Electronic Supplementary Material (ESI) for Polymer Chemistry.
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Supporting Information

Ionic Liquid Crystal-based Solid Polymer Electrolyte with Desirable Ion-conducting Channels for Superior Performance Ambient-temperature Lithium Batteries

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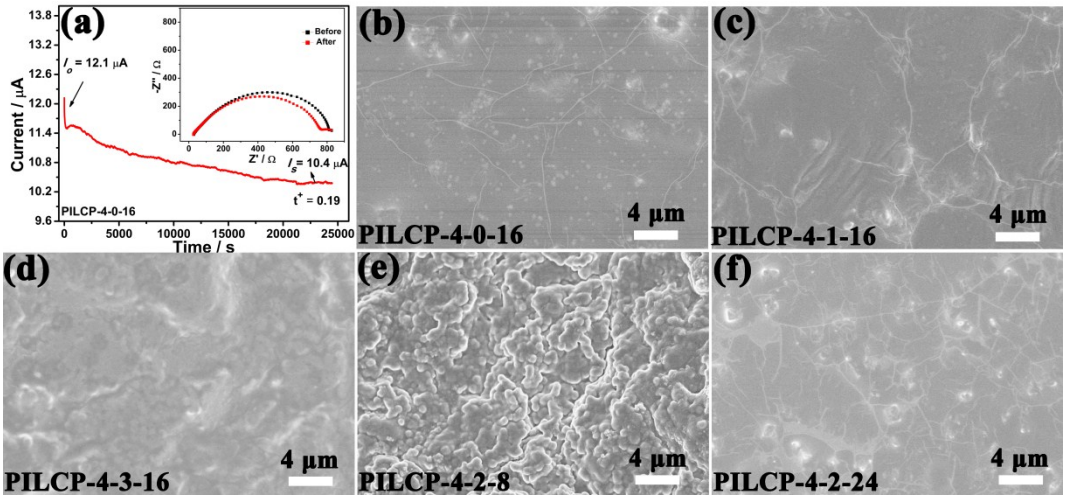

Figure S1. (a) The chronoamperometry of Li/PILCP-4-0-16/Li cell at a potential step of 10 mV (60 °C) (the insets show the AC impedance spectra before and after polarization at 60 °C). (b), (c), (d), (e) and (f) show the SEM images of corresponding ILC-based electrolytes, respectively.

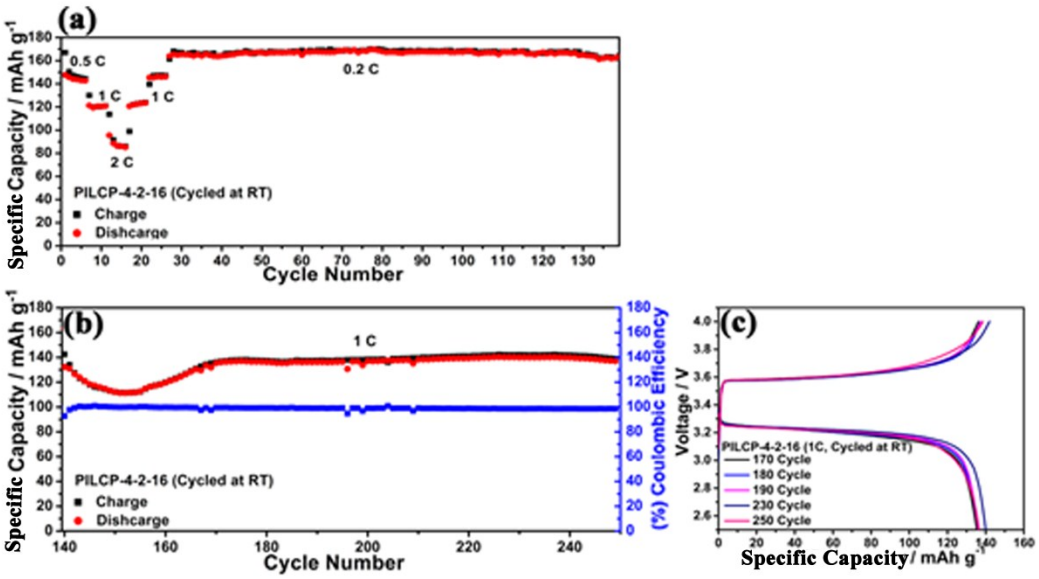

Figure S2. (a) The cycle performance of the LFP/PILCP-4-2-16/Li battery during galvanostatic cycling at 0.2, 0.5, 1 and 2 C. (b) Long cycle performance at 1 C for the solid-state LFP-based cell after the cell cycled at different current density (continuation of Figure S2a). (c) charge and discharge curves of the LFP/PILCP-4-2-16/Li cell at different cycles at 1C. The experiment was conducted at RT.

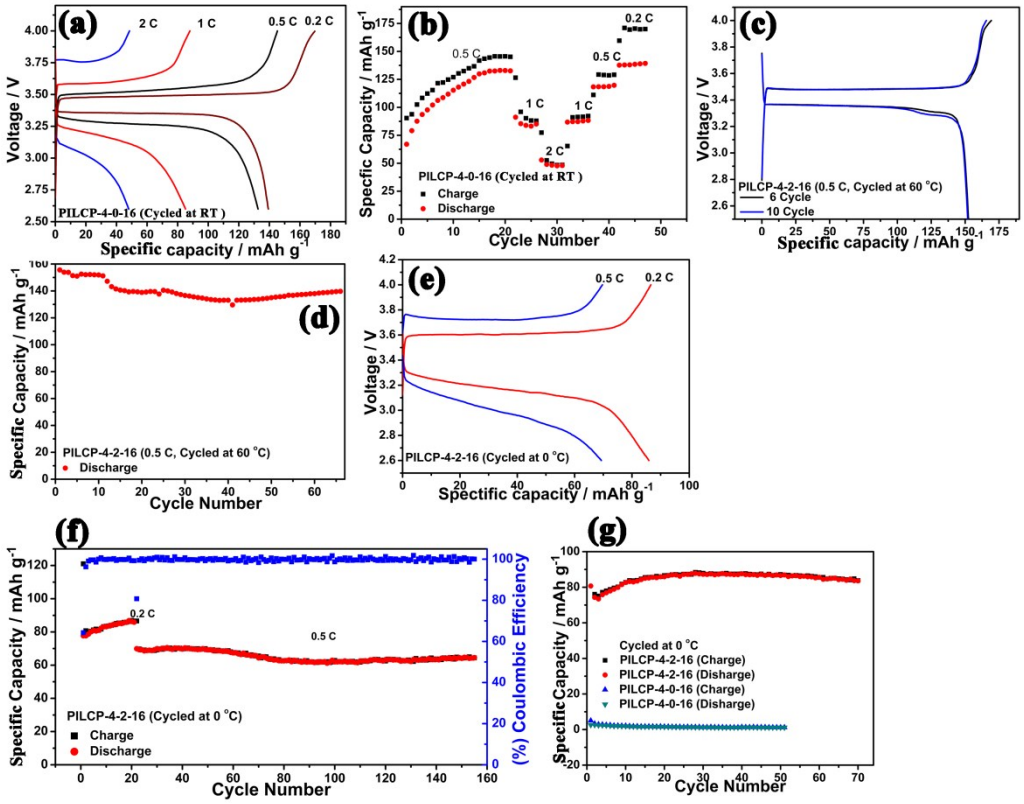

Figure S3. (a) Charge/discharge curves of LFP/PILCP-4-0-16/Li cell at different C-rates at RT. (b) The cycle performance of the Li/PILCP-4-0-16/LFP battery during galvanostatic cycling at 0.2, 0.5, 1 and 2 C at RT. (c) Charge/discharge curves of LFP/PILCP-4-2-16/Li cell at 0.5 C at 60 ^{o}C. (d) Cycle performance at 0.5 C for the solid-state LFP/Li cell based on PILCP-4-2-16 (cycled at 60 ^{o}C). (e) Charge/discharge curves of LFP/PILCP-4-2-16/Li cell at different C-rates (cycled at 0 ^{o}C). (f) The cycle performance of the Li/PILCP-4-2-16/LFP cell during galvanostatic cycling at 0.2 and 0.5 C (cycled at 0 ^{o}C), the coulombic efficiency is close to 100% in the whole cycling (155 cycles). (g) The cycle performance of the Li/PILCP-4-0-16/LFP and Li/PILCP-4-2-16/LFP cells during galvanostatic cycling at 0.2 C (cycled at 0 ^{o}C).

Table S1. the VTF fitting-papameters of ILC-based SSEs.

Samples	A (S^{-1} cm^{-1} $K^{-1/2}$)	E_a (kJ mol^{-1})	T_o (K)
PILCP-4-0-16	5.29	7.32	166.22
PILCP-4-1-16	16.34	8.57	161.46
PILCP-4-2-16	2.65	6.68	165.89
PILCP-4-3-16	15.99	9.27	164.58
PILCP-4-2-8	9.48	9.30	168.10
PILCP-4-2-24	32	9.53	163.63