Electronic Supplementary Information

Highly Stretchable, Nonflammable and Notch-insensitive Intrinsic Self-healing Solid-state Polymer Electrolyte for Stable and Safety Flexible Lithium Batteries

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1. Supplementary Figures and Table

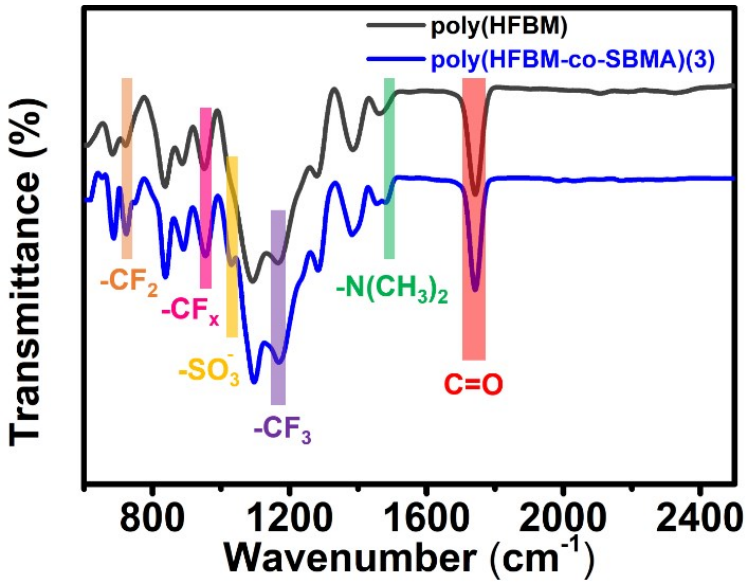

Fig. S1 FTIR spectra of poly(HFBM) and poly(HFBM-co-SBMA)-3.

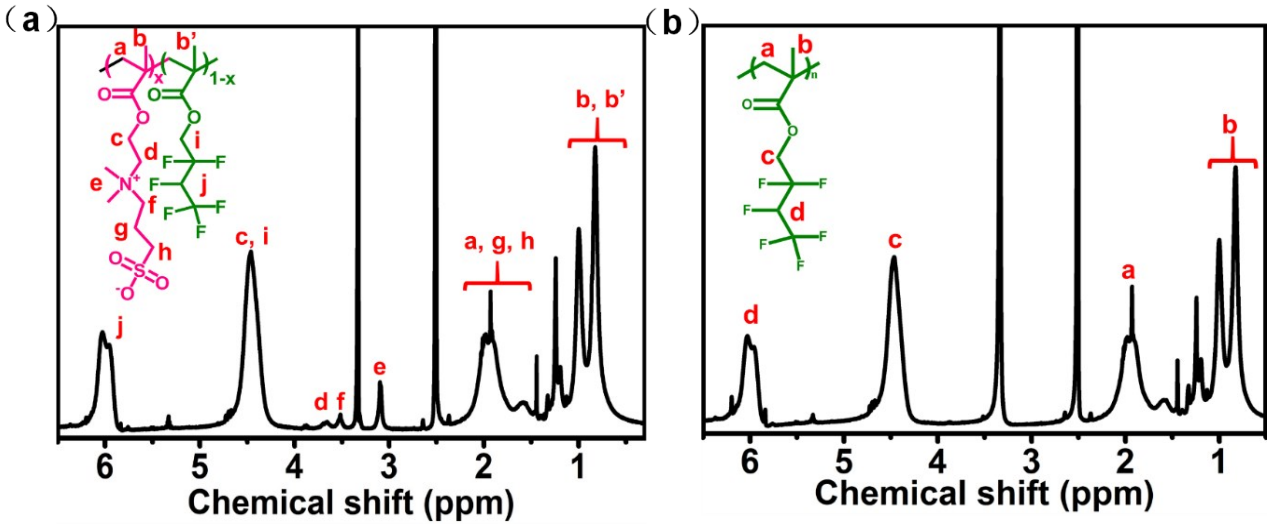

Fig. S2 ^{1}H NMR spectra of poly(HFBM-co-SBMA)-3 (a, DMSO-d_6, 500 MHz) and poly(HFBM) (b, DMSO-d_6, 500 MHz).

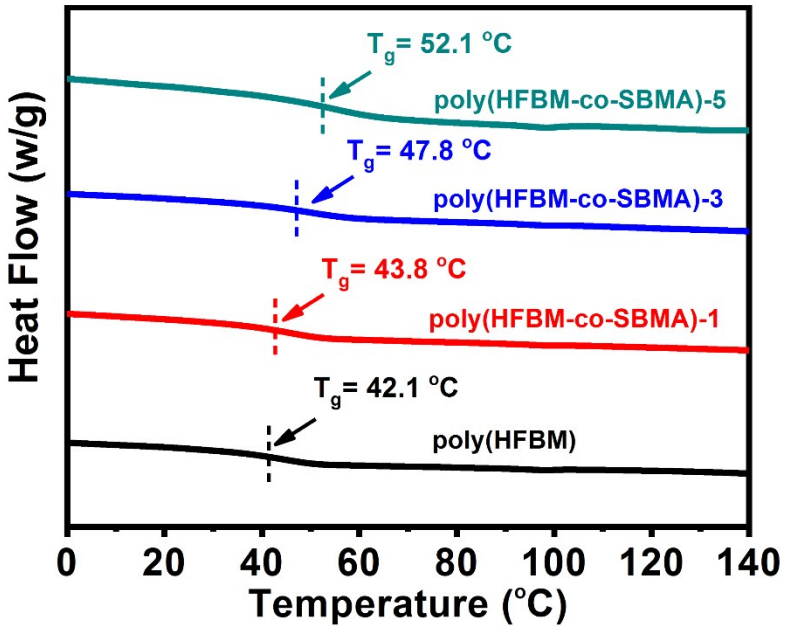

Fig. S3 DSC curve of the samples.

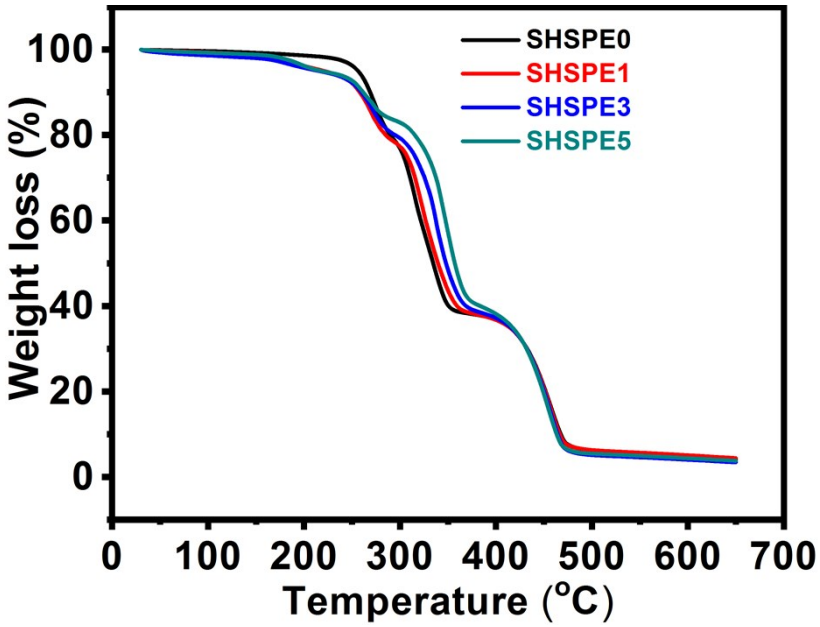

Fig. S4 TG curves of SHSPEs.

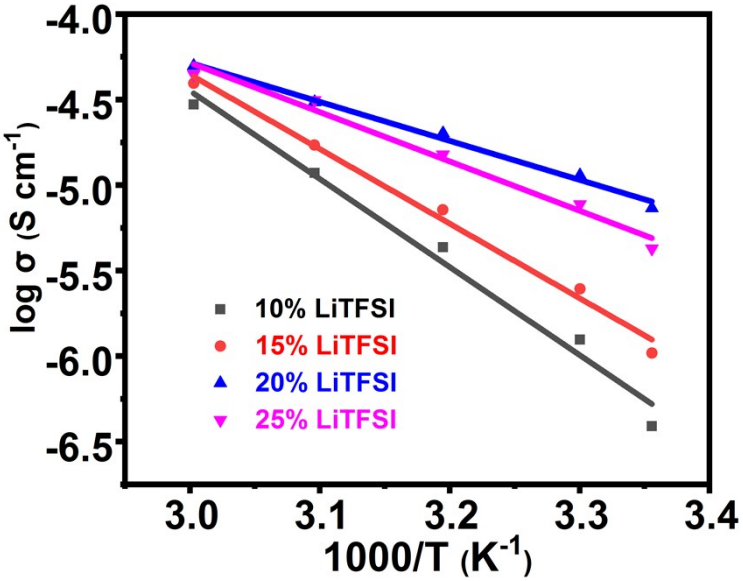

Fig. S5 Temperature dependence of the ionic conductivity for SHSPE3 with different weight ratios of LiTFSI.

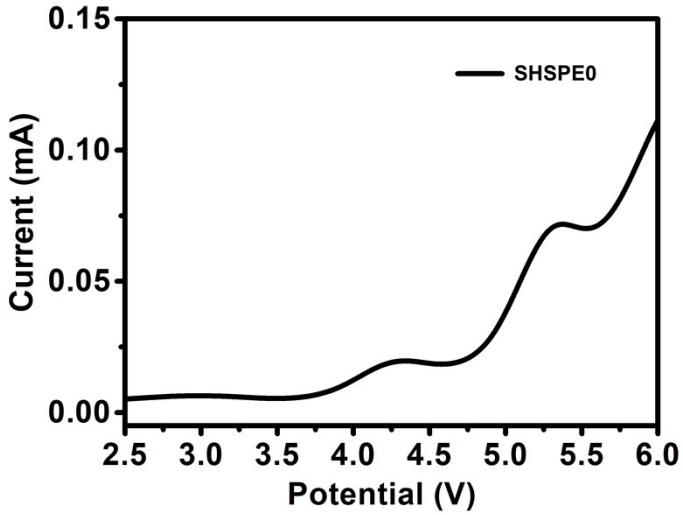

Fig. S6 The linear sweep voltammetry plot of SHSPE0.

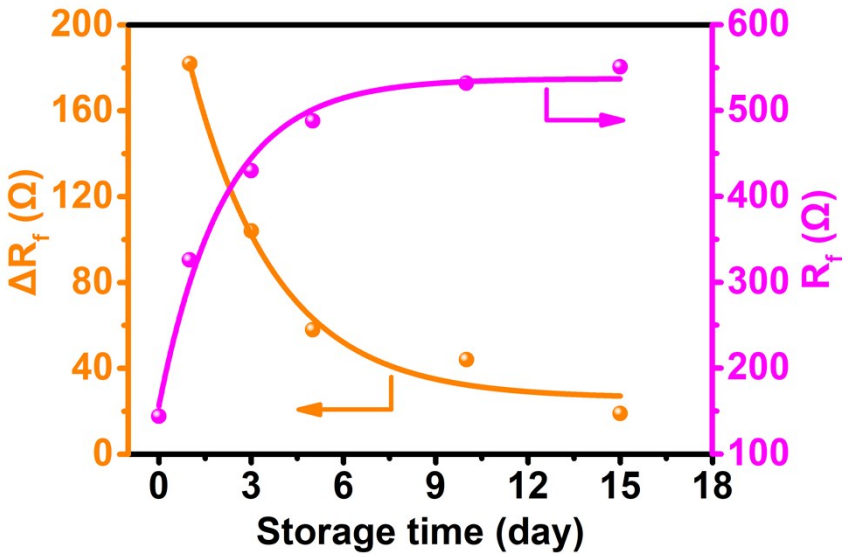

Fig. S7 The change of the interfacial resistance for Li/SHSPE3/Li symmetrical cell over different storage time.

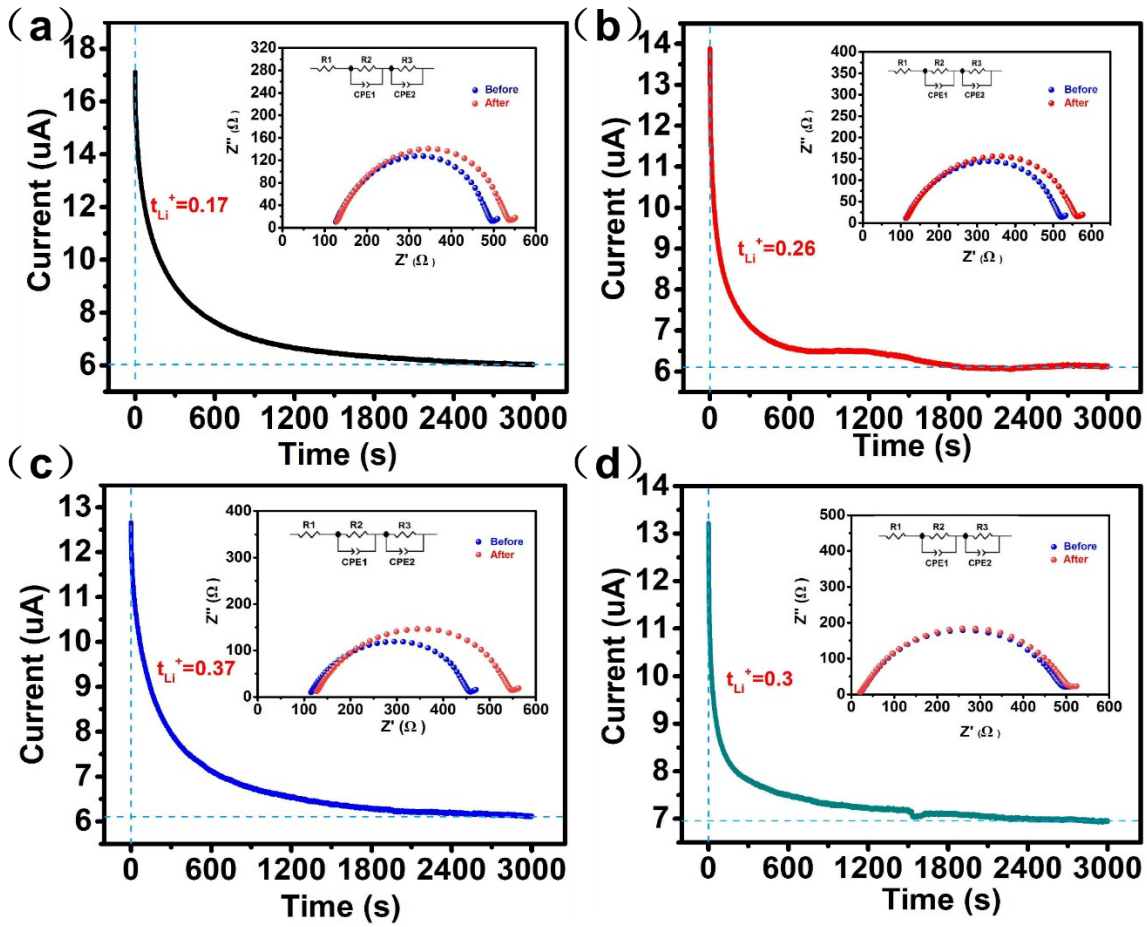

Fig. S8 Chronoamperometry profile and the AC impedance spectrum (inset) before and after polarization of (a) Li/SHSPE0/Li, (b) Li/SHSPE1/Li, (c) Li/SHSPE3/Li and (d) Li/SHSPE5/Li.

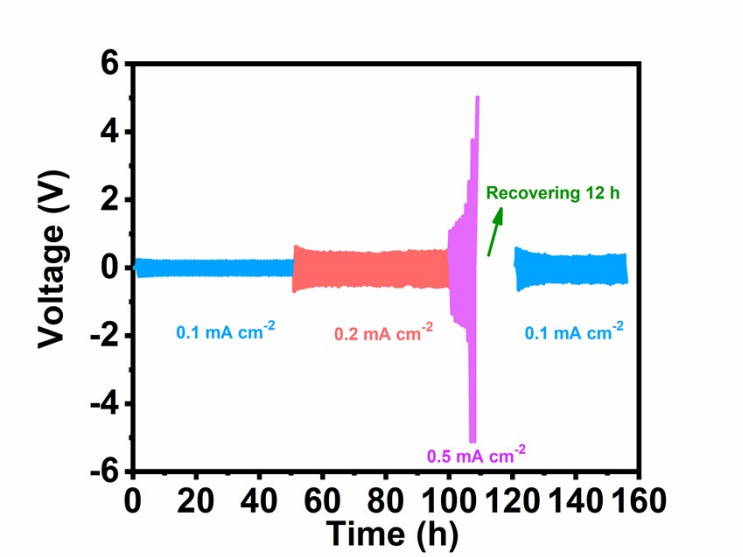

Fig. S9 The cycling performance of Li/SHSPE3/Li symmetric cell at different current density.

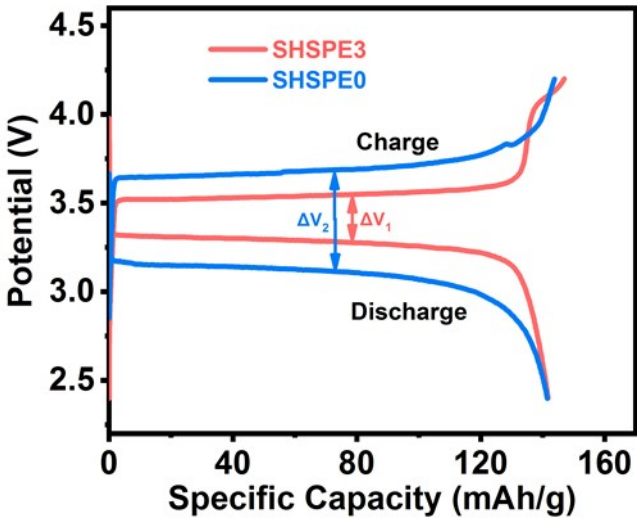

Fig. S10 The initial charge/discharge profiles of SHSPE0 and SHSPE3 based $LiFePO_4$/Li batteries at 0.2 C and 60 °C.

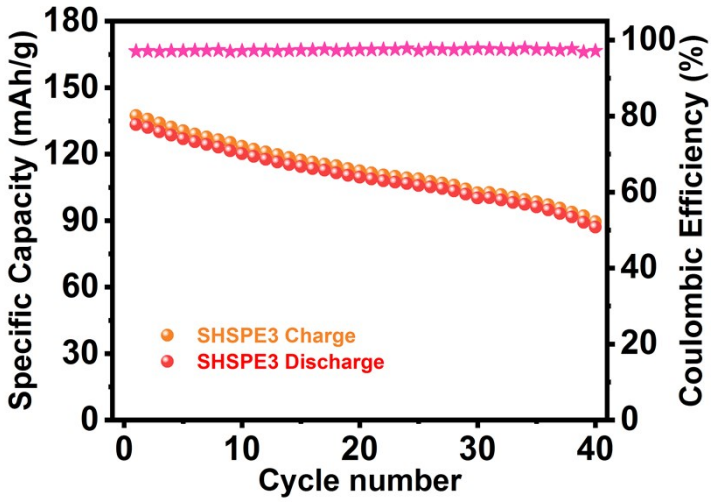

Fig. S11 Long-term cycling performance of Li/SHSPE3/$LiFePO_4$ at 0.2 C and 60 °C (The loading of $LiFePO_4$ is 12 mg cm^{-2}).

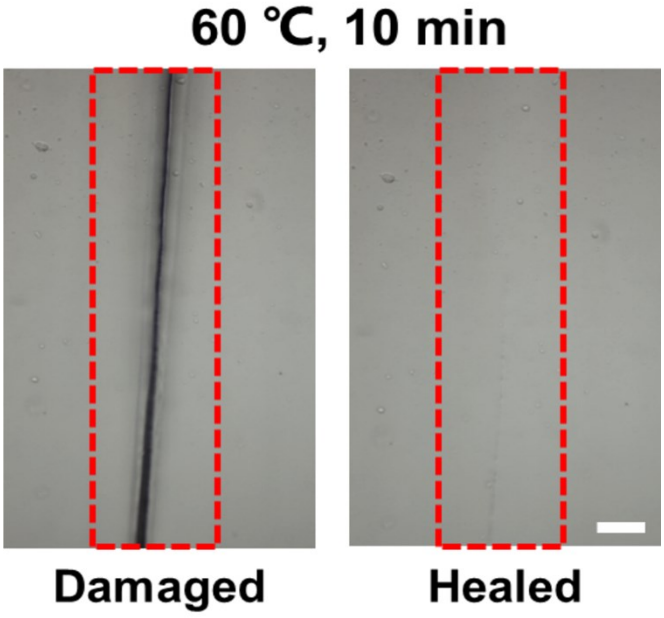

Fig. S12 Images of the damaged and healed SHSPE3 membrane at 60 °C for 10 min (Scale bar: 100 μm).

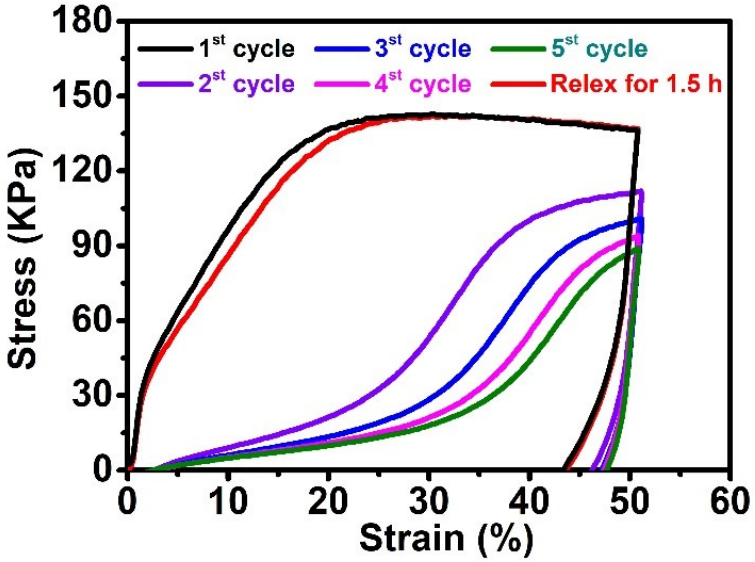

Fig. S13 Five successive loading-unloading cycles of SHSPE3.

Table S1 The self-healing property of SHSPE3.

Healing time (h)	Toughness[a] (MJ/m^3)	Self-healing efficiency[b] (%)
Original film	1.35 ± 0.03	/
0.5	0.28 ± 0.11	20.7
1.5	0.80 ± 0.08	59.3
3	1.03 ± 0.09	76.3
5	1.32 ± 0.05	97.8

a: Toughness was calculated by manually integrating the area under the stress-strain curve.

b: Self-healing efficiency was calculated from the ratio of toughness of healed films to that original film.

2. Supplementary Movie

The file contains supplementary video S1. In order to simulate the bending/folding of the soft-pack batteries during the actual use, SHSPE3 was compressed to 50% of the original length and relaxed to its initial state.