

Electronic Supplementary Information for
Single Lithium-Ion Polymer Electrolytes Based on Poly (ionic
liquid)s for Lithium-Ion Batteries

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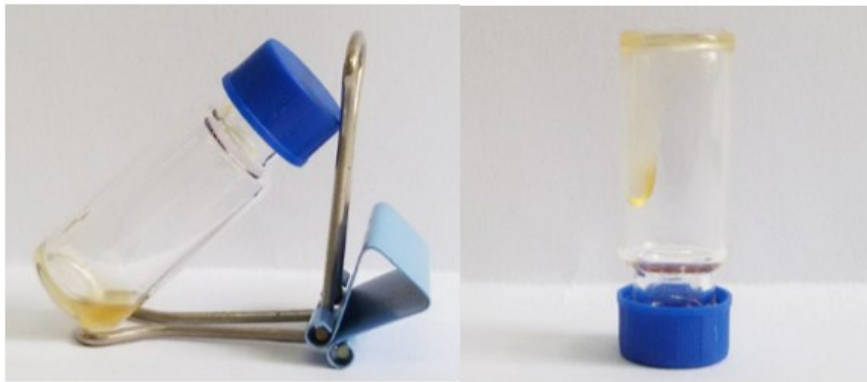


Figure S1. The photograph of the obtained PIL [LiSTFSI][VIPS].

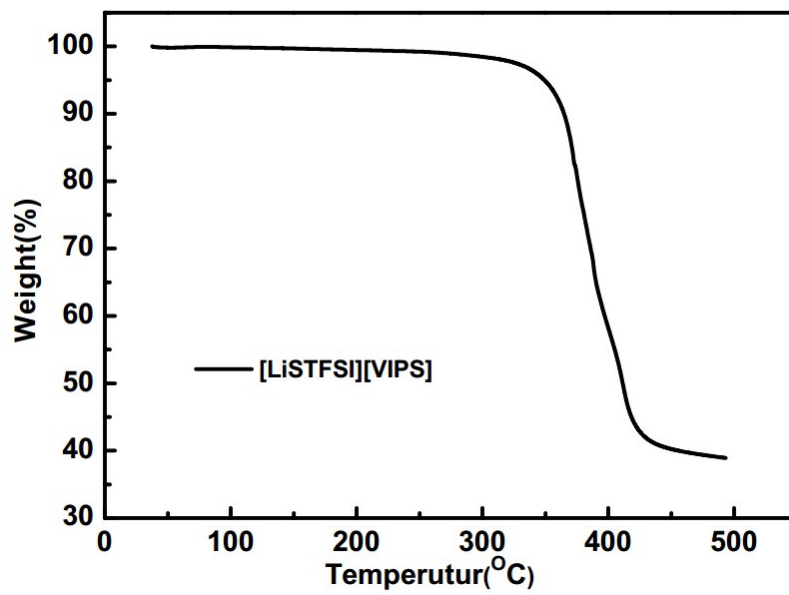


Figure S2. TGA traces measured under N₂ for [LiSTFSI][VIPS].

Table S1. Sample Composition in weight for SIPEs^a

| Sample | LiSTFSI-VIPS(wt) | PEGM (wt) | PEGDM (wt) | PC (wt) |
|--------|------------------|-----------|------------|---------|
| SIPE1 | 5 | 60 | 5 | 30 |
| SIPE2 | 10 | 55 | 5 | 30 |
| SIPE3 | 20 | 45 | 5 | 30 |
| SIPE4 | 5 | 50 | 5 | 40 |
| SIPE5 | 10 | 45 | 5 | 40 |
| SIPE6 | 15 | 40 | 5 | 40 |
| SIPE7 | 5 | 40 | 5 | 50 |
| SIPE8 | 10 | 35 | 5 | 50 |
| SIPE9 | 15 | 30 | 5 | 50 |

^a 1173 0.5% w/w of the monomers

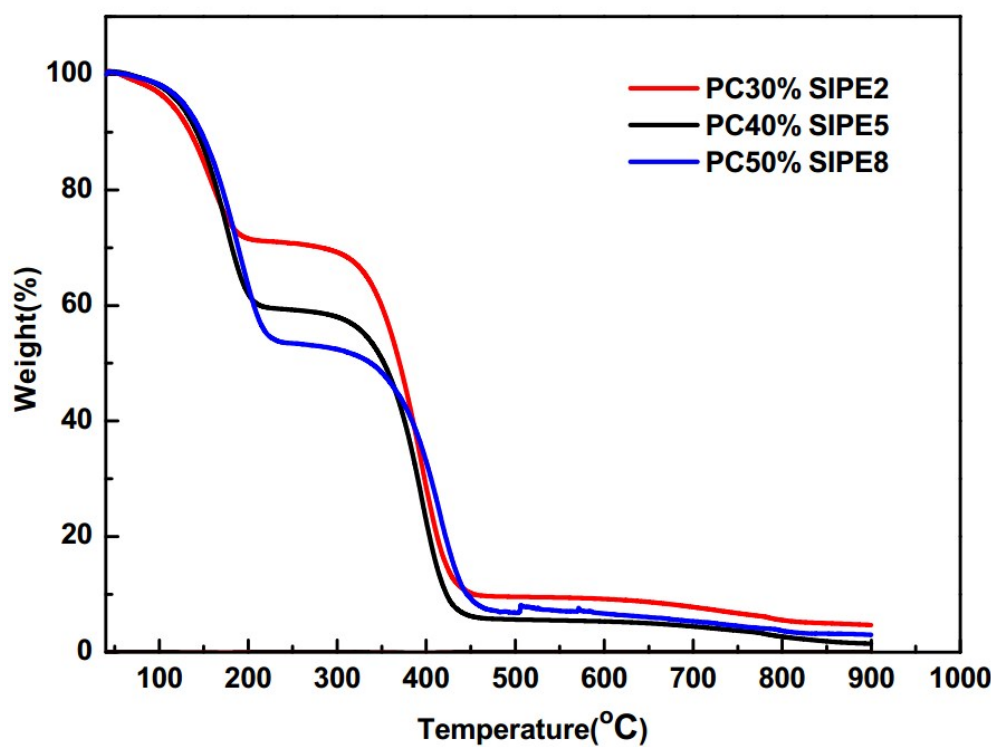


Figure S3. TGA traces measured under N₂ for SIPE (2, 5, 8).

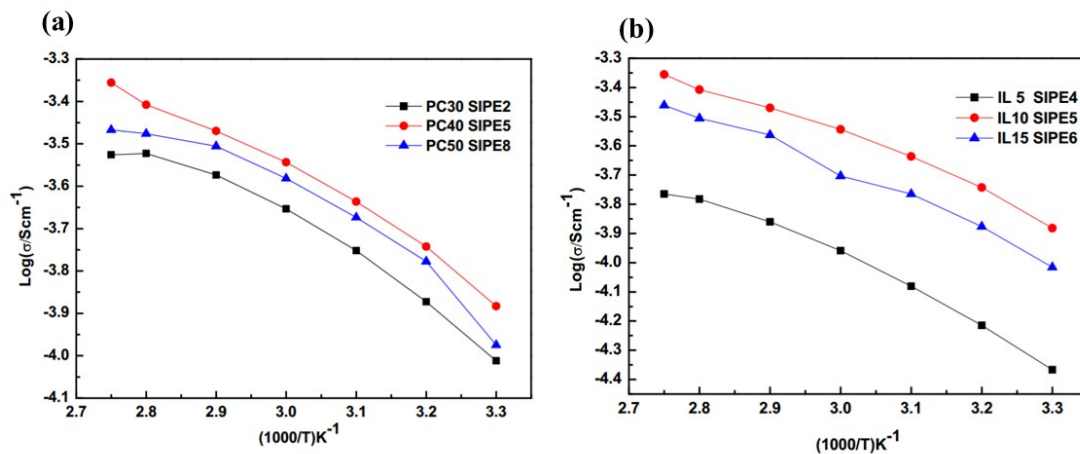


Figure S4. Ionic conductivities as a function of temperature indicating the effects of the contents of (a) PC(SIPE2,5,8) and (b) IL(SIPE4,5,6).

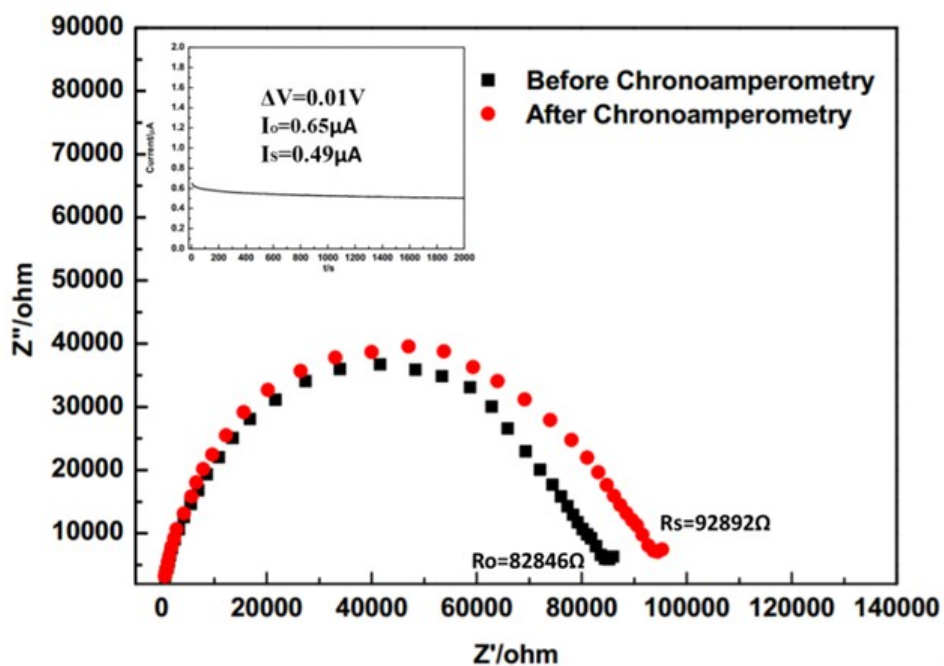


Figure S5. Impedance spectra before and after chronoamperometry for a Li symmetric cell with SIPE2 polymer electrolyte film; the inset is the time-dependence response of DC polarization.

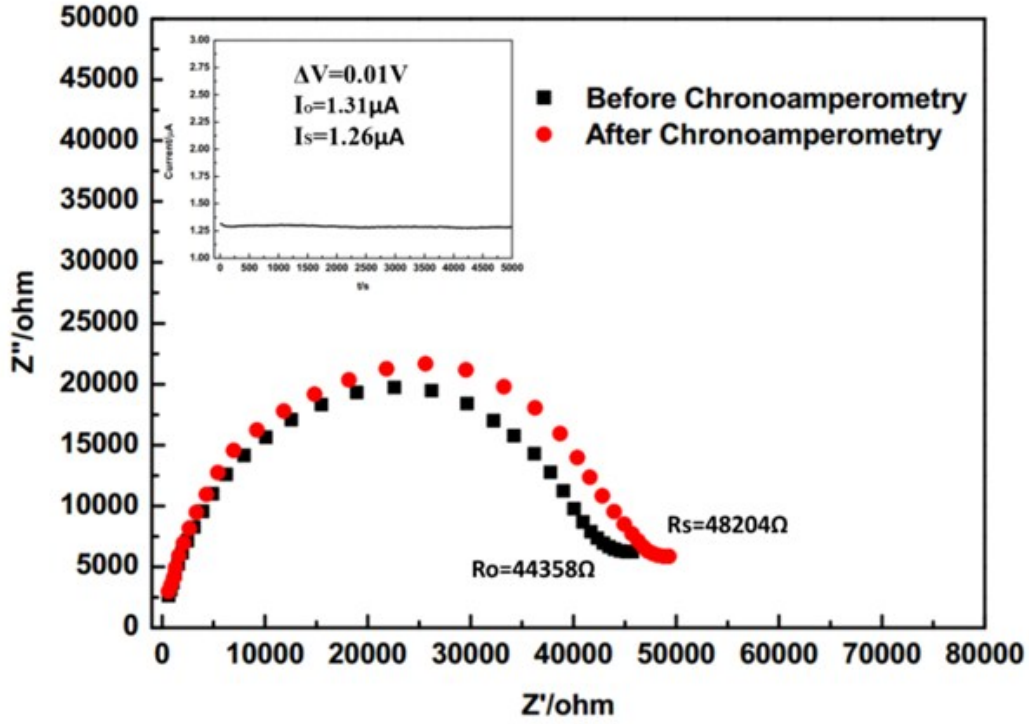


Figure S6. Impedance spectra before and after chronoamperometry for a Li symmetric cell with SIPE5 polymer electrolyte film; the inset is the time-dependence response of DC polarization.

Table S2. Values of the parameters in Equation S1 and the corresponding calculated values of lithium-ion transference number (t_{Li^+})

| Samples | I_0 (μA) | I_S (μA) | R_0 ($\text{K}\Omega$) | R_S ($\text{K}\Omega$) | ΔV (mV) | t_{Li^+} |
|---------|----------------------------|----------------------------|-------------------------------|-------------------------------|--------------------|------------|
| SIPE2 | 0.65 | 0.49 | 82.846 | 92.890 | 10 | 0.90 |
| SIPE5 | 1.31 | 1.26 | 44.358 | 48.204 | 10 | 0.91 |
| SIPE8 | 1.40 | 1.38 | 25.172 | 26.417 | 10 | 0.94 |

$$t_{Li^+} = \frac{I_s[\Delta V - I_0 R_0]}{I_0[\Delta V - I_s R_s]} \quad (\text{S1})$$

where I_0 and I_s are the initial and steady-state current determined by the DC

polarization, respectively; R_0 and R_s are the interface resistance measured by AC impedance before and after polarization; ΔV is the DV potential applied on the cell.

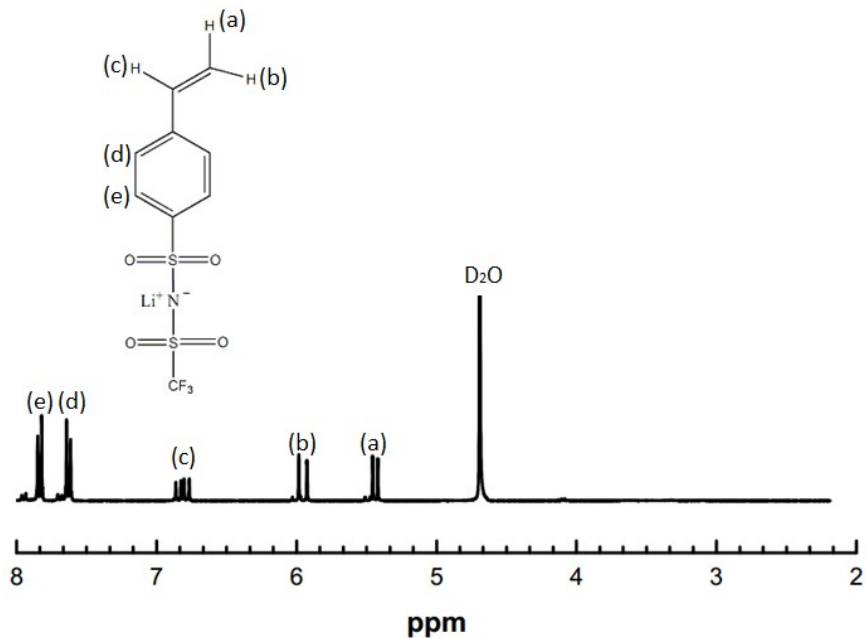


Figure S7. ^1H NMR spectra of LiSTFSI

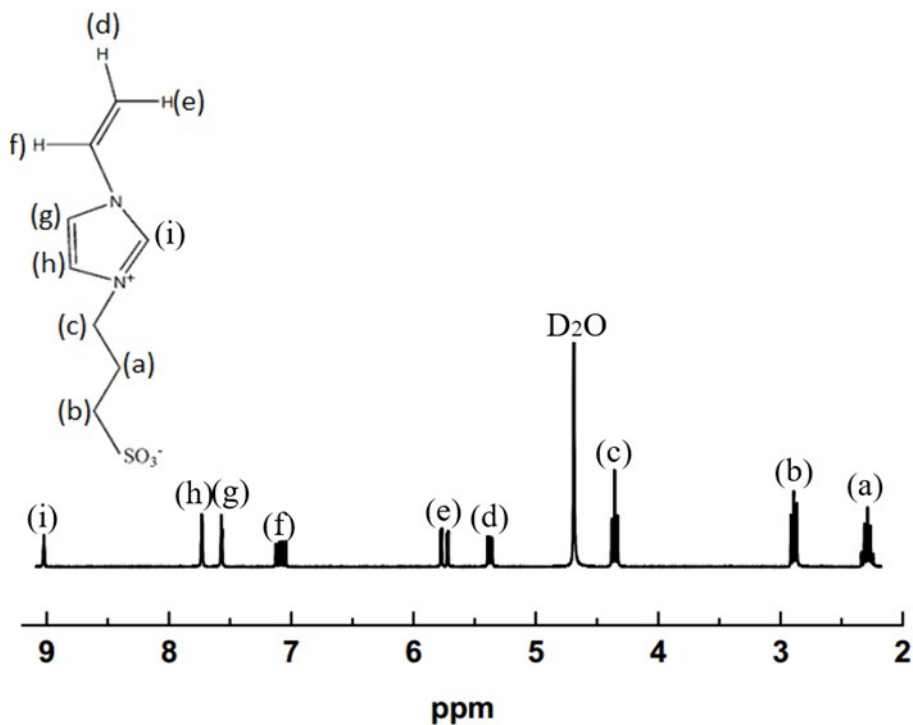


Figure S8. ^1H NMR spectra of VIPs

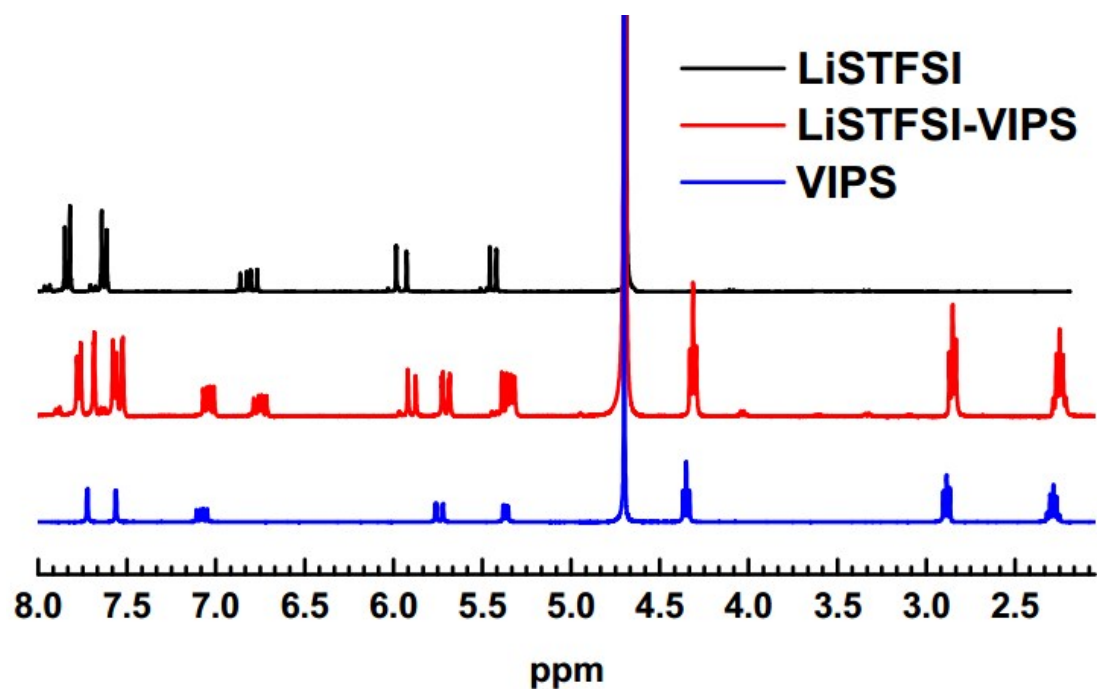


Figure S9. ¹H NMR spectra of LiSTFSI, VIPS, LiSTFSI-VIPS (n/n=1/1)