

Supporting Information

Suppressing Growth of Lithium Dendrites by Introducing Deep Eutectic Solvents for Stable Lithium Metal Batteries

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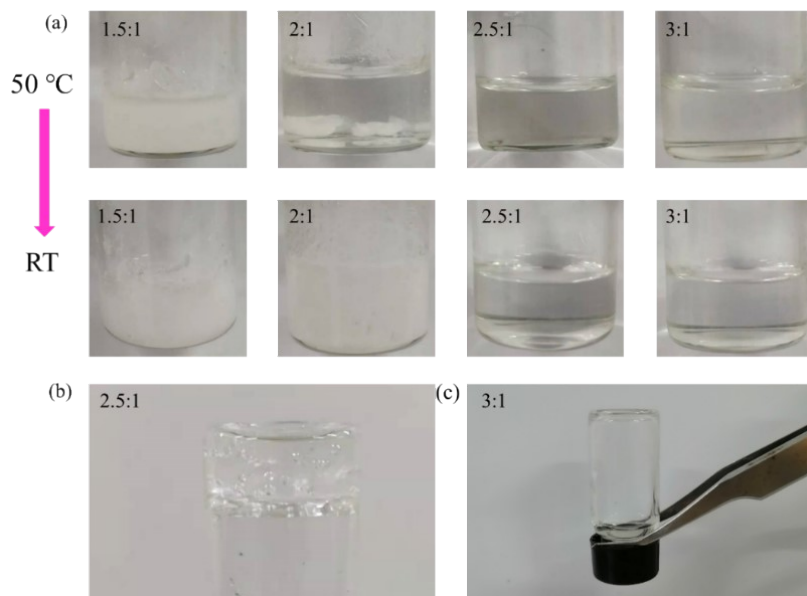


Fig. S1 (a) The photograph pictures of binary mixtures with various molar ratios at 50 °C and cool-down room temperature; The state of binary mixtures with (b) 2.5:1 and (c) 3:1 ratio after 1 week at room temperature.

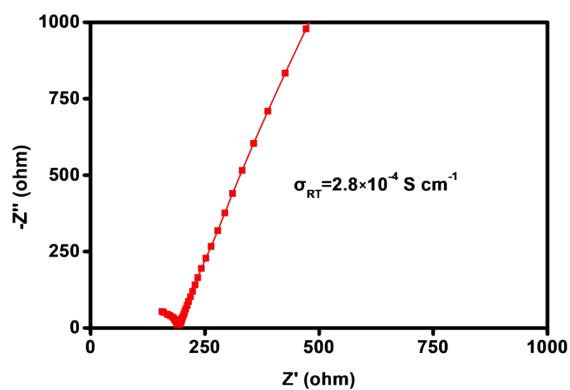


Fig. S2 Impedance spectrum of DES-3:1 measured at 25 °C, and the total conductivity are calculated from this spectrum.

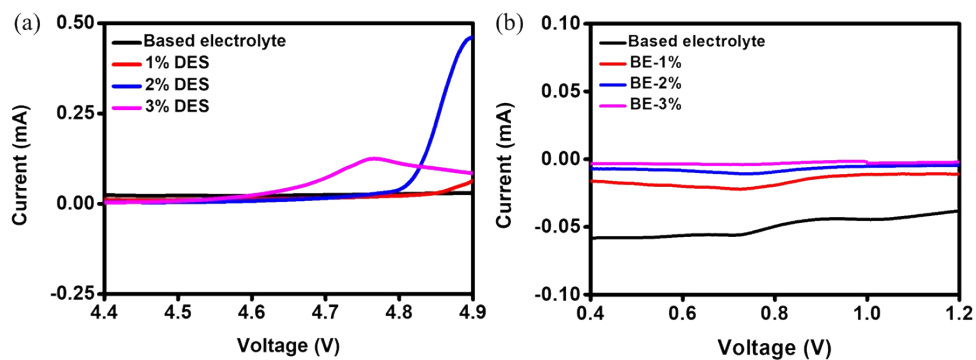


Fig. S3 The corresponding magnified views of electrolyte decomposed at oxidation reaction regions (a) and reduction reaction regions (b) in Figure 2(a).

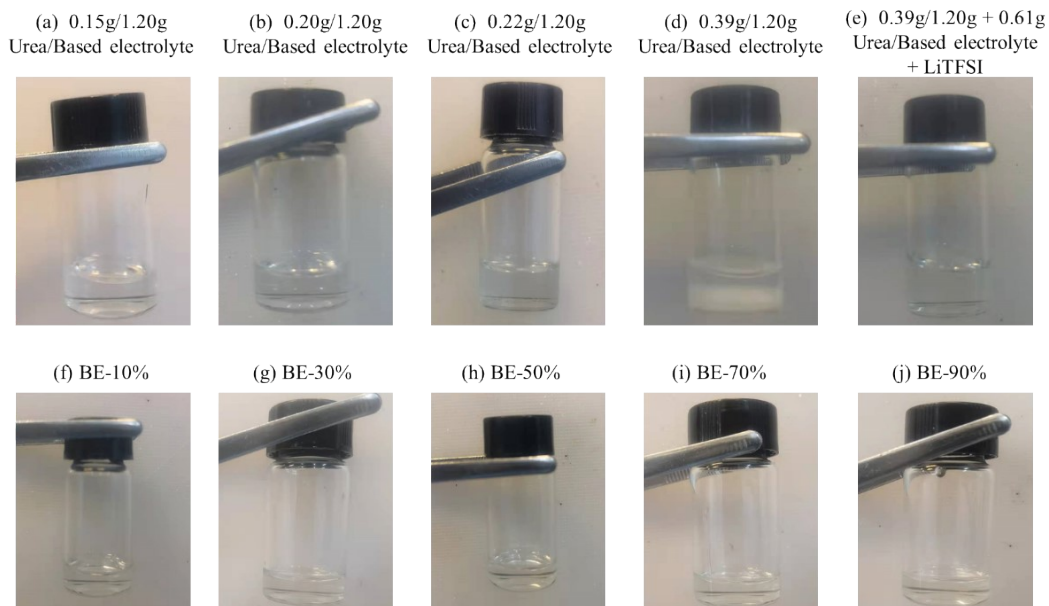


Fig. S4 (a-d) The photographs of urea/based electrolyte with various ratios; (e) LiTFSI added into urea/based electrolyte mixture; (f-j) The photographs of DES-3:1/based electrolyte solution with various ratios.

Table S1 The relative intensity ratios ($I_{\text{peak1}}/I_{\text{peak2}}$ and $I_{\text{peak3}}/I_{\text{peak4}}$) at different electrolyte.

	$I_{\text{peak1}}/I_{\text{peak2}}$ ratios	$I_{\text{peak3}}/I_{\text{peak4}}$ ratios
Based electrolyte	1.160	2.453
Urea-0.39%	1.199	2.434
LiTFSI-0.61%	1.122	2.401
BE-1%	1.128	2.008

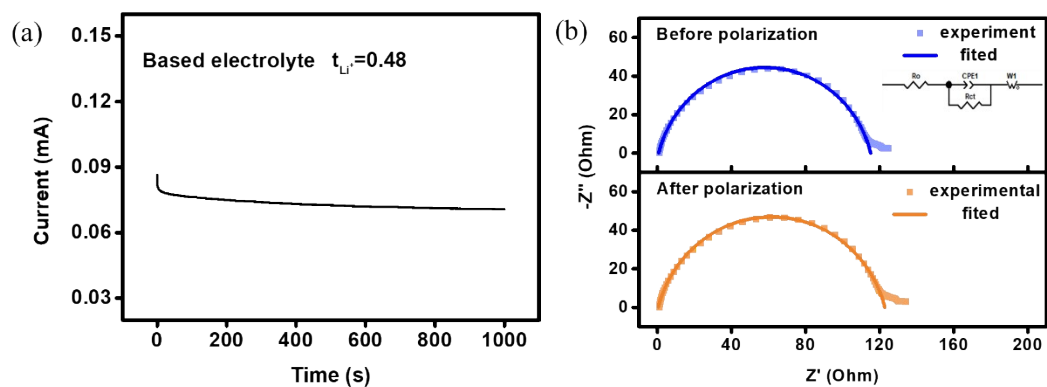


Fig. S5 (a) Chronoamperometry profile of Li/Li symmetric cells with the based electrolyte; and (b) the corresponding Nyquist plots of Li/Li symmetric cells before and after polarization.

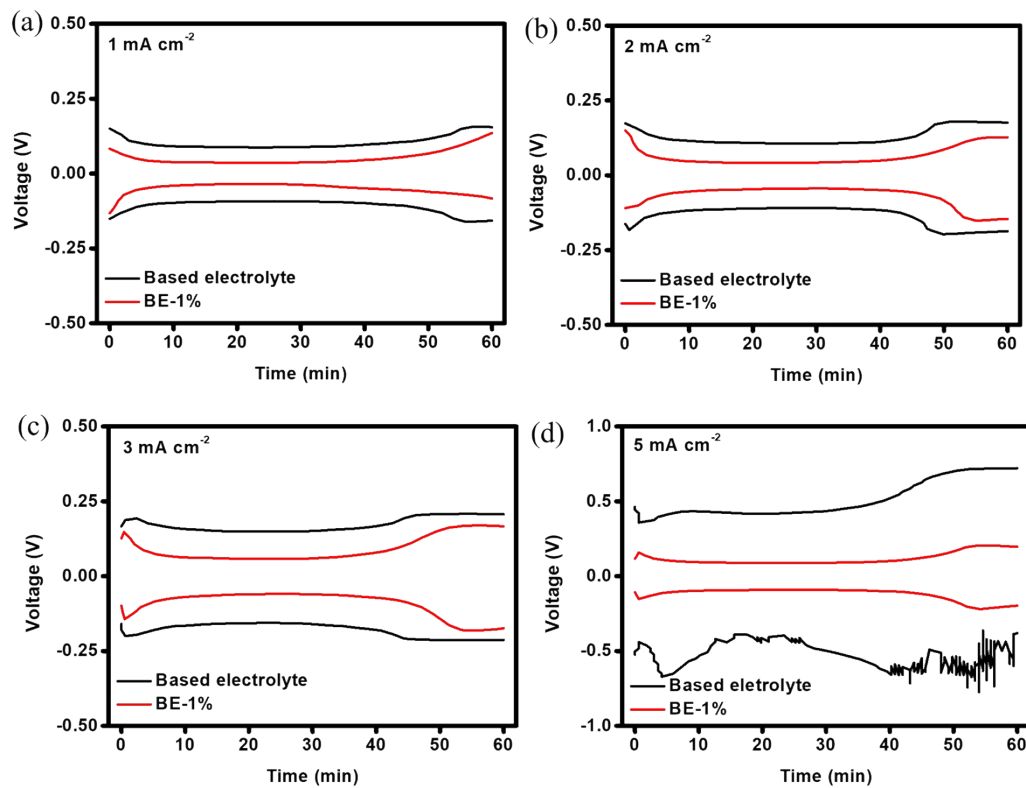


Fig. S6 The corresponding 3rd cycle voltage vs. time profiles of symmetric cells at current density of 1, 2, 3 and 5 mA cm⁻² in figure 3e.

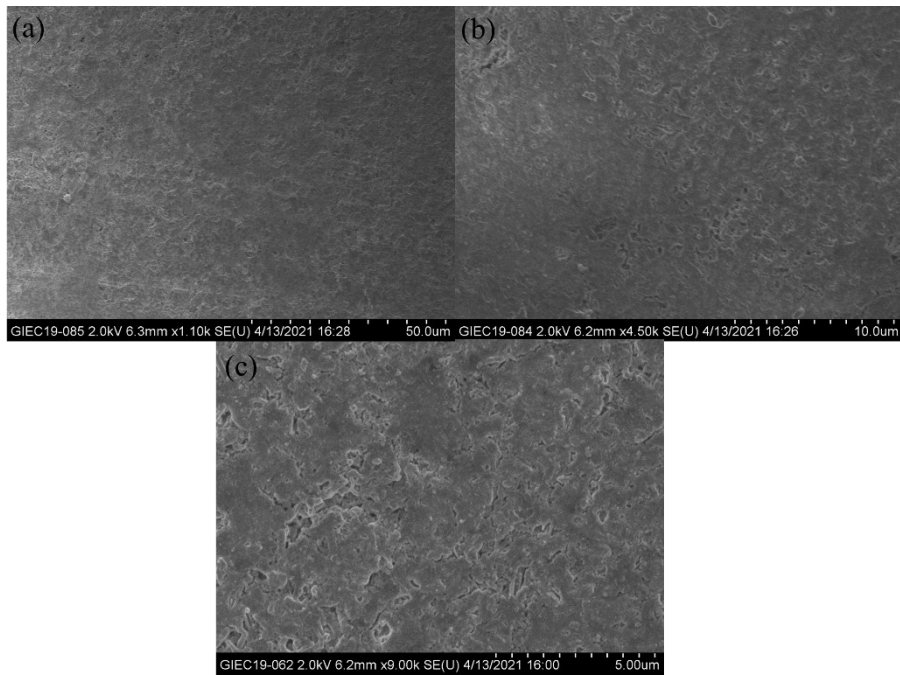


Fig. S7 SEM images at the surface of Li anode with BE-1% electrolyte after 50th cycles under different magnifications: (a) $\times 1100$, (b) $\times 4500$, (c) $\times 9000$.

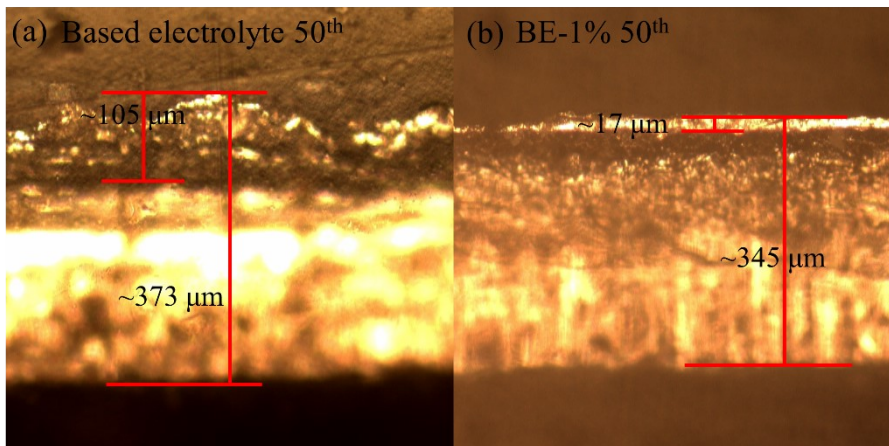


Fig. S8 The cross-sectional optical microscopic images of lithium metal anodes in BE-1% and based electrolyte after 50th cycles ($1\ \text{mA cm}^{-2}$, $1\ \text{mAh cm}^{-2}$).

Table S2 XPS surface element analysis parameters of Li anode with BE-1% after 50th cycles.

Element	Line Type	Apparent Concentration	k Ratio	wt.%	wt.% Sigma	Atomic %	Standard Label	Factory Standard
C	K series	1.27	0.01274	15.87	0.13	20.20	C Vit	Yes
N	K series	0.61	0.00108	1.78	0.15	1.95	BN	Yes
O	K series	22.31	0.07506	78.37	0.20	74.85	SiO ₂	Yes
F	K series	0.40	0.00079	3.37	0.13	2.71	CaF ₂	Yes
P	K series	0.14	0.00081	0.60	0.02	0.30	GaP	Yes
S	K series	0.00	0.00000	0.00	0.00	0.00	FeS ₂	Yes
Total:				100.00		100.00		

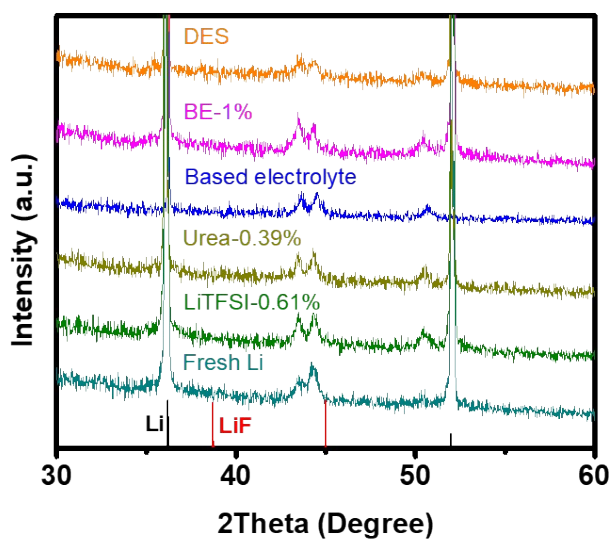


Fig. S9 XRD of Li anode cycled in DES, BE-1% electrolyte, based electrolyte, Urea-0.39%, LiTFSI-0.61% electrolyte.

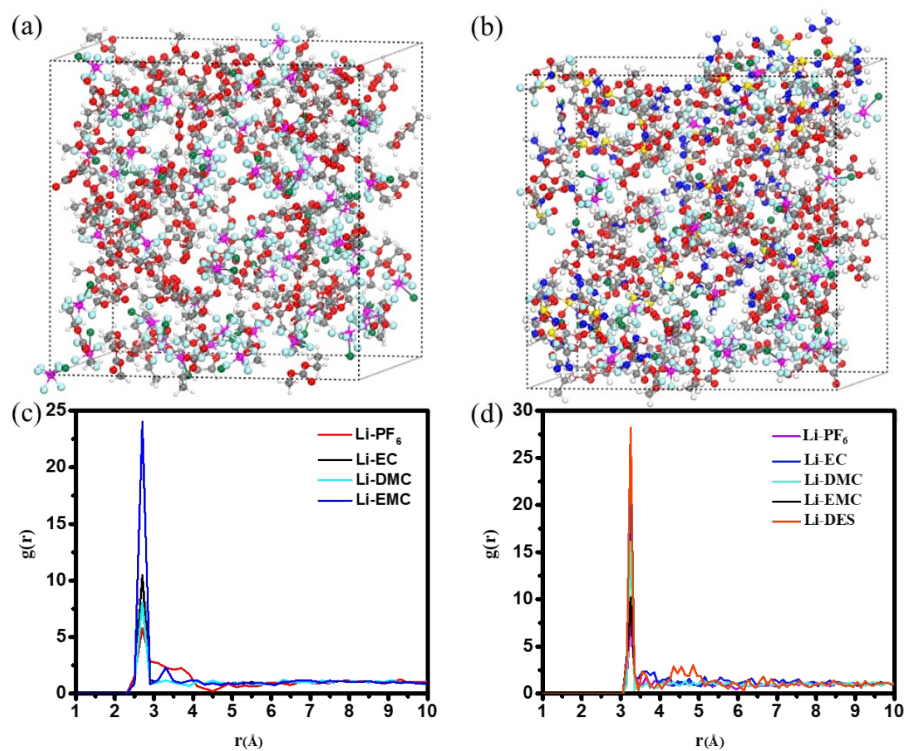


Fig. S10 Snapshots of (a) based electrolyte and (b) BE-1% electrolytes obtained by MD simulation at 300 K; Radial distribution function for (c) based electrolyte and (d) BE-1% electrolytes.

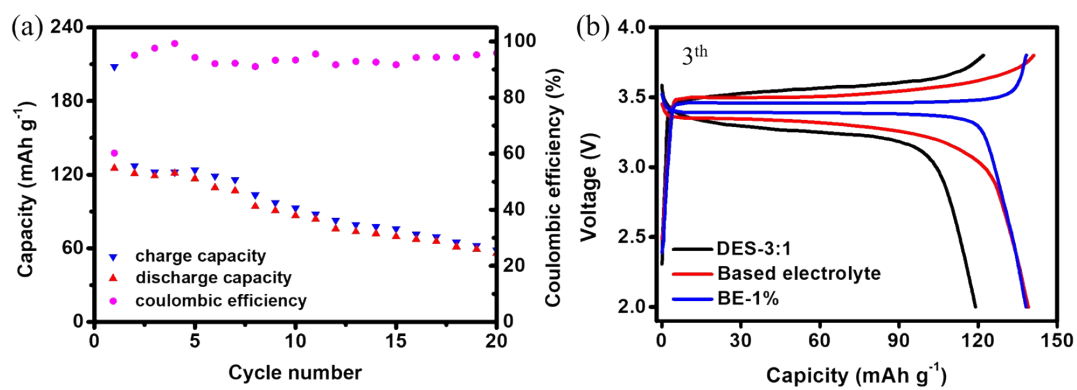


Fig. S11 (a) The cyclic performance of Li/LiFePO₄ with pure DES as electrolyte at a current density of 30 mA g⁻¹; (b) The corresponding charge/discharge profiles of three cells at 3th cycles.

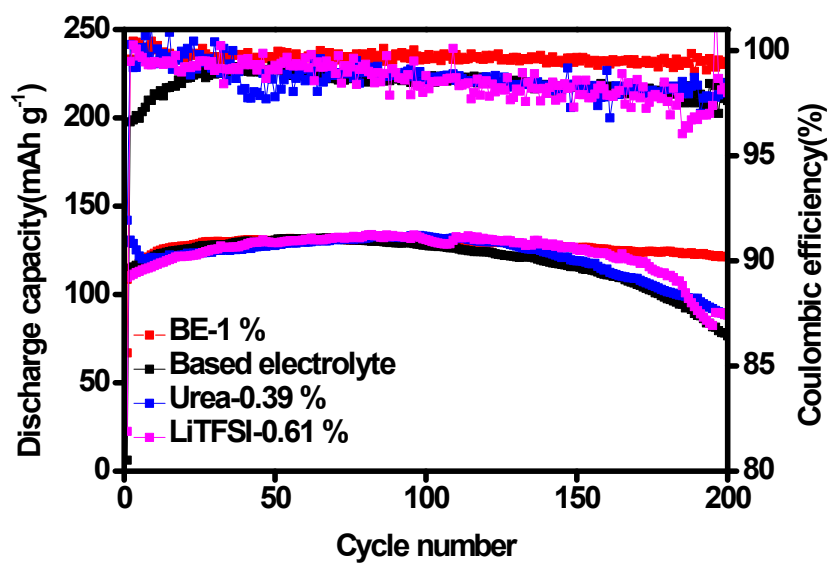


Fig. S12 Long-term cycling of Li/LiFePO₄ cells (LiFePO₄ loading ~10 mg cm⁻²) in different electrolytes (BE-1%, based electrolyte, Urea-0.39%, and LiTFSI-0.61%). The cells were charged and discharged between 2.0 and 3.8 V at a current rate of 1C (1C = 150 mA g⁻¹).