Supplementary Information for

Preparation of ROMP-type Imidazolium-Functionalized Norbornene Ionic Liquid Block Copolymer and Electrochemical Property for Lithium-ion Battery Polyelectrolyte Membranes

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Determination of PIL block composition ratios by ^{1}H NMR Analyses.

The PIL block composition ratios were determined to compare the integrating of polymer backbone and imidazolium block by ^{1}H NMR analyses. The (CH) of imidazolium protons peaks for the ionic block(n) appear at 8.70 ppm (signal 5 in **Fig. S1**–**S5**) look as integrate 1. Backbone protons peaks for two block (m&n) appear at between 5.50-5.13 ppm (signal 7 in **Fig. S1**–**S5**) (see **Eq. S1**). There are four methylene protons peaks of alkyl chain adjacent to the ester and N of imidazolium respectively and three methyl protons peaks of imidazolium ring appeared at 4.25-3.75 ppm (signal (6+9) in **Fig. S1**–**S5**) for PIL block (see **Eq. S2**).

$$2m + 2n = 7\ ^1\text{H NMR integration} \qquad \text{(Eq. S1)}$$

$$7n = (6+9)\ ^1\text{H NMR integration} \qquad \text{(Eq. S2)}$$

Using the two equations can calculated m and n, each PIL block composition ratios for copolymers 5-9 can be quantified as below:

(1) PIL block composition ratios for copolymer 5 (**Fig. S1**):

$$2m + 2n = 6.96$$

$$7n = 5.08$$

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$m = 1.00, n = 0.27$

$m : n_{calc.} = 1 : 0.27$

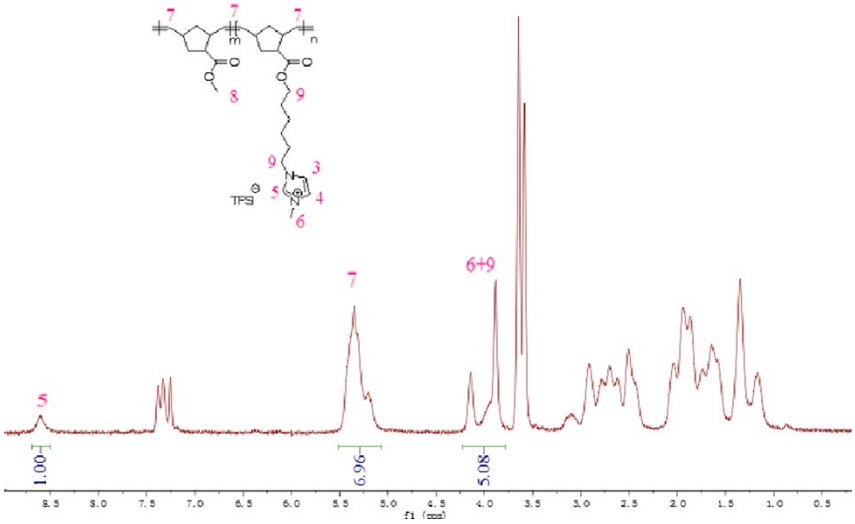

Fig. S1. ^{1}H NMR spectrum of copolymer 5 and the ^{1}H NMR peak integrated for calculating the PIL block Composition ratios in 5.

(2) PIL block composition ratios for copolymer 6 (**Fig. S2**):

$2m + 2n = 6.46$

$7n=5.49$

$m = 1.00, n = 0.32$

$m : n_{calc.} = 1 : 0.32$

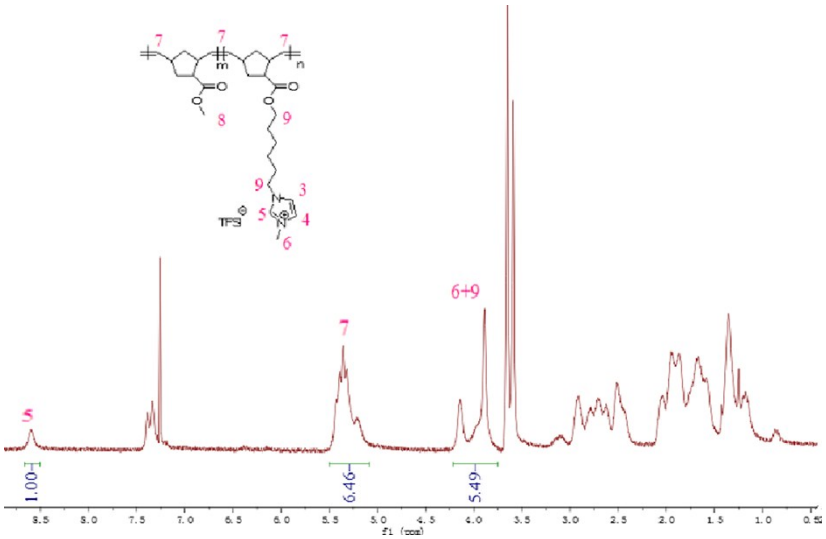

Fig. S2. ^{1}H NMR spectrum of copolymer 6 and the ^{1}H NMR peak integrated for calculating the PIL block composition ratios in 6.

(3) PIL block composition ratios for copolymer 7 (**Fig. S3**):

$$2m + 2n = 4.76$$

$$7n=5.18$$

$$m = 1.00, n = 0.45$$

$$m : n_{calc.} = 1 : 0.45$$

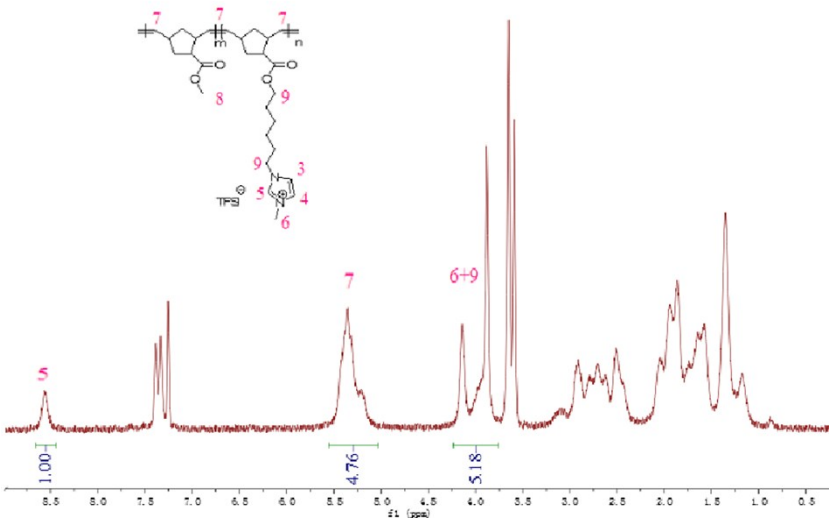

Fig. S3. ^{1}H NMR spectrum of copolymer 7 and the ^{1}H NMR peak integrated for calculating the PIL block composition ratios in 7.

(4) PIL block composition ratios for copolymer 8 (**Fig. S4**):

$$2m + 2n = 4.53$$

$$7n=6.13$$

$$m = 1.00, n = 0.63$$

$$m : n_{calc.} = 1 : 0.63$$

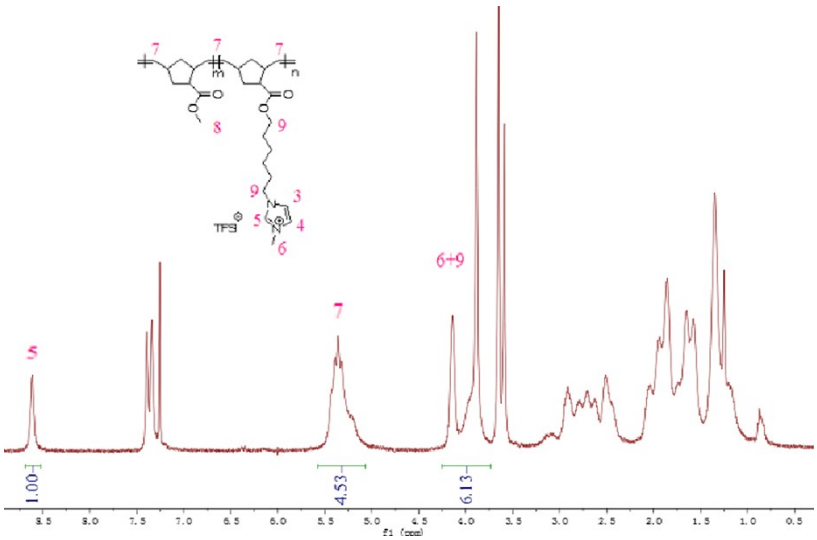

Fig. S4. ^{1}H NMR spectrum of copolymer 8 and the ^{1}H NMR peak integrated for

calculating the PIL block composition ratios in 8.

(5) PIL block composition ratios for copolymer 9 (**Fig. S5**):

$$2m + 2n = 3.23$$

$$7n=5.70$$

$$m = 1.00, n = 1.03$$

$$m : n_{calc.} = 1 : 1.03$$

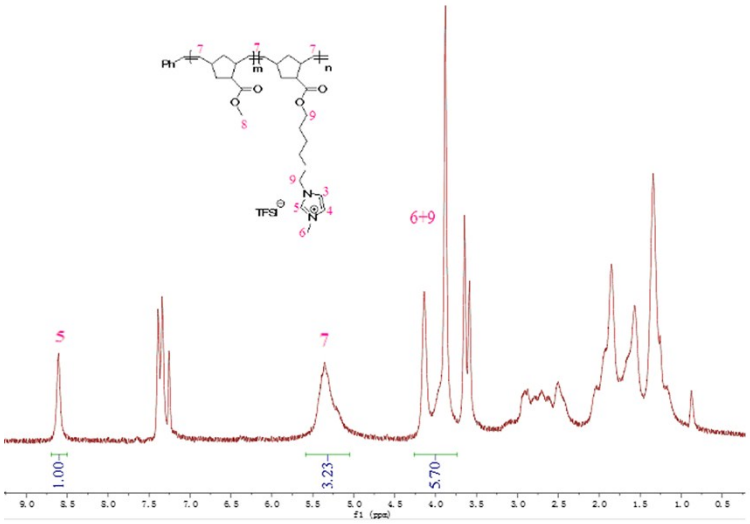

Fig. S5. ^{1}H NMR spectrum of copolymer 9 and the ^{1}H NMR peak integrated for calculating the PIL block composition ratios in 9.

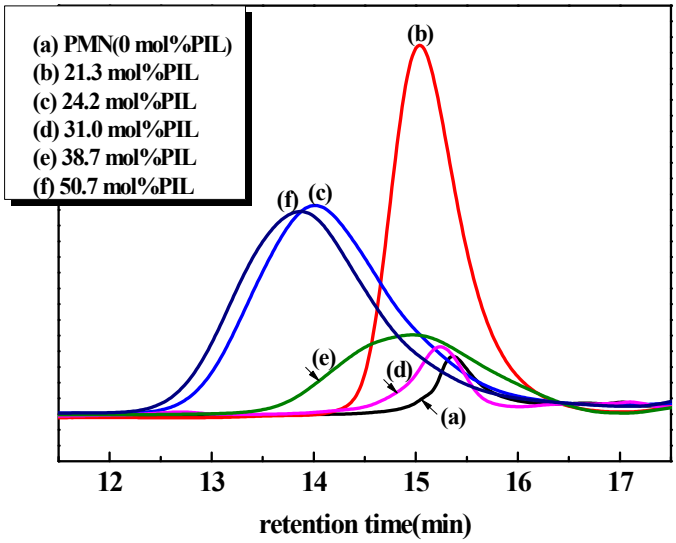

Fig. S6. GPC curves of all block copolymers