

Supporting Information

Quasi-Solid-State Electrolyte Synthesized Using a Thiol-Ene Click Chemistry for Rechargeable Lithium Metal Batteries with Enhanced Safety

Sungguk Park,[†] Bora Jeong,[†] Da-Ae Lim,[†] Chul Haeng Lee,[‡] Kyoung Ho Ahn,[‡] Jung Hoon Lee,[‡] and Dong-Won Kim^{*,†,§}

[†]Department of Chemical Engineering and [§]Institute of Nano Science and Technology, Hanyang University, Seoul 04763, Republic of Korea

[‡]Battery R&D, LG Chem, Daejeon 34122, Republic of Korea

*Corresponding author

Tel.: +82 2 2220 2337; Fax: +82 2 2298 4101

E-mail address: dongwonkim@hanyang.ac.kr (D.-W. Kim)

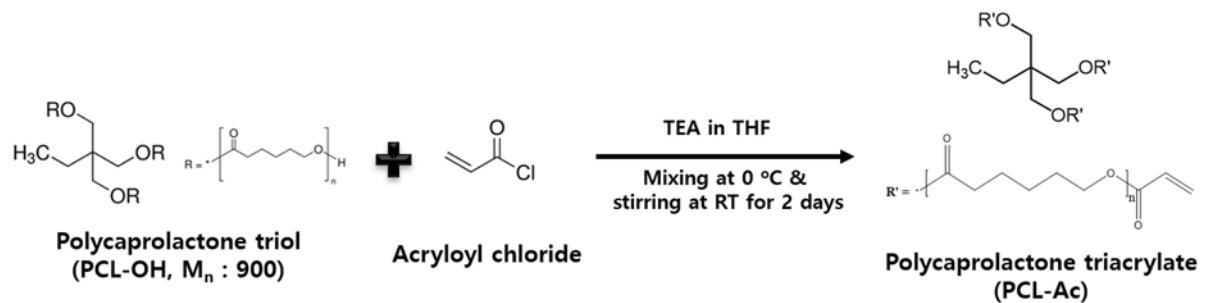


Figure S1. Schematic of the synthesis of polycaprolactone triacrylate (PCL-Ac).

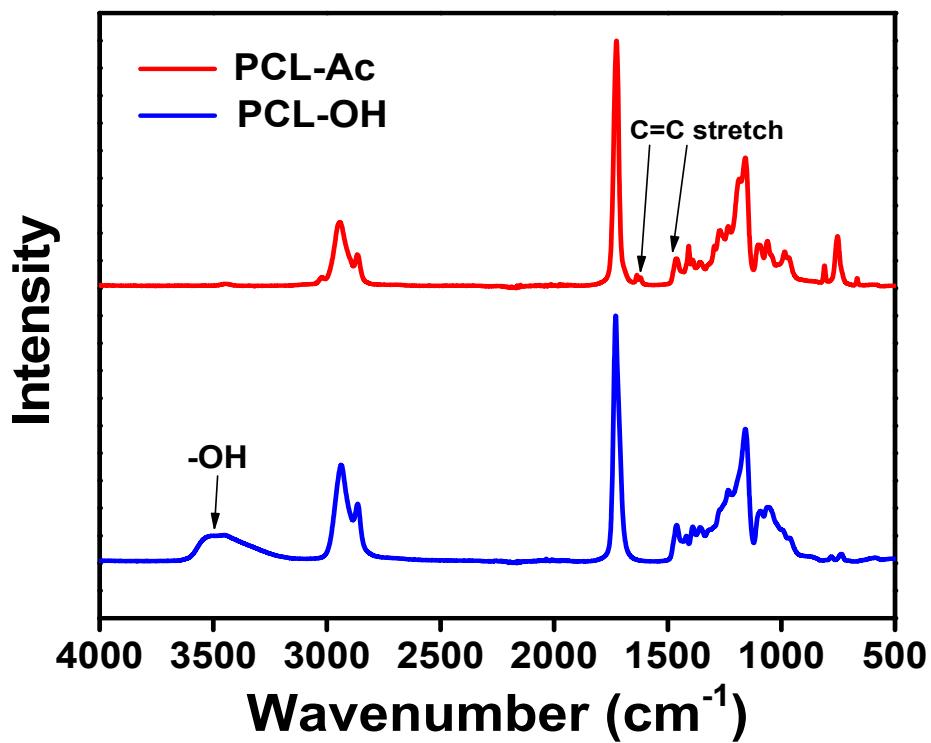


Figure S2. FT-IR spectra of polycaprolactone triol (PCL-OH) and polycaprolactone triacrylate (PCL-Ac).

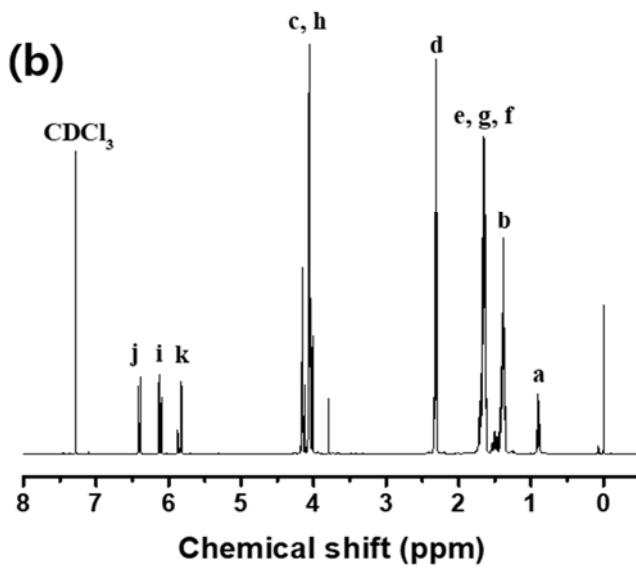
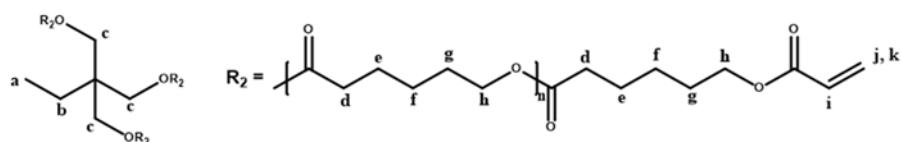
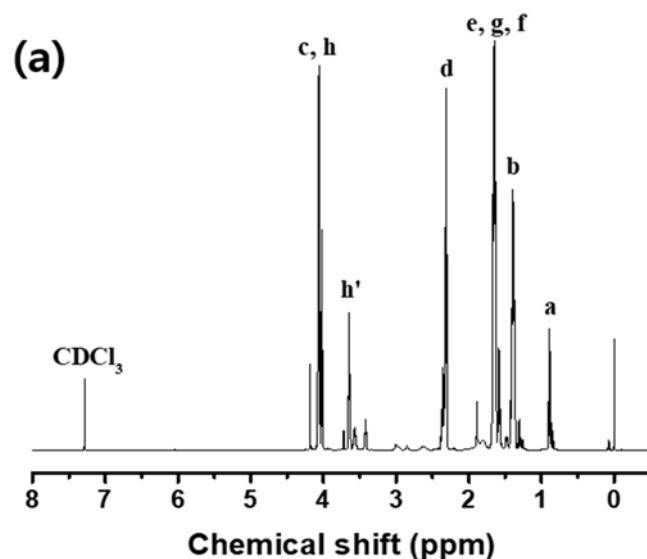
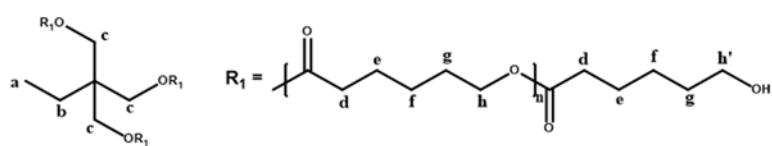


Figure S3. ¹H NMR spectra of (a) polycaprolactone triol (PCL-OH) and (b) polycaprolactone triacrylate (PCL-Ac).

Table S1. Relative intensities of carbonyl groups in liquid electrolyte and QSE.

Electrolyte	Carbonate C=O	Carbonate C=O···Li ⁺	Ester C=O	Ester C=O···Li ⁺
Liquid electrolyte	L 1.5	54.9	45.1	-
	L 3.0	32.1	67.9	-
	L 4.5	28.7	71.3	-
Quasi-solid- state electrolyte	L 5.4	27.6	72.4	-
	Q 1.5	54.0	46.0	46.9
	Q 3.0	33.4	66.6	38.6
	Q 4.5	30.5	69.5	36.4
	Q 5.4	29.9	70.1	35.4
				64.6

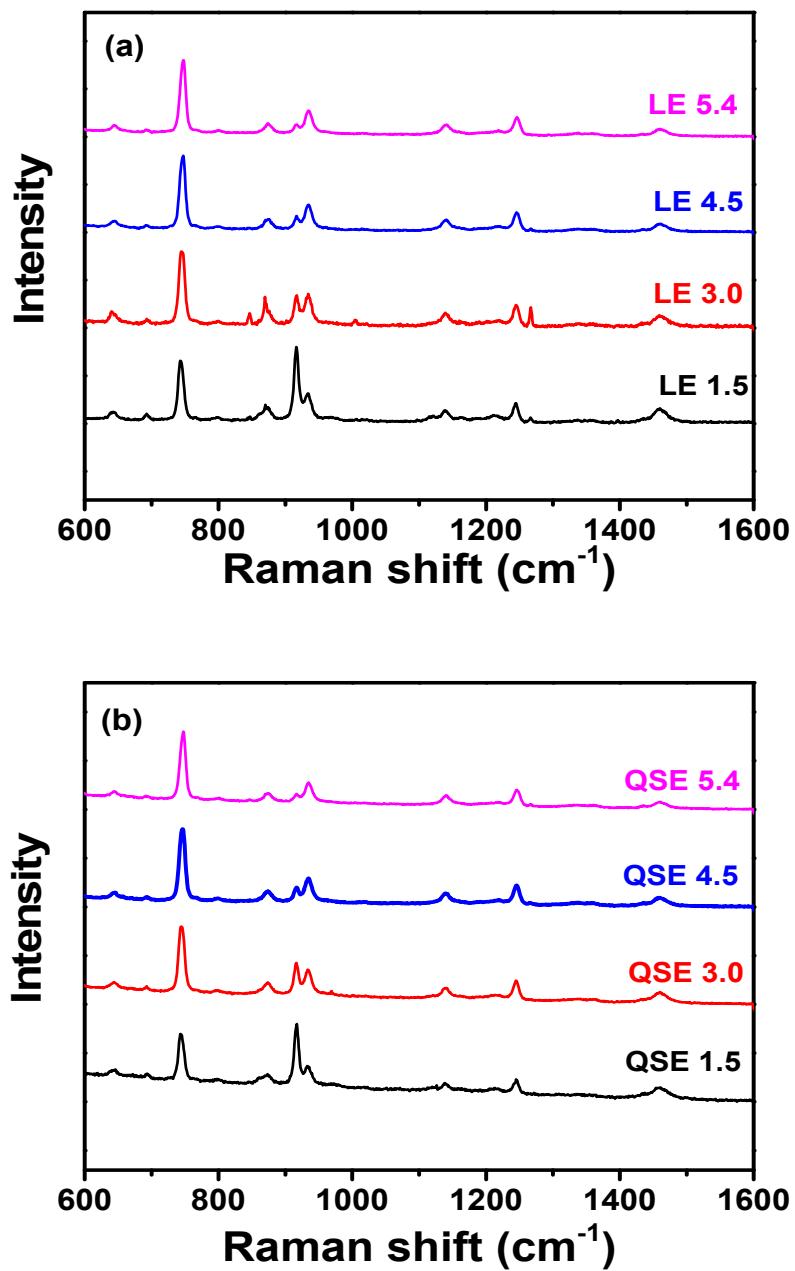


Figure S4. Raman spectra of (a) liquid electrolytes and (b) QSEs with different lithium salt content.

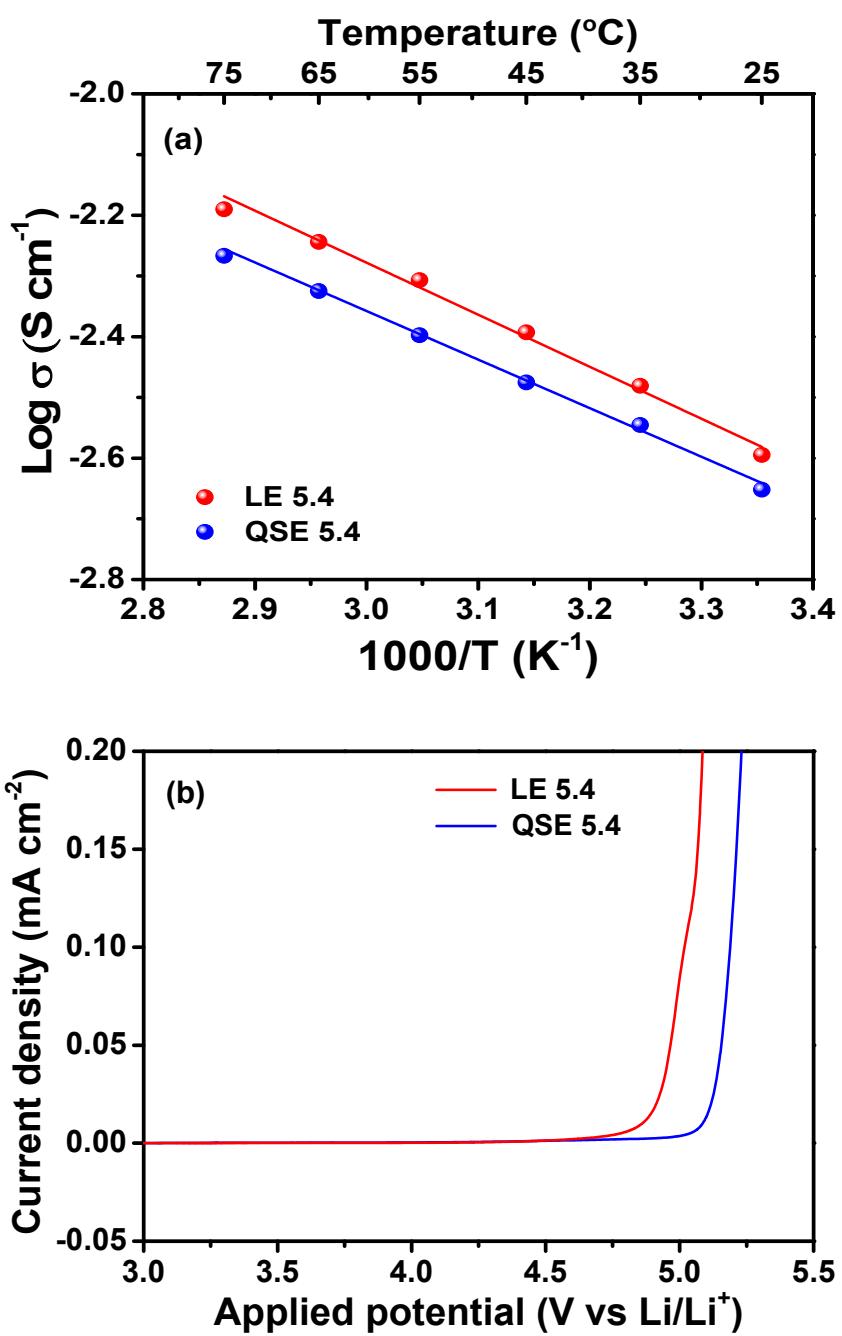


Figure S5. (a) Temperature dependence of ionic conductivity and (b) linear sweep voltammograms of liquid electrolyte (LE 5.4) and quasi-solid-state electrolyte (QSE 5.4) prepared with C1S9.

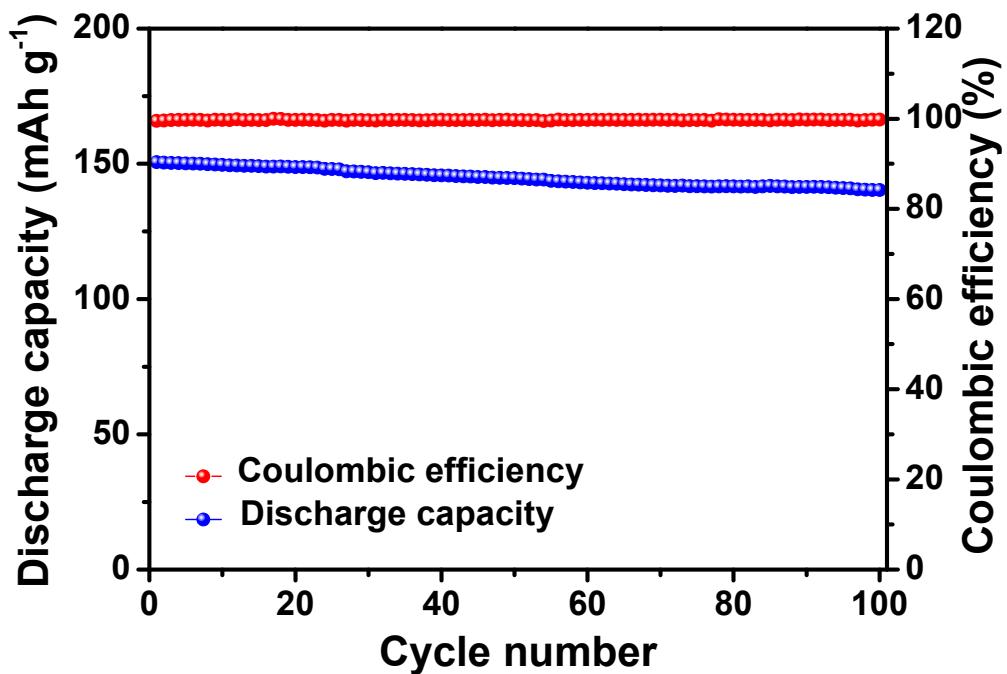


Figure S6. Cycling performance of the Li/LiNi_{0.6}Co_{0.2}Mn_{0.2}O₂ cell assembled with liquid electrolyte at 25 °C.

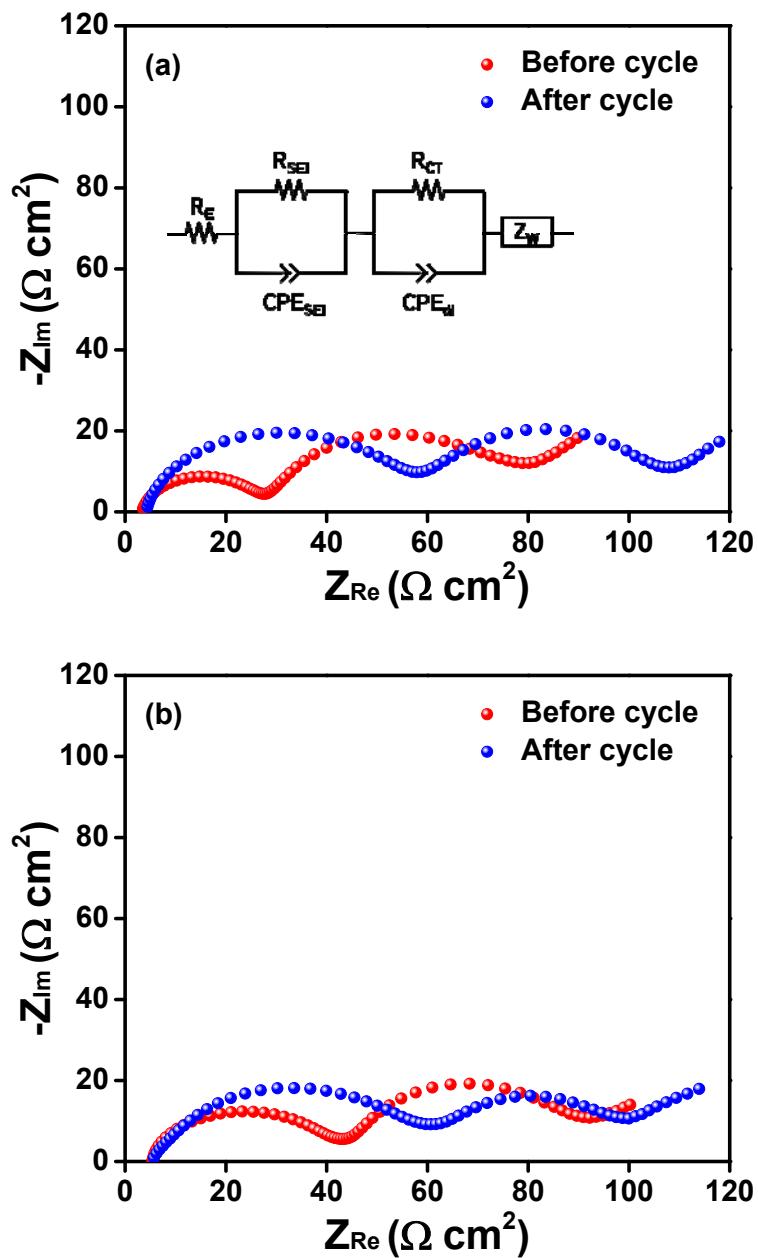


Figure S7. AC impedance spectra of the Li/LiNi_{0.6}Co_{0.2}Mn_{0.2}O₂ cells assembled with (a) liquid electrolyte and (b) QSE before and after 100 cycles.

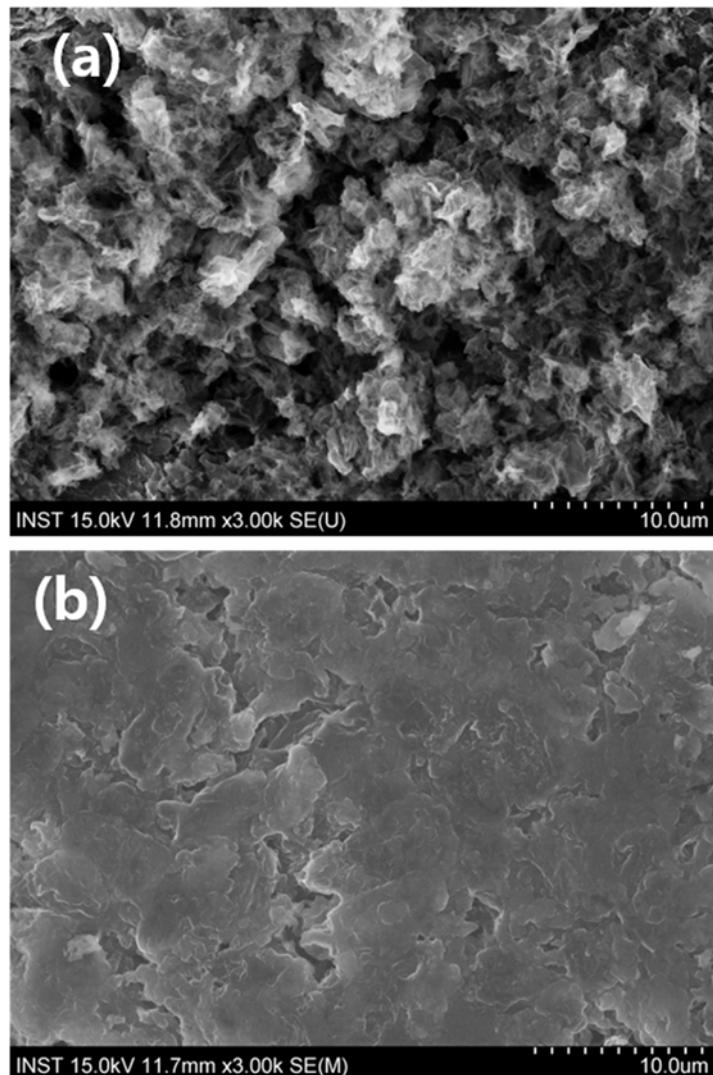


Figure S8. SEM images of lithium electrodes disassembled from the Li/LiNi_{0.6}Co_{0.2}Mn_{0.2}O₂ cells with (a) liquid electrolyte and (b) QSE after 100 cycles.



Figure S9. Photographs of (a) liquid electrolyte and (b) QSE during flammability test. Left: during ignition with a flame source, right : after removing the flame source.

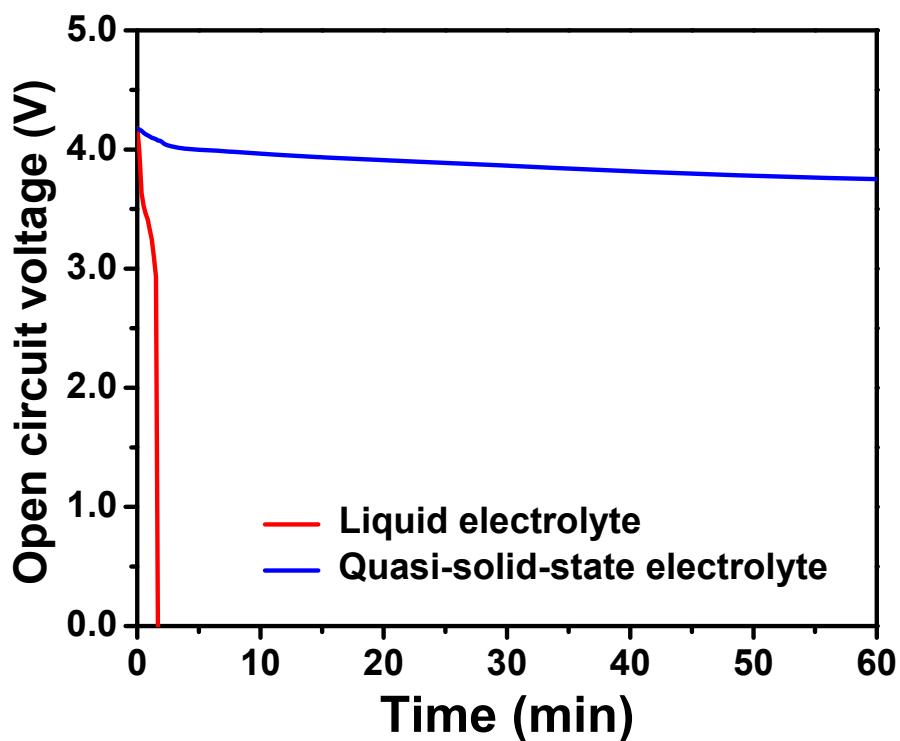


Figure S10. Variation of open circuit voltage of the charged Li/LiNi_{0.6}Co_{0.2}Mn_{0.2}O₂ cells assembled with liquid electrolyte and QSE at 150 °C for 1 h.

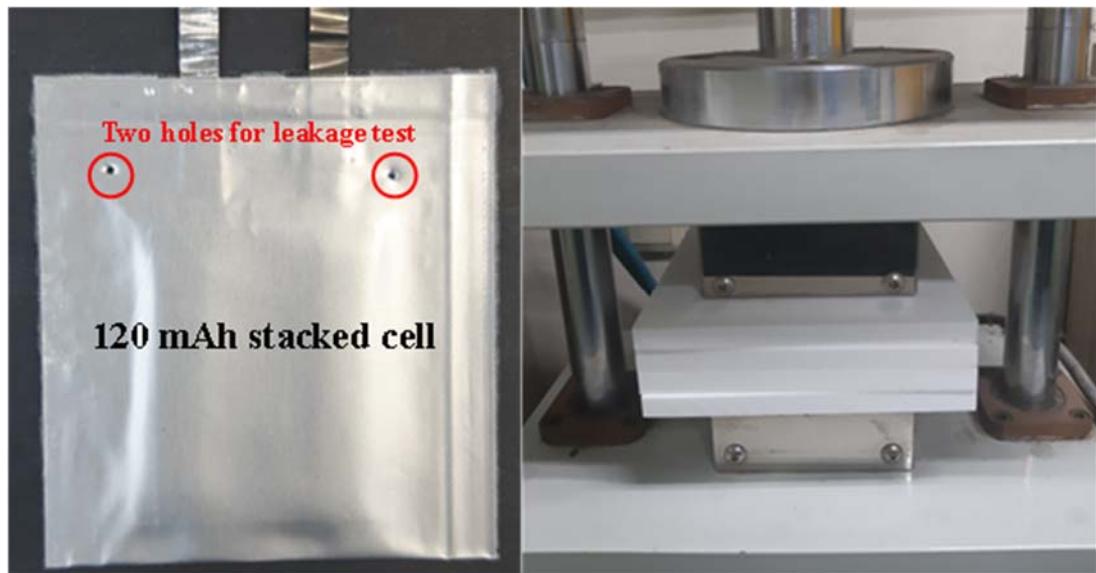


Figure S11. Leakage test of the 120 mAh-pouch cell under a constant load of 1 kgf cm^{-2} for 30 s.