Supporting Information

Novel Imidazolium-Based Poly(ionic liquid)s with Different Counter Ions for Self-Healing

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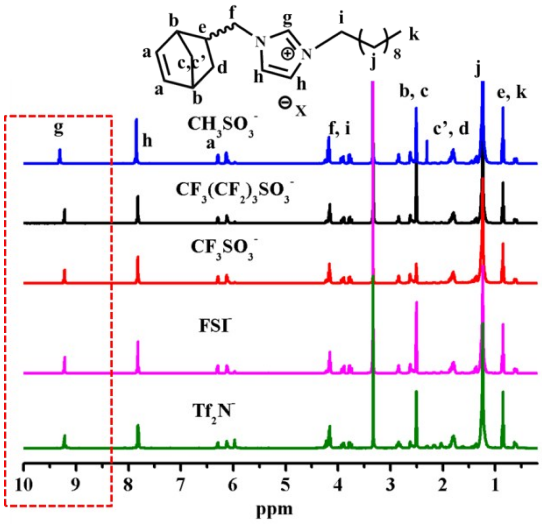

Fig. S1. The ^{1}H NMR spectra of imidazolium-based norbornene derivatives with different counter ions (methyl sulfoxide-d6).

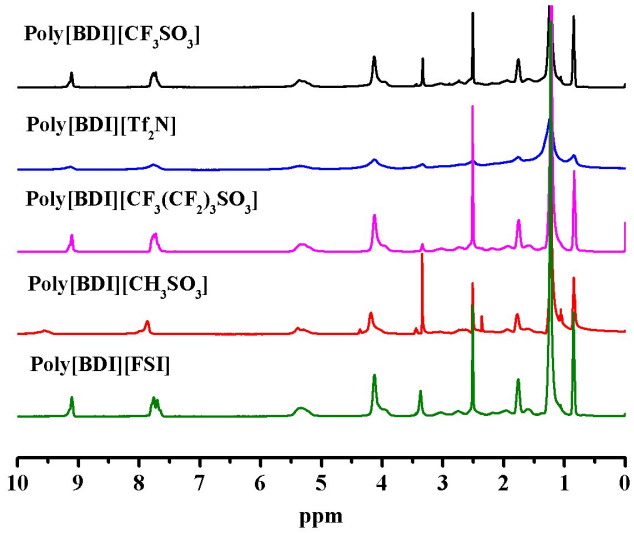

Fig. S2. The ^{1}H NMR spectra of PILs (methyl sulfoxide-d6).

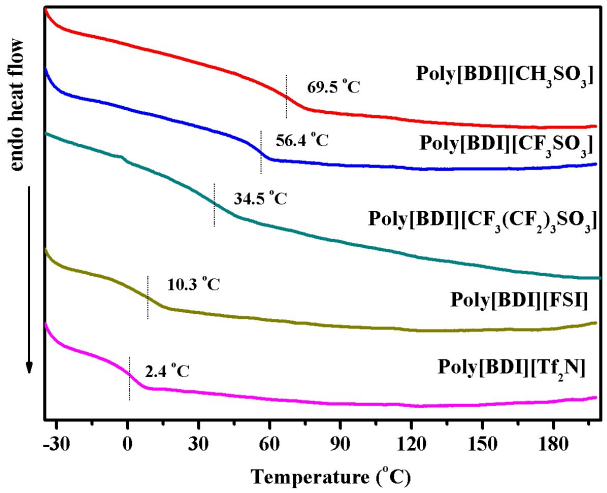

Fig. S3. DSC curves of PILs.

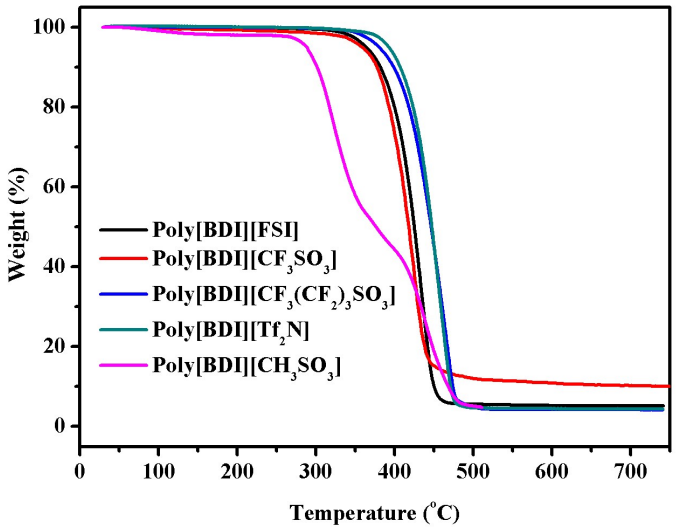

Fig. S4. TGA curves of PILs.

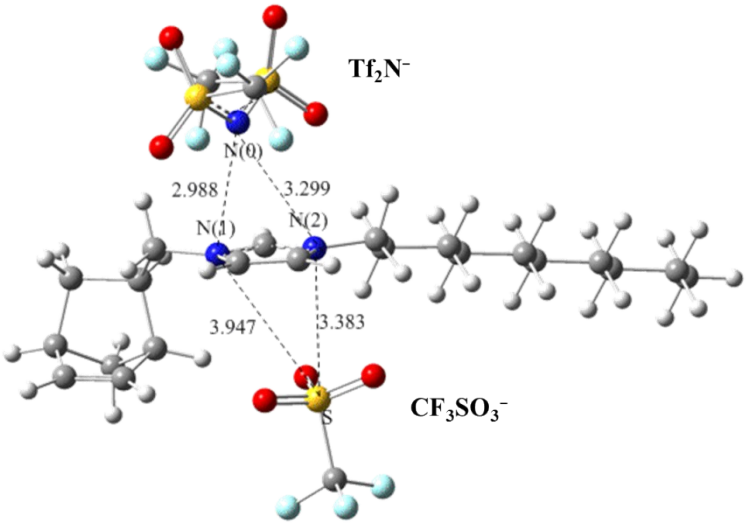

Fig. S5. An optimized model for ion aggregation of an imidazolium cation surrounded by a Tf_2N^- counter ion and a $CF_3SO_3^-$ counter ion.

Table S1. Interaction Energies [a] for 3-Bicyclo[2.2.1]hept-5-en-2-ylmethyl-1-decyl-3H-imidazolium ([BDI]) with two different counter ions (Tf_2N^- and M^-) shown in Fig. S5.

Å/(kcal/mol)	$CH_3SO_3^-$	$CF_3SO_3^-$	$CF_3(CF_2)_3SO_3^-$
N(0)-N(1)	3.014	2.988	2.982
N(0)-N(2)	3.339	3.299	3.285
S-N(1)	3.973	3.947	3.963
S-N(2)	3.408	3.383	3.401
ΔE	-114.4	-108.8	-107.7

[a] All calculations were carried out at the level of M05-2X/6-31+G(d) planted in Gaussian 09 program.

Table S2. Mechanical properties of polymer blends and Poly[BDI][FSI].[a]

Sample	Young's modulus (MPa) [b]	Yield stress (MPa)	Breaking stress (MPa)	Breaking strain (%)
Poly[BDI][FSI]	7.76±0.49	×[c]	3.98±0.25	1843±58
Poly[BDI][CH_3SO_3]-30	42.20±3.62	3.90±0.08	6.97±0.44	722±25
Poly[BDI][CH_3SO_3]-50	146.00±2.94	13.15±0.57	11.48±0.34	481±15
Poly[BDI][CF_3SO_3]-30	14.68±1.80	×	4.49±0.13	1170±23
Poly[BDI][CF_3SO_3]-50	49.00±2.16	4.60±0.21	7.12±0.16	705±33
Poly[BDI][CF_3SO_3]-70	90.70±5.86	9.25±0.67	9.35±0.40	537±8
Poly[BDI][$CF_3(CF_2)_3SO_3$]-30	13.78±1.06	×	3.58±0.15	1238±33
Poly[BDI][$CF_3(CF_2)_3SO_3$]-50	43.05±2.05	3.41±0.01	6.24±0.19	707±27

[a] Strain rate = 100 mm min^{-1}, room temperature; [b] Young's modulus, calculated from the initial slope of stress-strain curves(strain< 5%); [c] no detected.

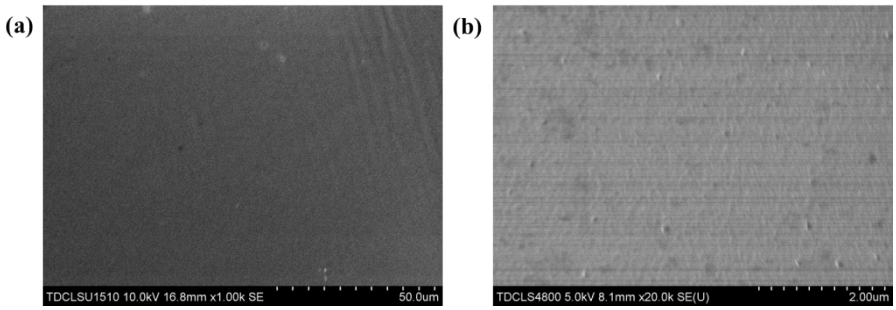

Fig. S6. SEM photograph of Poly[BDI][Tf_2N][CF_3SO_3]-50.

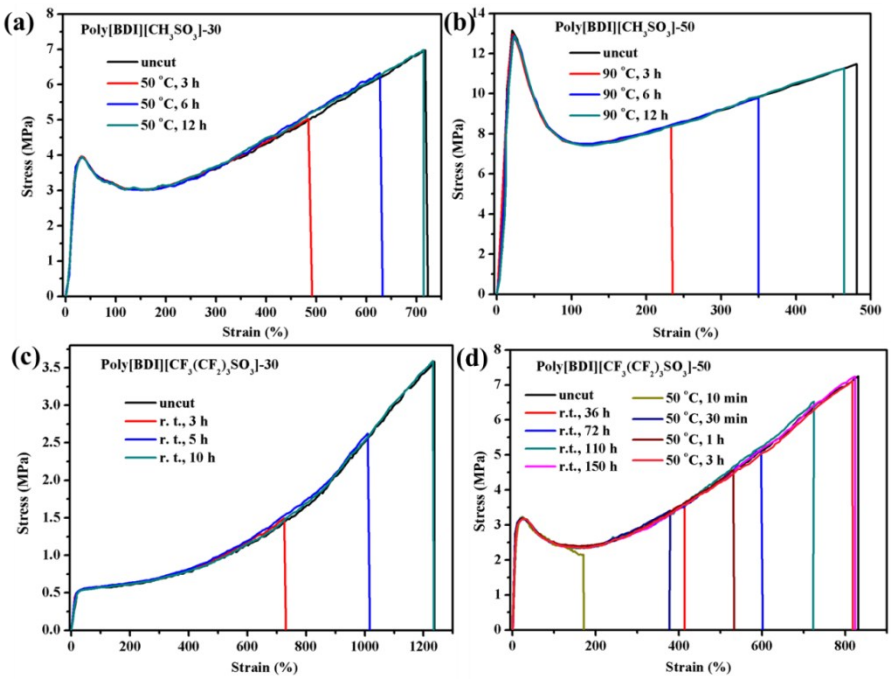

Fig. S7. Stress-strain curves of the original and healed polymer blends. (a) Poly[BDI][CH_3SO_3]-30; (b) Poly[BDI][CH_3SO_3]-50; (c) Poly[BDI][$CF_3(CF_2)_3SO_3$]-30; (d)

Poly[BDI][$CF_3(CF_2)_3SO_3$]-50.

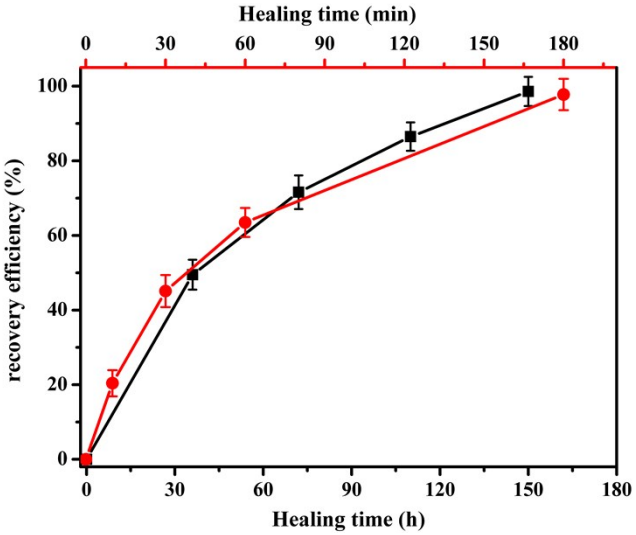

Fig. S8. Plots of the recovery efficiency of fracture strain as a function healing time for Poly[BDI][Tf_2N][$CF_3(CF_2)_3SO_3$]-50 at different temperatures, black plot represented room temperature and red plot represented 50 ^oC; Error bars denoted the standard deviations from at least five experiments