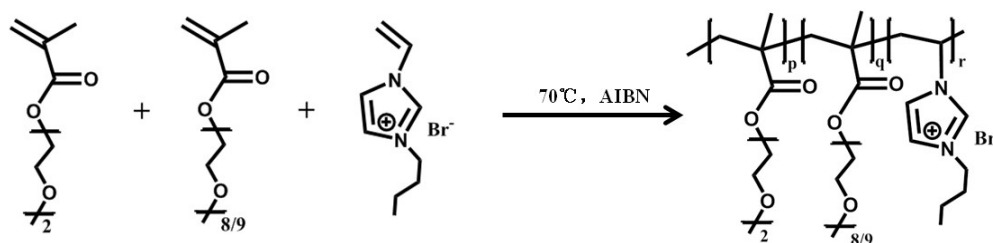# Supporting Information (SI)

Multiple Interactions Regulated Phase Transition Behavior of Thermo-responsive Copolymers Containing Cationic Poly(ionic liquid)s

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Synthesis of copolymers

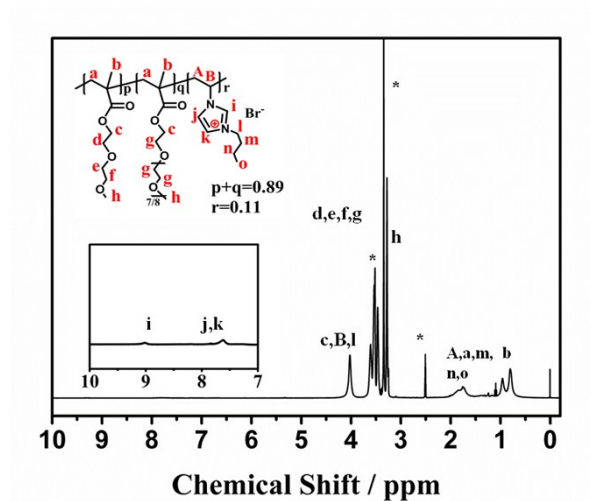**Scheme S1.** Chemical structures and Synthesis of copolymers

¹H NMR

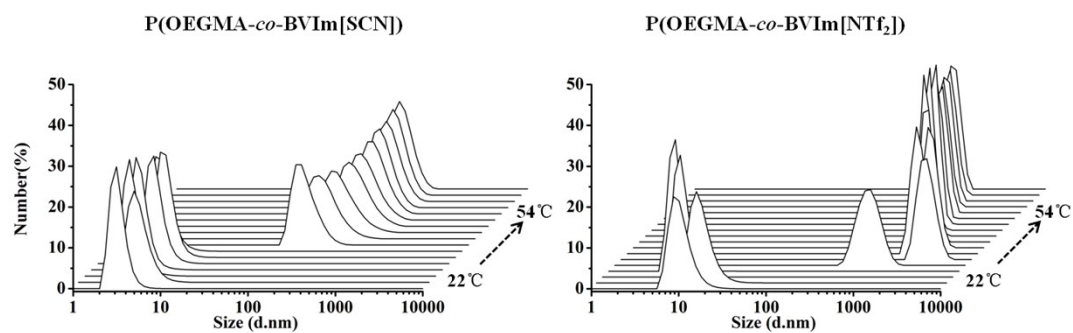**Figure S1.** ¹H-NMR spectra of P(OEGMA-*co*-BVIm[Br]) copolymer (DMSO-*d*6).

DLS

Figure S2. Size distributions of P(OEGMA-*co*-BVIm[SCN]) and P(OEGMA-*co*-BVIm[NTf2]) solutions with an interval of 2.0 °C during heating.
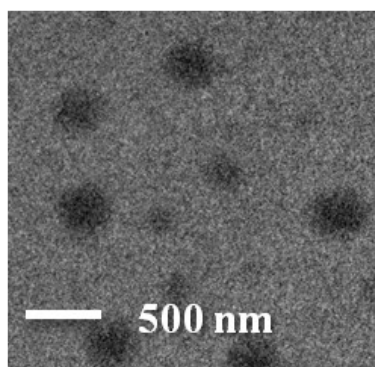
TEM

Figure S3. TEM image of P(OEGMA-*co*-BVIm[SCN] at 50°C in air-dried state.

Perturbation Correlation Moving Window (PCMW)
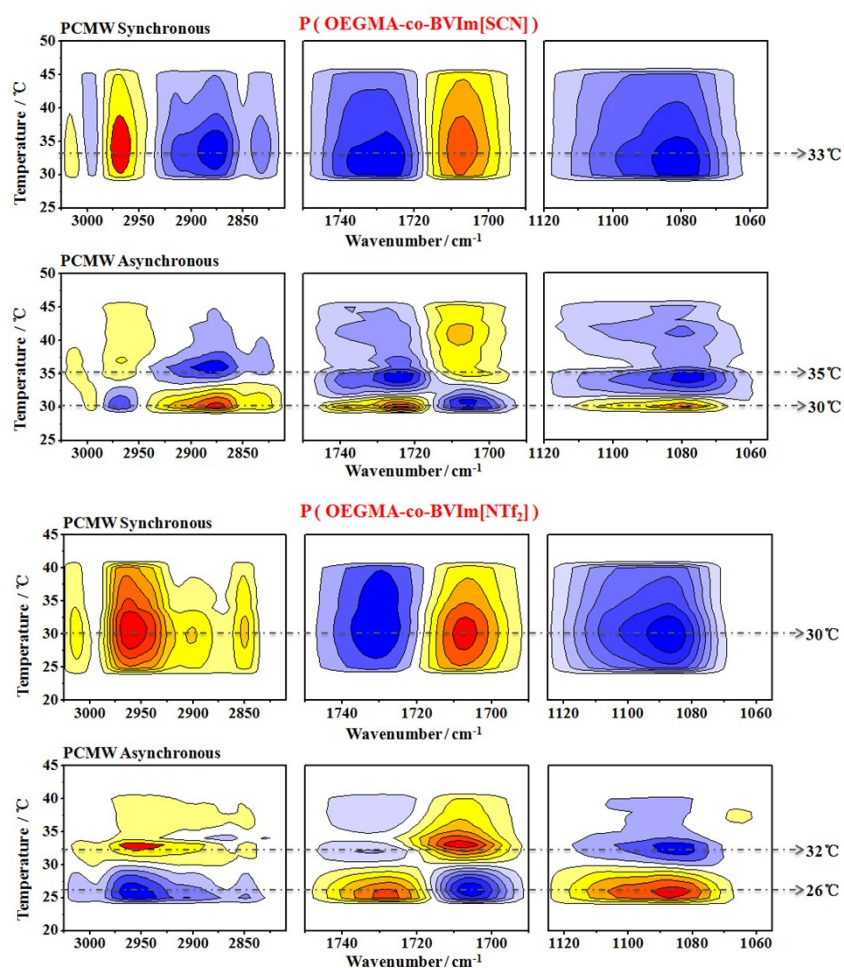

Figure S4. PCMW synchronous and asynchronous spectra of P(OEGMA-*co*-BVIm[SCN]) solution between 25 to 50 °C and P(OEGMA-*co*-BVIm[NTf$_2$]) solution between 20 to 45 °C during heating.

Two-Dimensional Correlation Analysis (2Dcos).

Noda's rule: when the cross-peaks of v_1 and v_2 ($v_1 > v_2$) in synchronous and asynchronous spectra have the same symbol (both positive or negative), then the change at peak v_1 has an earlier response than that at peak v_2, and vice versa.

Table S1. Final results of multiplication on the signs of each cross-peak in the synchronous and asynchronous spectra of P(OEGMA-*co*-BVIm[SCN]).

	2992	2985	2956	2935	2916	2874	2867	2835	2822	1732	1714	1096	1077
1077	+	+	+	+	+	−	−	−	+	+	−	+	
1096	+	+	+	+	+	−	−	−	+	+	−		
1714	+	+	+	+	+	+	+	−	+	+			
1732	+	−	+	+	+	−	−	−	+				
2822	+	−	+	+	+	−	−	−					
2835	+	+	+	+	+	+	+						
2867	+	+	+	+	+	+							
2874	+	+	+	+	+								
2916	−	−	+	+									
2935	−	−	+										
2956	−	−											
2985	+												
2992													

Table S2. Final results of multiplication on the signs of each cross-peak in the synchronous and asynchronous spectra of P(OEGMA-*co*-BVIm[NTf$_2$]).

	2993	2983	2955	2947	2914	2875	2867	2836	2823	1740	1736	1728	1715	1704	1096	1077
1077	−	−	+	+	−	+	−	−	−	−	−	+	+	+	+	
1096	−	−	+	+	−	+	−	−	−	−	−	−	+	−		
1704	−	−	+	+	−	+	−	−	−	−	−	−	+			
1715	−	−	_	−	−	+	−	−	−	−	−	−				
1728	−	−	+	+	−	+	−	−	−	−						
1736	−	−	+	+	−	+	+	−	−	−						
1740	+	+	+	+	+	+	+	−	+							
2823	−		+	+	−	+	+	−								
2836	+	+	+	+	+	+	+									
2867	−	−	+	+	−	+										
2875	−	−	−	−	−											
2914	−	−	+	+												
2947	−	−	−													
2955	−	−														
2983	−															
2993																