Supplementary Information

Improvement of Li metal-electrolyte interfacial stability by *cis-trans* polar conformer formation in carbonate electrolyte

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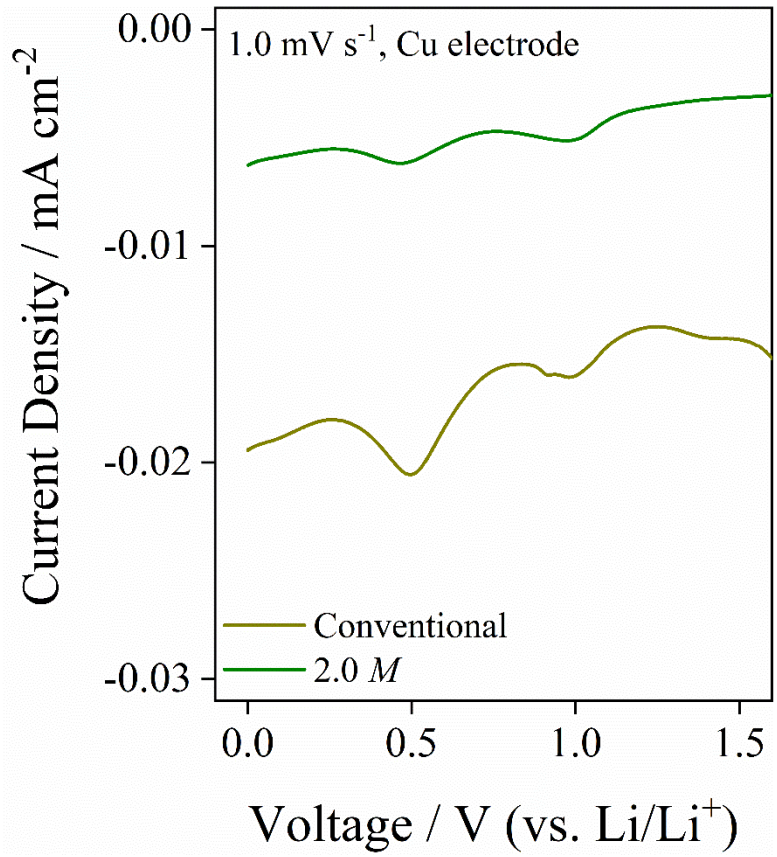

Figure S1. Linear sweep voltammogram obtained from coin type Cu/Li cells with conventional and 2.0 *M* conformer electrolytes

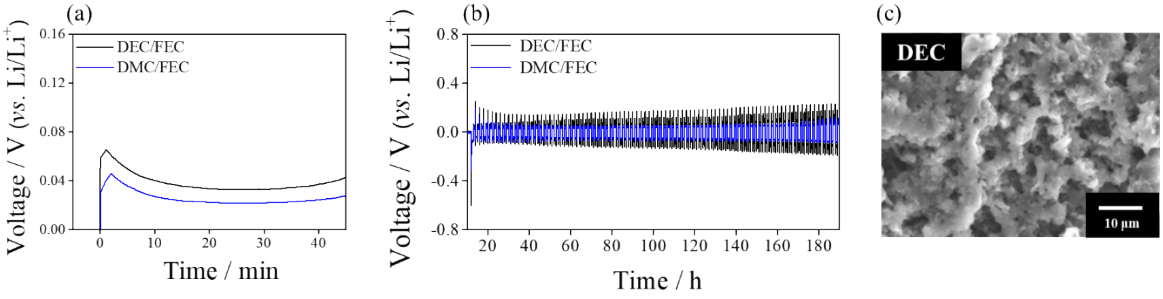

Figure S2. (a) Initial polarization, (b) time versus voltage curves obtained from conformer forming (DMC) and less forming (DEC) electrolytes, (c) *ex-situ* SEM image of fifth cycled Li metal with DEC-based electrolyte

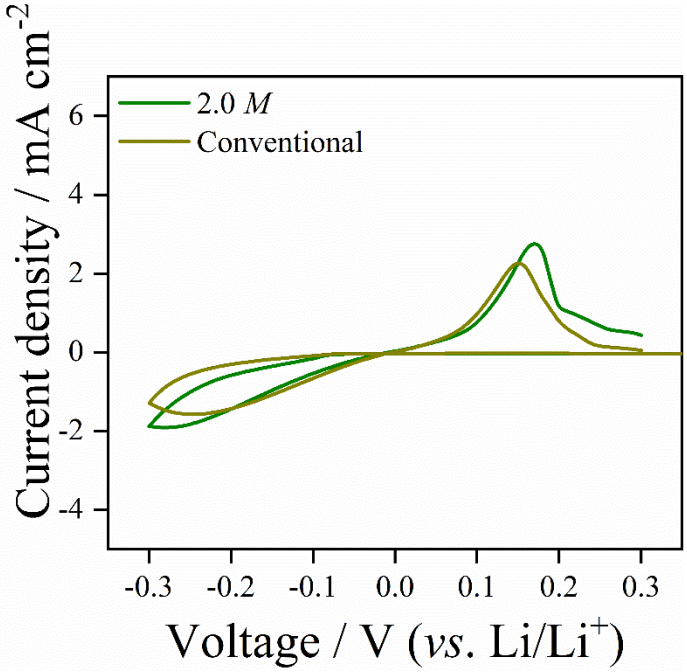

Figure S3. Cyclic voltammogram recorded from conventional and conformer electrolytes

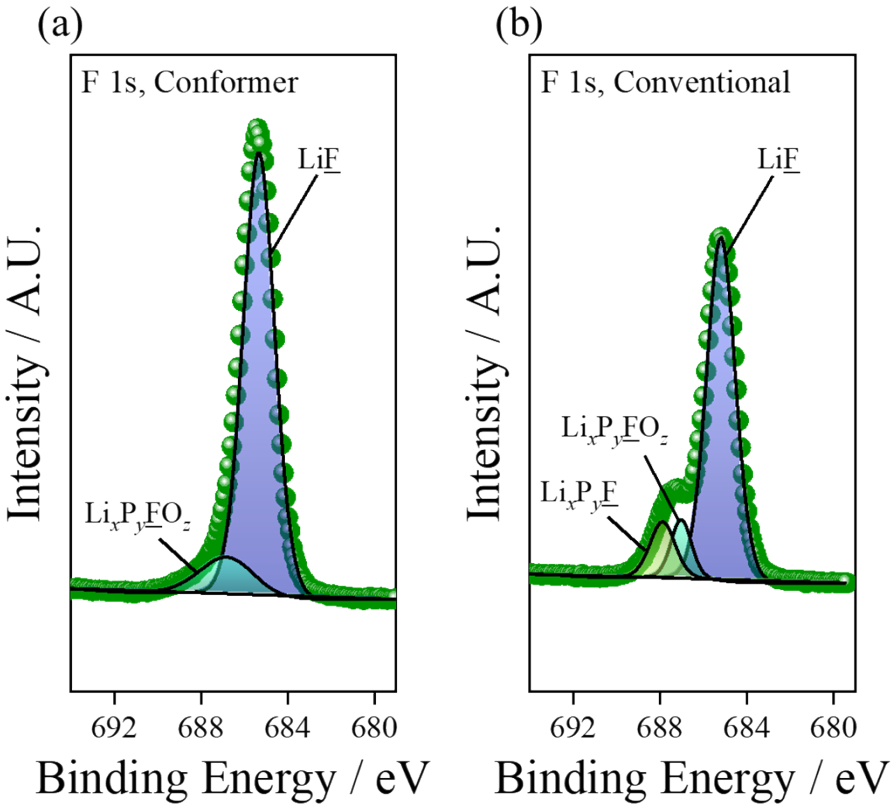

Figure S4. F 1s XPS spectrum obtained from lithium electrode with (a) conformer and (b) background electrolyte

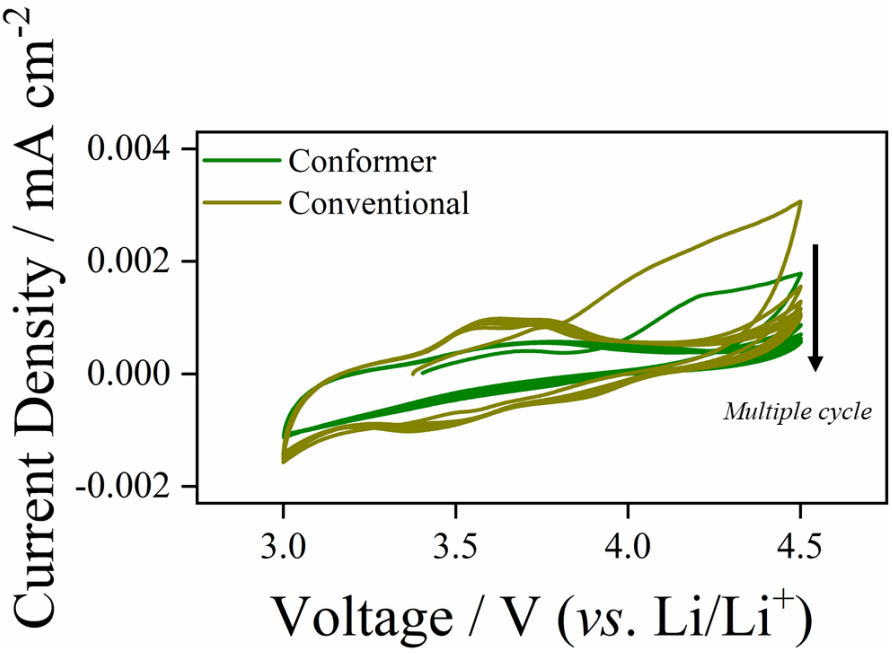

Figure S5. Cyclic voltammogram recorded from conventional and conformer electrolytes

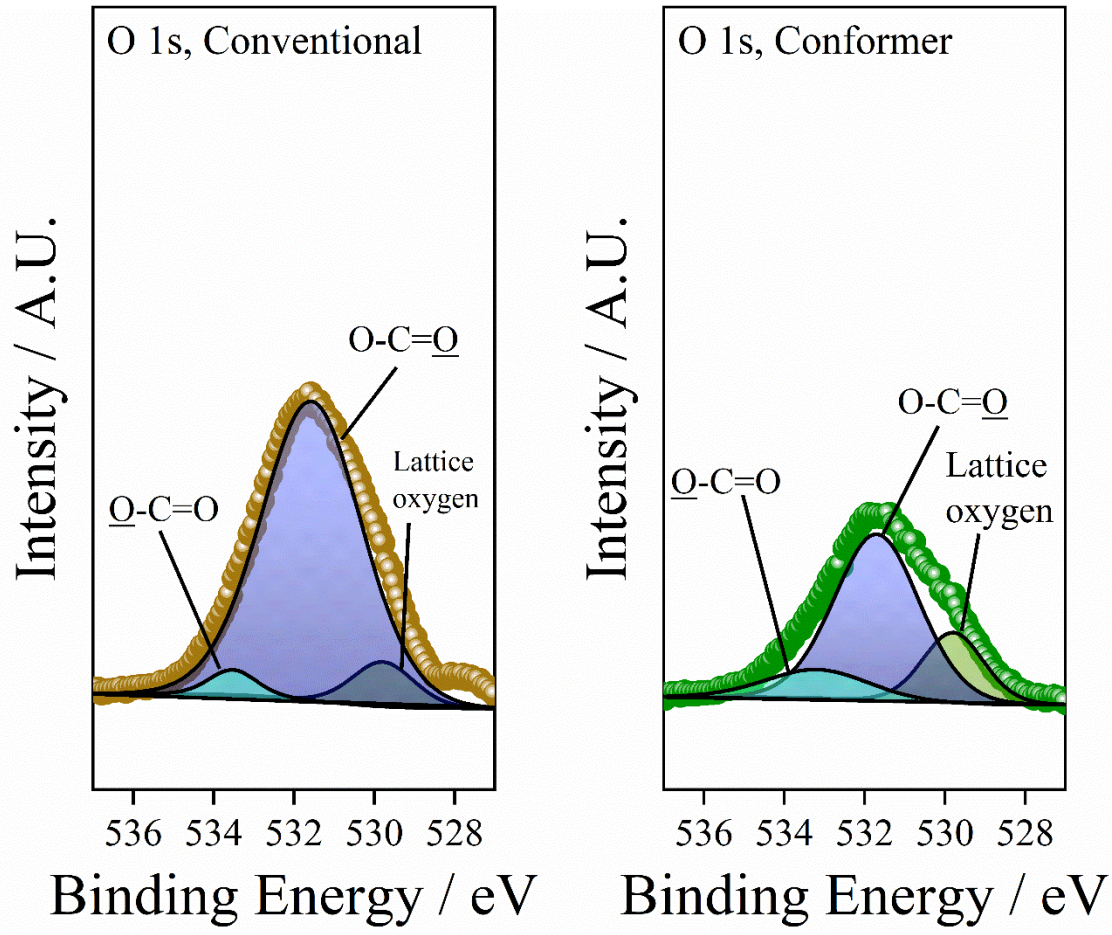

Figure S6. O 1s XPS spectra obtained from 60 s-etched NCM811 electrodes

Figure S7. Optical image of fabricated lithium metal pouch cell

Table S1. Comparison with recently reported carbonate electrolytes for lithium metal batteries

Published Year	**Applied positive electrode**	**Evaluated Areal Capacity / mA h cm^{-2}**	**End-of-life cycle number**
2018[1]	NCA	2.50	300
2020[2]	$LiNi_{0.8}Co_{0.1}Mn_{0.1}O_2$	2.50	200
2020[3]	$LiNi_{0.8}Co_{0.1}Mn_{0.1}O_2$	1.30	80
2021[4]	$LiNi_{0.8}Co_{0.1}Mn_{0.1}O_2$	2.50	200
2021[5]	NCA	1.65	150
2021[6]	$LiNi_{0.8}Co_{0.1}Mn_{0.1}O_2$	2.62	200
2021[7]	$LiNi_{0.6}Co_{0.2}Mn_{0.2}O_2$	0.68	100
2021[8]	$LiNi_{0.6}Co_{0.2}Mn_{0.2}O_2$	0.50	200
2021[9]	$LiNi_{0.6}Co_{0.2}Mn_{0.2}O_2$	3.50	120
2022[10]	$LiNi_{0.8}Co_{0.1}Mn_{0.1}O_2$	4.00	200
2022[11]	$LiNi_{0.8}Co_{0.1}Mn_{0.1}O_2$	4.3	120
This work	**$LiNi_{0.8}Co_{0.1}Mn_{0.1}O_2$**	**4.5**	**200**

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