1

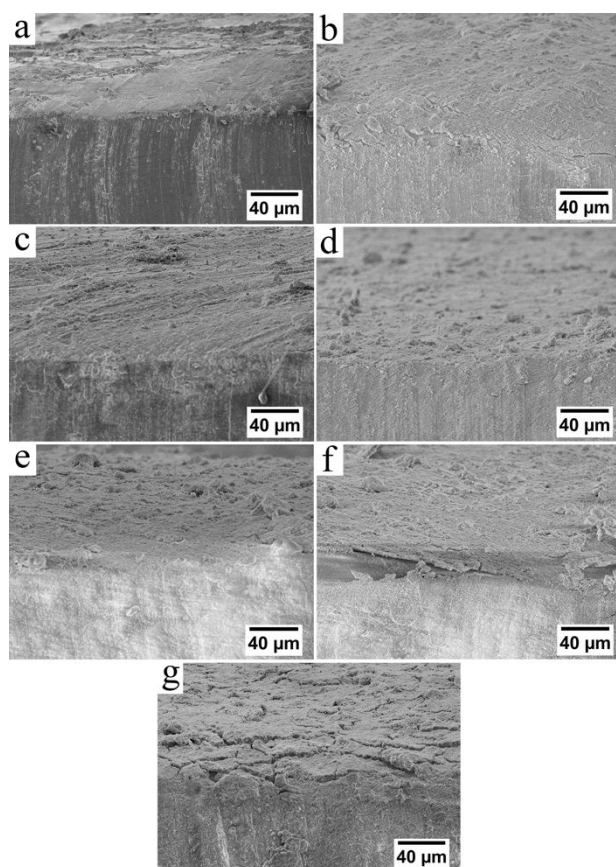
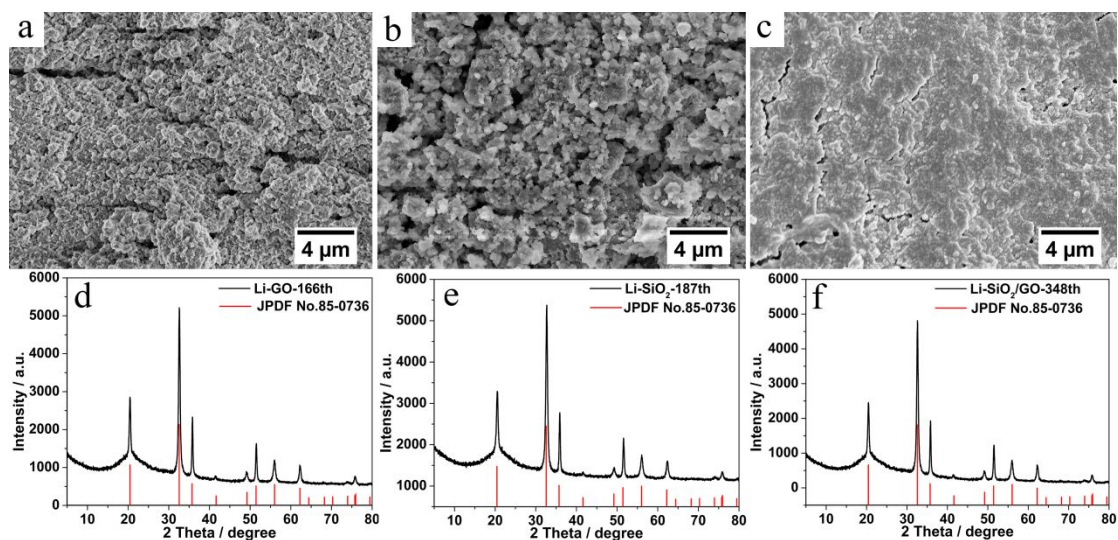


Figure S8 Cross-section images of the Li-SiO₂/GO anodes with different loading amounts of the hybrid: a — 0.1 mg; b— 0.2 mg; c— 0.5 mg; d— 0.6 mg; e — 0.8 mg; f — 1.0 mg; g — 1.5 mg.

Table S1 Component analysis of SEI from XPS

Element	Binding energy	Possible chemistry
C	284.8	C-C
	285.5	RC*H ₂ CO ₂ Li
	286.8	RC*OCO ₂ Li
	288.8	RCOC*O ₂ Li, RCH ₂ C*O ₂ Li
	289.9	Li ₂ C*O ₃
Li	54.6	Li*OH
	55.4	RCOCO ₂ Li*, RCH ₂ CO ₂ Li*, Li* ₂ CO ₃
O	531.2	LiO*H
	531.7	RCOCO ₂ *Li
	532.6	RCH ₂ CO ₂ *Li, Li ₂ CO ₃ *
	533.1	RCO*CO ₂ Li

**Figure S9** The SEM images and XRD patterns of (a, d) Li-GO after 166 cycles, (b, e) Li-SiO₂ after 187 cycles and (c, f) Li-SiO₂/GO after 348 cycles

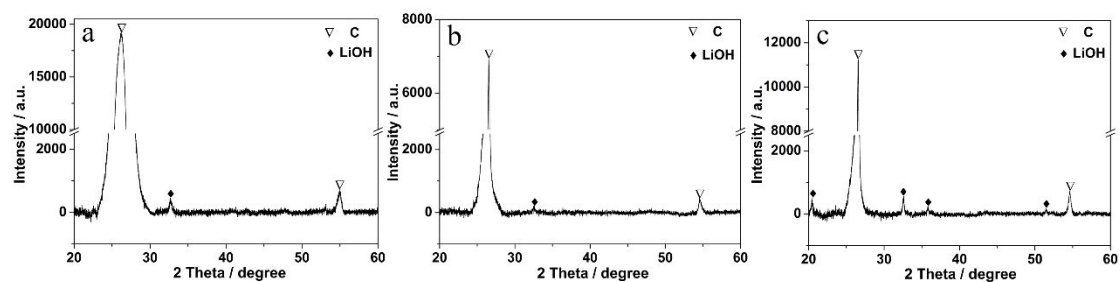


Figure S10 XRD analysis of the MWNTs cathodes in the cells with the pristine Li at the 58th cycle (a) and the Li-SiO₂/GO anode at the 58th (b) and 348th (c) cycles.

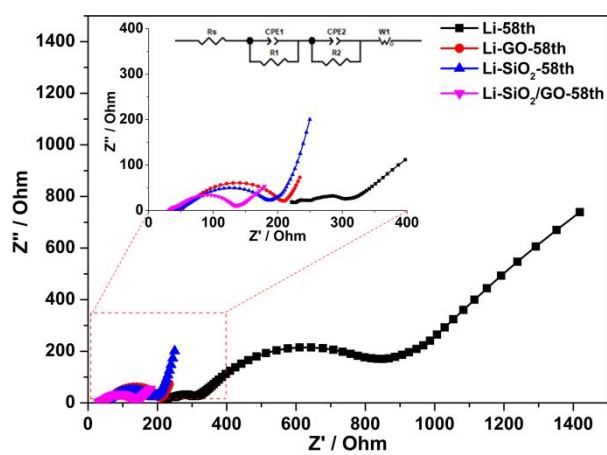


Figure S11 Nyquist plots of the LOBs (after cycling for 58 cycles and getting rid of O₂ with N₂) with the pristine Li, Li-GO, Li-SiO₂ and Li-SiO₂/GO anodes, the enlarged view of the red dotted frame and equivalent circuit (inset)

Table S2 R_s , R_1 and R_2 values by EIS analysis

Sample	R_s / Ω	R_1 / Ω	R_2 / Ω
pristine Li	219	248.5	329
Li-GO	48.4	83.4	93.4
Li-SiO ₂	41.1	69.3	86.4
Li-SiO ₂ /GO	34.2	17.8	74.1