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Electronic Supplementary Information (ESI) for

Alkaliphilic Cu_2O Nanowires on Copper Foam for Hosting Li/Na as Ultrastable Alkali-Metal Anodes

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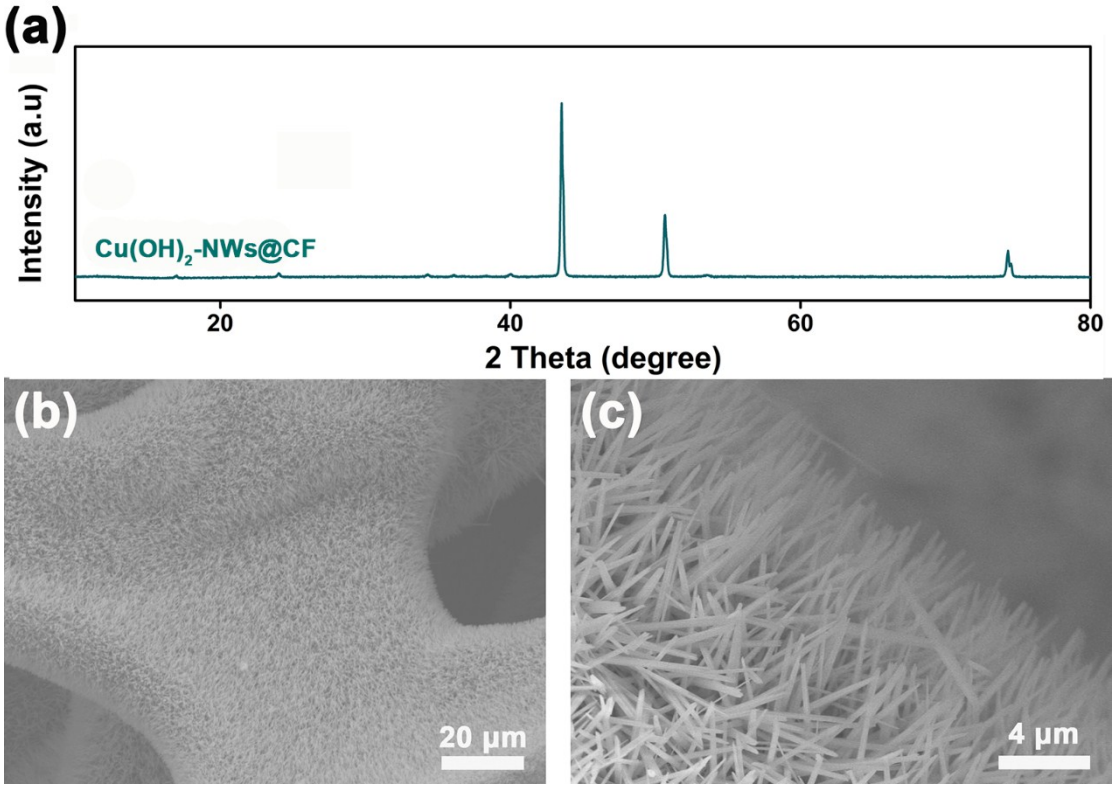

Figure S1. (a) XRD patterns of the $Cu(OH)_2$-NWs@CF composite. (b-c) Top-view SEM images of the $Cu(OH)_2$-NWs@CF.

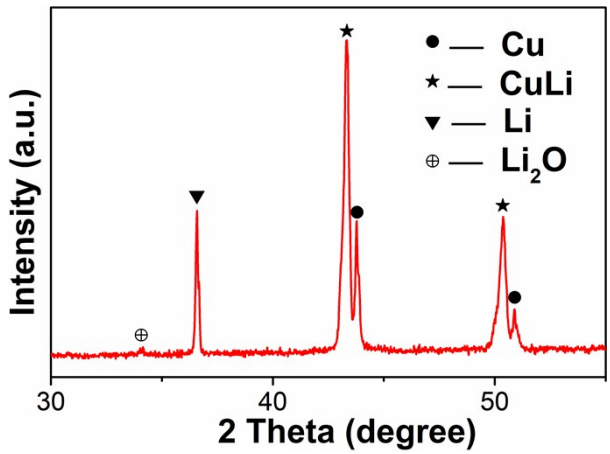

Figure S2. Magnified XRD pattern of Li@CF.

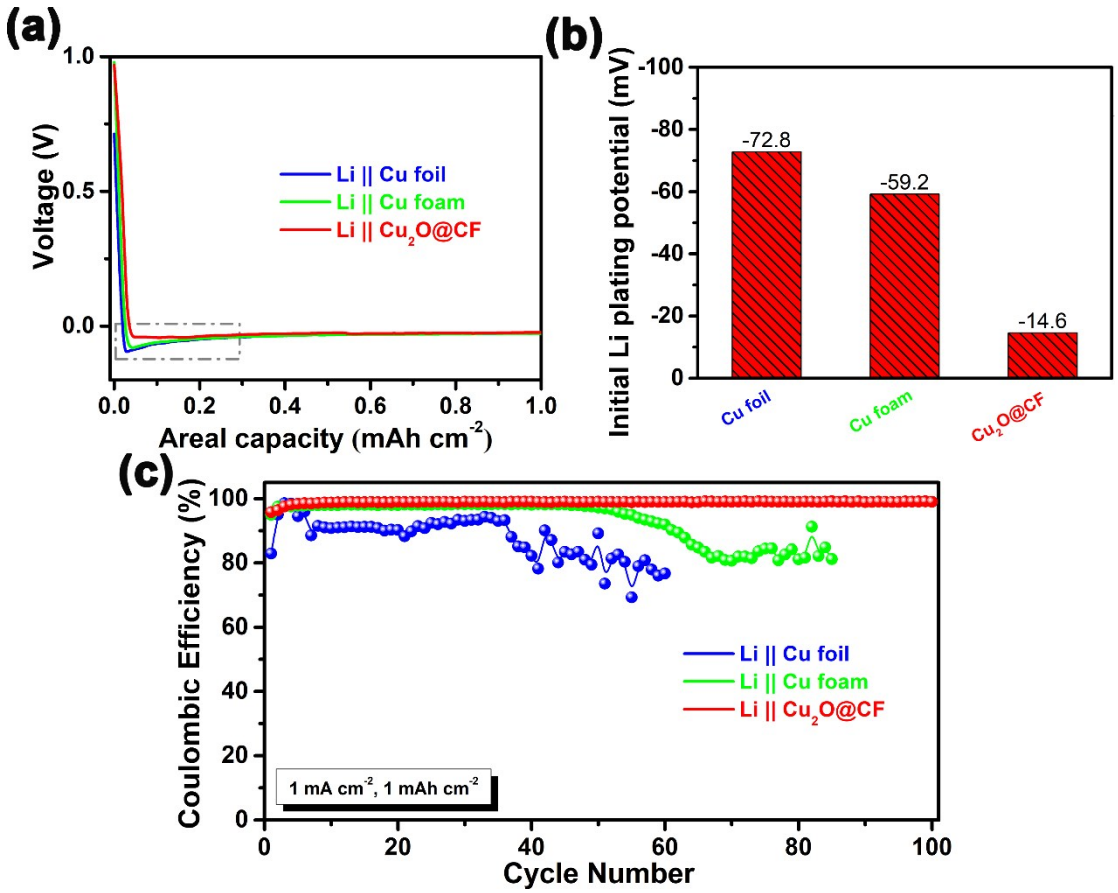

Figure S3. Comparison of (a) the first Li-plating curves, (b) the initial Li nucleation potentials, and (c) Coulombic e□ciencies for the Cu_2O-NWs@CF, Cu-foam and Cu-foil electrodes at a current density of 1 mA cm^{-2} with a plating capacity of 1 mAh cm^{-2}.

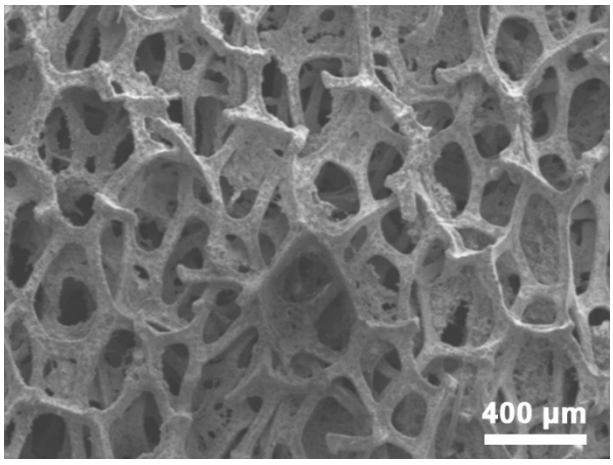

Figure S4. SEM image of the Li@CF composite after removing Li by immersing into deionized water.

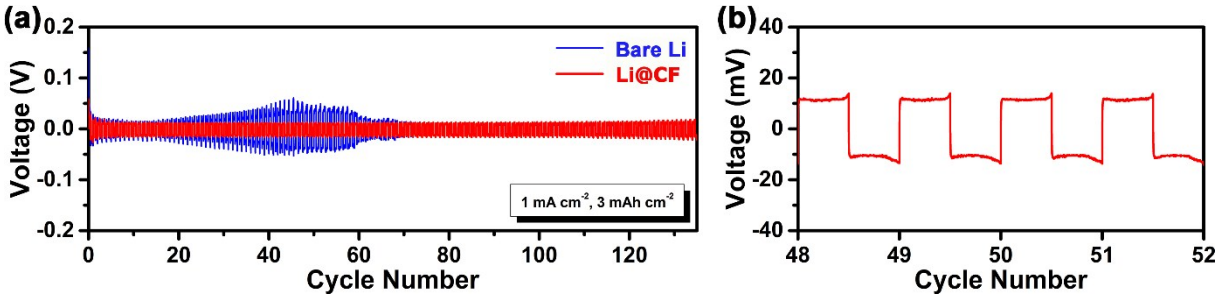

Figure S5. (a) Galvanostatic cycling of the symmetric Li@CF||Li@CF cell *vs*. Li||Li cell with a cycling capacity of 3 mAh cm^{-2} and (b) magnified voltage platforms of the Li@CF||Li@CF cell.

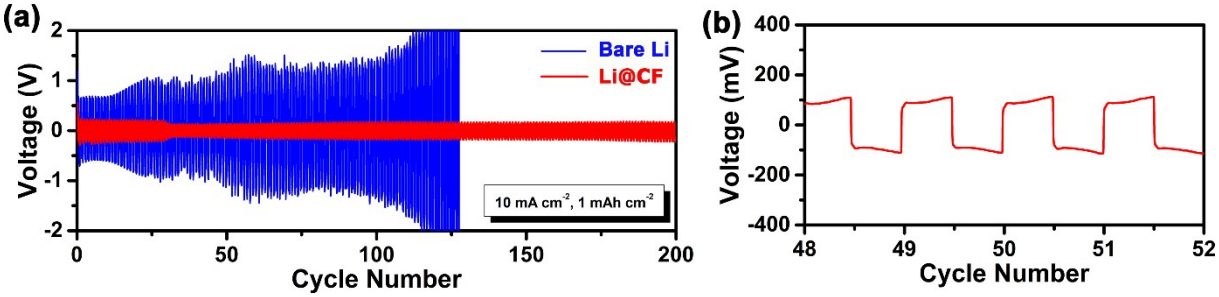

Figure S6. (a) Galvanostatic cycling of the symmetric Li@CF||Li@CF cell *vs*. Li||Li cell at the current density of 10 mA cm^{-2} and (b) magnified voltage platforms of the Li@CF||Li@CF cell.

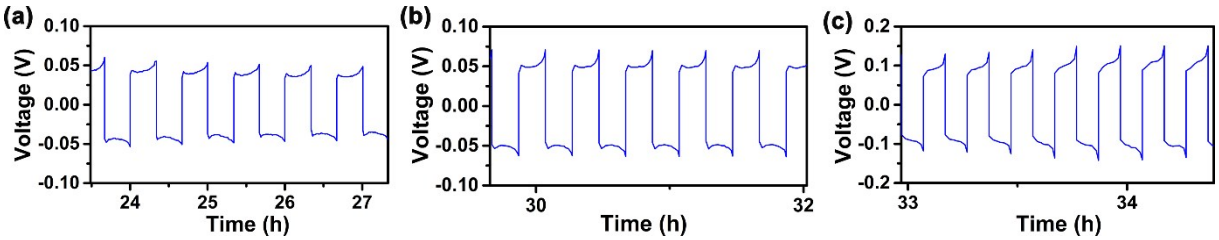

Figure S7. The detailed voltage profiles of the symmetric Li||Li cell at different current densities: (a) 3 mA cm^{-2}, (b) 5 mA cm^{-2}, (c) 10 mA cm^{-2}.

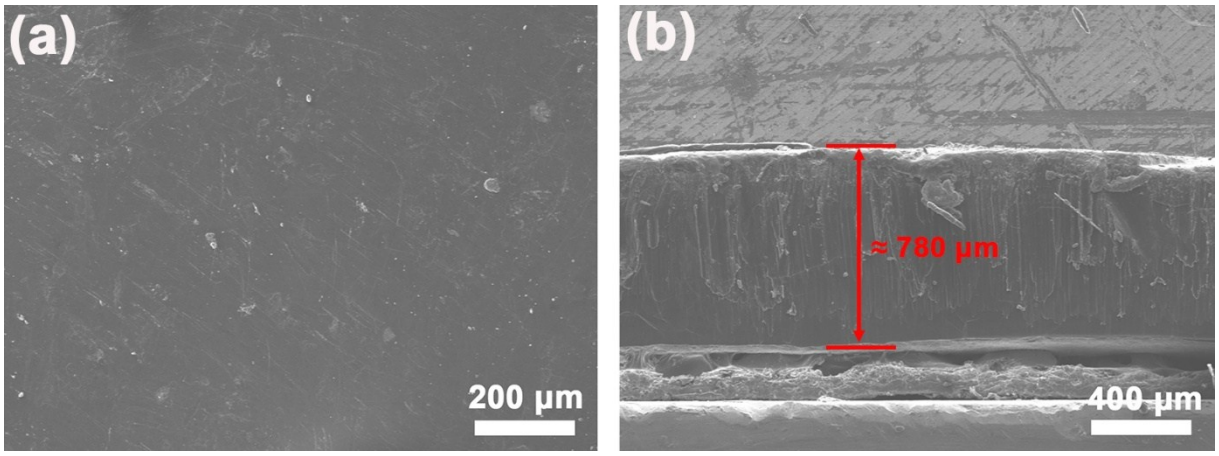

Figure S8. (a) Top-view and (b) cross-section SEM images of the bare Li before cycling.

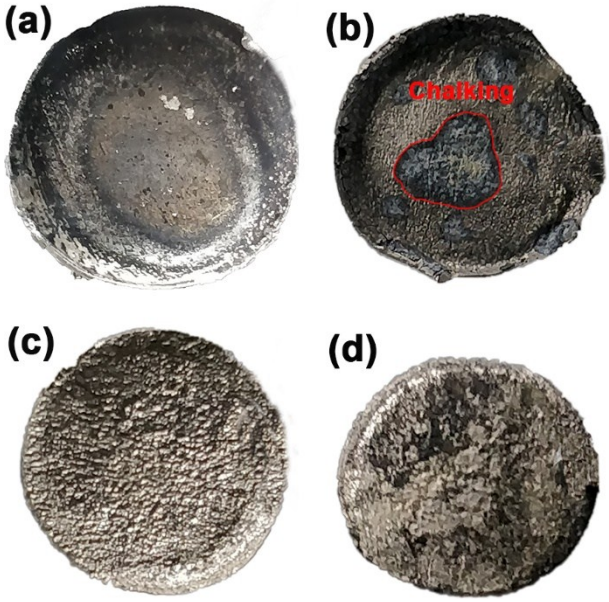

Figure S9. Digital photos of the bare Li (a) after 20 cycles and (b) after 100 cycles in a symmetrical cell at a current density of 1 mA cm^{-2} with a cycling capacity of 1 mAh cm^{-2}. Digital photos of the Li@CF anodes (c) after 20 cycles and (d) after 100 cycles in a symmetrical cell at a current density of 1 mA cm^{-2} with a cycling capacity of 1 mAh cm^{-2}.

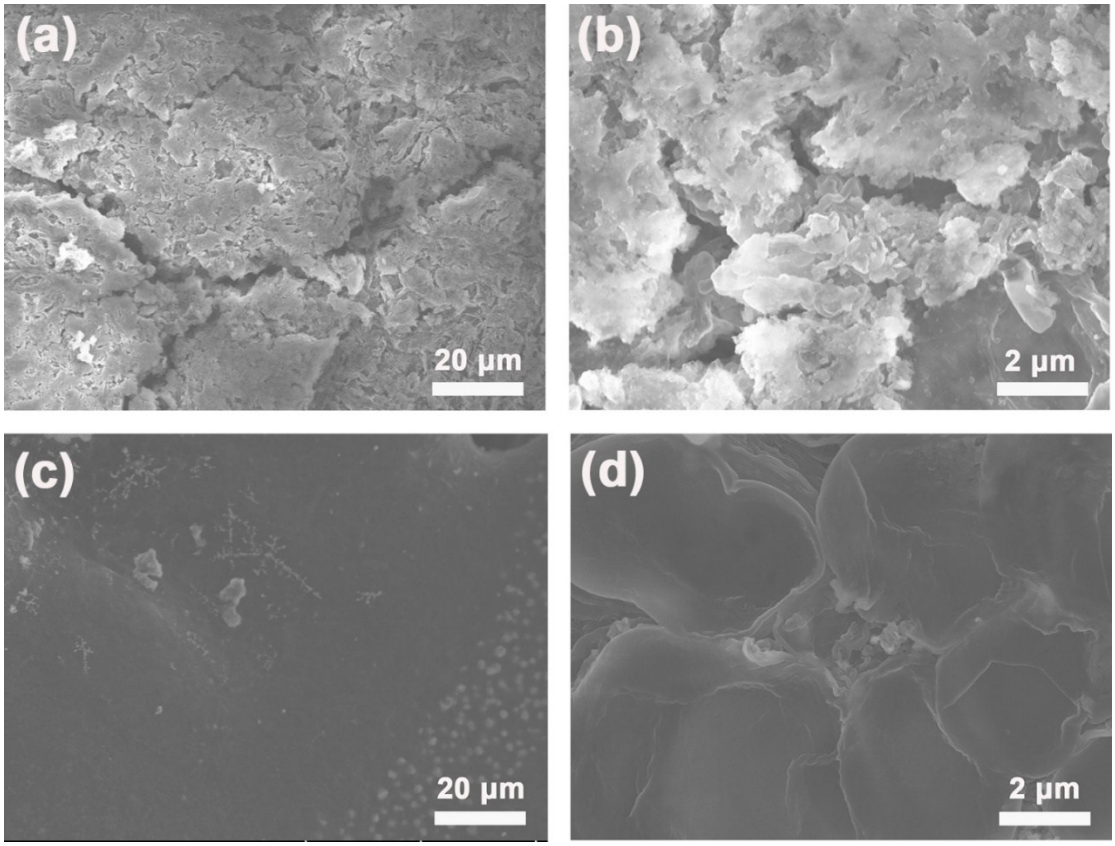

Figure S10. Top-view SEM images of (a-b) the Li||Cu and (c-d) Li@CF||Cu half cells after 100 cycles at a current density of 1 mA cm^{-2} with a cycling capacity of 1 mAh cm^{-2}.

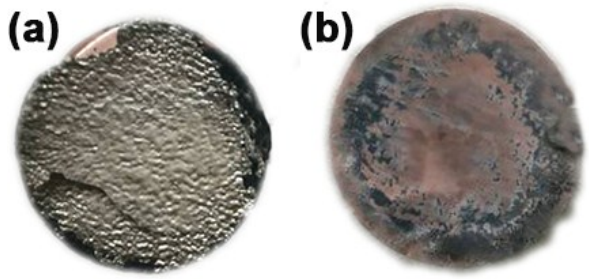

Figure S11. Digital photos of the Cu foil from the (a) Li||Cu and (b) Li@CF||Cu half cells after 100 cycles at a current density of 1 mA cm^{-2} with a cycling capacity of 1 mAh cm^{-2}.

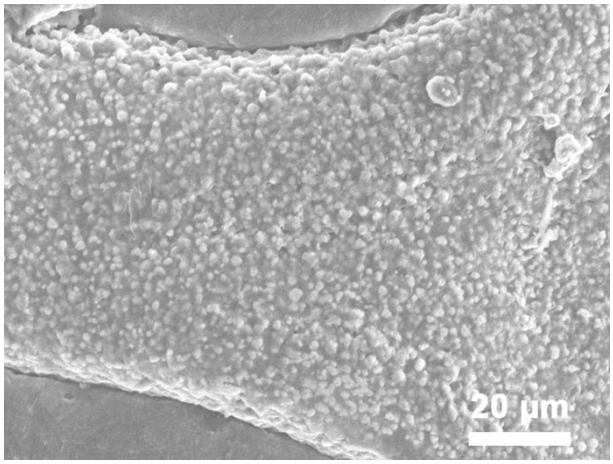

Figure S12. The zoomed-in surface SEM image of the Li@CF after Li stripping 6 mAh cm^{-2}.

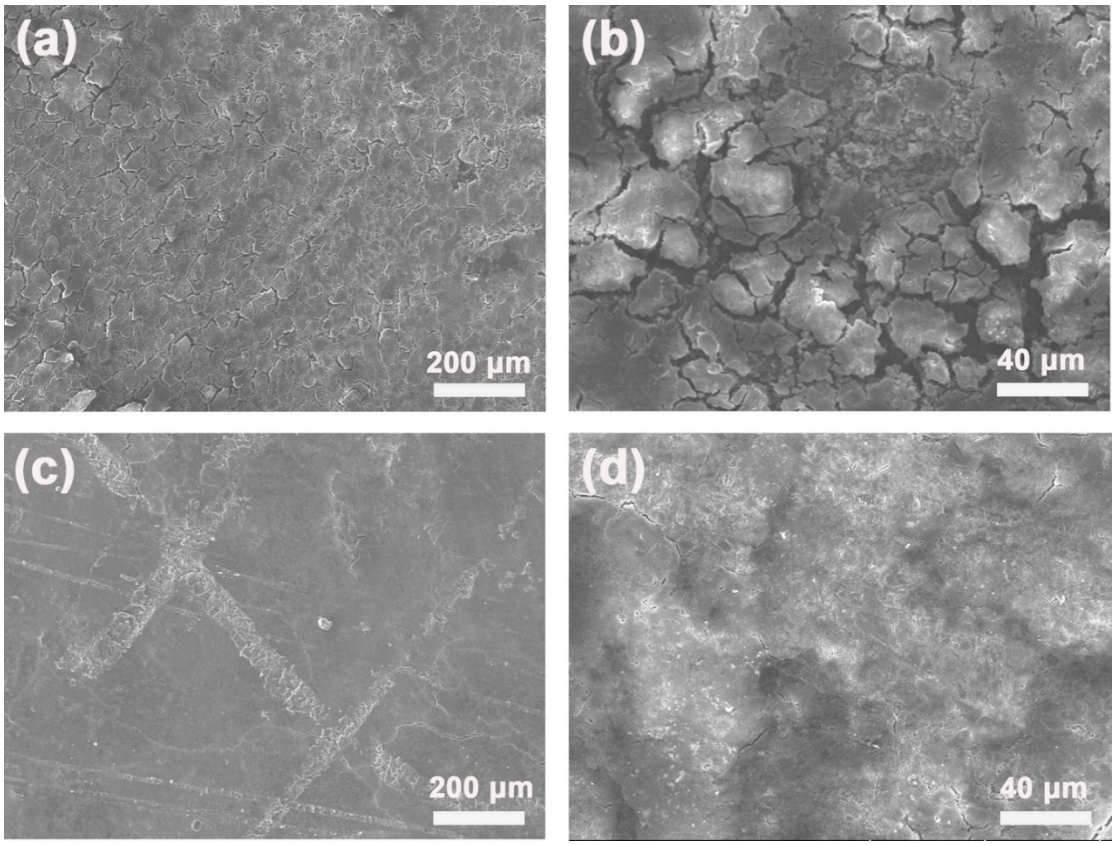

Figure S13. Top-view SEM images of the (a-b) bare-Li and (c-d) Li@CF electrodes paired with the LFP cathodes in full cells after 100 cycles at 1 C.

Table S1. Weight of Cu_2O@CF before and after Li infusion

Materials	Average weight/mg
Cu_2O@CF	79.4
Li@CF composite	130.6

The sample of Cu_2O@CF with a thickness of 780 μm were cut into circular disks (diameter of 1.3 cm) and weighed before and after Li infusion for a total of 10 disks. The areal mass loading of Li in the composite Li@CF anode is (130.6 mg – 79.4 mg) / 1.33 cm^2 = 38.5 mg cm^{-2}. Thus, the weight percentage of Li in the Li@CF anode is 39.2%, and the corresponding gravimetric specific capacity is 39.2% × 3860 mAh g^{-1} = 1513.3 mAh g^{-1}. While the volume of each disk is 1.33 cm^2 × 0.078 cm = 0.104 cm^3, the corresponding volumetric specific capacity = (130.6 mg – 79.4 mg) × 3860 mAh g^{-1} / 0.104 cm^3 = 1900.3 mAh cm^{-3}

Table S2. Comparison of symmetric cell performance for the composite Li/Na@CF anodes in this work *vs*. other alkali metal anodes in literature fabricated by thermal infusion

Sample	Current density (mA cm^{-2})	Cycling performance (overpotential @ cycles)	
		Li || Li	Na || Na
This work	1	10 mV for 500 cycles	10 mV for 500 cycles
	3	40 mV for 200 cycles	/
	5	55 mV for 200 cycles	/
	10	100 mV for 200 cycles	/
Co-CS/alkali metal[1]	1	25mV for 400 cycles	30 mV for 125 cycles
	3	50 mV for 270 cycles	/
	5	70 mV for 175 cycles	/
	10	100 mV for 150 cycles	/
TiC/C/Li[2]	0.5	20 mV for 200 cycles	/
	1	42 mV for 200 cycles	/
	3	85 mV for 200 cycles	/
alkali metal-CF[3]	0.5	/	70 mV for 150 cycles
	1	36 mV for 372 cycles	/
	3	105 mV for 180 cycles	/
Li@CuLi[4]	1	40 mV for 350 cycles	/
	3	186 mV for 200 cycles	/
	5	233 mV for 200 cycles	/
	10	241 mV for 200 cycles	/
CFeltCu-Li[5]	1	30 mV for 500 cycles	/
LCZ[6]	3	15 mV for 100 cycles	/
	5	33 mV for 100 cycles	/
	8	50 mV for 100 cycles	/
Li-cMOFs[7]	1	32 mV for 350 cycles	/
CCOF-Li[8]	1	15 mV for 500 cycles	/
CF/Ag-Li[9	1	30 mV for 200 cycles	/

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