Electronic Supplementary Information

Polymeric ionic liquids tailored by different chain groups for efficient conversion of CO_2 into cyclic carbonates

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1. Molecular weight and Element analysis

Table S1 Molecular weight for P(DMAEMA-Et)Br and P(DMAEMA-EtOH)Br

Sample[a]	M_n(g/mol)	M_w(g/mol)	PDI
P(DMAEMA-Et)Br	42502	114287	2.689
P(DMAEMA-EtOH)Br	44733	124536	2.784

[a]Determined by GPC.

Gel permeation chromatography (GPC) methodology for molecular weight (MW) characterization was referred to the literature previously reported[1].

2. Element analysis

Table S2 Result for element analysis

Entry	C%	N%	H%
(DMAEMA-Et)Br	45.12	5.26	7.57
(DMAEMA-Pr)Br	47.15	5.60	7.91
(DMAEMA-Bu)Br	48.99	4.76	8.22
(DMAEMA-EtOH)Br	42.57	4.96	7.14
(DMAEMA-Pr)SO_3	45.27	5.28	7.22
P(DMAEMA-Et)Br	40.35	4.75	7.328
P(DMAEMA-Pr)Br	46.39	4.92	8.498
P(DMAEMA-Bu)Br	46.63	4.63	8.387
P(DMAEMA-EtOH)Br	40.35	4.75	7.328
P(DMAEMA-Pr)SO_3	41.58	4.51	7.747
P(DMAEMA-PrOH)Br	43.24	3.91	7.732

3. FT-IR spectrums

FT-IR spectrums of P(DMAEMA-EtOH)Br and (DMAEMA-EtOH)Br was listed below**.**

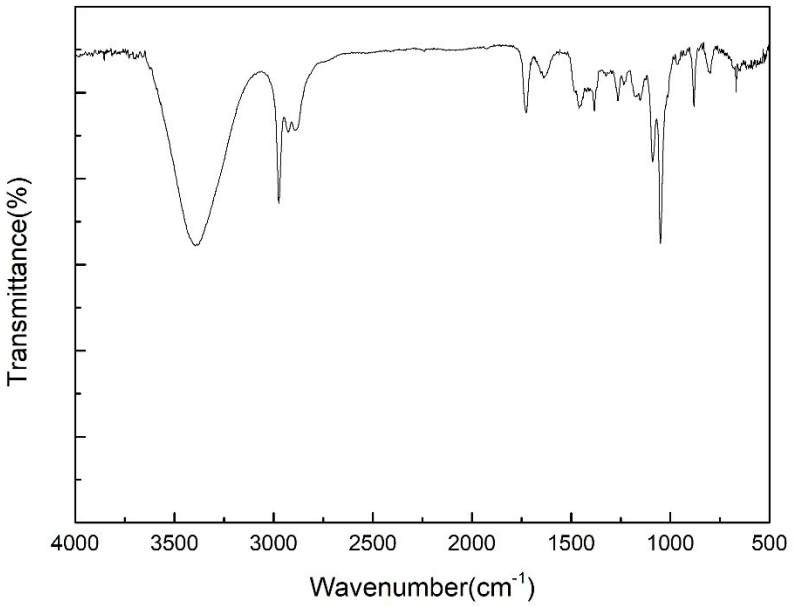


Figure S1 FT-IR spectrum of P(DMAEMA-EtOH)Br

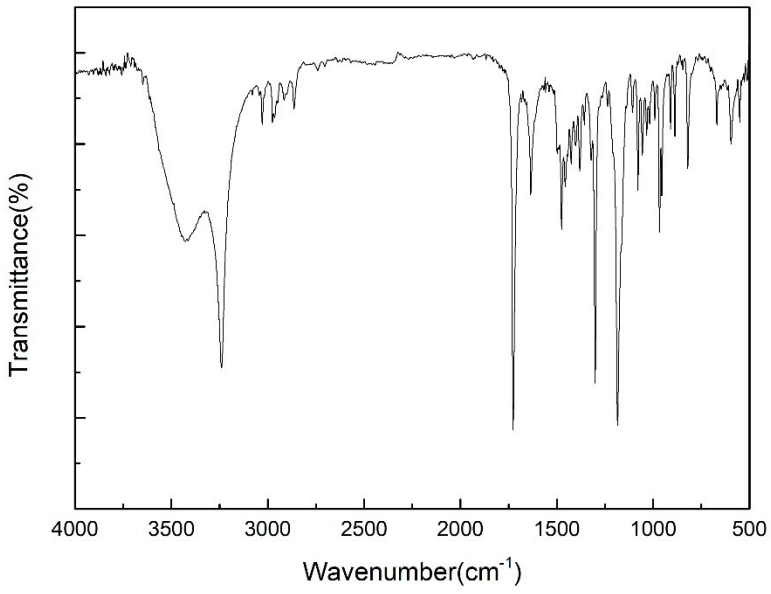


Figure S2 FT-IR spectrum of (DMAEMA-EtOH)Br

4. Characterization of synthesized ILs

(DMAEMA-Et)Br

^{1}H NMR (600 MHz, $CDCl_3$) δ 6.16 (s, 1H), 5.69 (d, J = 1.2 Hz, 1H), 4.72 – 4.64 (m, 2H), 4.17 – 4.09 (m, 2H), 3.84 (q, J = 7.2 Hz, 2H), 3.48 (s, 6H), 1.96 (s, 3H), 1.49 (t, J = 7.2 Hz, 3H).

(DMAEMA-Pr)Br

^{1}H NMR (600 MHz, D_2O) δ 6.08 (s, 1H), 5.72 – 5.67 (m, 1H), 4.57 – 4.53 (m, 2H), 3.71 – 3.66 (m, 2H), 3.35 – 3.24 (m, 2H), 3.09 (s, 6H), 1.87 (s, 3H), 1.79 – 1.71 (m, 2H), 1.30 (m,2H), 0.90 (t, J = 7.3 Hz, 3H).

(DMAEMA-Bu)Br

^{1}H NMR (600 MHz, $CDCl_3$) δ 6.15 (s, 1H), 5.69 (s, 1H), 4.67 (s, 2H), 4.18 (dd, J = 11.5, 6.9 Hz, 2H), 3.68 (dd, J = 20.8, 12.3 Hz, 2H), 3.53 (s, 6H), 1.96 (s, 3H), 1.81 – 1.72 (m, 2H), 1.49 – 1.38 (m, 2H), 1.01 (dt, J = 14.7, 7.4 Hz, 3H).

(DMAEMA-EtOH)Br

^{1}H NMR (600 MHz, $CDCl_3$) δ 6.15 (s, 1H), 5.69 (d, J = 1.2 Hz, 1H), 4.81(s,1H), 4.72 – 4.64 (m, 2H), 4.17 – 4.09 (m, 2H), 3.85 (q, J = 7.2 Hz, 2H), 3.46 (s, 2H), 2.27 (s, 6H), 2.01 (t, J = 7.2 Hz, 3H).

(DMAEMA-PrOH)Br

^{1}H NMR (600 MHz, D_2O) δ 6.08 (s, 1H), 5.72 – 5.67 (m, 1H), 4.57 – 4.53 (m, 2H), 4.43(s,1H), 3.71 – 3.66 (m, 2H), 3.50(m,2H), 3.35 – 3.24 (m, 2H), 3.09 (s, 6H), 1.87 (s, 3H), 1.79 – 1.71 (m, 2H), 1.30 (m,2H).

5. XRD pattern

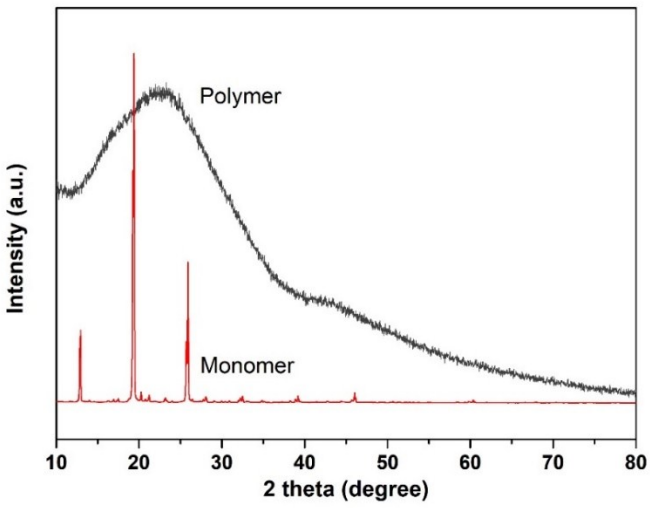
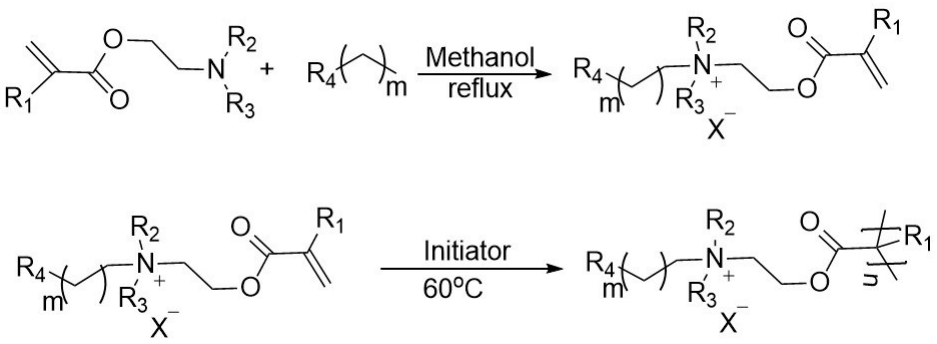


Figure S3 Typical XRD patterns for (DMAEMA-EtOH)Br and its polymer

6. Synthesis of polymeric ionic liquid



Scheme S1 General Procedure regarding typical synthesis of polymeric ionic liquid

7. Cooling process of polymeric ionic liquid in aqueous solution

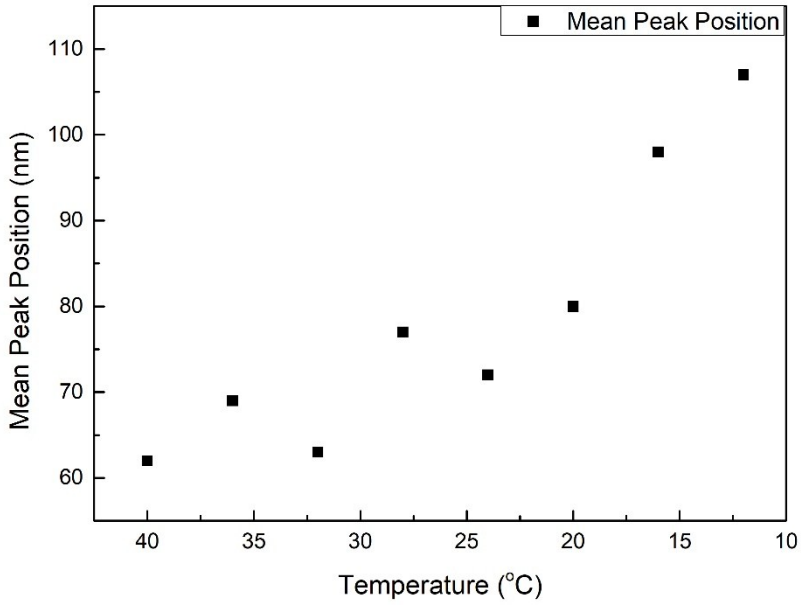


Figure S4 Mean peak position of hydrodynamic diameter observed by DLS (cooling)

8. DSC of P(DMAEMA-EtOH)Br and (DMAEMA-EtOH)Br

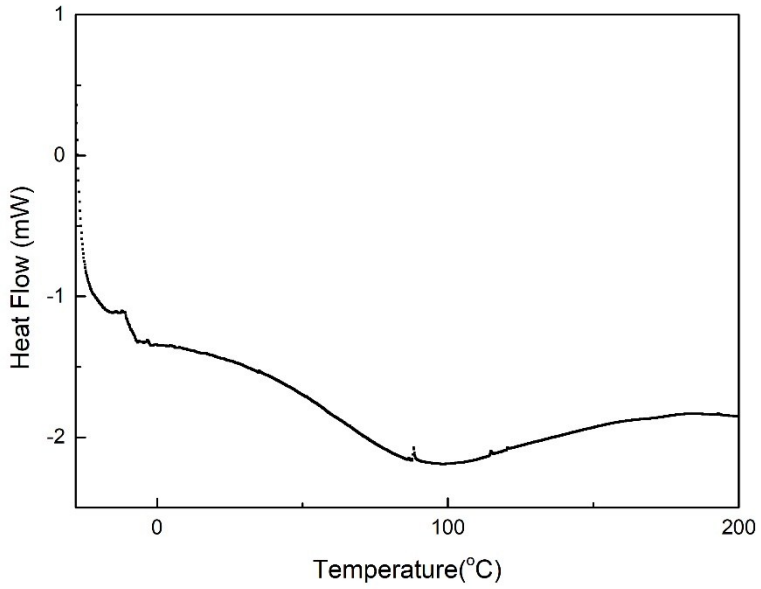


Figure S5 DSC spectrum of P(DMAEMA-EtOH)Br

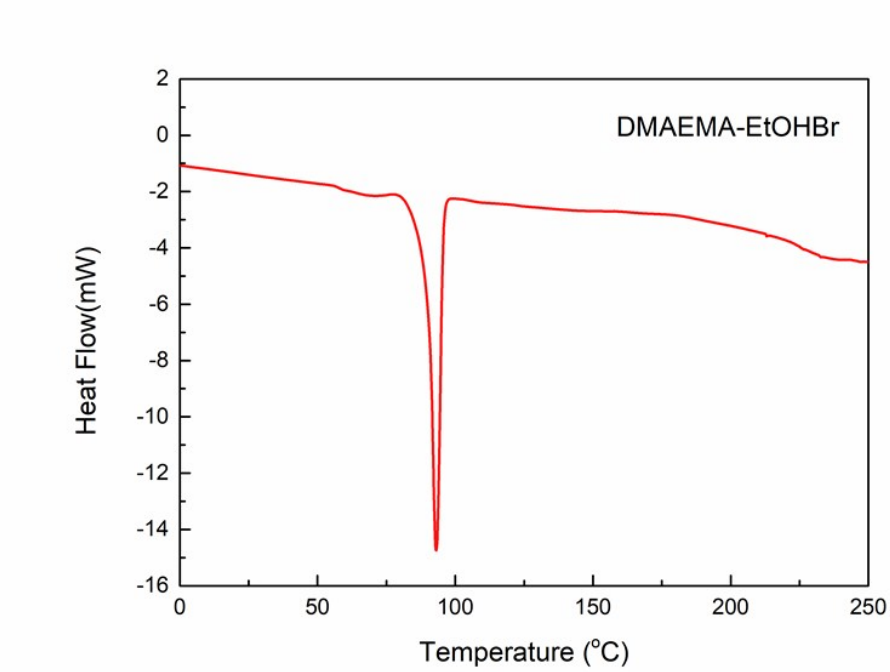


Figure S5-1 DSC spectrum of (DMAEMA-EtOH)Br

9. DLS of P(DMAEMA-Et)Br

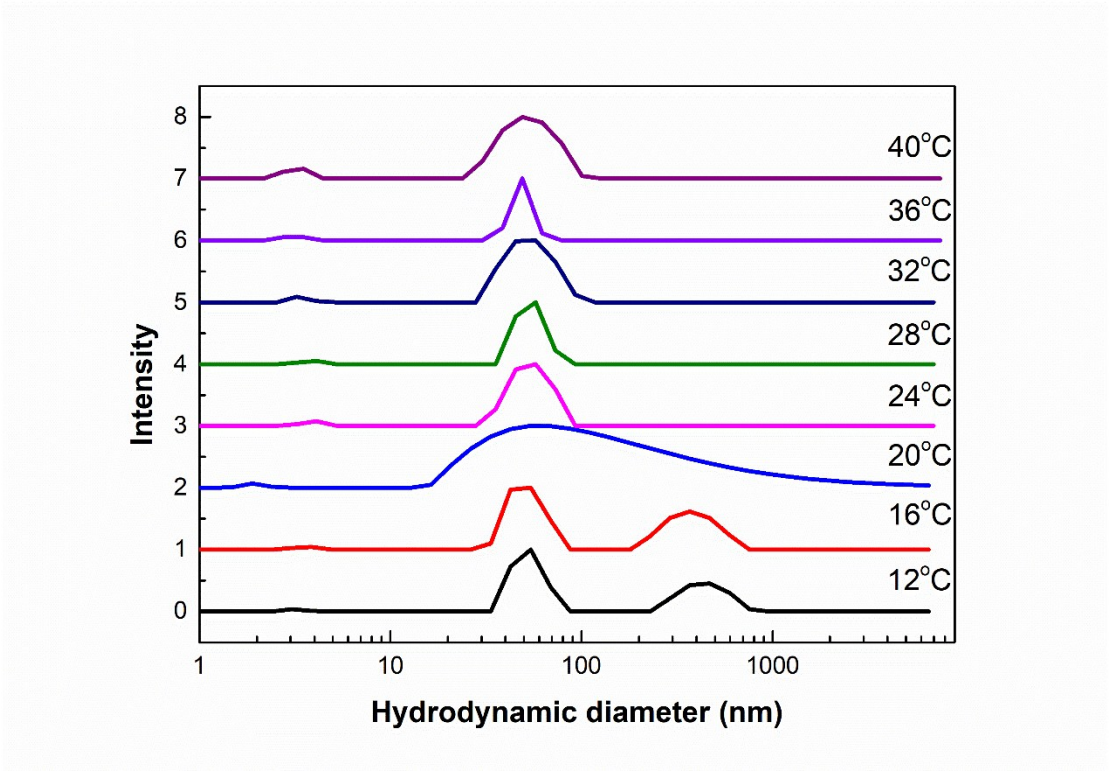


Figure S6 DLS of P(DMAEMA-Et)Br (heating)

10. RDF graph

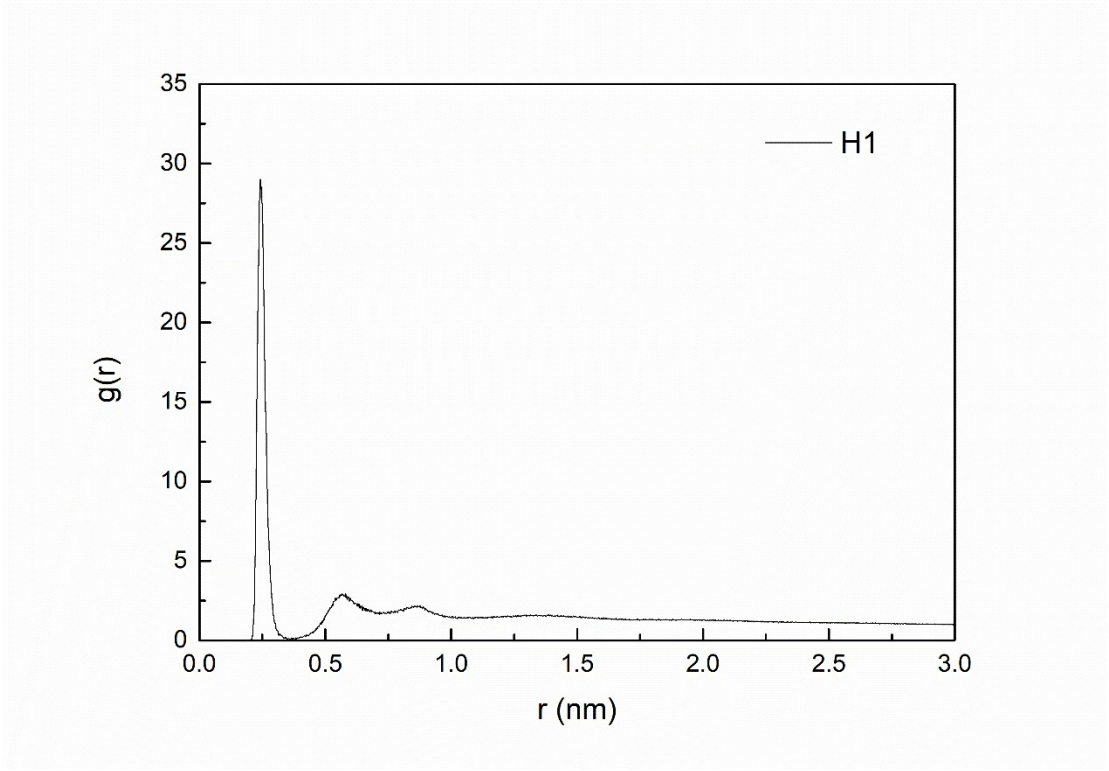


Figure S7 RDF of hydroxyl group and bromide ion in system 1

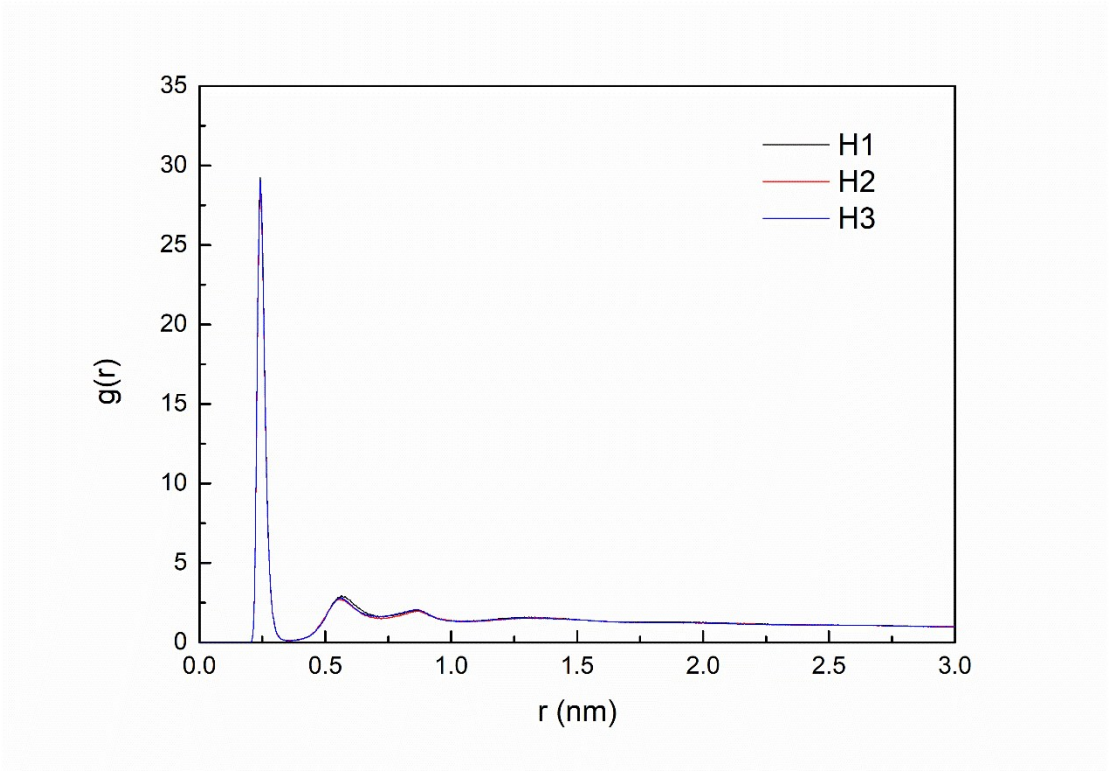


Figure S8 RDF of hydroxyl group and bromide ion in system 2

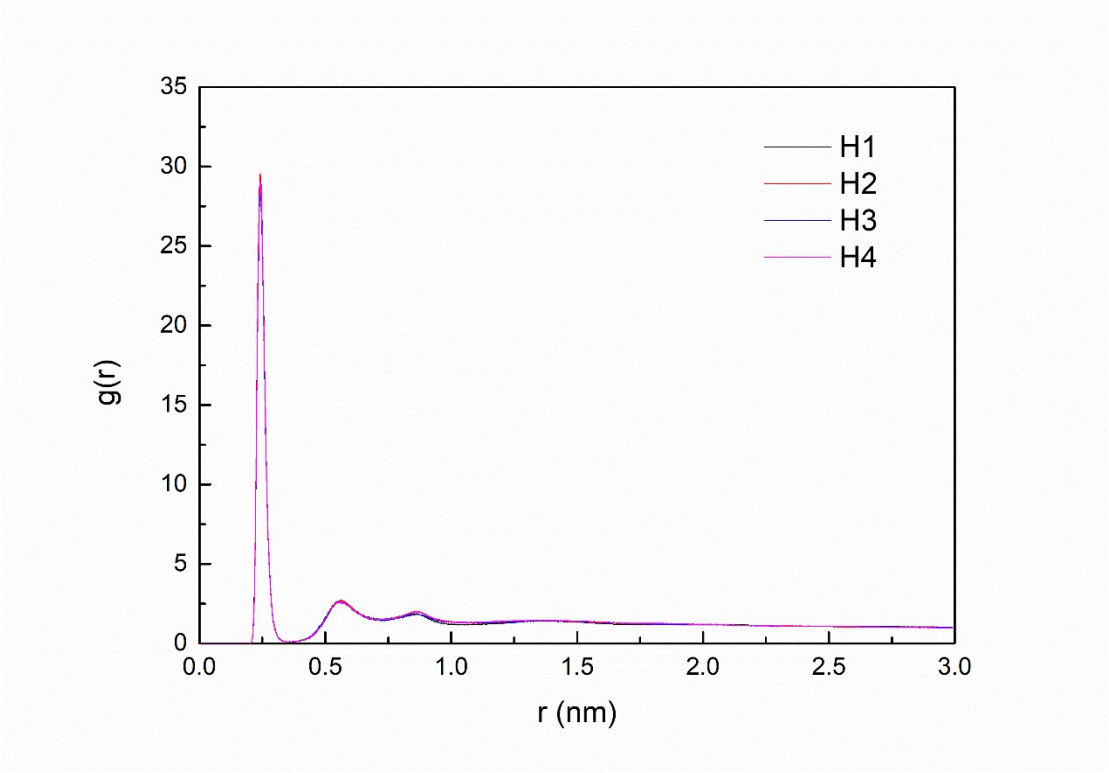


Figure S9 RDF of hydroxyl group and bromide ion in system 3

11. TGA curves

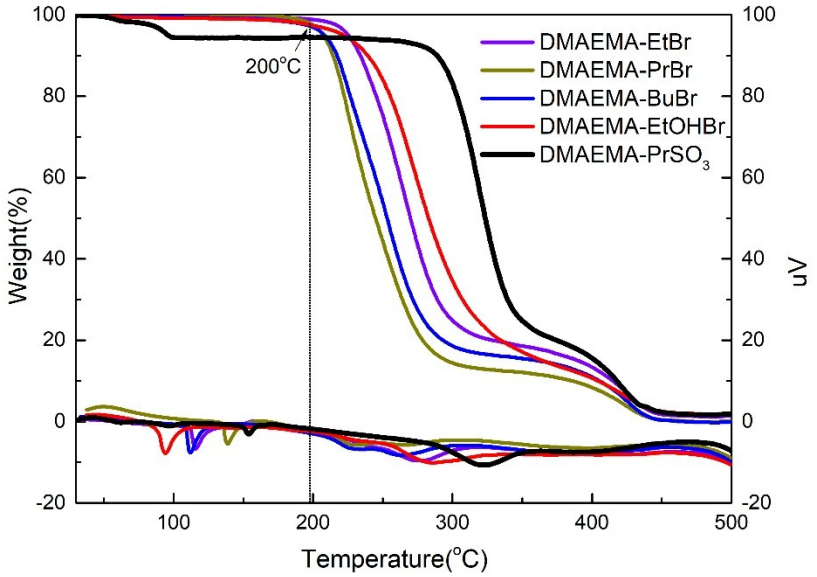


Figure S10 TGA-DTG curves of ionic liquid monomers

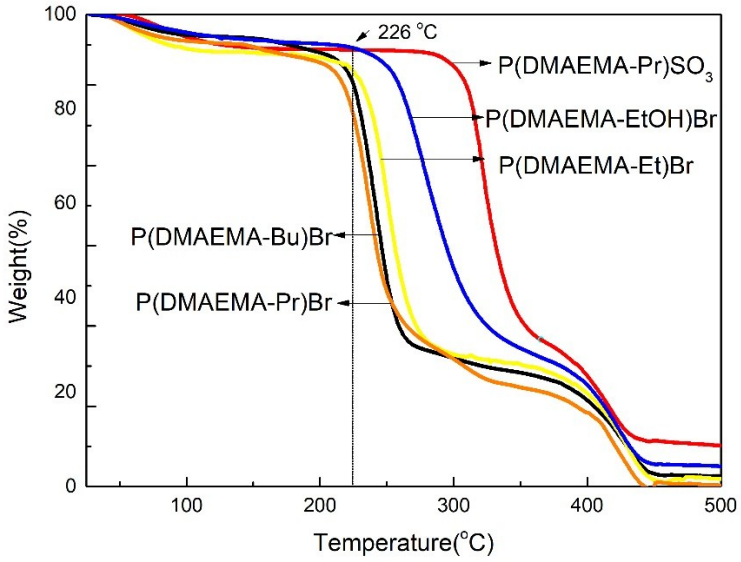


Figure S11 TGA curves of polymeric ionic liquids

References

1. H. He, M. Zhong, B. Adzima, D. Luebke, H. Nulwala and K. Matyjaszewski, J Am Chem Soc, 2013, 135, 4227-4230.