

## Supporting Information for

# Nonafluorobutyl Ether Enhancing Stability of Fluorobenzene-based Diluted High-Concentration Electrolyte in High-Voltage Lithium Metal Batteries

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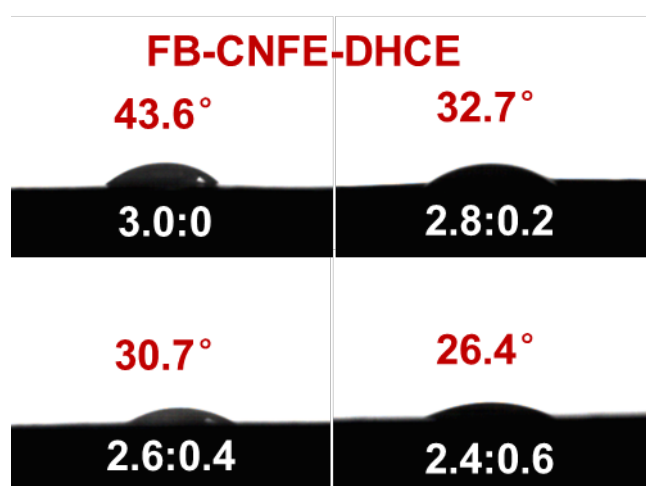


Fig. S1 Wettability tests of separator contact with different electrolytes.

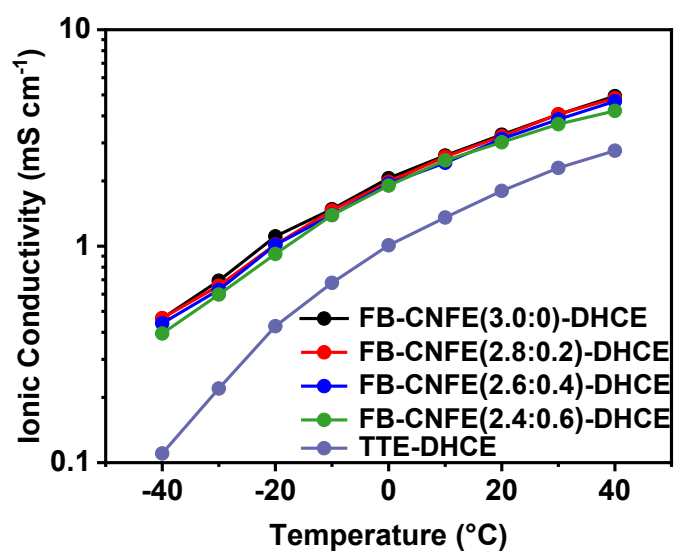


Fig. S2 Ionic conductivity of different electrolytes of -40 to 40 °C.

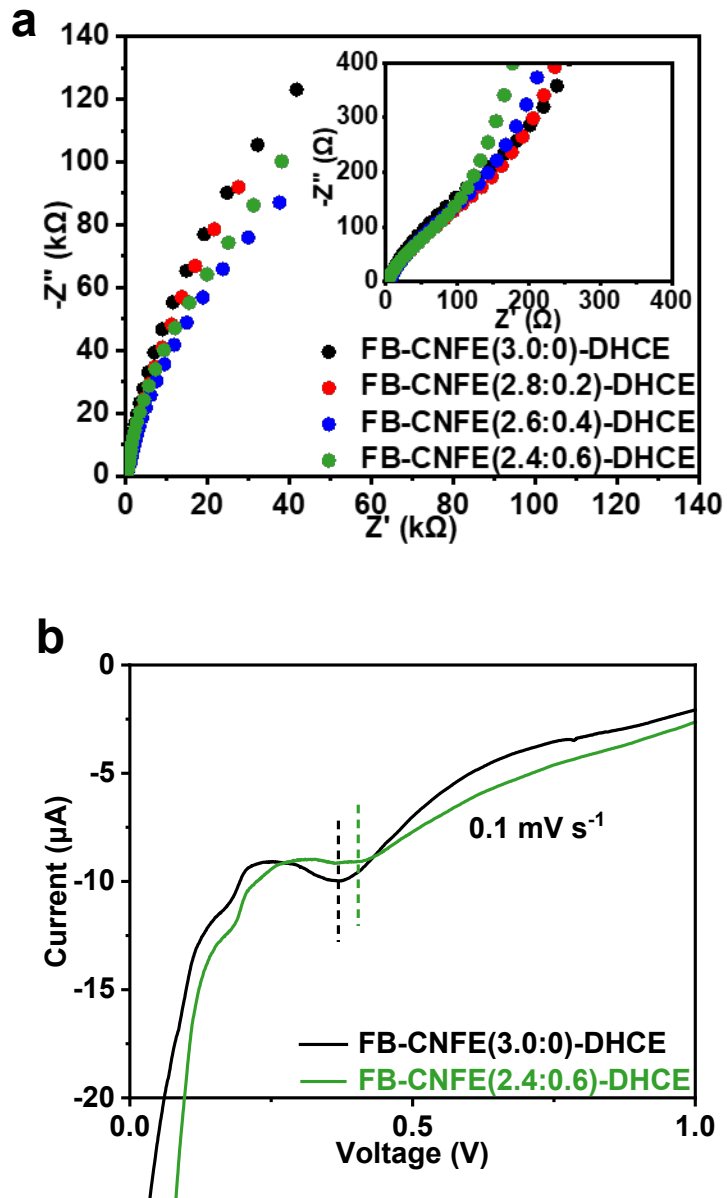


Fig. S3 (a) EIS results before the LSV tests. (b) LSV curves of FB-DHCE and FB-CNFE-DHCE from 1 V to 0 V.

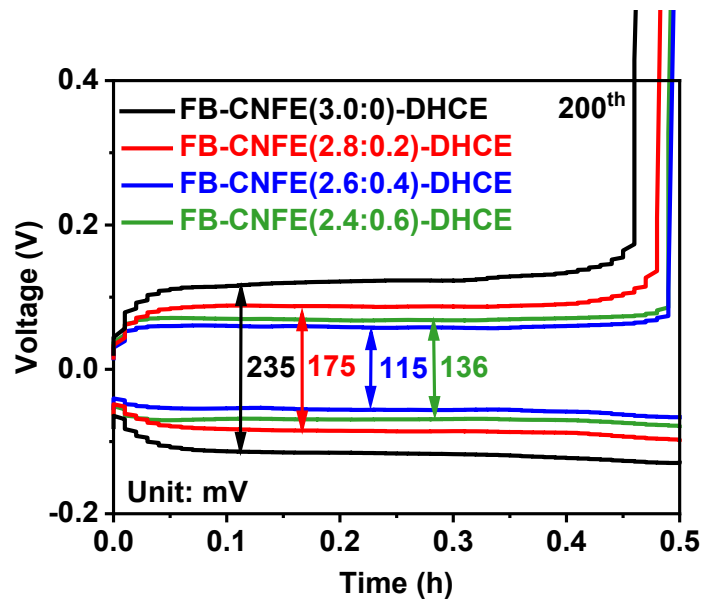


Fig. S4 Discharge-charge curves of the cells at 200<sup>th</sup> cycle in the different electrolytes.

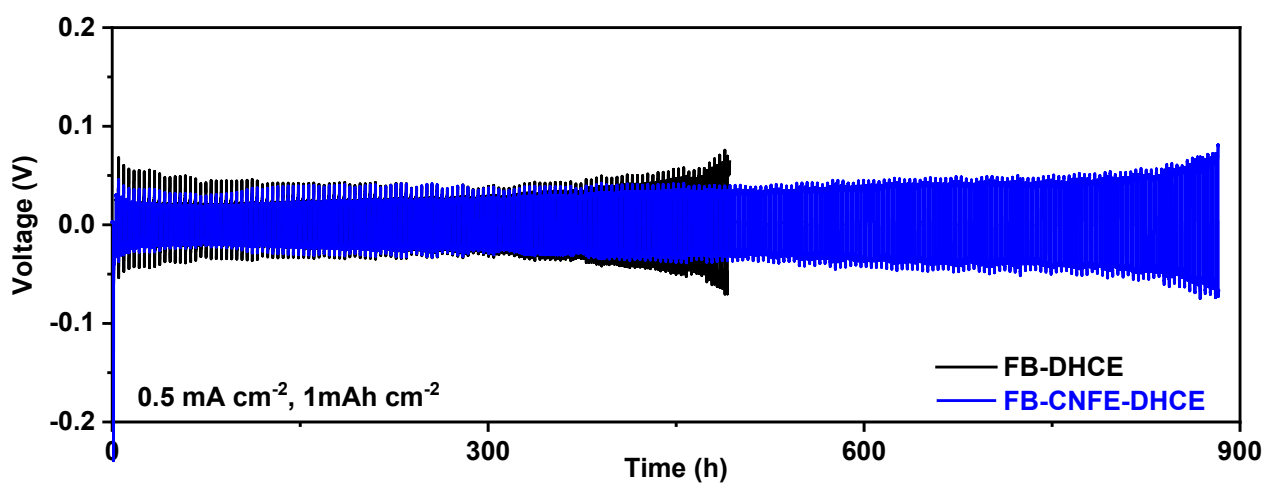


Fig. S5 Cycling performance of Li||Li cells at 0.5 mA cm<sup>-2</sup>.

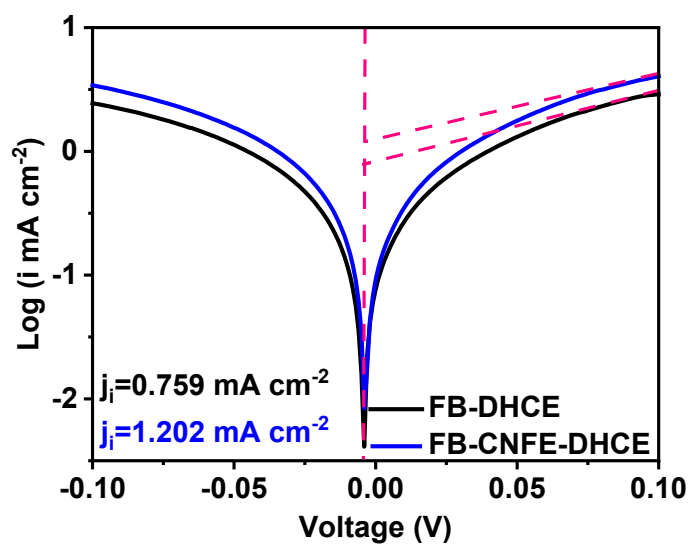


Fig. S6 Tafel plots for Li stripping/plating in the different electrolytes.

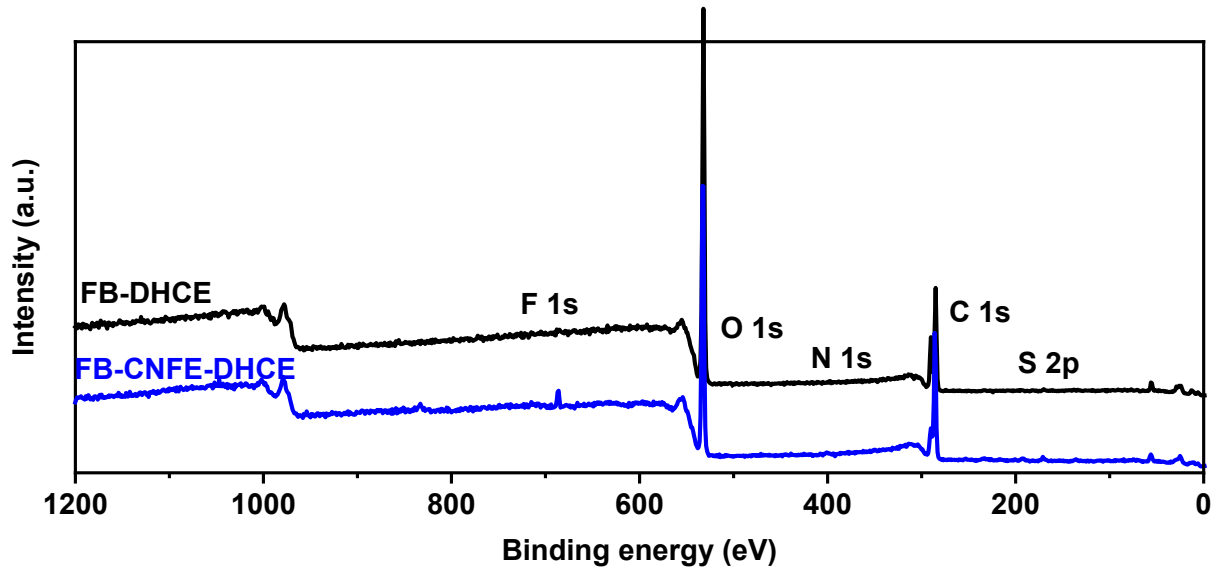


Fig. S7 The full XPS of deposited Li in different electrolytes.

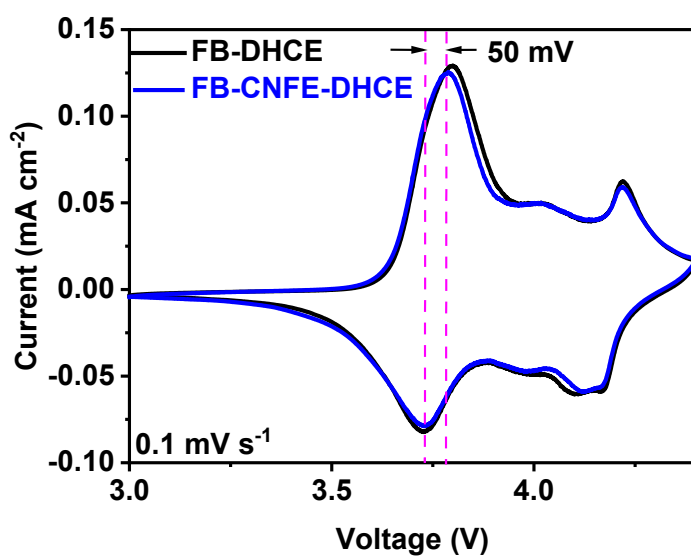


Fig. S8 CV curves of the initial cycles for Li||NCM811 cell under different electrolytes (3 - 4.4 V, 0.1 mV s<sup>-1</sup>).



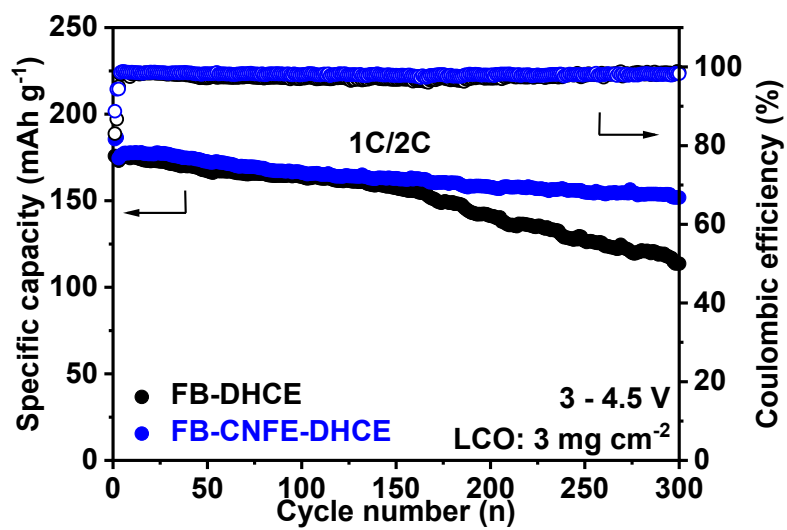


Fig. S9 Cycling performance of Li||LCO cells (LCO loading: 3 mg cm<sup>-2</sup>) with different electrolytes, cycled between 3.0 and 4.5 V at 1 C charge and 2 C discharge.

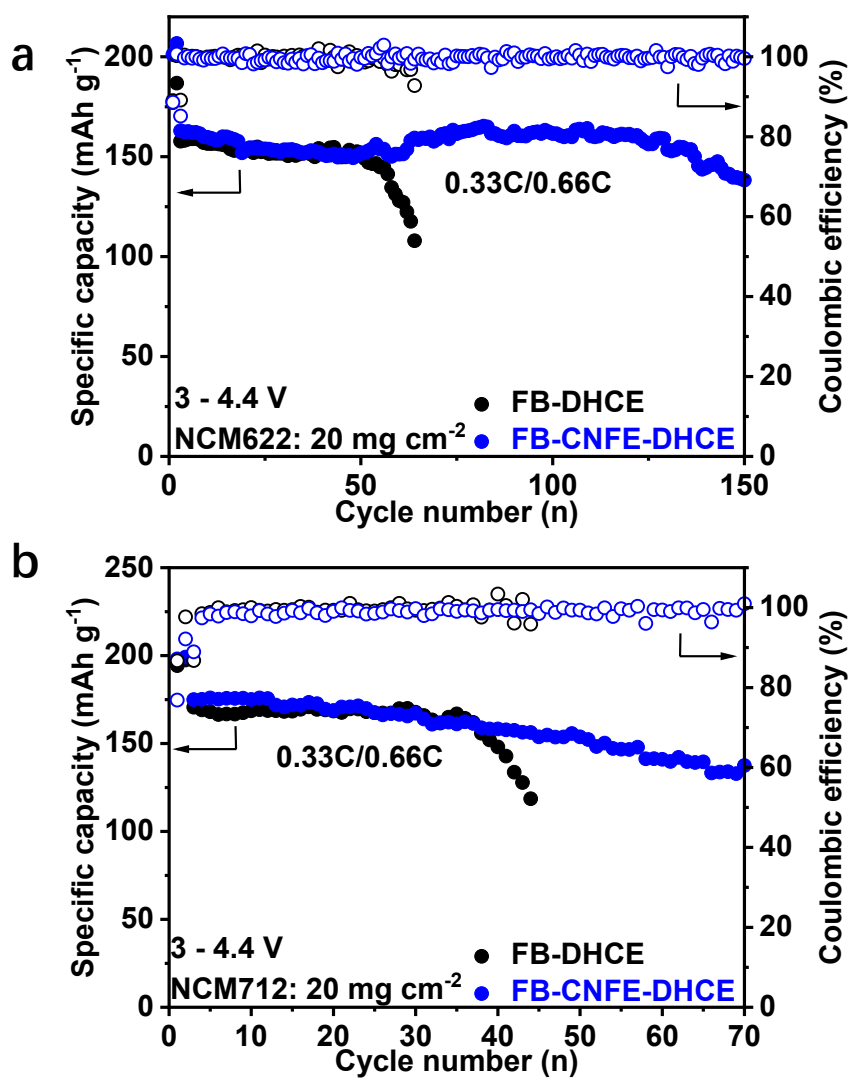


Fig. S10 Cycling performance of (a) Li||NCM622 cells (NCM622 loading:  $20 \text{ mg cm}^{-2}$ ) and (b) Li||NCM712 cells (NCM712 loading:  $20 \text{ mg cm}^{-2}$ ) with different electrolytes, cycled between 3.0 and 4.4 V at 0.33 C charge and 0.66 C discharge.

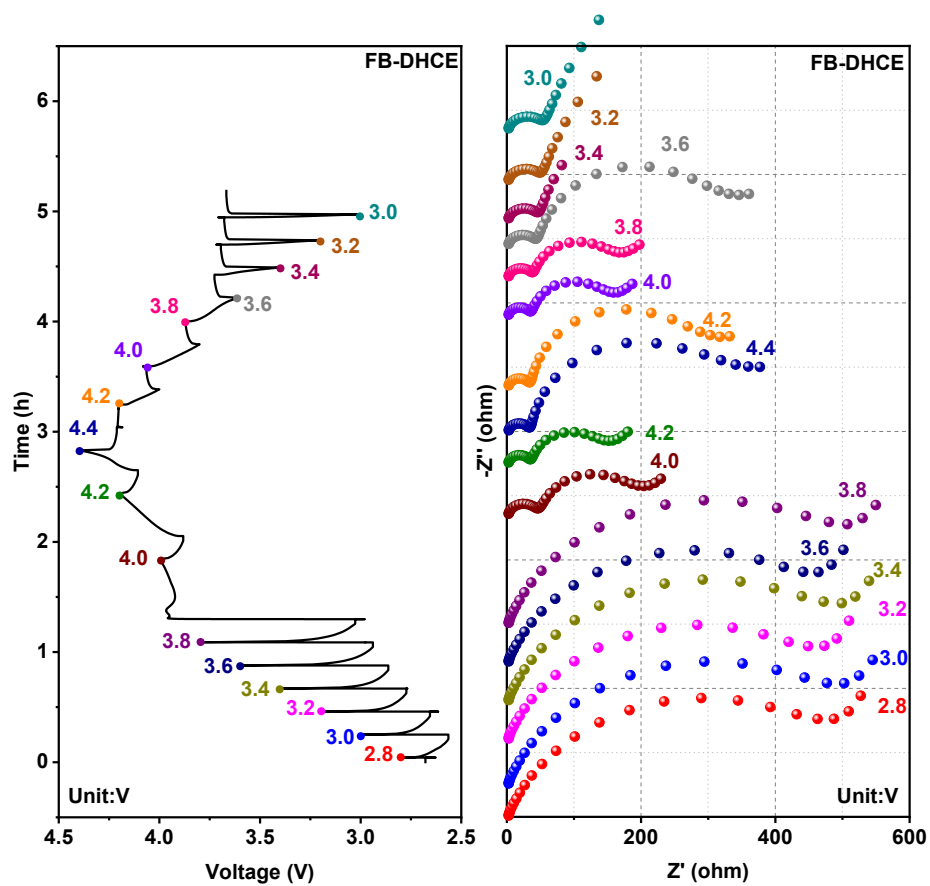


Fig. S11 The in-situ EIS spectra of Li||NCM811 cell in FB-DHCE. The initial cycle charge and discharge profile are plotted at left side of each spectrum.

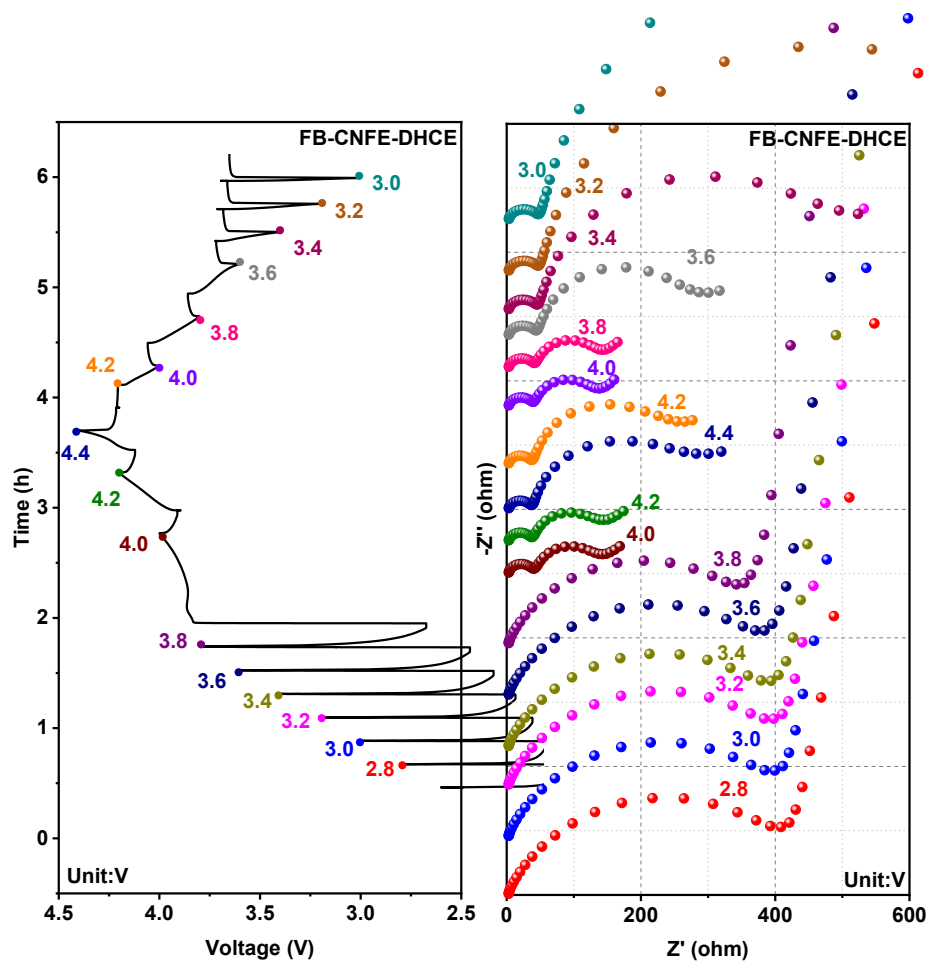


Fig. S12 The in-situ EIS spectra of Li||NCM811 cell in FB-CNFE-DHCE.

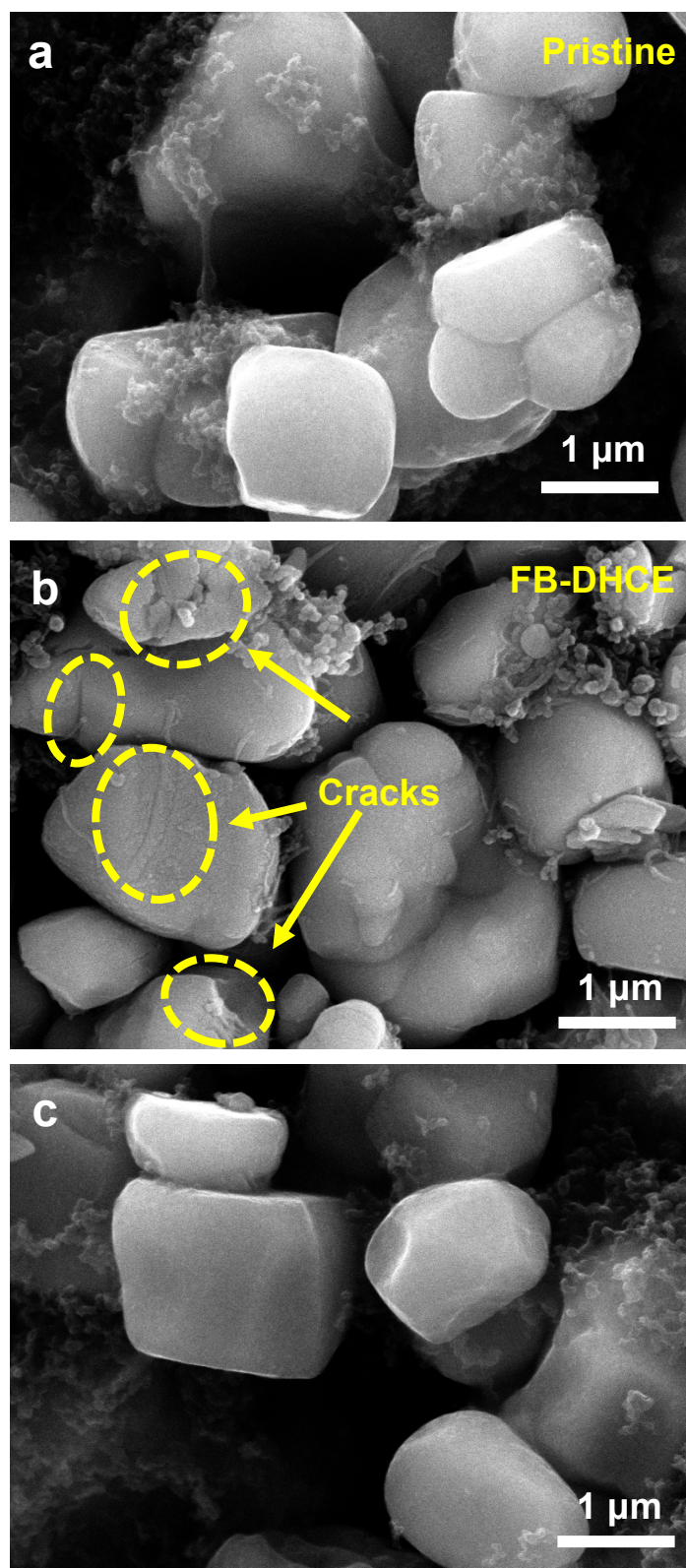


Fig. S13 SEM images of NCM811 (a) uncycled and after cycling at 4.4 V in (b) FB-DHCE and (c) FB-CNFE-DHCE.

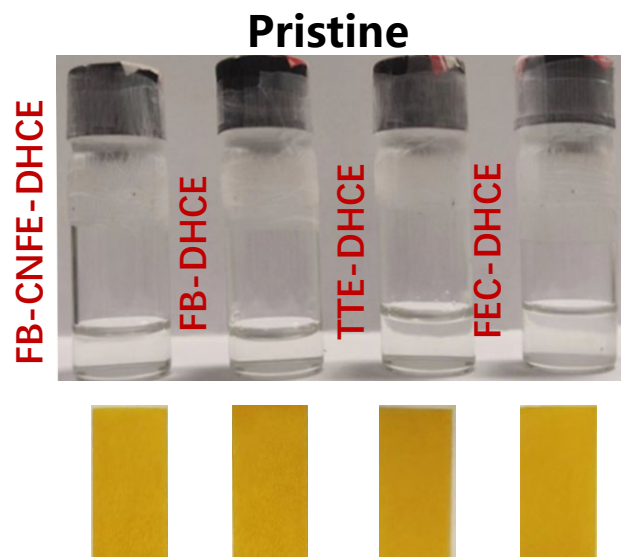


Fig. S14 Photographs and pH results of FB-CNFE-DHCE, FB-DHCE, TTE-DHCE, and FEC-DHCE before storage.

Table S1. Chemical element on Li metal films in different electrolytes.

Atomic Conc. %	C	O	F	N	S
FB-DHCE	37.35	51.48	5.08	2.67	3.42
FB-CNFE-DHCE	34.19	55.58	6.11	1.75	2.37

Table S2. Chemical element on NCM811 films in different electrolytes.

Atomic Conc. %	C	O	F	N	S
FB-DHCE	32.63	43.03	21.37	1.11	1.87
FB-CNFE-DHCE	30.74	41.8	25.11	0.91	1.45