Electronic Supplementary Material (ESI) for Sustainable Energy & Fuels.

Supporting Information

Efficient and Stable Cycling of Lithium Metal Enabled by a Conductive Carbon Primer Layer

Sheng S. Zhang[a,*], Xiulin Fan[b], Chunsheng Wang[b]

[a] *Electrochemistry Branch, RDRL-SED-C, Sensors and Electron Devices Directorate, U.S. Army Research Laboratory, Adelphi, MD 20783-1138, USA. Email: shengshui.zhang.civ@mail.mil; shengshui@gmail.com*

[b] *Department of Chemical and Biomolecular Engineering, University of Maryland, College Park, MD 20742, USA*

1. Figures

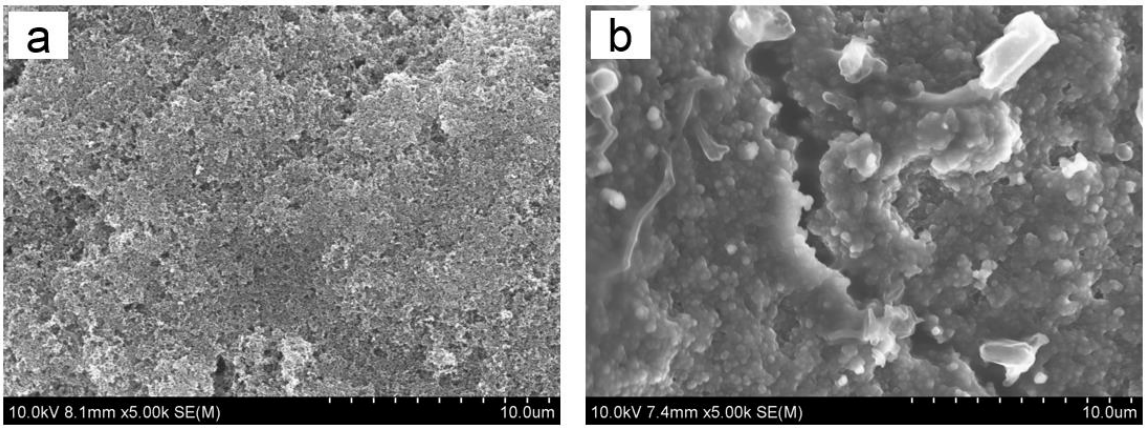

Fig. S1. SEM images of the surface morphology of conductive carbon primer layer. (a) Before, and (b) after Li plating to a 0.39 mAh cm^{-2} Li loading. Both are in x5000 magnification.

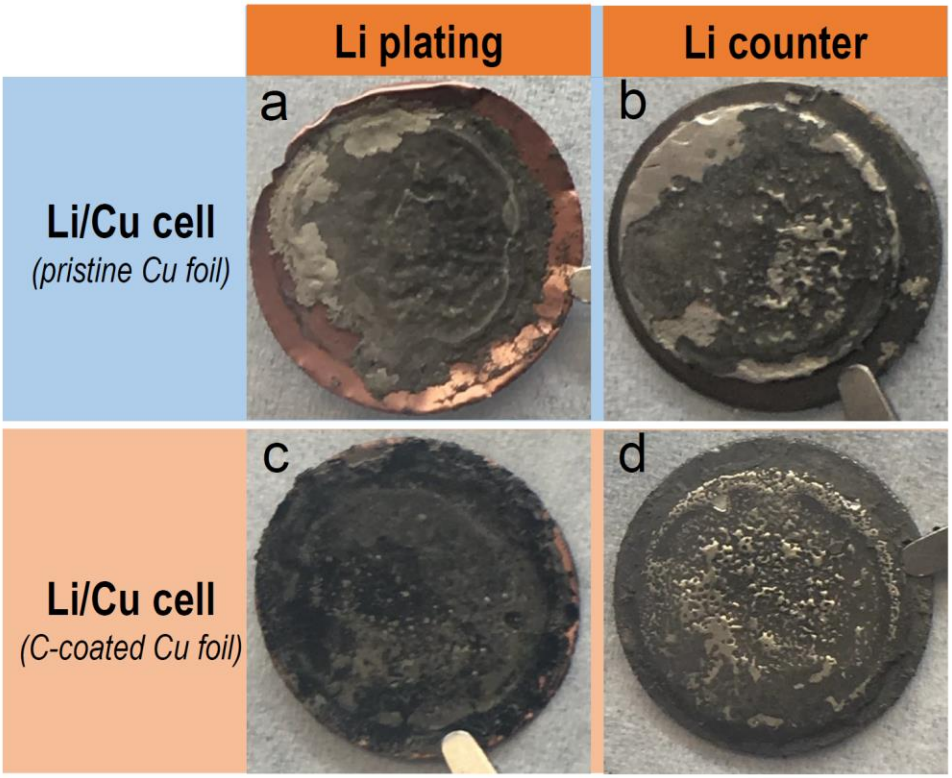

Fig. S2. Digital photos of Li plating and Li counter electrode after the cells were cycled at 1.0 mA cm^{-2} for 100 cycles and ended at a 0.39 mAh cm^{-2} Li loading. (a) Li plating on pristine Cu foil, (b) Li counter electrode with pristine Cu foil working electrode, (c) Li plating on C-coated Cu foil, and (d) Li counter electrode with C-coated Cu foil working electrode.

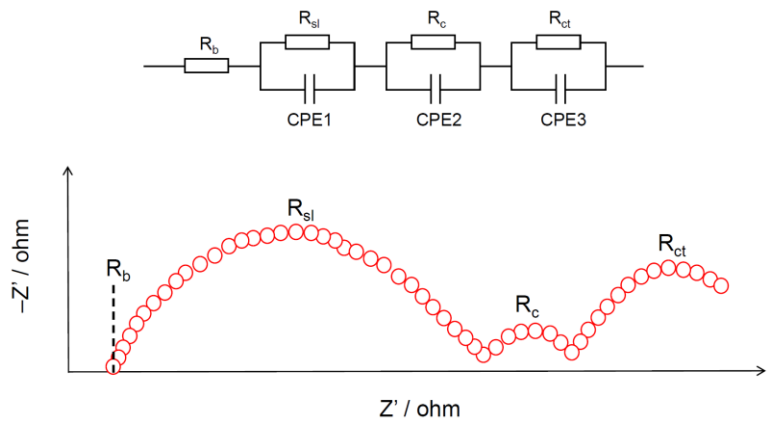

Fig. S3. Equivalent circuit used for fitting the observed ac-impedance spectra, where the resistances are respectively the cell's bulk resistance (R_b), surface layer resistance (R_{sl}), contact resistance (R_c) between the plated Li and electrode substrate, and charge-transfer resistance (R_{ct}).

2. Table

Table S1. Resistance values fitted by the equivalent circuit shown in Fig. S3.

Li state	Substrate	R_b / Ω	R_{sl} / Ω	R_c / Ω	R_{ct} / Ω
Plated	Pristine Cu	13	85	110	135
	C-coated Cu	12	50	51	172
Stripped	Pristine Cu	13	214	863	
	C-coated Cu	12	144	196	