

Supporting Information for
Three-dimensional lithium anode with an in-situ generated Li₂O-rich
solid electrolyte interface for high-rate and long-storage lithium
battery

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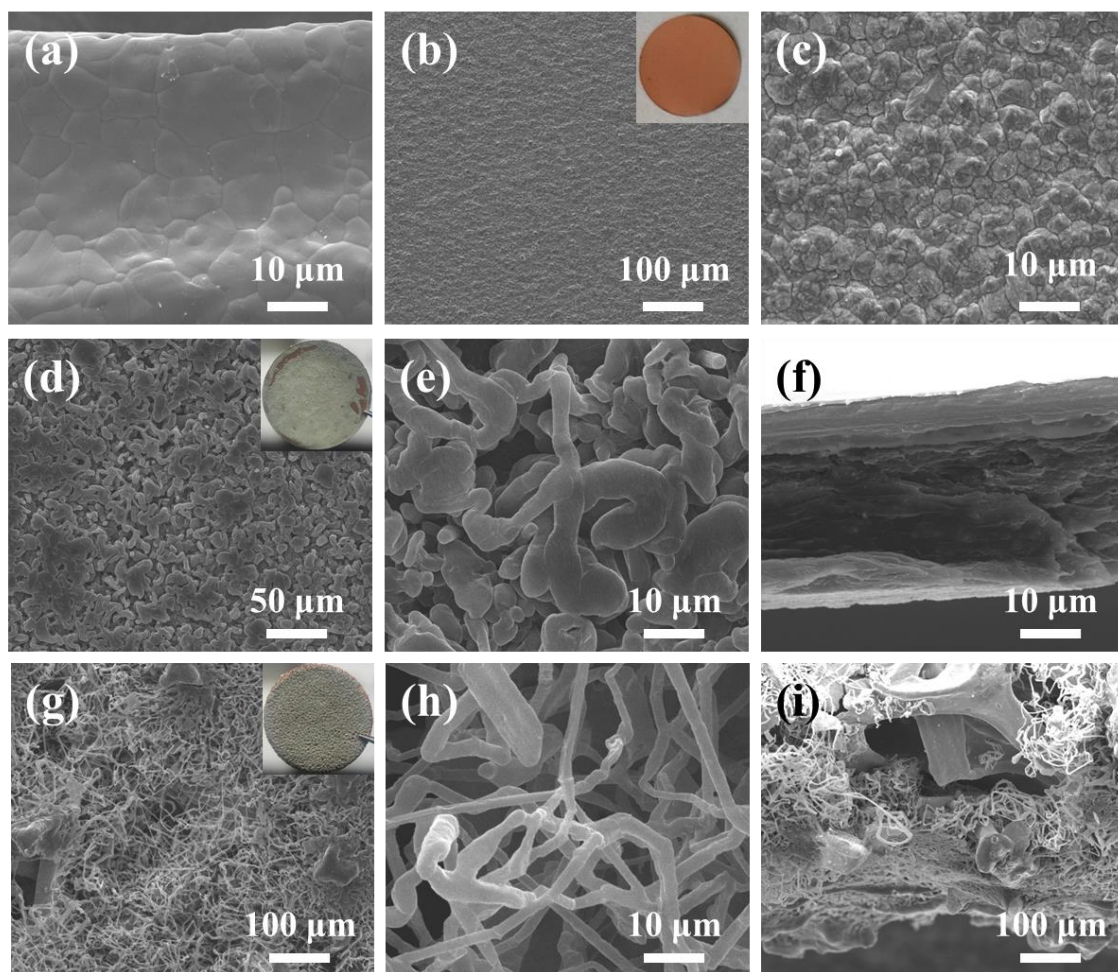


Figure S1 SEM images of the Cu foam (a) and Cu foil surface (b, c), and Li@Cu composite anodes prepared by electrochemical deposition from Li||Cu foil (d-f) and Li||Cu foam half cells (g-i).

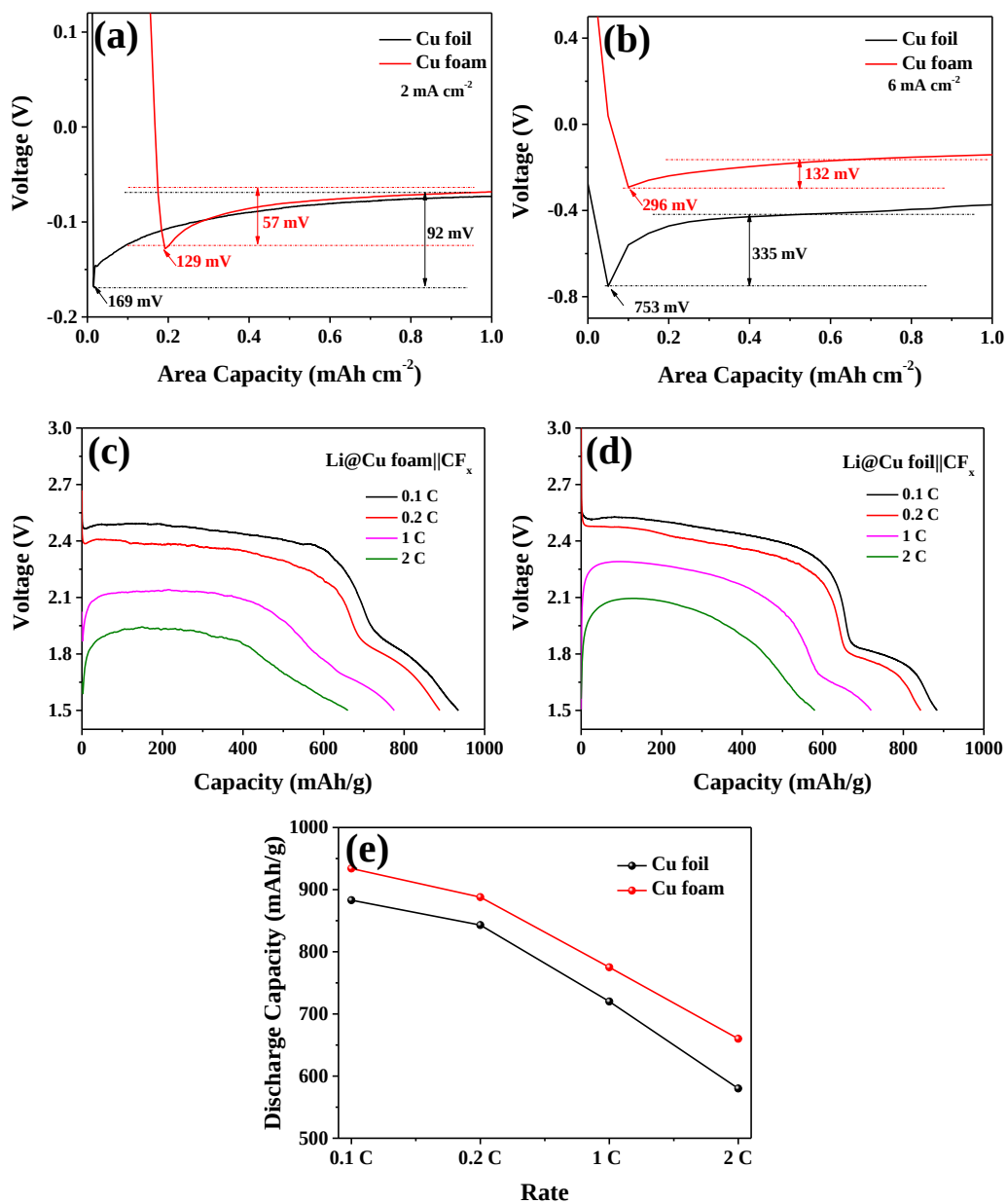


Figure S2 Electrodeposition curves at 2 (a) and 6 mA cm^{-2} (b) of Li||Cu half-cells. Rate discharge curves of Li@Cu foam||CF_x (c) and Li@Cu foil||CF_x batteries (d) and comparison of rate discharge specific capacity (e).

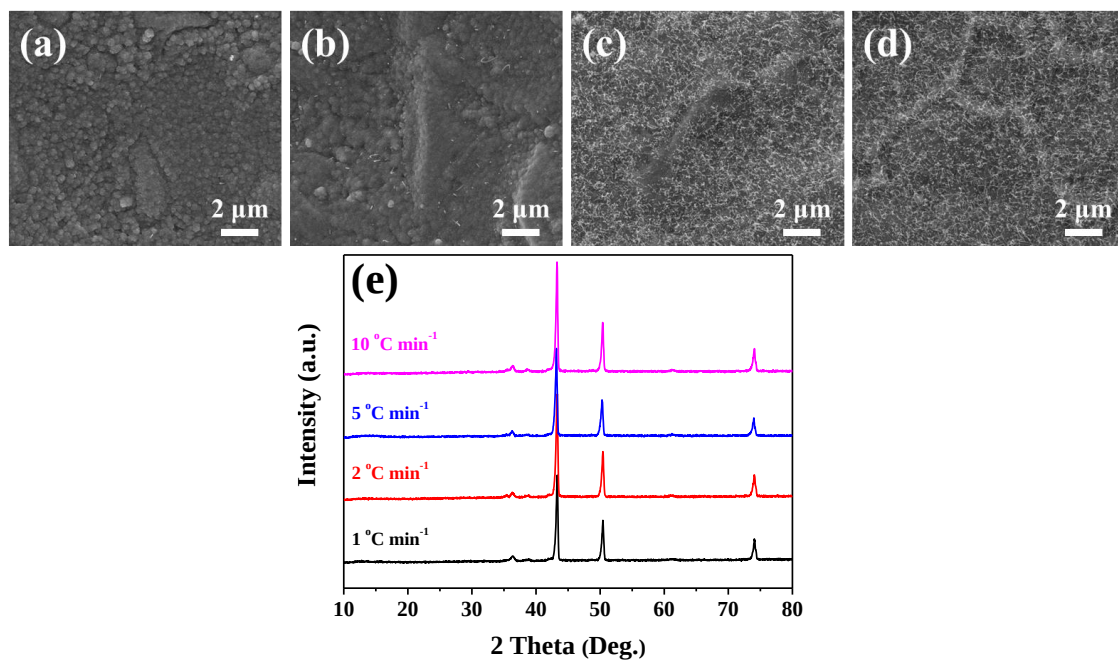


Figure S3 SEM images (a-d) and XRD patterns (e) of CuO-Cu foam prepared at different heating rates: (a) 1 °C min⁻¹, (b) 2 °C min⁻¹, (c) 5 °C min⁻¹ and (d) 10 °C min⁻¹

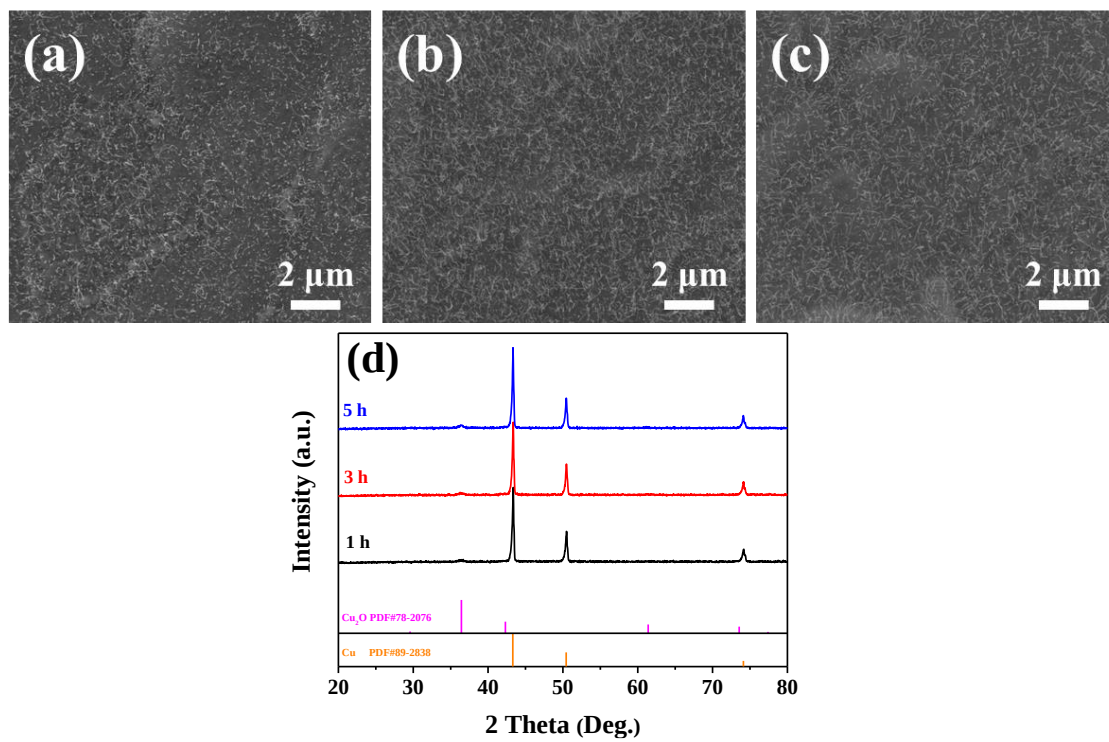


Figure S4 SEM images (a-c) and XRD patterns (d) of CuO-Cu foam prepared at different reaction times: (a) 1 h, (b) 3 h, (c) 5 h.

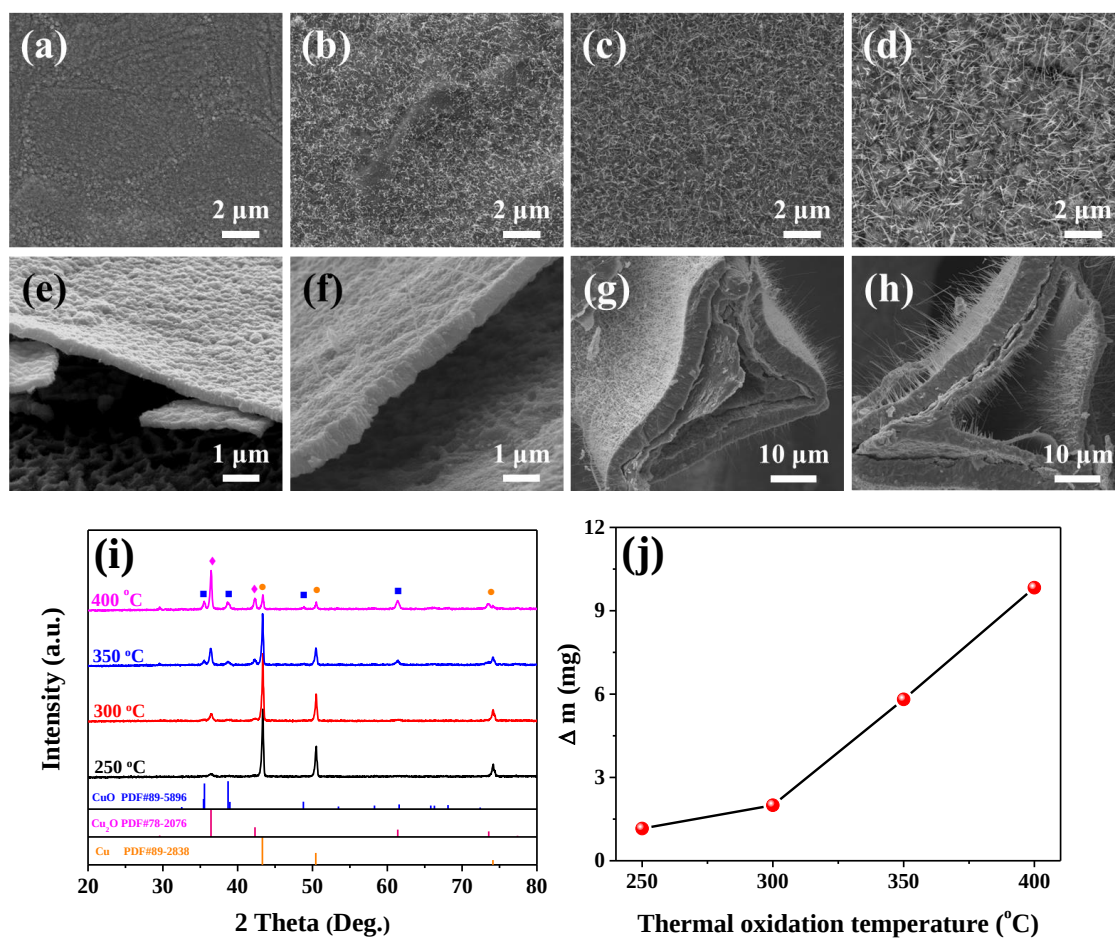


Figure S5 SEM images (a-h) and XRD patterns (i) of CuO-Cu foam prepared at different thermal oxidation temperatures: (a, e) 250 °C, (b, f) 300 °C, (c, g) 350 °C, (d, h) 400 °C; (a-d) skeleton surfaces, (e-h) cross-sectional. The mass variation of Cu oxides with reaction temperature (j).

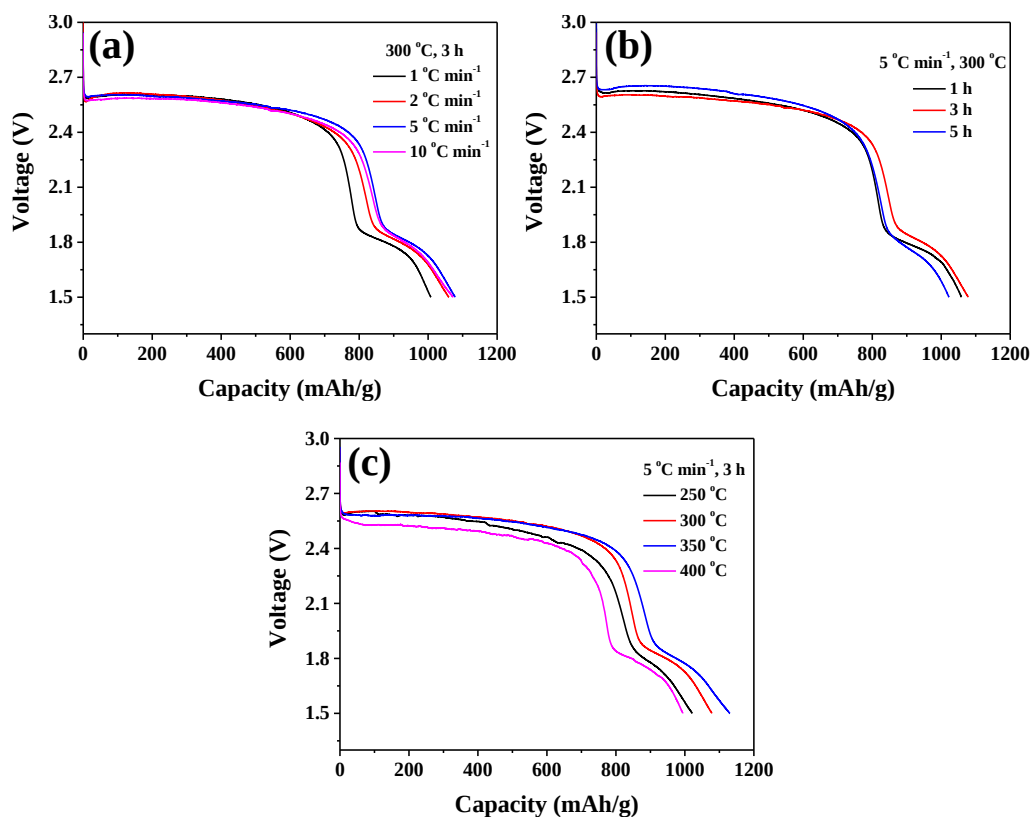


Figure S6 Discharge curves of Li@CuO-Cu foam||CF_x batteries with 3D Li anode constructed by CuO-Cu foam prepared at different conditions: (a) heating rate, (b) thermal oxidation time, (c) thermal oxidation temperature.

Table S1 Functional groups of Li and Li@CuO-Cu foam anode surface.

Storage time		Functional groups of Li anode surface	Functional groups of Li@CuO-Cu foam anode surface
1 D	Undischarged	C-O, C=O	C-O, C=O, Li-O
	Discharged	C-O, C=O	C-O, C=O, Li-O
60 D	Undischarged	C-O, C=O	C-O, C=O, Li-O
	Discharged	C-O, C=O	C-O, C=O, Li-O

Table S2 R_{ct} of Li and Li@CuO-Cu foam electrode at different storage times

Storage time	R_{ct} of Li/ Ω	R_{ct} of Li@CuO-Cu foam/ Ω
0 h	92.2	15.8
24 h	105.65	16.05
72 h	112.9	17.9
120 h	123.25	18.25
168 h	123.35	18.1