Science Advances

AAAS

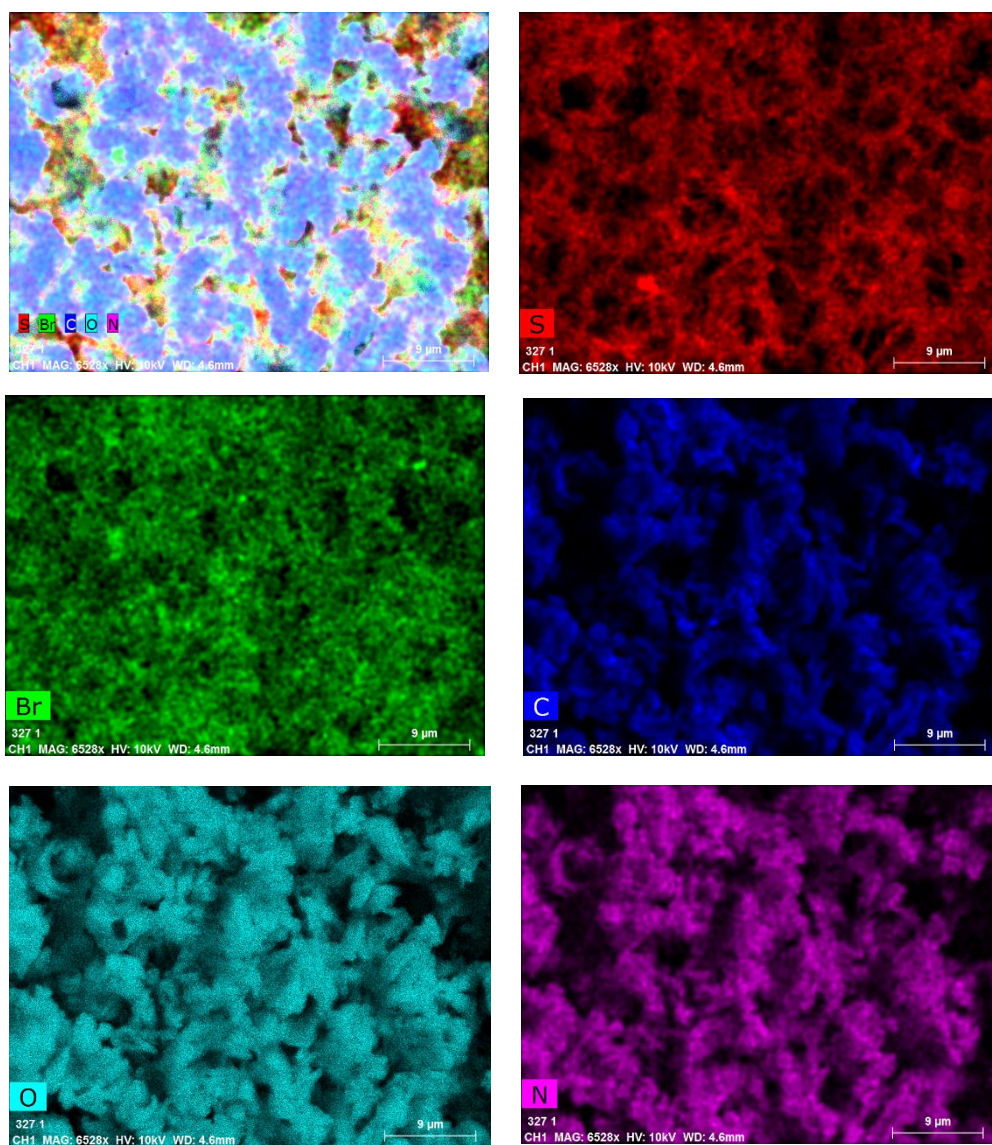## Supplementary Materials for

Designer interphases for the lithium-oxygen electrochemical cell

Snehashis Choudhury, Charles Tai-Chieh Wan, Wajdi I. Al Sadat, Zhengyuan Tu, Sampson Lau,
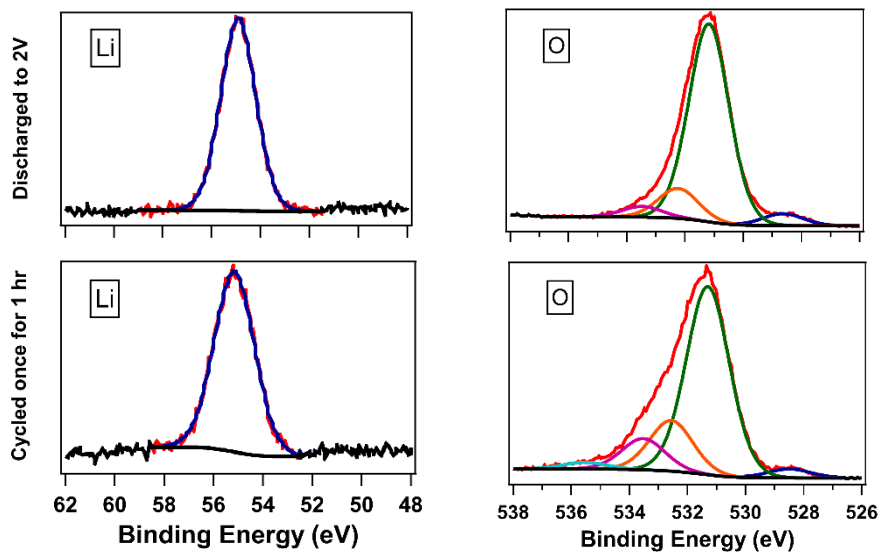Michael J. Zachman, Lena F. Kourkoutis, Lynden A. Archer

This PDF file includes:

fig. S1. Two-dimensional EDAX mapping of lithium-deposited stainless steel substrate with 1 M LiNO$_3$-DMA electrolyte and 10% ionomer additive. The atoms taken into consideration are Sulfur, Bromine, Carbon, Oxygen and Nitrogen

fig. S2. XPS results showing the binding energy of Li and O atoms with the control electrolyte (1 M LiNO₃-DMA). The first row shows results when the battery is discharged to 2V, the second row shows results when the Li-O₂ battery is cycled once for 1 hour.
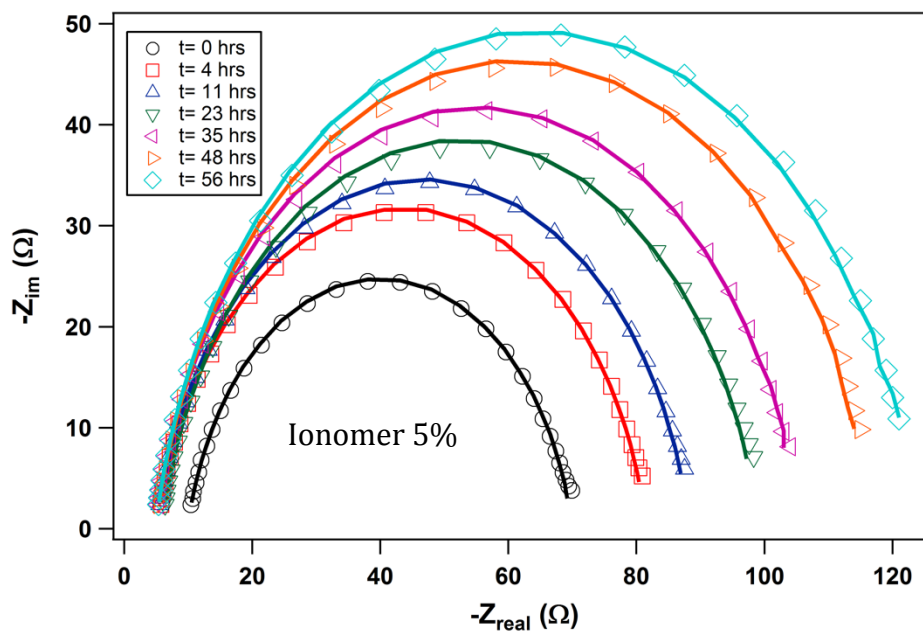
fig. S3. Nyquist plots of 1 M LiNO₃-DMA enriched with 5% (by weight) ionomer additive, showing impedance for different storage times of the battery.
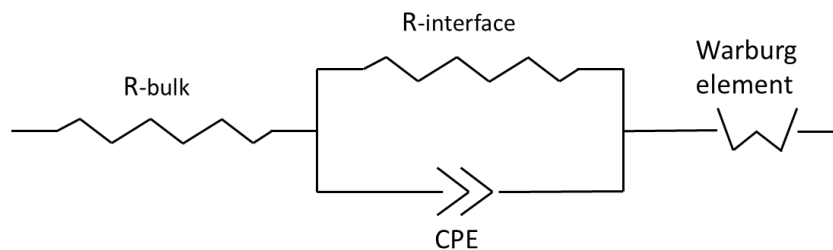
fig. S4. Equivalent circuit model to fit the Nyquist plot obtained from impedance spectroscopy measurement comprising bulk resistance, interfacial resistance parallel to a constant phase element, and a solid-state diffusion element.
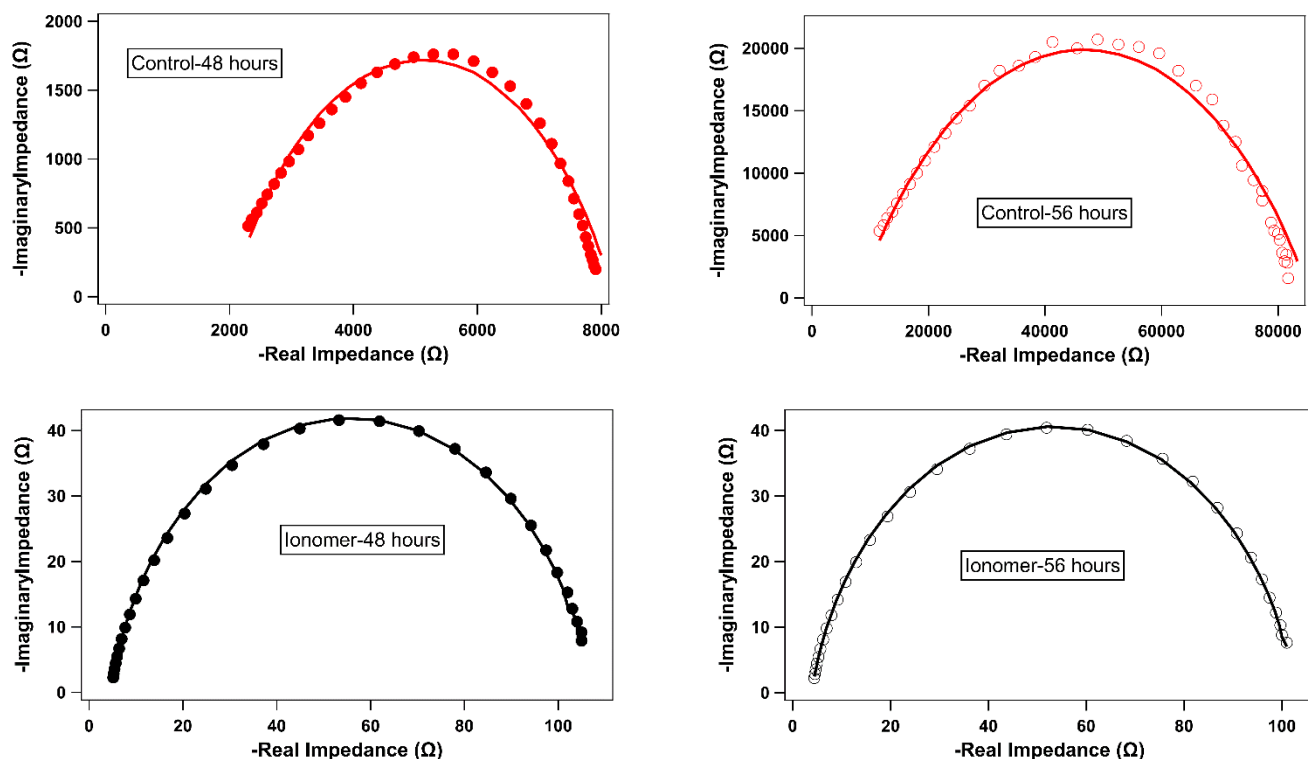
fig. S5. Nyquist plots showing experimental as well as circuit model–fitted results of impedance measurements with symmetric cells for the control electrolyte and ionomer-added batteries after 48 and 56 hours of storage. The red plot represents control and black shows data for ionomer added electrolyte.

fig. S6. Stripping and plating of Li versus stainless steel cell after depositing lithium (10 mAh/cm²,) onto stainless steel. It is seen that for all cells the voltage diverges for all cells however at different point of times.
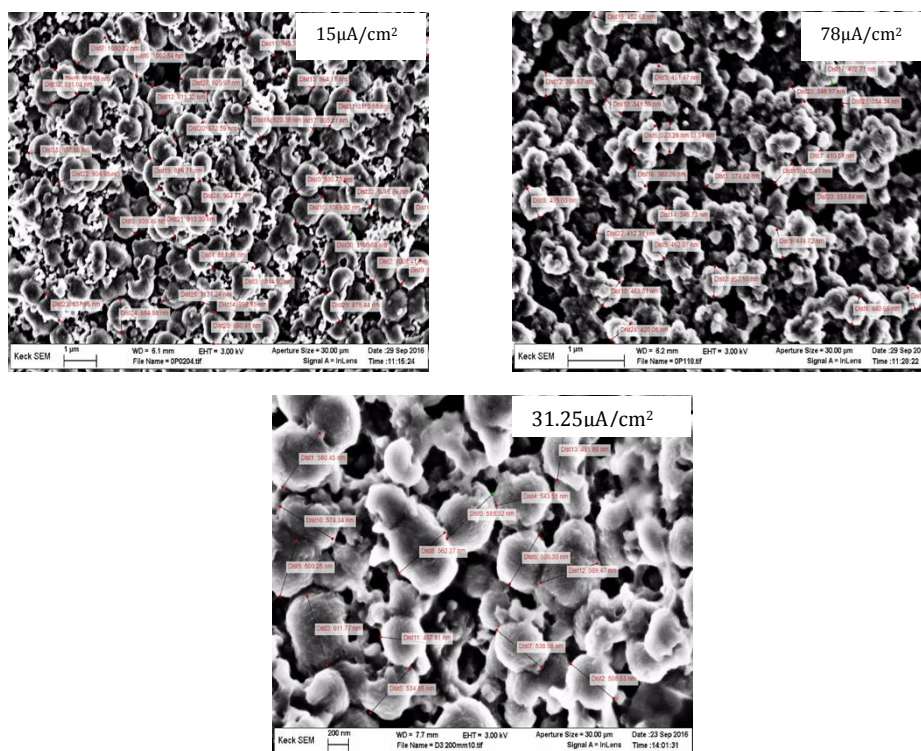
fig. S7. Size analysis of lithium peroxide particles after discharging a Li-O₂ cell with 1 M LiNO₃-DMA electrolyte and the ionomer additive at different current densities, as indicated in the box.
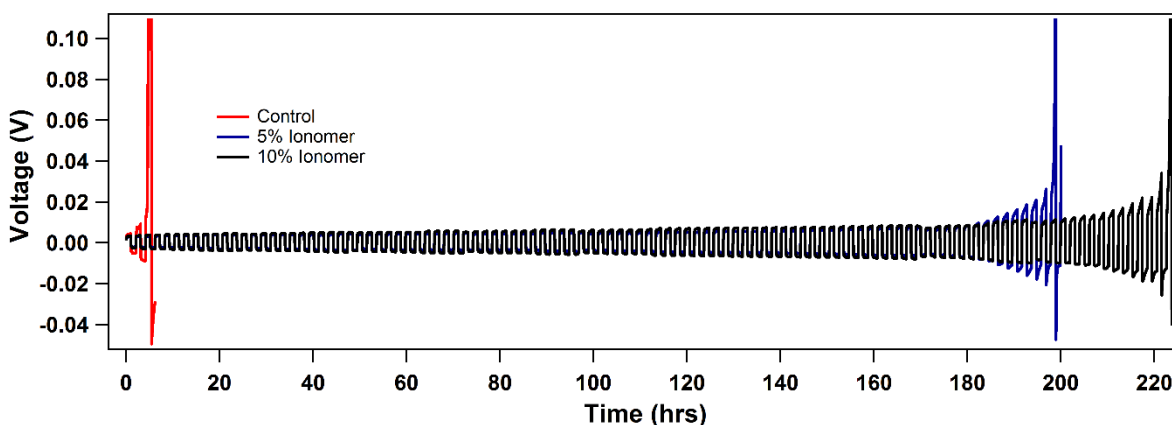
table S1. Atomic percentage of detected elements on lithium anodes. Samples (1) without ionomer discharged to 2V, (2) without ionomer discharged and recharged for one hour, (3) with ionomer discharged to 2V, (4) with ionomer discharged and recharged for one hour and (5) with ionomer cycled five times for one hour each.

Component	Anode				
	1	2	3	4	5
O 1s	44.93	38.42	42.35	40.11	40.99
C 1s	10.52	15.23	12.88	16.4	16.42
N 1s	2.02	3.61	2.61	2.84	2.92
F 1s	1.12	5.12	1.25	1.73	2.35
Br 3p			1.01	1.74	1.71
S 2p			2.11	3.80	4.09
Li 1s	41.42	37.62	37.8	33.38	31.52