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Supplementary Material

Key factors to prepare polyelectrolytes showing temperature-sensitive LCST-type phase transition in water

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Characterization of ILs

[P_{4444}][SS]: ^{1}H NMR (400MHz, $CDCl_3$, δ/ppm relative to TMS): 0.92(t, *J* 6.4, 12H), 1.43-1.44(m, 16H), 2.2(m, 8H), 5.2(d, *J* 10.5, 1H), 5.7(d, *J* 17.4, 1H), 6.7(q, *J* 28.4, 1H), 7.3(d, *J* 6.4, 2H), 7.8(t, *J* 7.8, 2H).

[P_{4446}][SS]: ^{1}H NMR (400MHz, $CDCl_3$, δ/ppm relative to TMS): 0.85-0.93(m, 12H), 0.93-1.46(m, 20H), 2.18-2.23(m, 8H), 5.23(d, *J* 11.9, 1H), 5.72(d, *J* 18.3, 1H), 6.68(q, *J* 28.4, 1H), 7.34(d, *J* 7.8, 2H), 7.83(d, *J* 6.8, 2H).

Phase separation temperature of $[P_{4444}][SS]$/water mixture

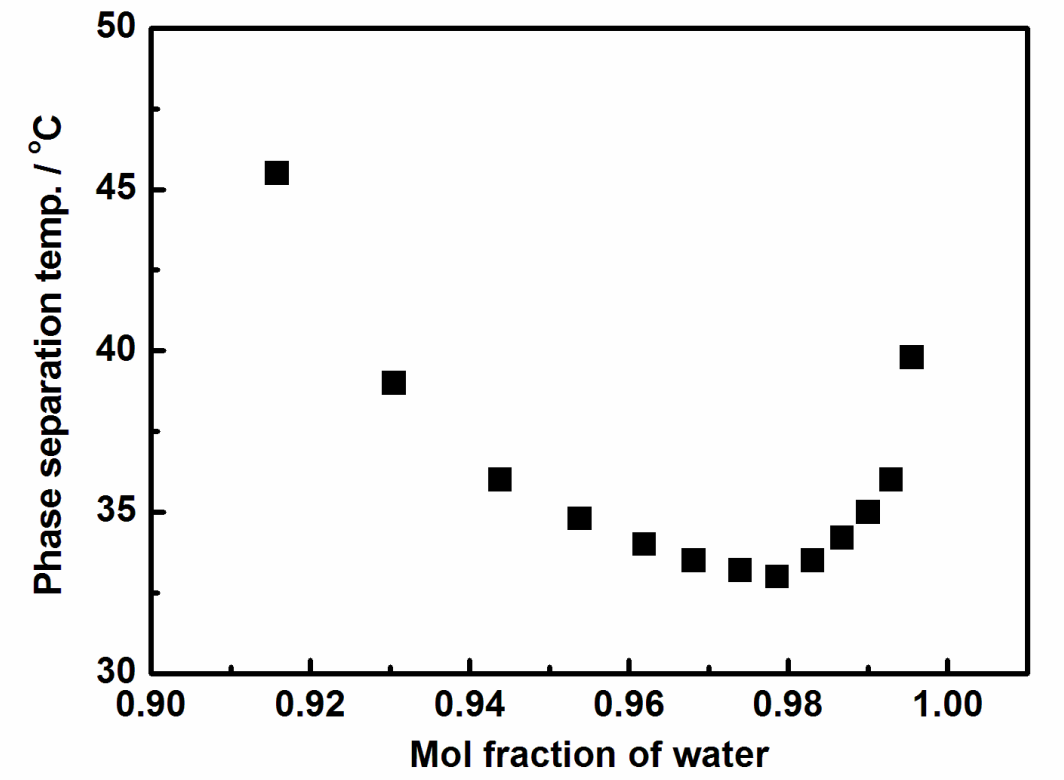

Fig. S1. Phase separation temperature of $[P_{4444}][SS]$ after mixing with different amount of water.

ATR-FTIR spectra of [P_{444n}][SS] and their polymers

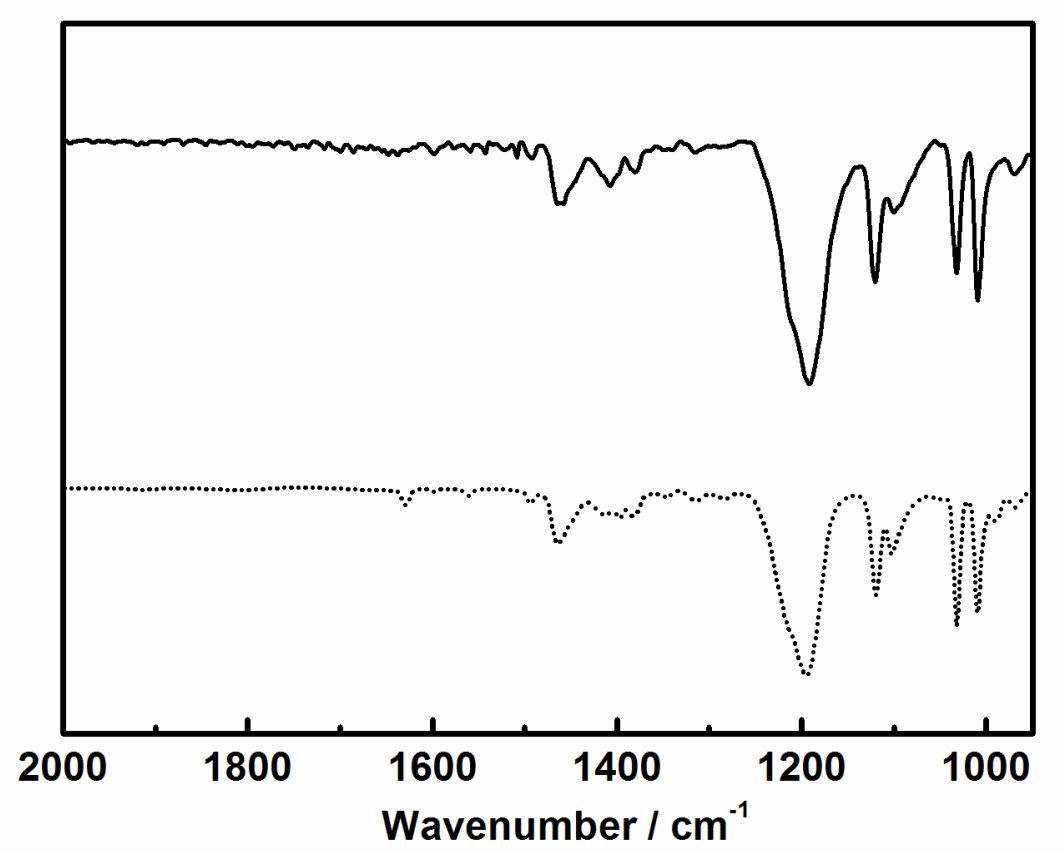

Fig. S2. ATR-FTIR spectra of [P_{4444}][SS] (dotted line), and poly([P_{4444}][SS]) (solid line).

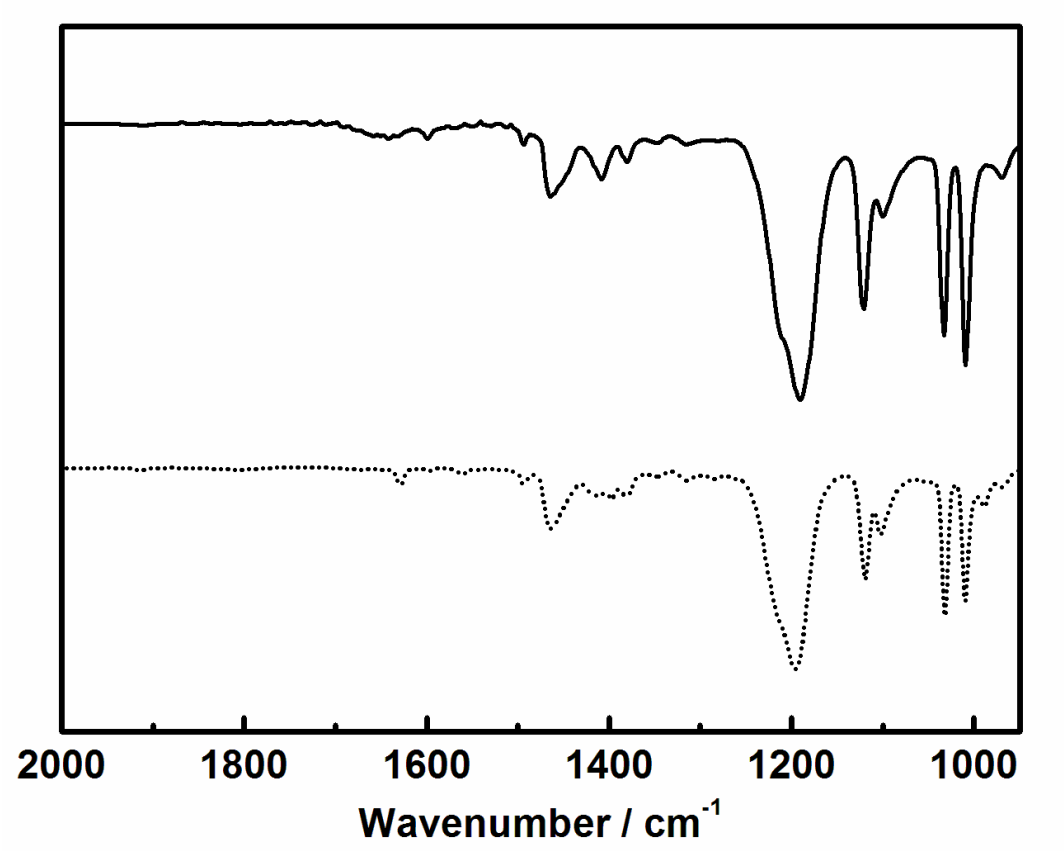

Fig. S3. ATR-FTIR spectra of $[P_{4446}][SS]$ (dotted line), and poly($[P_{4446}][SS]$) (solid line).

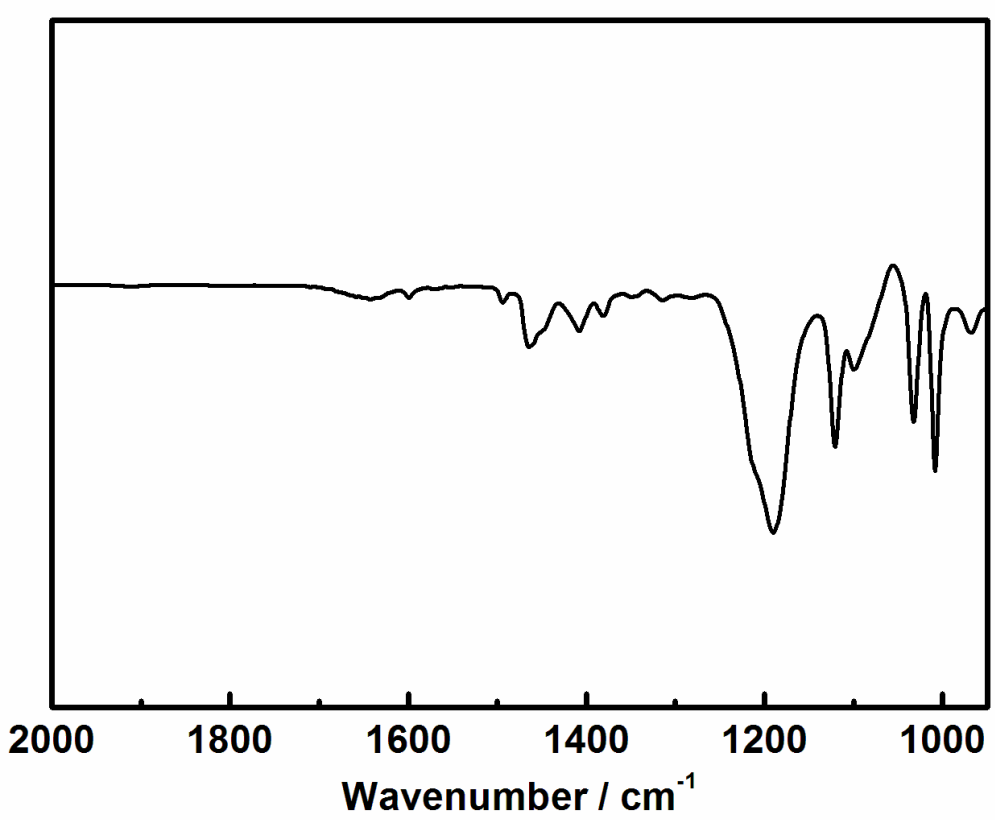

Fig. S4. ATR-FTIR spectra of poly([P_{4444}][SS]$_{0.7}$-*co*-[P_{4446}][SS]$_{0.3}$).

^{1}H NMR spectra of [P_{444n}][SS] and their polymers

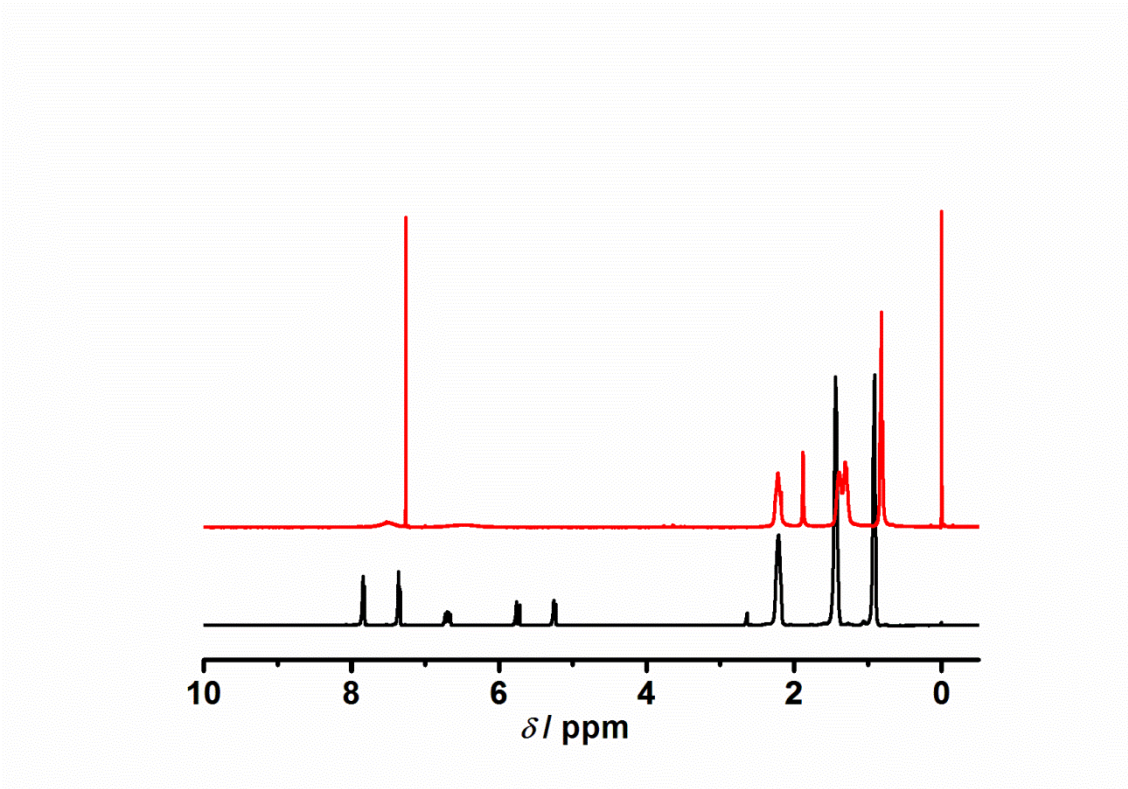

Fig. S5. ^{1}H NMR spectra of [P_{4444}][SS] (black line), and poly([P_{4444}][SS]) (red line).

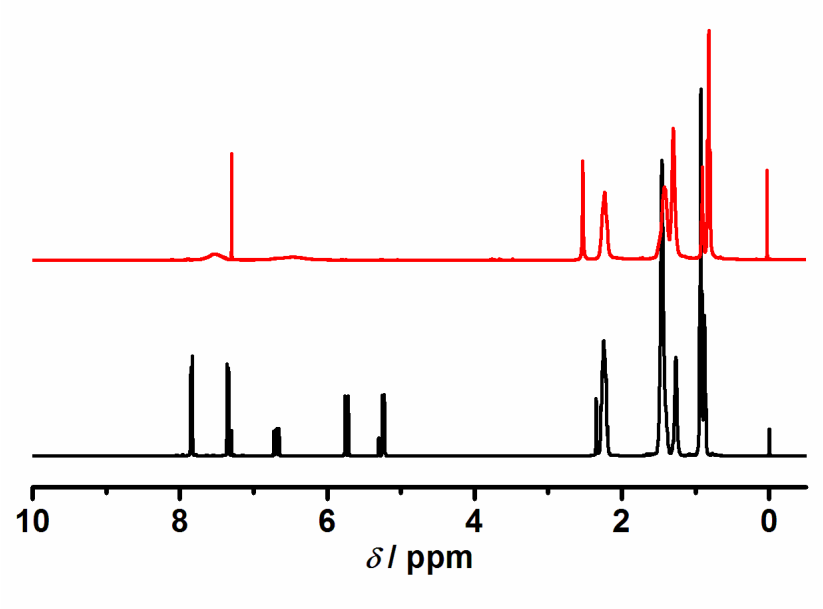

Fig. S6. ^{1}H NMR spectra of [P_{4446}][SS] (black line), and poly([P_{4446}][SS]) (red line).

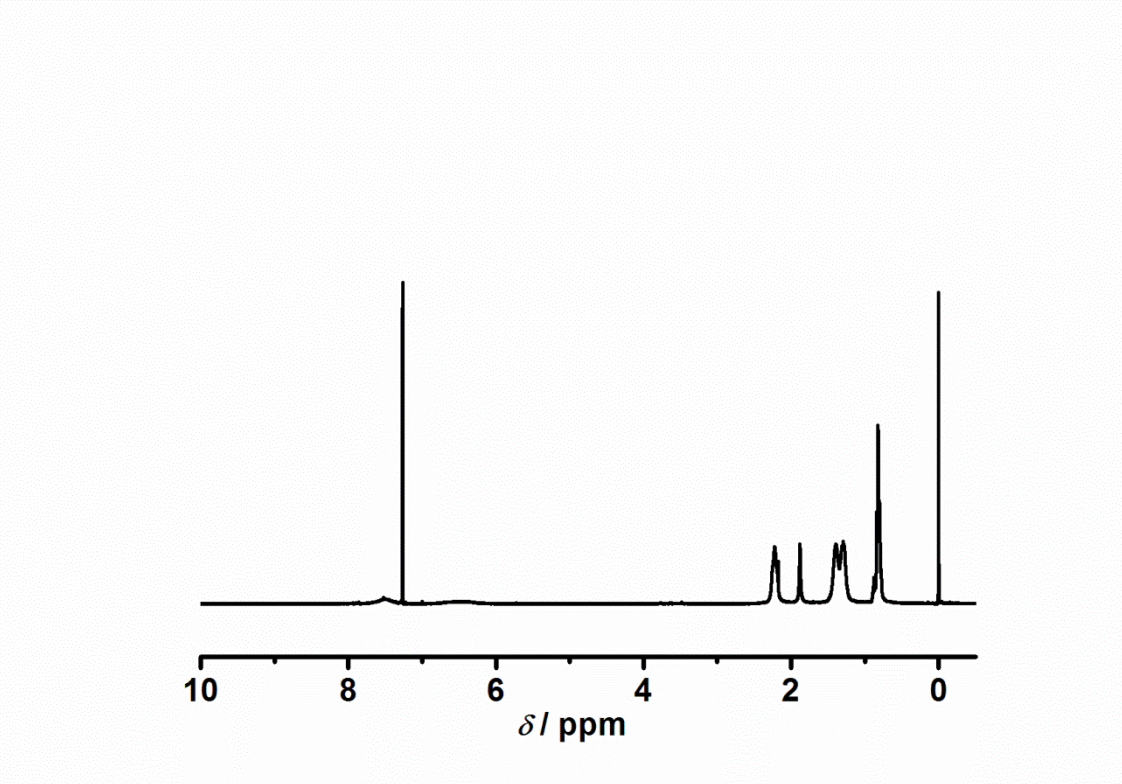

Fig. S7. ^{1}H NMR spectra of poly([P_{4444}][SS]$_{0.7}$-*co*-[P_{4446}][SS]$_{0.3}$).