Electronic Supplementary Material (ESI) for Journal of Materials Chemistry A.

Tape-cast Ce-substituted $Li_7La_3Zr_2O_{12}$ Electrolyte for Improving Electrochemical Performance of Solid-State Lithium Batteries

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Table S1. Chemical composition of LLZO, LGLZO, and various LLZCO samples examined using ICP-MS.

Sample	Chemical formula	Li	La	Zr	Ce	Ga
LLZO	$Li_7La_3Zr_2O_{12}$	5.16	3.000	1.97	NA	NA
LGLZO	$Li_{6.25}Ga_{0.25}La_3Zr_2O_{12}$	4.18	3.000	2.00	NA	0.28
LLZCO-0.05	$Li_7La_3Zr_{1.95}Ce_{0.05}O_{12}$	4.99	3.000	1.96	0.050	NA
LLZCO-0.10	$Li_7La_3Zr_{1.90}Ce_{0.10}O_{12}$	5.02	3.000	1.90	0.095	NA
LLZCO-0.15	$Li_7La_3Zr_{1.85}Ce_{0.15}O_{12}$	5.02	3.000	1.84	0.145	NA

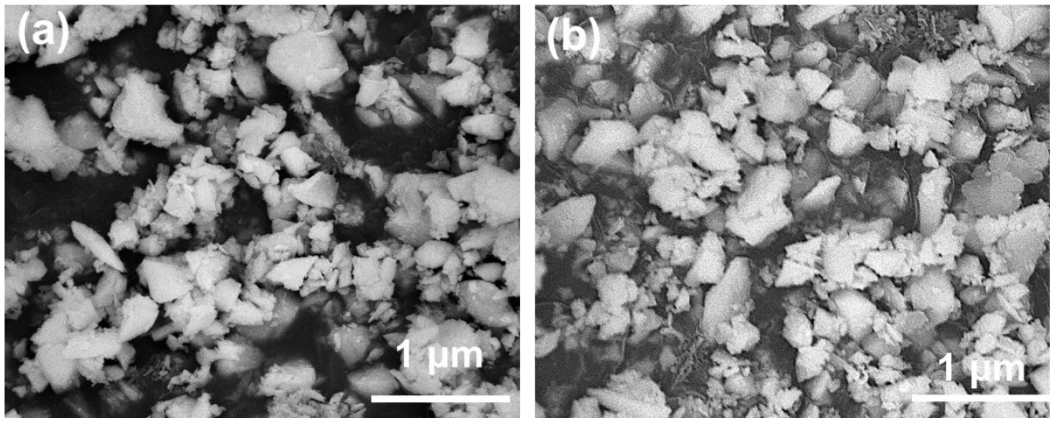

Fig. S1. SEM images of (a) LLZCO-0.05 and (b) LLZCO-0.15 samples.

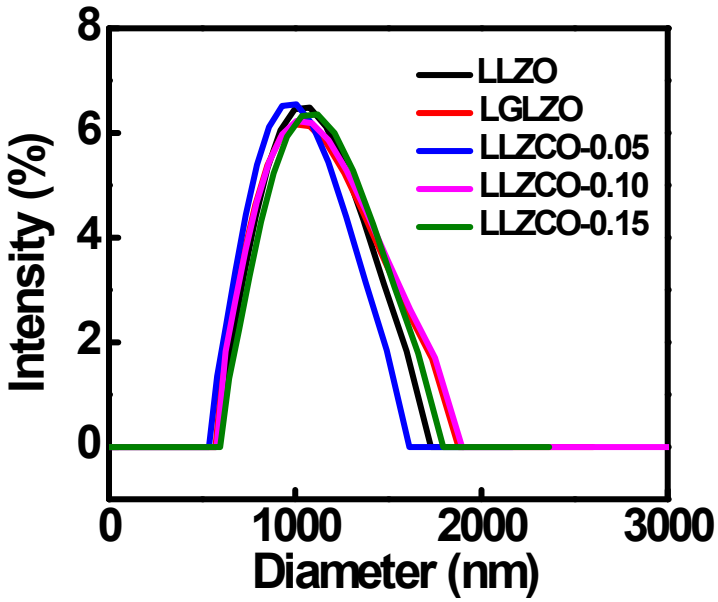

Fig. S2. DLS data of LLZO, LGLZO, and various LLZCO samples.

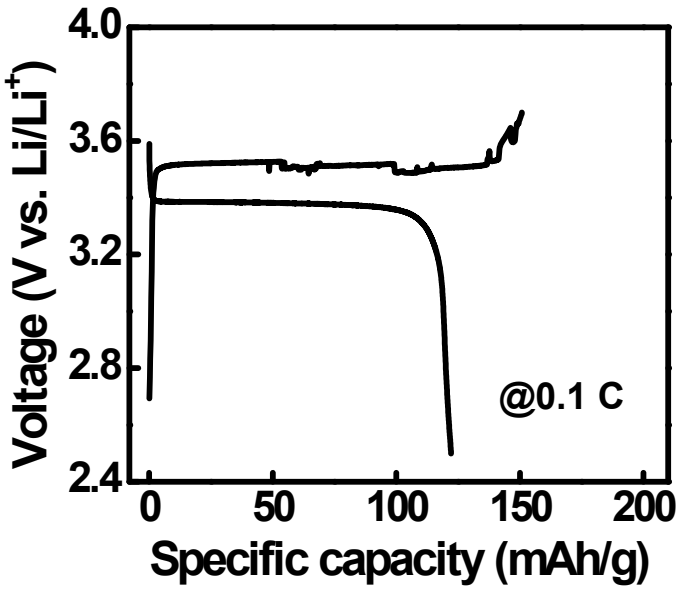

Fig. S3. Charge-discharge curves of Li//CSE//LFP cell with 25 wt.% LGLZO and EO/Li^+ molar ratio of 5 in CSE.

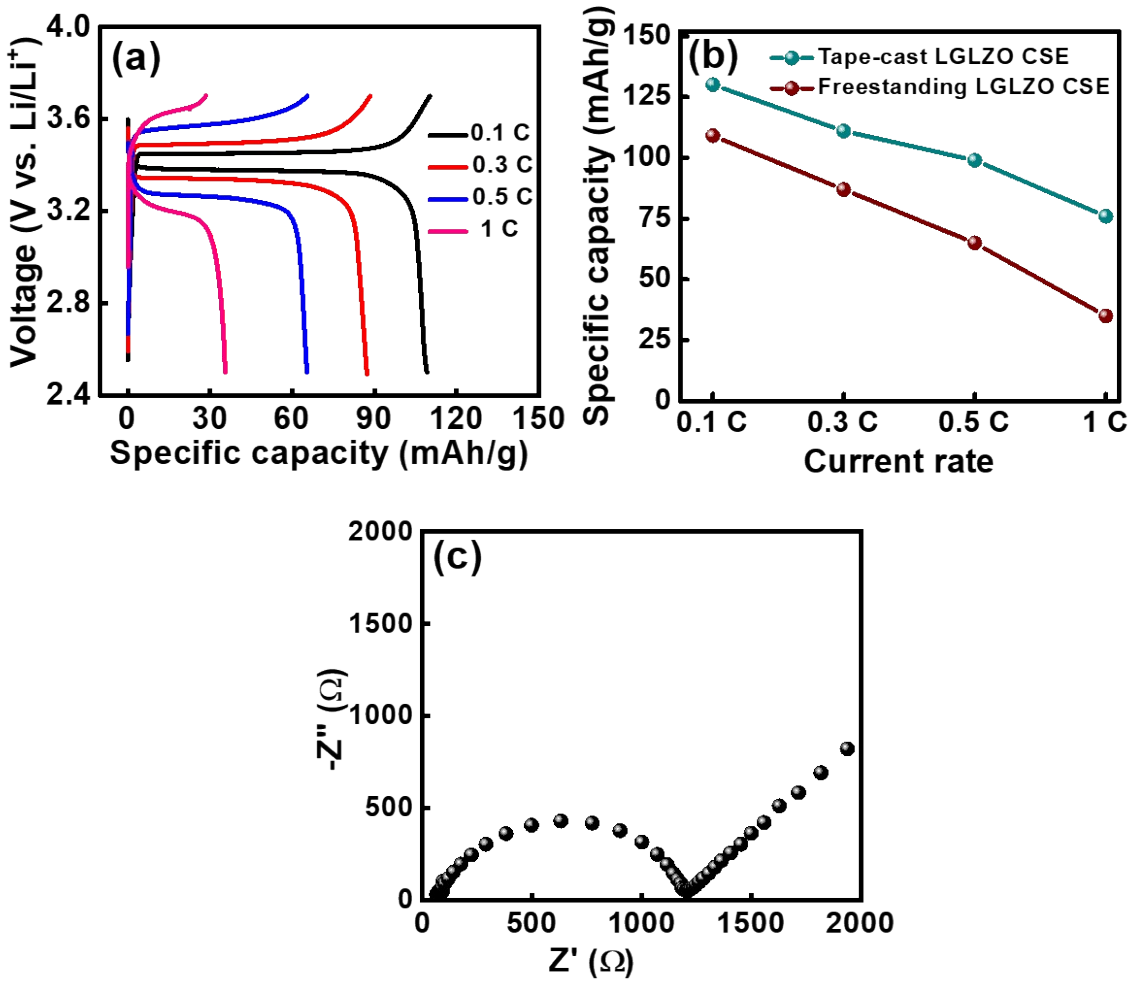

Fig. S4. (a) Charge-discharge curves of Li//LFP cell assembled with freestanding CSE. (b) Comparative rate performance of Li//LFP cells with freestanding and tape-cast CSE layers. (c) EIS spectra of Li//LFP cell assembled with freestanding CSE.

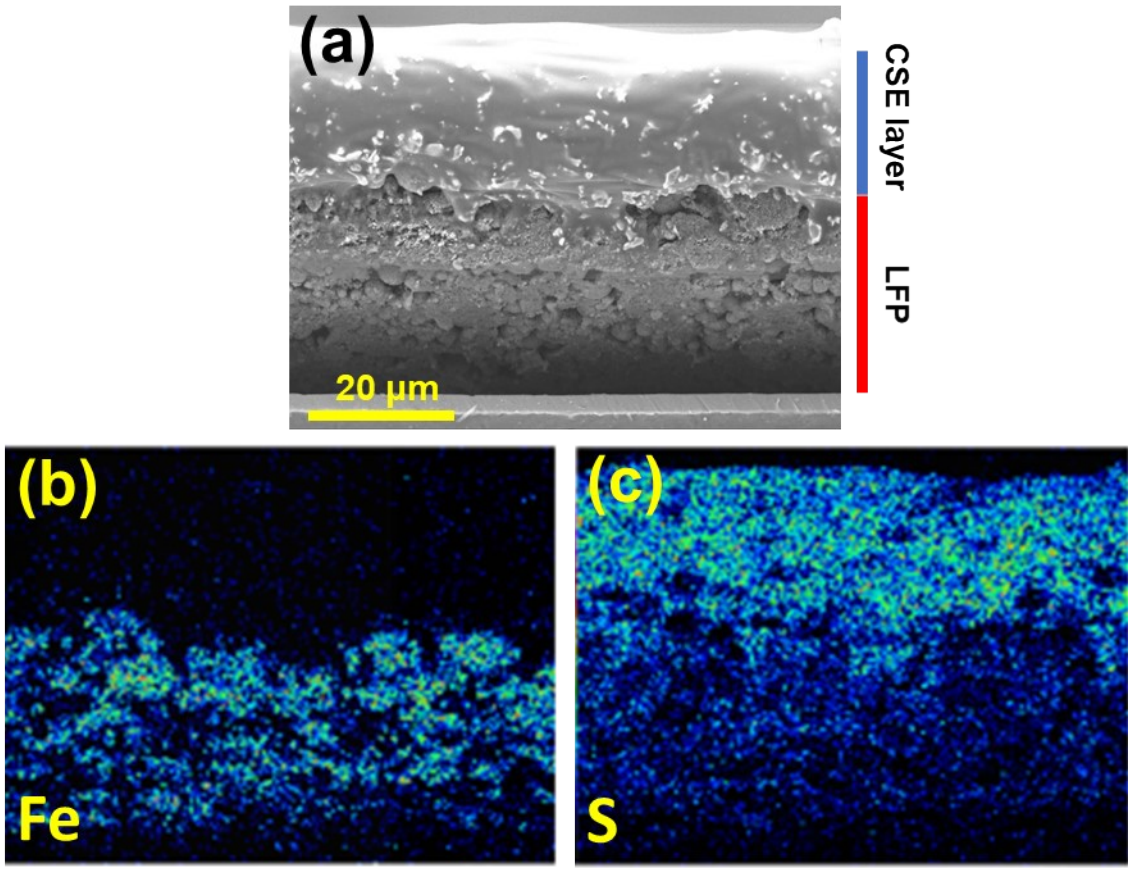

Fig. S5. (a) Cross-sectional SEM image of tape-cast CSE on LFP cathode. (b) The corresponding EDS Fe and S mapping in the same region.

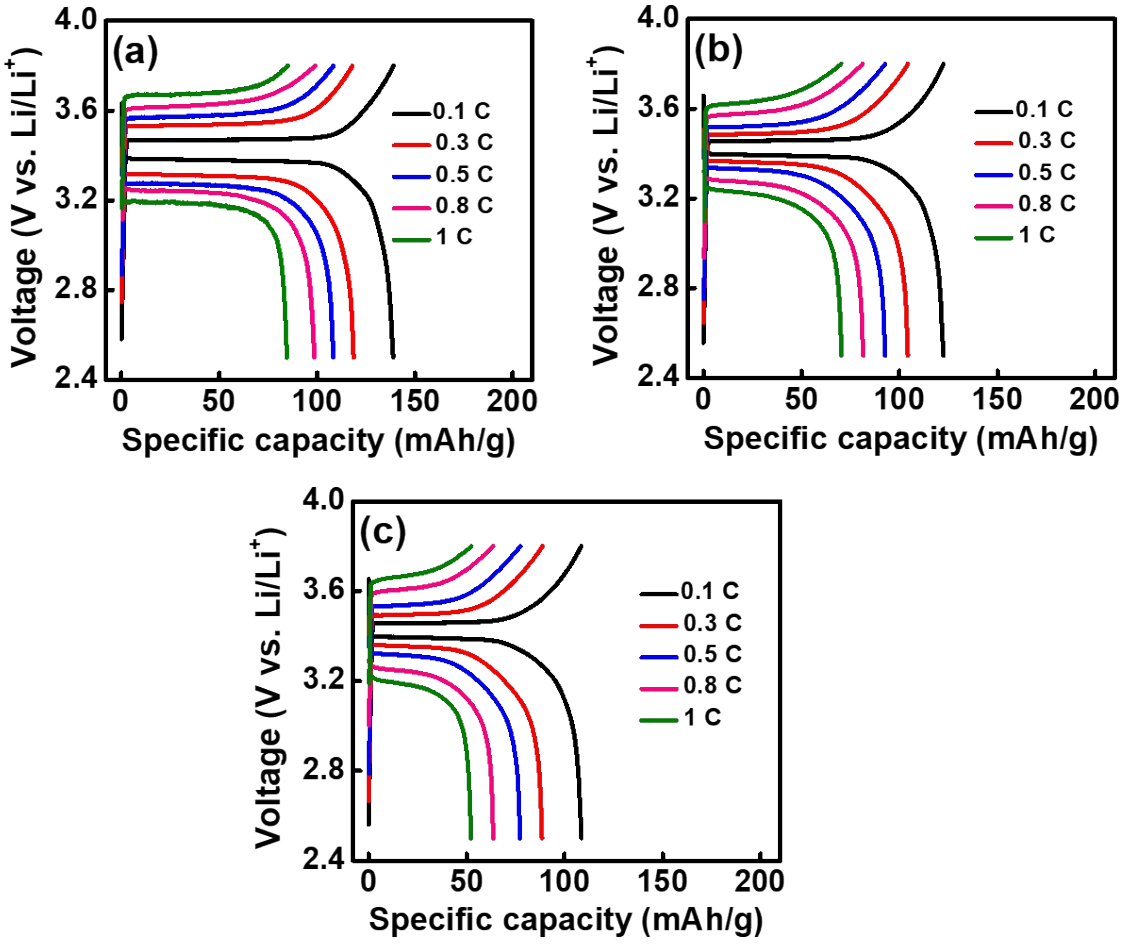

Fig. S6. Charge-discharge curves of Li//CSE (with EO/Li^+ = 10 and 35 wt.% LGLZO)//LFP cell with CSE thickness of (a) 20, (b) 50, and (c) 80 µm.

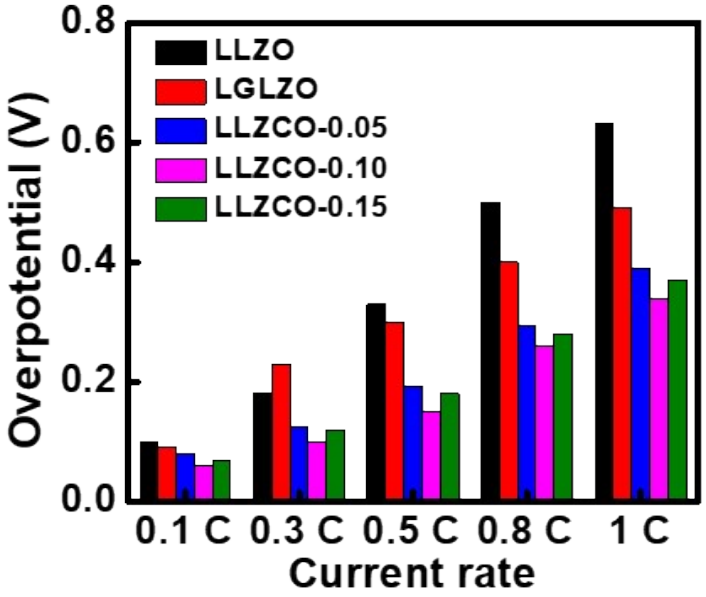

Fig. S7. Overpotential derived from charge-discharge curves (in **Fig. 7**) of Li//CSE//LFP cells with various CSEs.

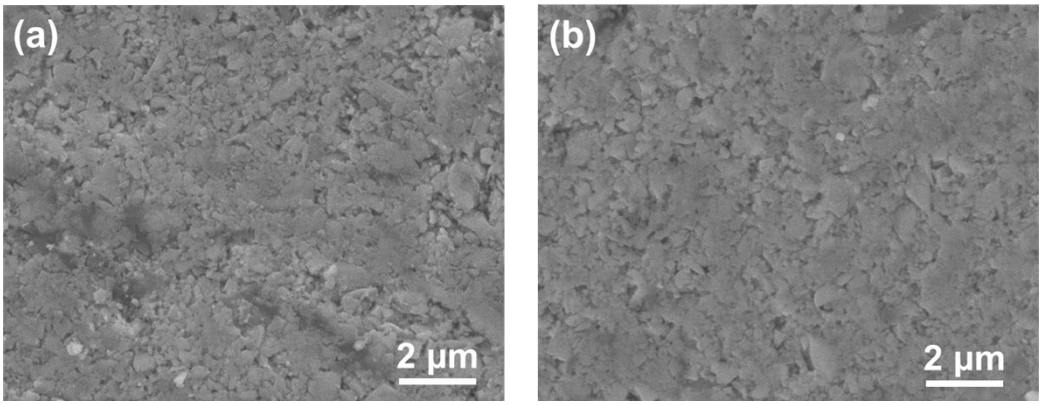

Fig. S8. SEM images of (a) LLZO (b) LLZCO-0.10 pellets after Li contact for 48 hours at 70 °C.

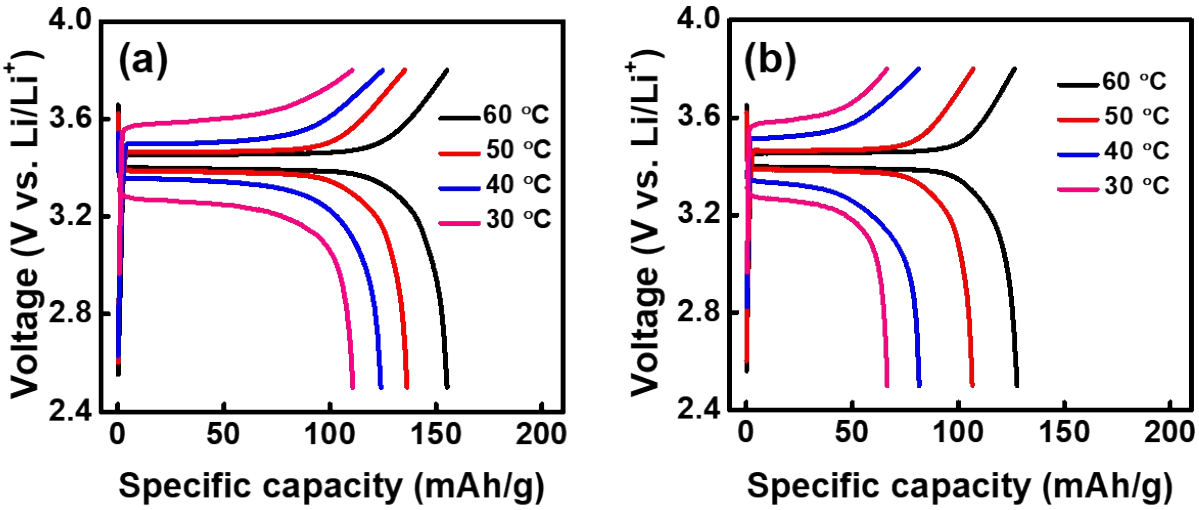

Fig. S9. Charge-discharge curves of Li//LLZCO-0.10 CSE//LFP cell measured at (a) 0.1 C and (b) 0.5 C at various temperatures.