Supplementary materials

1．Conversion rate.

The molecular structural formula and ^{1}H NMR spectrum of 3-(trimethoxysilyl) propyl acrylate (TMSiPA) and poly (ethylene glycol) methyl ether acrylate (PEGMA) monomer are shown in Figure S1. It can be seen from the molecular structural formulas that three hydrogen atoms of the double bond are located on the main chain of acrylic acid for both monomers. Because of the similar chemical environment, the chemical shifts of these hydrogen atoms are basically consistent (δ=6.35, 6.20, 5.95). The characteristic peak which can be used to quantitatively calculate the content of TMSiPA is located at the chemical shift of 4.18, corresponding to the methylene group on the molecule. And the chemical shift of the characteristic peak of PEGMA is 3.24, corresponding to the methyl group on the molecule. The ^{1}H NMR spectra of TMSiPA and PEGMA random copolymer and synthesis process of triblock copolymer are shown in Figure S2. The chemical shifts of the characteristic peak of PEGMA and TMSiPA are marked by red and blue arrows respectively. In all spectra, the absence peak of hydrogen atom of the double bond indicates that monomers are completely reacted and the conversion rate reached 100%. The obvious peak at the chemical shift of 1.25 is belong to anhydrous ethanol, which is used as the solvent of the polymerization.

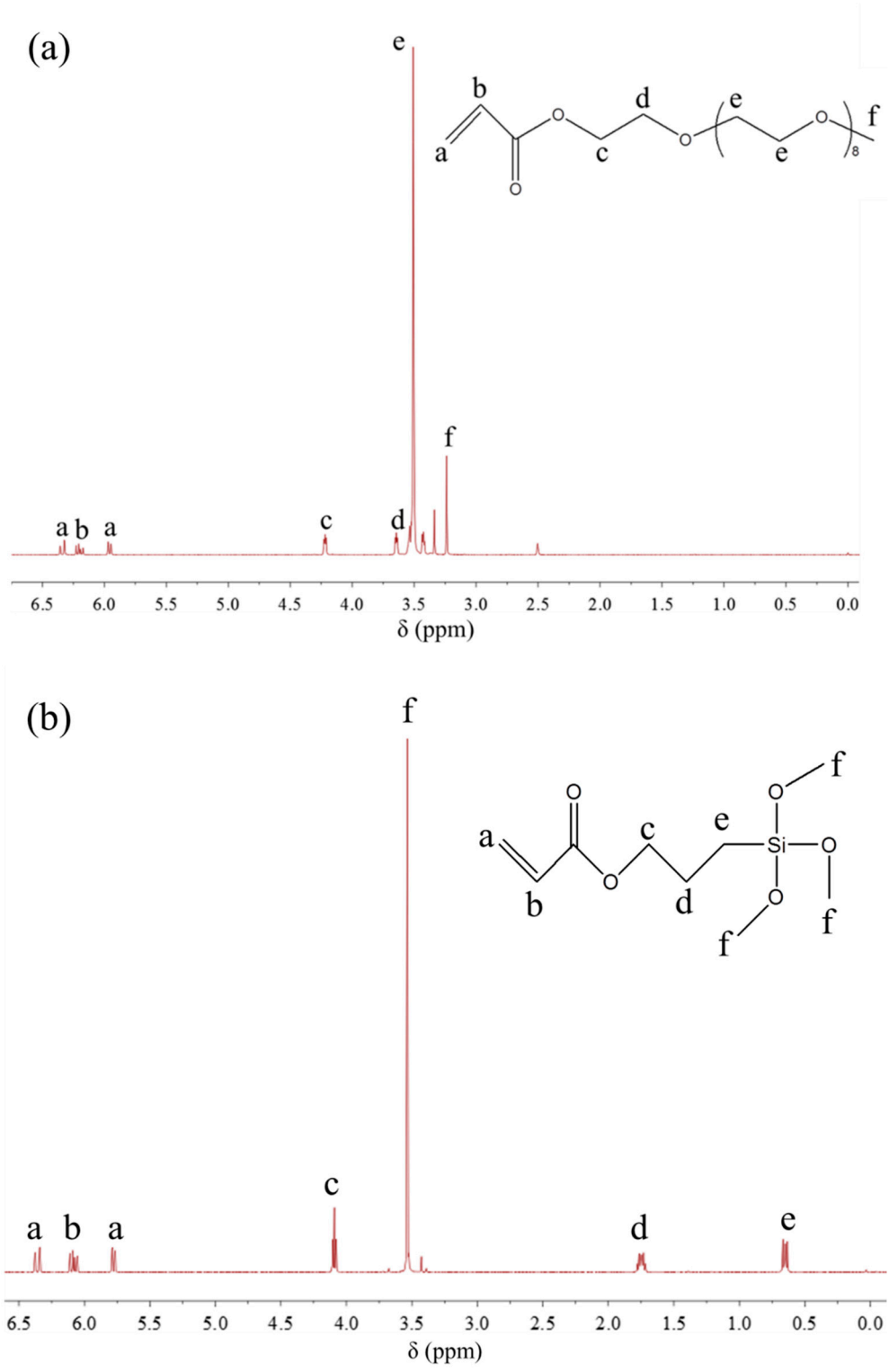
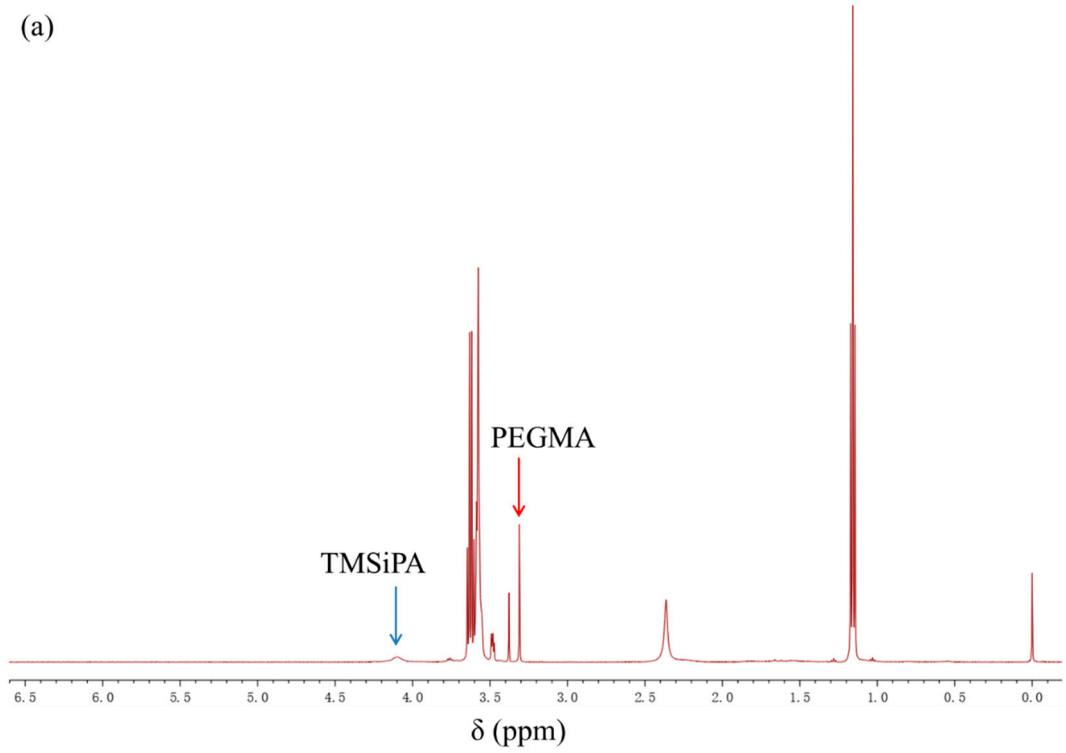
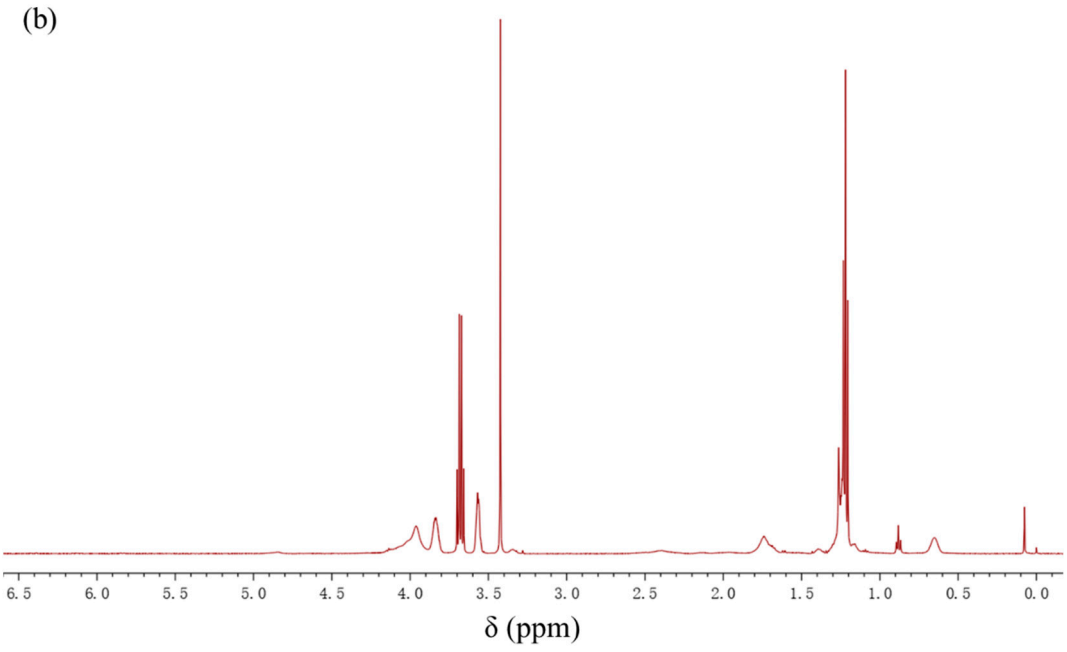


Figure S1. ^{1}H-NMR spectrum and molecular structural formula (inset) of (a) poly (ethylene glycol) methyl ether acrylate (PEGMA) and (b) 3-(trimethoxysilyl) propyl acrylate (TMSiPA).


(a)
PEGMA
TMSiPA
6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
δ (ppm)


(b)
6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
δ (ppm)

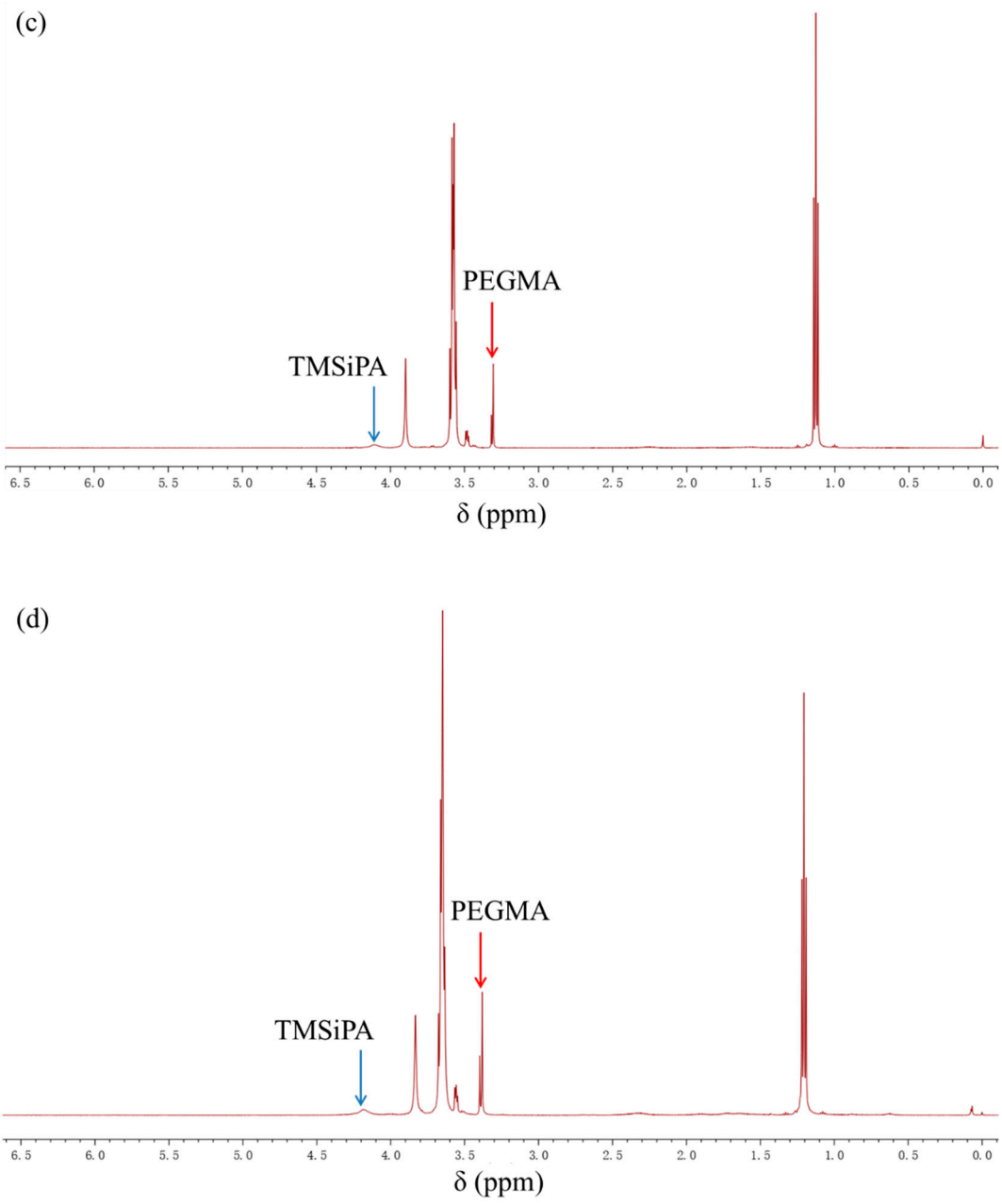


Figure S2. ^{1}H-NMR spectra of (a) poly (PEGMA-co-TMSiPA) random copolymer, (b) poly TMSiPA, (c) poly (TMSiPA-b-PEGMA), and (d) poly [TMSiPA-b-PEGMA-b-(TMSiPA-co-PEGMA)].

2．Linear viscoelastic region (LVR) scanning

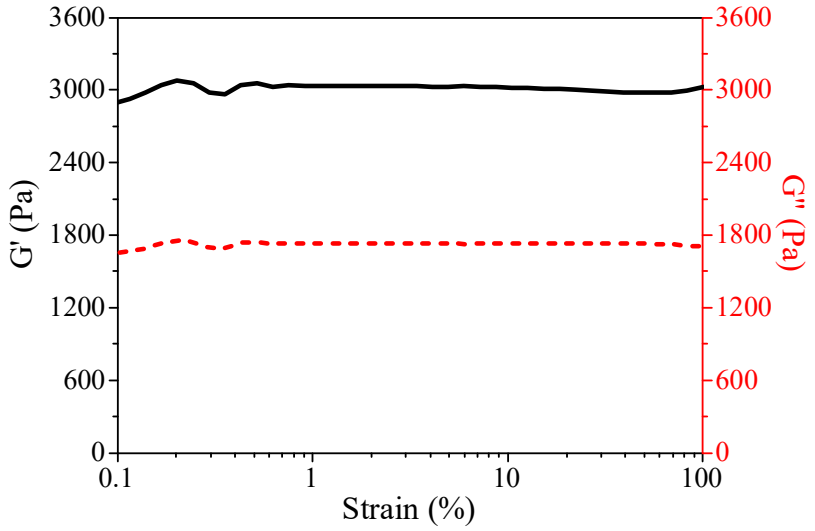


Figure S3. Linear viscoelastic region scanning of synthesized copolymer electrolyte. The test temperature was 60 ºC.

3. The DSC curve of PEGMA homopolymer.

It can be seen from the Figure S4 that the glass transition temperature (T_g) of PEGMA homopolymer is -71.2 ºC, the crystallization temperature is -50.1 ºC and the crystallization melting temperature is -4.1 ºC.

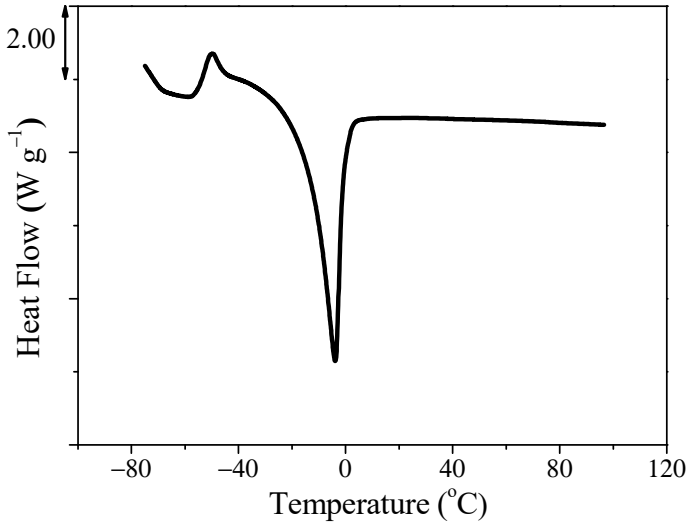


Figure S4. The DSC curve of PEGMA homopolymer.

4. The linear fitting curves of ln σ and 1000/T.

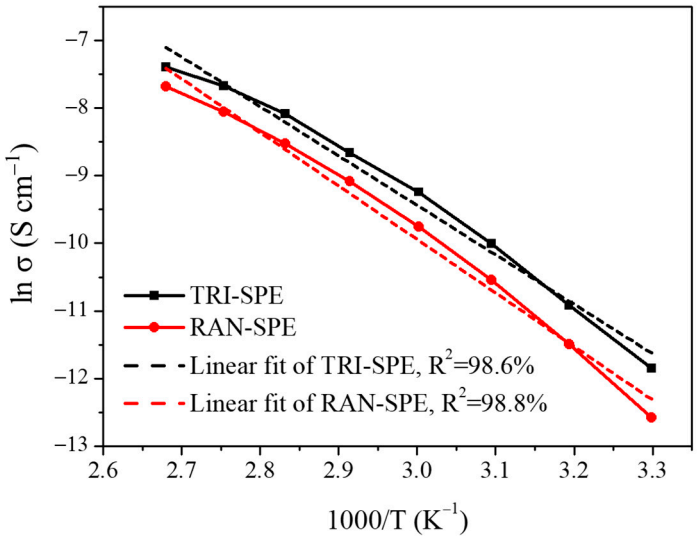
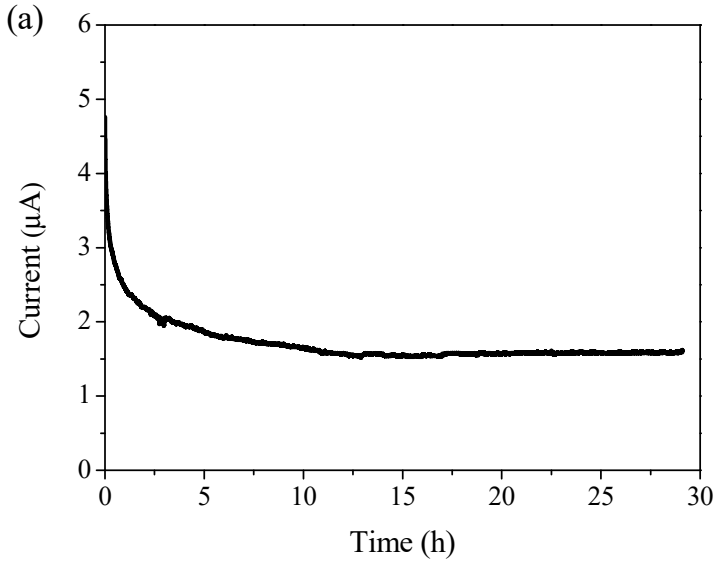


Figure S5. The linear fitting curves of ln σ and 1000/T.

5. The test curves of lithium-ion migration number.



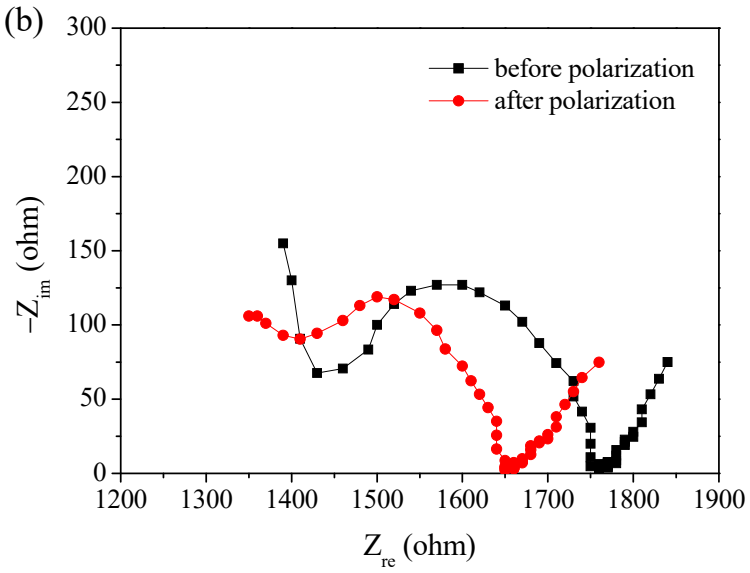
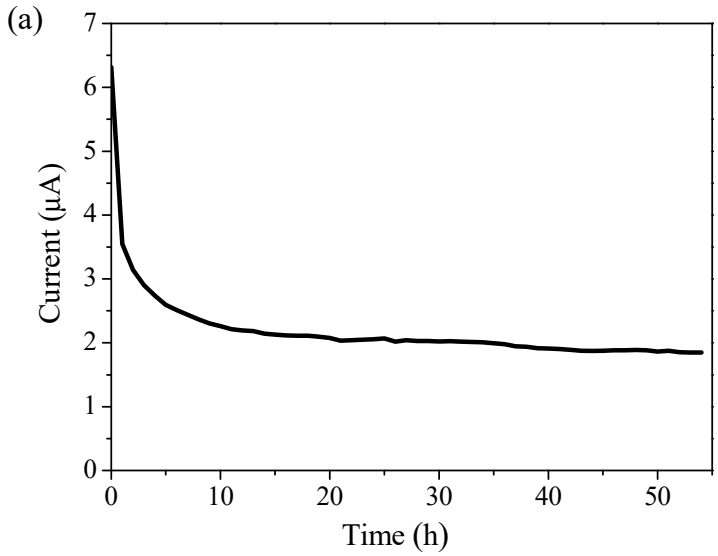


Figure S6. (a) Time dependence response of DC polarization (10 mV) for Li//RAN-SPE//Li symmetric cell at 60 ºC. (b) Impedance spectra of Li//RAN-SPE//Li symmetric cell before and after DC polarization. The test temperature was 60 ºC.



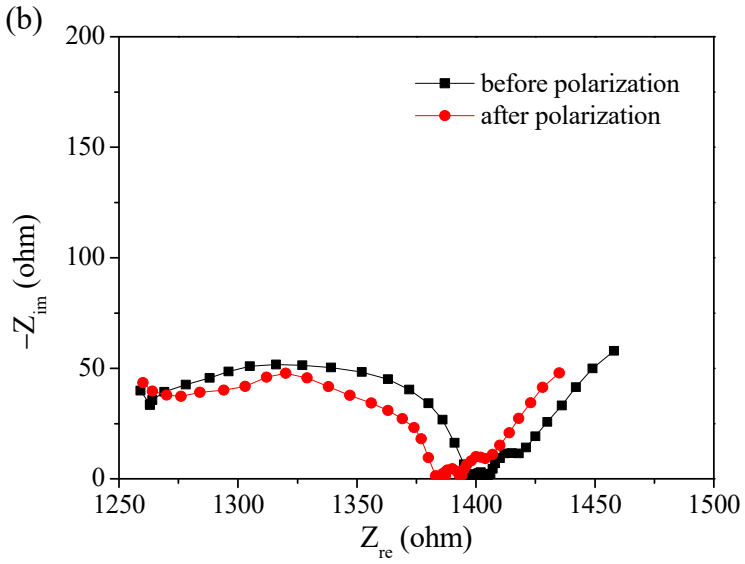
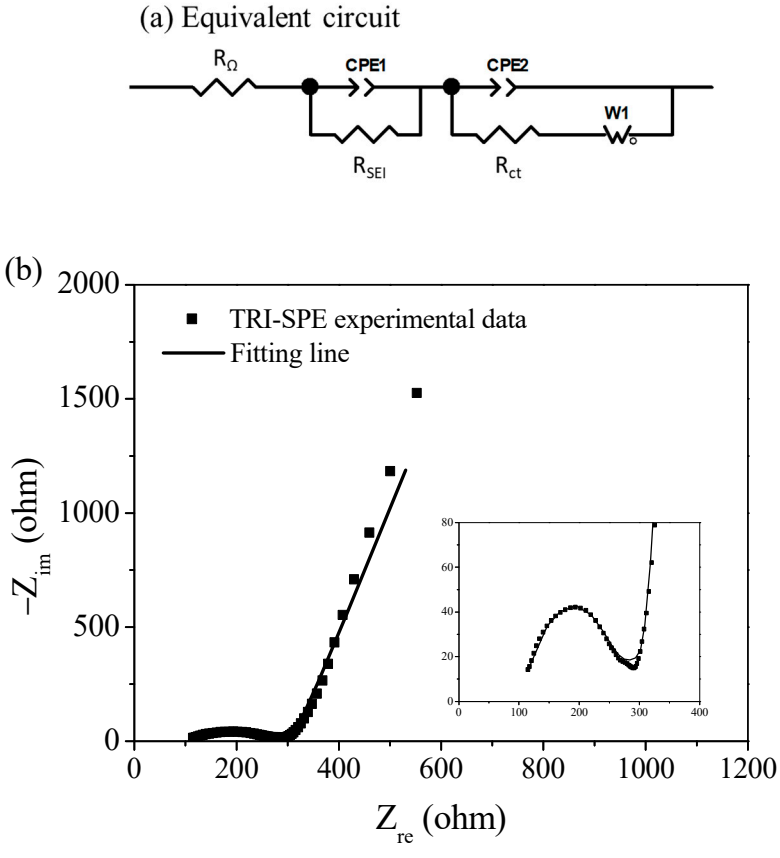


Figure S7. (a) Time dependence response of dc polarization (10 mV) for Li//TRI-SPE//Li symmetric cell at 60 ºC. (b) Impedance spectra of Li//TRI-SPE//Li symmetric cell before and after DC polarization. The test temperature was 60 ºC.

6. Equivalent circuit and data fitting results for Figure 8.



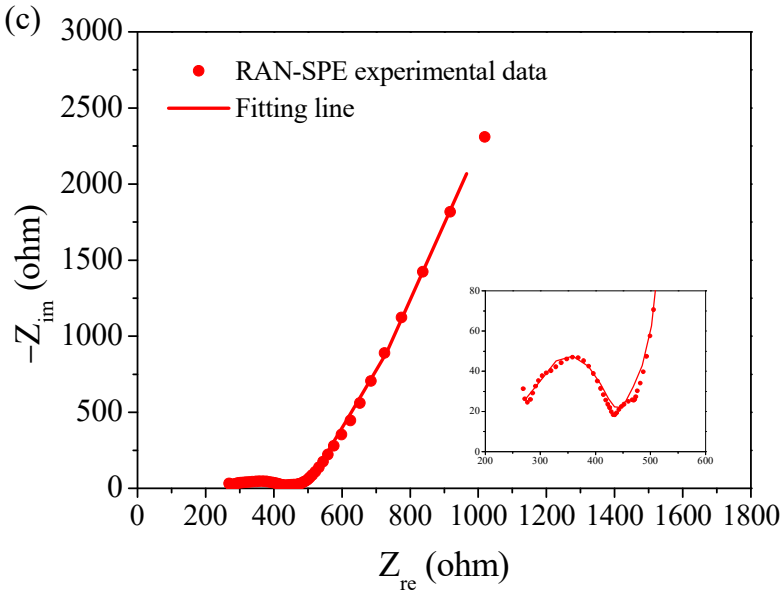


Figure S8. (a) Equivalent circuit used in this study and (b, c) data fitting results for Figure 8.