

Figure: ¹H-NMR of BEHA TFA

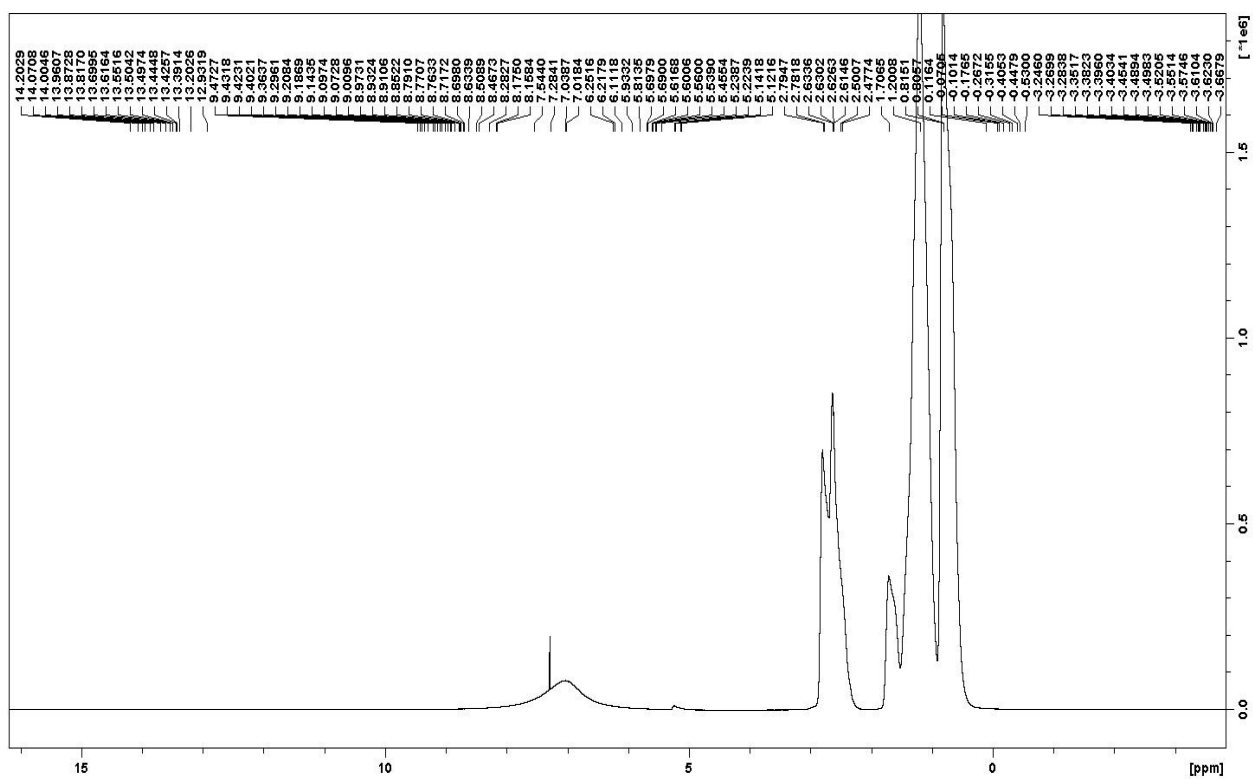


Figure: ¹H-NMR of BEHA MS

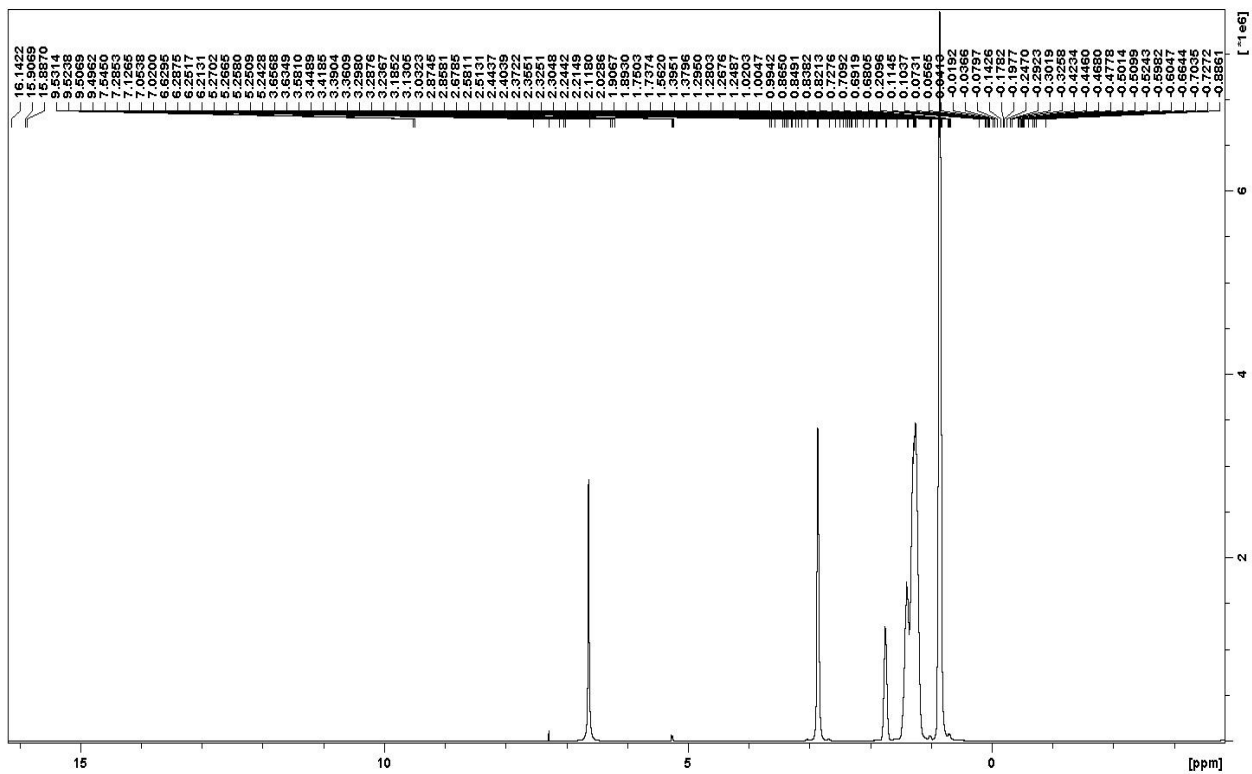


Figure: $^1\text{H-NMR}$ of BEHA TFMS

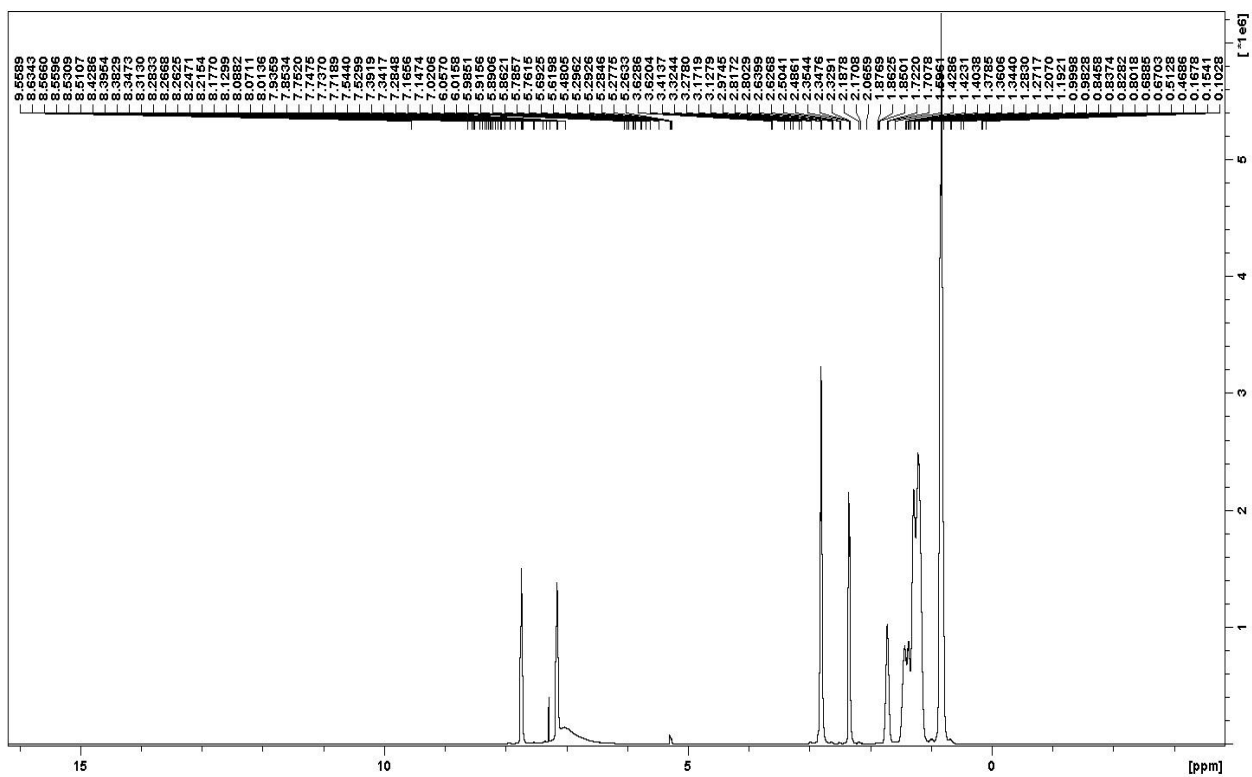


Figure: $^1\text{H-NMR}$ of BEHA Tosylate

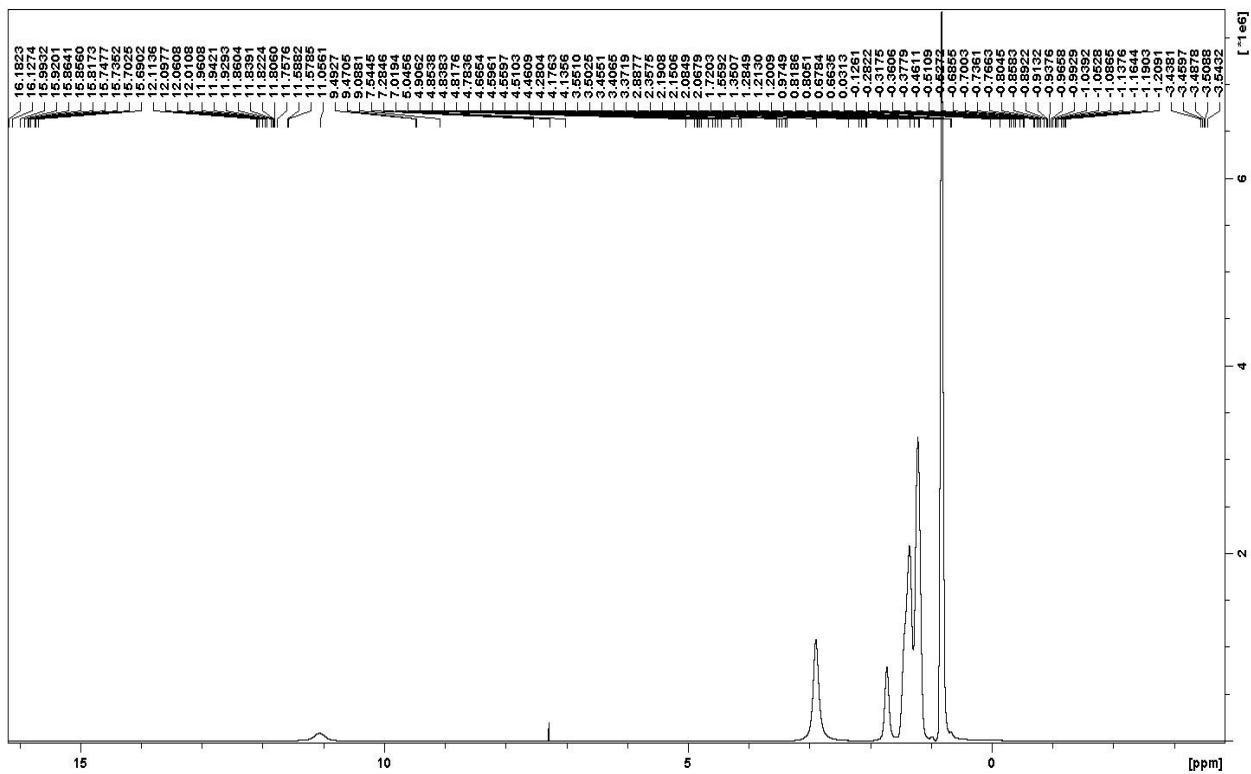


Figure: ¹H-NMR of TEHA TFA

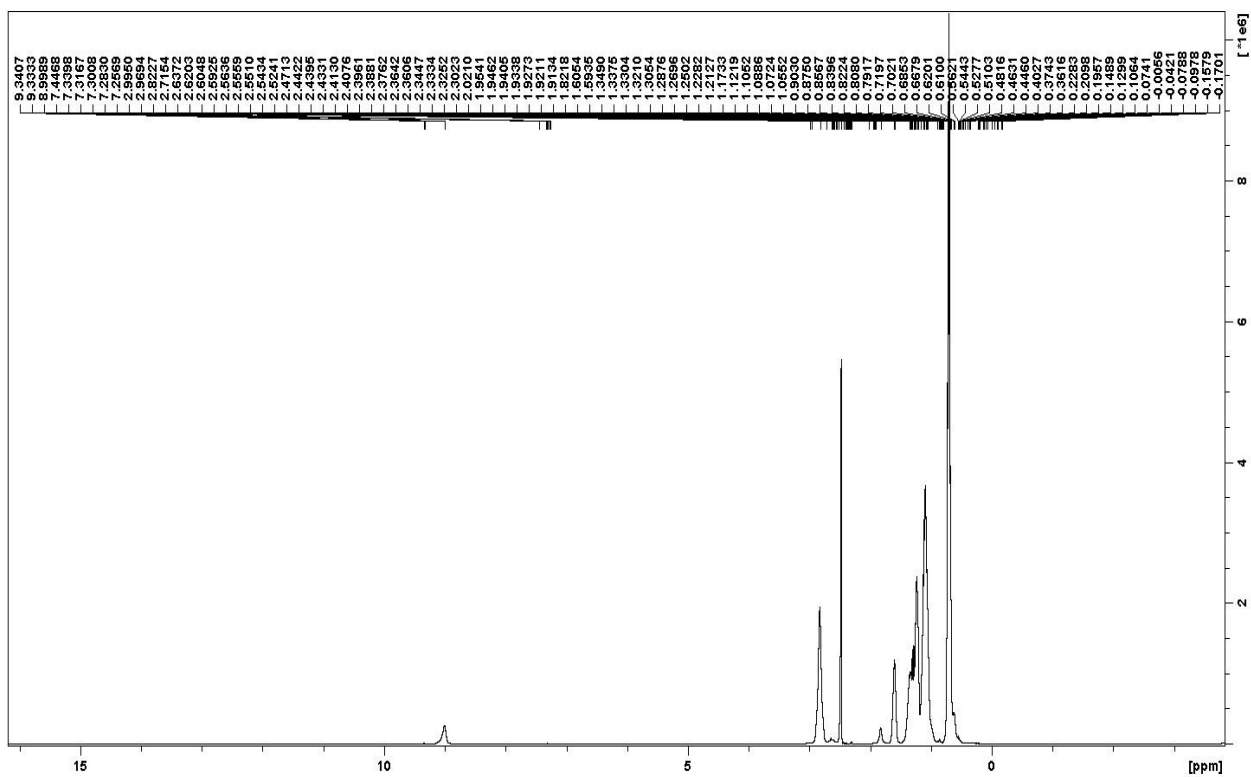


Figure: ¹H-NMR of TEHA MS

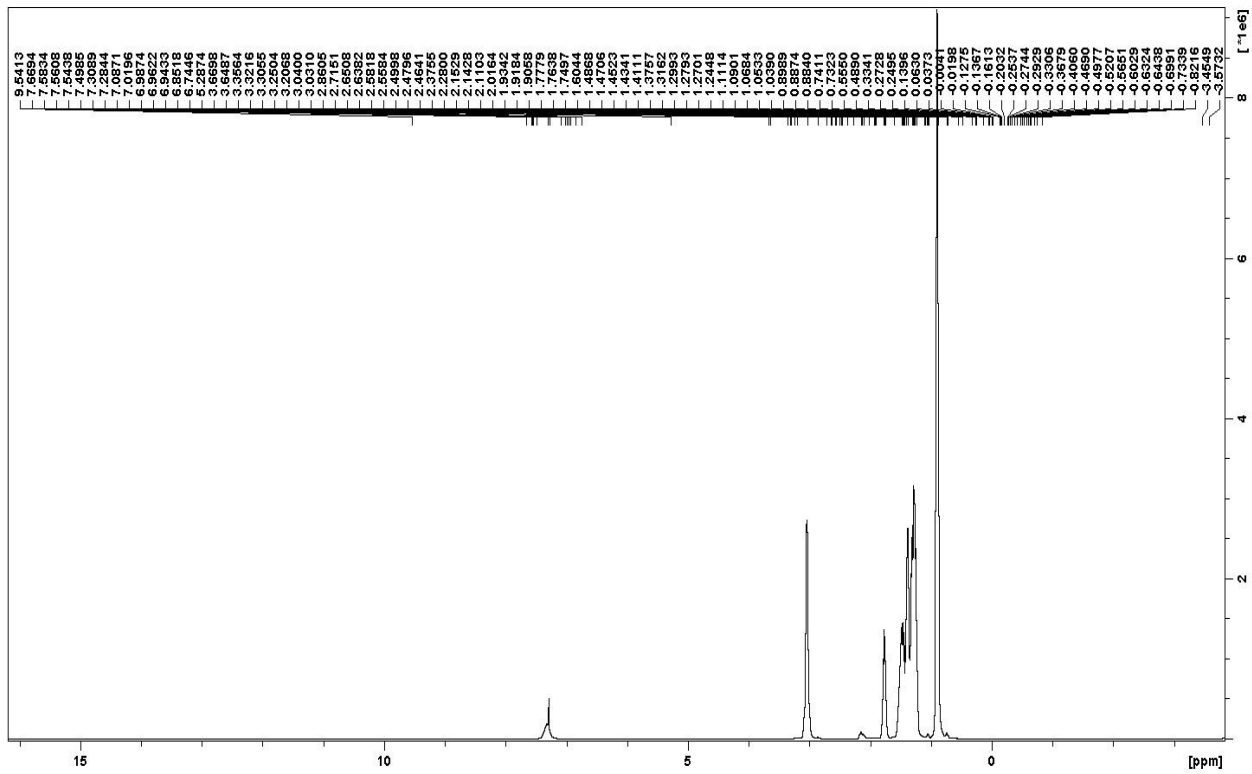


Figure: ¹H-NMR of TEHA TFMS

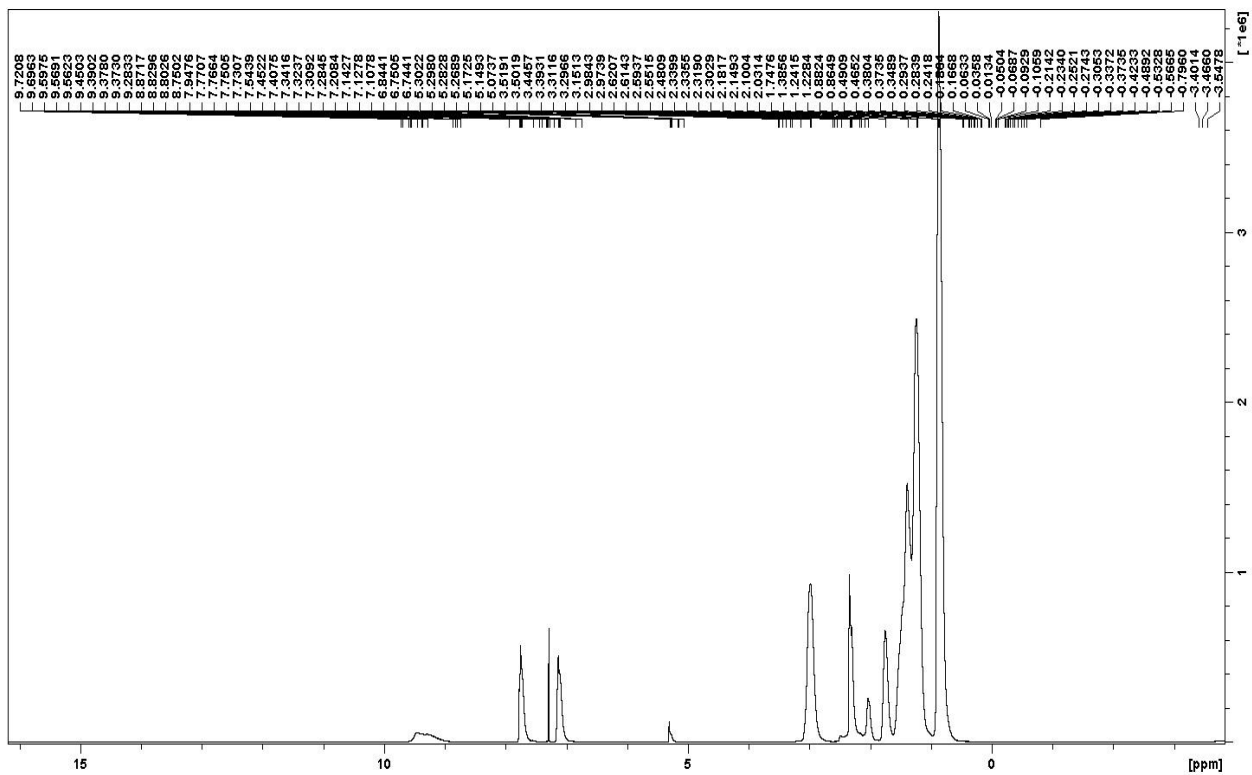


Figure: ¹H-NMR of TEHA Tosylate

Table: Density, refractive index and viscosity of synthesized PILs at various temperature.

Temperature (°C)	BEHA TFA	BEHA MS	BEHA TFMS	BEHA Tosylate	TEHA TFA	TEHA MS	TEHA TFMS	TEHA Tosylate
Density, ρ (g/cm³)								
20	--	0.9806	1.0635	0.9995	0.9553	0.9387	1.0164	0.9648
30	--	0.9737	1.0558	0.9927	0.9475	0.9322	1.0094	0.9583
40	--	0.9668	1.0480	0.9859	0.9396	0.9256	1.0024	0.9517
50	0.9667	0.9600	1.0403	0.9792	0.9317	0.9189	0.9954	0.9452
60	0.9587	0.9531	1.0327	0.9724	0.9238	0.9121	0.9884	0.9388
70	0.9508	0.9464	1.0251	0.9656	0.9159	0.9053	0.9814	0.9323
80	0.9429	0.9396	1.0176	0.9590	0.9080	0.8984	0.9745	0.9258
90	0.9351	0.9330	1.0101	0.9523	0.9000	0.8914	0.9676	0.9193
Refractive index, n_D (unit)								
20	--	1.4615	1.436	1.4924	1.4419	1.4652	1.4469	1.4869
30	--	1.4581	1.4327	1.4888	1.4381	1.4619	1.4436	1.4838
40	--	1.4548	1.4294	1.4853	1.4343	1.4584	1.4403	1.4803
50	1.4229	1.4515	1.4261	1.4818	1.4305	1.4550	1.4371	1.4769
60	1.4193	1.4478	1.4228	1.4783	1.4268	1.4514	1.4339	1.4734
70	1.4156	1.4445	1.4196	1.4746	1.4231	1.4476	1.4307	1.4699
80	1.4120	1.4414	1.4163	1.4713	1.4194	1.4440	1.4275	1.4664
90	1.4084	1.4382	1.413	1.4679	1.4156	1.4407	1.4243	1.4632
Viscosity, η (Pa.s)								
20	--	1.07	0.622	1.74	0.357	2.41	1.72	4.3584
30	--	0.635	0.382	1	0.216	1.38	1.02	2.47
40	--	0.331	0.209	0.503	0.116	0.69	0.535	1.25
50	0.051	0.184	0.122	0.27	0.0662	0.367	0.298	0.653
60	0.0319	0.11	0.0755	0.157	0.0405	0.206	0.176	0.367
70	0.0211	0.0695	0.0496	0.0977	0.0263	0.123	0.11	0.221
80	0.015	0.0454	0.0343	0.0627	0.0179	0.0751	0.0702	0.139
90	0.0109	0.032	0.0241	0.0435	0.0124	0.0498	0.0483	0.0944

Table: Thermal Conductivity of the synthesized PILs

PILs	Thermal Conductivity, κ (W/m.K)	Temperature (°C)
BEHA TFA	0.133	49.54
BEHA MS	0.159	25.26
BEHA TFMS	0.143	25.23
BEHA Tosylate	0.153	25.23
TEHA TFA	0.138	25.25
TEHA MS	0.150	25.26
TEHA TFMS	0.135	25.25
TEHA Tosylate	0.146	25.2

Table: Ionic and Thermal conductivity of the fixed ratio of PILs and 0.05M I^-/I_3^-

Temperature (°C)	BEHA TFA	BEHA MS	BEHA TFMS	BEHA Tosylate	TEHA TFA	TEHA MS	TEHA TFMS	TEHA Tosylate
Ionic Conductivity, σ (mS/cm)								
25	1.444	1.22	2.45	0.753	2.27	0.837	1.382	0.667
30	1.52	1.328	2.56	0.824	2.34	0.863	1.49	0.747
35	1.555	1.44	2.75	0.898	2.45	0.963	1.61	0.827
40	1.688	1.54	3.08	0.998	2.6	1.051	1.755	0.885
45	1.826	1.636	3.37	1.122	2.8	1.13	1.84	0.965
50	1.879	1.738	3.75	1.213	2.99	1.226	2.02	1.038
55	2	1.838	4.09	1.323	3.21	1.365	2.24	1.102
60	2.13	2.02	4.36	1.438	3.46	1.45	2.47	1.2
65	2.23	2.19	4.62	1.51	3.64	1.51	2.67	1.27
70	2.34	2.26	4.93	1.627	3.85	1.635	2.9	1.388
Thermal Conductivity, κ (W/m.K)								
20	0.0365	0.039	0.035	0.033	0.0375	0.039	0.036	0.041
30	0.037	0.0395	0.036	0.034	0.038	0.0395	0.037	0.042
40	0.0375	0.04	0.037	0.035	0.0385	0.04	0.038	0.043
50	0.038	0.0405	0.038	0.036	0.039	0.041	0.0385	0.044
60	0.039	0.041	0.039	0.03633	0.0395	0.0415	0.039	0.045
70	0.0395	0.0415	0.04	0.03667	0.04	0.042	0.0395	0.046