Supporting Information

A comprehensive investigation on the thermal stability of 66 ionic liquids by thermogravimetric analysis

*Yuanyuan Cao, Tiancheng Mu**

Department of Chemistry, Renmin University of China, Beijing 100872, P. R. China

Table S1. Thermal decomposition kinetics of all the 66 ILs investigated.

NO.	Abbreviate Name	T / °C	k / %·min^{-1}	E_a / kJ·mol^{-1}	E_a (lit) / kJ·mol^{-1}	pre-exponential factor A	pre-exponential factor A (lit)	R^2	$t_{0.99}$ / min	Fitted Curves	$T_{0.01/10h}$ / °C
		200	0.000786						1272.3		
		220	0.001887						529.94		
1	[EMIM][BF_4]	240	0.003898	110.9 [e]		1.037E^9		0.9655	256.54	y=5.86E+6e$^{-0.04219x}$	217
		260	0.009065						110.31	R^2=0.9986	
		280	0.04254						23.51		
		300	0.1047						9.55		
		200	0.000883						1131.8		
		220	0.001791						558.35		
2	[BMIM][BF_4]	240	0.004469	108.4 [e]		6.2296E^8		0.9828	223.76	y=3.07E+6e$^{-0.03948x}$	216
		260	0.01277						78.31	R^2=0.9958	
		280	0.03675						27.21		
		300	0.1012						9.88		
		200	0.001407						710.73		
		220	0.003856						259.34		
3	[HMIM] [BF_4]	240	0.009493	107.8 [e]		1.0068E^9		0.9964	105.34	y=1.33E+7e$^{-0.04919x}$	203
		260	0.02513						39.79	R^2=0.9997	
		280	0.06892						14.51		
		300	0.1667						6.00		
		200	0.001726						579.37		
		220	0.004455						224.47	y=1.13E+7e$^{-0.04937x}$	
4	[OMIM] [BF_4]	240	0.01349	116.0 [e]		9.2695E^9		0.9968	74.13	R^2=0.9992	199

		260	0.0421					23.75			
		280	0.1143					8.75			
		300	0.2637					3.79			
		200	0.002218					450.86			
		220	0.002674					373.97			
5	[DMIM] [BF_4]	240	0.006811	96.1 [e]		$5.5952E^{7}$	0.9511	146.82	$y=1.24E+5e^{-0.02768x}$	192
		260	0.01903					52.55	$R^2=0.9076$	
		280	0.04992					20.03		
		300	0.1277					7.83		
		200	0.000307					3258.4		
		220	0.000475					2106.6		
6	[BMIM][PF_6]	240	0.001588	137.8 [e]	68 ± 2.8 [1]	$2.6686E^{11}$	0.953	629.72	$y=4.32E+6e^{-0.03575x}$	248
		260	0.006159		(*137-232°C*)			162.36	$R^2=0.9533$	
		280	0.02804					35.66		
		300	0.1133					8.83		
		200	0.000388					2578.6		
		220	0.000439					2276.4		
7	[HMIM] [PF_6]	240	0.001483	135.6 [e]		$1.7016E^{11}$	0.9364	674.31	$y=1.13E+6e^{-0.02993x}$	252
		260	0.007599					131.60	$R^2=0.855$	
		280	0.03221					31.05		
		300	0.1042					9.60		
		200	0.000312					3208.2		
		220	0.000400					2500		
8	[OMIM] [PF_6]	240	0.001378	136.0 [e]		$1.6186E^{11}$	0.9455	725.69	$y=2.14E+6e^{-0.03217x}$	254
		260	0.00611					163.67	$R^2=0.9021$	
		280	0.02658					37.62		

		300	0.09363					10.68		
		200	0.000505					1978.2		
		220	0.001298					770.42		
9	[EMIM][Tf_2N]	240	0.01032	131.6 [e]	131[2]	1.716E[11]	0.9696	96.90	$y=1.12E+8e^{-0.05468x}$	222
		260	0.03379		(*200-300 °C*)			29.59	$R^2=0.9884$	
		280	0.05578					17.93		
		300	0.1398					7.15		
		200	0.000433					2309.5		
		220	0.001175					851.06		
10	[BMIM] [Tf_2N]	240	0.00335	126.4 [e]	113[2]	3.047E[10]	0.9843	298.51	$y=5.66E+7e^{-0.05053x}$	227
		260	0.009033		(*200-300 °C*)			110.71	$R^2=0.9998$	
		280	0.04227					23.66		
		300	0.109					9.17		
		200	0.000566					1765.5		
		220	0.00191					523.56		
11	[HMIM] [Tf_2N]	240	0.00533	119.6 [e]		8.5569E[9]	0.9986	187.62	$y=2.37E+8e^{-0.05904x}$	218
		260	0.01569					63.73	$R^2=0.9995$	
		280	0.04853					20.61		
		300	0.109					9.17		
		200	0.002128					469.92		
		220	0.006158					162.39		
12	[MIM][Tf_2N]	240	0.01625	102.7 [e]		4.6614E[8]	0.9999	61.54	$y=1.49E+7e^{-0.05182x}$	195
		260	0.0403					24.81	$R^2=0.9996$	
		280	0.09406					10.63		
		300	0.2012					4.97		
		200	0.001105					904.98		

		220	0.005511						181.46		
13	$[M_{12}IM][Tf_2N]$	240	0.01668	119.5 [e]		$2.1472E^{10}$		0.9932	59.95	$y=4.87E+9e^{-0.0775x}$	205
		260	0.04389						22.78	$R^2=0.9985$	
		280	0.1107						9.03		
		300	0.242						4.13		
		200	0.000317						3155.6		
		220	0.000771						1297.5		
14	$[M_{13}IM][Tf_2N]$	240	0.002039	116.1 [e]		$1.5948E^{9}$		0.9803	490.44	$y=2.86E+7e^{-0.04554x}$	236
		260	0.004865						205.55	$R^2=0.9996$	
		280	0.01795						55.71		
		300	0.05626						17.77		
		200	0.000265						3779.3		
		220	0.000743						1345.9		
15	$[MMMIM][Tf_2N]$	240	0.002027	116.6 [e]		$1.7276E^{9}$		0.9965	493.34	$y=1.12E+8e^{-0.05148x}$	235.7
		260	0.006138						162.92	$R^2=0.9997$	
		280	0.01753						57.05		
		300	0.04462						22.41		
		120	0.003929						254.52		
16	[EMIM][Ac]	140	0.0254	112.6[a]	115.8[3]	$3.9832E^{12}$	$2.98E^{9}$ [3]	0.9873	39.37	$y=1.7E+5e^{-0.03517x}$	110.7
		160	0.1317		(*105-170 °C*)				7.59	$R^2=0.9441$	
		180	0.3525						2.84		
		120	0.003395						294.55		
17	[BMIM][Ac]	140	0.0254	115.9 [a]		$9.9645E^{12}$		0.9832	39.37	$y=1.7E+7e^{-0.09261x}$	112.8
		160	0.1317						7.59	$R^2=0.9998$	
		180	0.3525						2.84		

		120	0.004175						239.52		
18	[HMIM][Ac]	140	0.02667	111.0 [a]		$2.6766E^{12}$		0.9823	37.5	$y=1.51E+5e^{-0.09208x}$	110.1
		160	0.1417						7.06	$R^2=0.9998$	
		180	0.3458						2.89		
		120	0.00353						282.97		
19	[OMIM][Ac]	140	0.02862	115.4 [a]		$9.3330E^{12}$		0.9690	34.94	$y=7.2E+7e^{-0.1037x}$	112.7
		160	0.1556						6.43	$R^2=0.9997$	
		180	0.3502						2.86		
		200	0.000198						5047.9		
		220	0.000979						1021.4		
20	[BMMIM][BF_4]	240	0.002774	114.7 [e]	88.4^4	$1.1465E^9$	$2.876E^{6\,4}$	0.992	360.49	$y=2.21E+10e^{-0.07647x}$	228
		260	0.006542		(*200-360 °C*)				152.86		
		280	0.01541						64.89	$R^2=0.9978$	
		300	0.0383						26.11		
		200	0.0005925						1687.7		
		220	0.001316						759.88	$y=9E+6e^{-0.04286x}$	
21	[BMMIM][PF_6]	240	0.003764	101.7 [e]		$8.5532E^7$		0.9908	265.67	$R^2=0.998$	224.2
		260	0.008229						121.52		
		280	0.01908						52.41		
		300	0.05705						17.53		
		120	0.003375						296.30		
22	[EMMIM][Ac]	140	0.01522	108.6 [a]		$8.6660E^{11}$		0.9991	65.70	$y=2.5E+6e^{-0.07544x}$	110.6
		160	0.07176						13.94	$R^2=0.9998$	
		180	0.2668						3.75		
		120	0.00272						368.32		
23	[BMMIM][Ac]	140	0.01351	118.4 [a]		$1.3654E^{13}$		0.9985	74.02	$y=5.8E+6e^{-0.08058x}$	113.9

		160	0.0749					13.35	R^2=0.9997	
		180	0.3163					3.16		
		120	0.000285		121[5]			6706.9		
		140	0.001579		(*150-200 °C*)		$3.8E^{10}$ [5]	986.19		
24	[BMIM][Cl]	160	0.011530	132.2 [b]		$9.6446E^{13}$	$2.8E^{13}$ [6]	0.9978	168.78	y= $1.1E+8e^{-0.08626x}$	140.4
		180	0.06149		129[6]				35.63	R^2=0.9999	
		200	0.2331		(*150-190 °C*)				9		
		120	0.0002854						3503.8		
		140	0.001579						633.31		
25	[OMIM][Cl]	160	0.01153	129.9 [b]		$9.2169E^{13}$		0.9957	86.73	y= $2.9E+8e^{-0.09931x}$	131.8
		180	0.06149						16.26	R^2=0.9997	
		200	0.2331						4.29		
		120	0.000149						6711.4		
		140	0.001014						986.19		
26	[BMIM][Br]	160	0.005925	128.2 [b]	212.51[7]	$1.6428E^{13}$	$2.43E^{18}$ [7]	0.9998	168.78	y= $6.4E+8e^{-0.09551x}$	145.2
		180	0.02807		(*260-300 °C*)				35.63	R^2=0.9999	
		200	0.1111						9.00		
		120	0.000236						4237.3		
		140	0.000976						1024.6		
27	[BMIM][I]	160	0.006693	126.5 [b]		$1.2292E^{13}$		0.9943	149.41	y= $2.7E+7e^{-0.07307x}$	146.7
		180	0.03526						28.36	R^2=0.9991	
		200	0.1406						7.11		
		160	0.000442						2262.4		
		180	0.00133						751.88		
28	[BMIM][NO_3]	200	0.006235	120.7 [d]		$7.8583E^{11}$		0.9704	160.38	y= $2.4E+7e^{-0.05811x}$	182.9
		220	0.01718						58.21	R^2=0.9981	

		240	0.04892				20.44		
		260	0.1287				7.77		
		160	0.001714				583.43		
		180	0.002564				390.02		
29	[HMIM][NO_3]	200	0.008291	120.1 [d]	$2.7467E^{11}$	0.9519	120.61	$y= 1.7E+5e^{-0.03517}$	160.5
		220	0.04602				21.73	R^2=0.9441	
		240	0.2179				4.59		
		260	0.5754				1.74		
		160	0.001863				536.77		
		180	0.0106				94.34		
30	[BMIM][TFO]	200	0.03972	130.5 [d]	$1.0686E^{13}$	0.9944	25.18	$y= 4.5E+8e^{-0.0853x}$	158.7
		220	0.1547				6.46	R^2=0.9996	
		240	0.5432				1.84		
		260	1.63				0.61		
		200	0.0000845				11838		
		220	0.0002189				4568.3		
31	[BMIM][ClO_4]	240	0.00053	128.7 [e]	$9.3813E^{9}$	0.9616	1886.8	$y= 1.5E+8e^{-0.04714x}$	263.2
		260	0.001395				716.85	R^2=0.9996	
		280	0.006814				146.76		
		300	0.02779				35.98		
		200	0.000902				1111.1		
		220	0.00425				250.00		
32	[BMIM][HSO_4]	240	0.007903	133.2 [e]	$4.2547E^{11}$	0.9855	126.53	$y= 1.0E+9e^{-0.06858x}$	208.9
		260	0.0318				31.45	R^2=0.9943	
		280	0.132				7.58		
		300	0.357				2.80		

		200	0.000787						1270.5		
		220	0.002608						383.44		
33	[BMIM][TS]	240	0.01087	150.1 [e]		$2.3925E^{13}$		0.9959	92.00	$y= 2.8E+8e^{-0.06158x}$	212.2
		260	0.0437						22.88	$R^2=0.9995$	
		280	0.1691						5.91		
		300	0.5498						1.82		
		120	0.000382						2617.8		
		140	0.002499						400.16		
34	[AMIM][Cl]	160	0.01349	126.1 [b]	125[6]	$2.1295E^{13}$	$3E^{13}$ [6]	0.9993	74.13	$y= 1.9E+8e^{-0.09339x}$	135.7
		180	0.05898		(*150-190°C*)				16.95	$R^2=0.9999$	
		200	0.2693						3.71		
		120	0.000326						3065.6		
		140	0.001771						564.65		
35	[AMIM][Br]	160	0.00712	111.2 [b]		$1.9498E^{11}$		0.9988	140.45	$y= 6.8E+7e^{-0.08339x}$	139.5
		180	0.02886						34.65	$R^2=0.9997$	
		200	0.1067						9.37		
		120	0.004371						228.78		
		140	0.01679						59.56		
36	[AVIM][Cl]	160	0.05786	92.8 [b]		$9.2440E^{9}$		0.9903	17.28	$y= 6.7E+5e^{-0.06657x}$	105.5
		180	0.2222						4.50	$R^2=0.9998$	
		200	0.4773						2.10		
		200	0.005059						197.67		
		220	0.009545						104.77		
37	[ABIM][BF_4]	240	0.01802	92.6 [e]		$6.5660E^{7}$		0.9760	55.49	$y= 1.7E+5e^{-0.03392x}$	167.5
		260	0.0471						21.23	$R^2=0.9956$	
		280	0.1353						7.39		

		300	0.2745				3.64		
		200	0.002135				468.38		
		220	0.007171				139.45		
38	[ABIM][PF_6]	240	0.02028	110.3 [e]	$3.3868E^{9}$	0.9994	49.31	y= $5.9E+7e^{-0.05876x}$	195.7
		260	0.05255				19.03	R^2=0.9993	
		280	0.1346				7.43		
		300	0.2818				3.55		
		120	0.000722				1384.5		
		140	0.003832				260.96		
39	[ABIM][Cl]	160	0.01661	115.5 [b]	$1.4266E^{12}$	0.9996	60.20	y= $2.8E+7e^{-0.08265x}$	130.1
		180	0.07051				14.18	R^2=0.9998	
		200	0.2498				4.00		
		120	0.000531				1881.8		
		140	0.002728				366.57		
40	[ABIM][Br]	160	0.01218	114.9 [b]	$8.9388E^{11}$	0.9998	82.10	y= $3.2E+7e^{-0.08121x}$	134.1
		180	0.05159				19.38	R^2=0.9999	
		200	0.1875				5.33		
		160	0.001009				991.08		
		180	0.008066				123.98		
41	[ABIM][NO_3]	200	0.0327	148.5 [d]	$8.8938E^{14}$	0.9850	30.58	y= $1.3E+10e^{-0.1024x}$	164.9
		220	0.153				6.54	R^2=0.9996	
		240	0.6049				1.65		
		200	0.0029				344.83		
		220	0.01046				95.60		
42	[HOEMIm][BF_4]	240	0.03001	91.2 [e]	$4.1867E^{7}$	0.9794	33.32	y= $6.6E+7e^{-0.06083x}$	190.8
		260	0.04689				21.33	R^2=0.9957	

		280	0.08703				11.49		
		300	0.2066				4.84		
		200	0.000169				5910.2		
		220	0.000469				2133.1		
43	[HOEMIm][Tf_2N]	240	0.002041	126 [e]	$1.2607E^{10}$	0.9969	489.96	y= $3.3E+8e^{-0.05459x}$	242
		260	0.005965				167.64	R^2=0.9974	
		280	0.0161				62.11		
		300	0.04033				24.80		
		120	0.000975				1025.2		
44	[HOEMIm][Ac]	140	0.00536	132.8 [a]	$3.8500E^{14}$	0.9964	186.57	y= $3.1E+7e^{-0.0859x}$	126.2
		160	0.03838				26.06	R^2=0.9998	
		180	0.2005				4.99		
		120	0.000050				19805		
		140	0.000402				145.45	y= $3.5E+9e^{-0.1008x}$	
45	[HOEMIm][Cl]	160	0.001124	126.2 [b]	$2.6885E^{12}$	0.9644	889.68	R^2=0.9985	154.7
		180	0.006875				2487.5		
		200	0.039980				25.01		
		160	0.000039				25641		
		180	0.0002591				3859.5		
46	[HOEMIm][NO_3]	200	0.003519	178.7 [d]	$1.4420E^{17}$	0.9843	284.17	y= $2.5E+9e^{-0.09578x}$	159.2
		220	0.02389				41.86	R^2=0.998	
		240	0.09738				10.27		
		260	0.3401				2.94		
		160	0.0001157				8643		
		180	0.0002668				3748.1		
47	[HOEMIm][TFO]	200	0.0003911	60.2 [d]	$2.125E^{4}$	0.9828	2556.9	y= $2.2E+6e^{-0.03472x}$	236.3

		220	0.0009192				1087.9	R^2=0.9877	
		240	0.001898				526.87		
		260	0.002401				416.49		
		160	0.000263				3802.3		
		180	0.0006439				1553.1		
48	[HOEMIm][ClO_4]	200	0.001818	134.1 [d]	1.8359E^{12}	0.8329	550.06	y= 6.1E+6e$^{-0.04612x}$	200.1
		220	0.003489				286.62	R^2=0.9987	
		240	0.02712				36.87		
		260	0.5107				1.96		
		120	0.006729				148.61		
		140	0.01366				73.21		
49	[HOEMIm][DCA]	160	0.06055	69.1 [b]	9.9194E^{6}	0.9541	16.52	y= 2.8E+4e$^{-0.04352x}$	88.3
		180	0.1374				7.28	R^2=0.9807	
		200	0.1803				5.55		
		200	0.0001169				8554.3		
		220	0.0002677				3735.5		
50	[EPy][Tf_2N]	240	0.000696	127.5 [e]	9.4492E^{9}	0.9683	1436.8	y= 5.7E+7e$^{-0.04399x}$	260.5
		260	0.002212				452.08	R^2=0.9982	
		280	0.008038				124.41		
		300	0.03503				28.55		
		200	0.002369				422.12		
		220	0.004955				201.82		
51	[BPy][BF_4]	240	0.012400	106.0 [e]	9.2285E^{8}	0.9860	80.65	y= 1.3E+6e$^{-0.04023x}$	191.4
		260	0.032880				30.41	R^2=0.9974	
		280	0.092960				10.76		
		300	0.248200				4.03		

		200	0.000895				1117.3		
		220	0.002638				379.08		
52	[BPy][PF_6]	240	0.0097	127.1 [e]	$8.9054E^{10}$	0.9961	103.09	$y= 8.2E+7e^{-0.056x}$	211.6
		260	0.03322				30.10	R^2=0.9993	
		280	0.1022				9.78		
		300	0.2061				4.85		
		200	0.000123				8123.5		
		220	0.000394				2534.8		
53	[BPy][Tf_2N]	240	0.001272	132.6 [e]	$4.6374E^{10}$	0.995	786.16	$y= 9.4E+8e^{-0.05829x}$	244.7
		260	0.00408				245.10	R^2=0.9999	
		280	0.01384				72.25		
		300	0.0441				22.68		
		120	0.000103				9699.3		
		140	0.002427				412.03		
54	[BPy][Br]	160	0.01942	161.9 [b]	$4.9961E^{17}$	0.9860	51.49	$y= 1.6E+12e^{-0.1576x}$	137.6
		180	0.1177				8.50	R^2=0.9999	
		200	0.4861				2.06		
		160	0.00135				740.19		
		180	0.00744				134.48		
55	[BPy][NO_3]	200	0.06491	147.9 [d]	$9.9100E^{14}$	0.9864	15.41	$y= 7.4E+8e^{-0.08636x}$	162.4
		220	0.2607				3.84	R^2=0.9997	
		240	0.6575				1.52		
		160	0.0001038				9633.9		
		180	0.0002069				4833.2		
56	[BPy][TFO]	200	0.0006969	108.8 [d]	$9.4829E^{8}$	0.9814	1434.9	$y= 8.5E+6e^{-0.04232x}$	226
		220	0.002756				362.84	R^2=0.9866	

		240	0.009855				101.47		
		260	0.02212				45.21		
		120	0.0005179				1930.8		
		140	0.00142				704.23		
57	[BPy][DCA]	160	0.007165	115.3 [b]	$7.5481E^{11}$	0.9784	139.57	$y= 1.5E+6e^{-0.05554x}$	141.1
		180	0.04584				21.82	$R^2=0.9941$	
		200	0.1622				6.17		
		160	0.007159				139.68		
		180	0.0126				79.37		
58	[BPy][HSO_4]	200	0.04567	101.6 [d]	$9.7271E^{9}$	0.9525	21.90	$y= 6.8E+4e^{-0.03854x}$	226
		220	0.1096				9.12	$R^2=0.9701$	
		240	0.4909				2.04		
		120	0.001899				526.59		
		140	0.006197				161.37		
59	[BPy][H_2PO_4]	160	0.02077	81.6 [b]	$1.3534E^{8}$	0.9716	48.15	$y= 6.1E+5e^{-0.05884x}$	117.7
		180	0.04641				21.55	$R^2=0.9997$	
		200	0.1419				7.05		
		200	0.000242				4132.2		
		220	0.001727				579.04		
60	[P_{66614}][Br]	240	0.002862	143.6 [e]	$1.7386E^{12}$	0.9394	349.41	$y= 3.5E+11e^{-0.0913x}$	221.1
		260	0.009402				106.36	$R^2=0.9929$	
		280	0.0464				21.55		
		300	0.2038				4.91		
		120	0.0022				455.17		
		140	0.00316				316.46		109.5
61	[P_{4444}][Gly]	160	0.00413	15.04 [c]	3.170	0.8996	241.90	$y= 7.1E+4e^{-0.02263x}$	

		180	0.00917				109.03	R^2=0.9517	
		200	0.0244				40.98		
		220	0.06268				15.95		
		120	0.01017				98.33		
		140	0.01527				65.49		
62	$[P_{4444}]$[Ala]	160	0.02338	33.02 [c]	230.950	0.9656	42.77	y= 1.1E+3$e^{-0.0202x}$	30.7
		180	0.03305				30.26	R^2=0.9992	
		200	0.05155				19.40		
		220	0.07957				12.57		
		120	0.02844				35.16		
		140	0.0462				21.65		
63	$[P_{4444}]$[Ser]	160	0.0491	14.94 [c]	3.115	0.8952	20.37	y= 118$e^{-0.01086x}$	---
		180	0.06432				15.55	R^2=0.8652	
		200	0.06871				14.55		
		220	0.07563				13.22		
		120	0.00218				457.67		
		140	0.00455				219.83		
64	$[P_{4444}]$[Glu]	160	0.00802	50.82 [c]	1.20E^4	0.9567	124.75	y= 2.8E+4$e^{-0.03431x}$	112
		180	0.01849				54.08	R^2=0.9977	
		200	0.03351				29.84		
		220	0.04394				22.76		
		120	0.00966				103.52		
		140	0.02209				45.27		
65	$[P_{4444}]$[Lys]	160	0.03914	34.58 [c]	457.457	0.8868	25.55	y= 4.0E+3$e^{-0.03075x}$	61.6
		180	0.04665				21.44	R^2=0.9519	
		200	0.06004				16.66		

		220	0.09862				10.14		
		120	0.00766				130.46		
		140	0.01202				83.19		
66	$[P_{4444}][Pro]$	160	0.01981	42.78 [c]	3090.93	0.9479	50.48	$y= 2.1E+3e^{-0.02322x}$	54.5
		180	0.02594				38.55	$R^2=0.992$	
		200	0.05674				17.62		
		220	0.1188				8.42		

[a] Temperature of isothermal TGA experiment ranges from 120 to 180℃ with anion [Ac].

[b] Temperature of isothermal TGA experiment ranges from 120 to 200℃ with anion [Cl], [Br], [I], [DCA] and $[H_2PO_4]$.

[c] Temperature of isothermal TGA experiment ranges from 120 to 220℃ with anion [Gly], [Ala], [Ser], [Glu], [Lys] and [Pro].

[d] Temperature of isothermal TGA experiment ranges from 160 to 260℃ with anion $[NO_3]$, [TFO], [HOEMIm]$[ClO_4]$ and [BPy] $[HSO_4]$.

[e] Temperature of isothermal TGA experiment ranges from 200 to 300℃ with anion $[BF_4]$, $[PF_6]$, $[Tf_2N]$, [TS], [BMIM]$[ClO_4]$, [BMIM]$[HSO_4]$ and $[P_{66614}][Br]$.

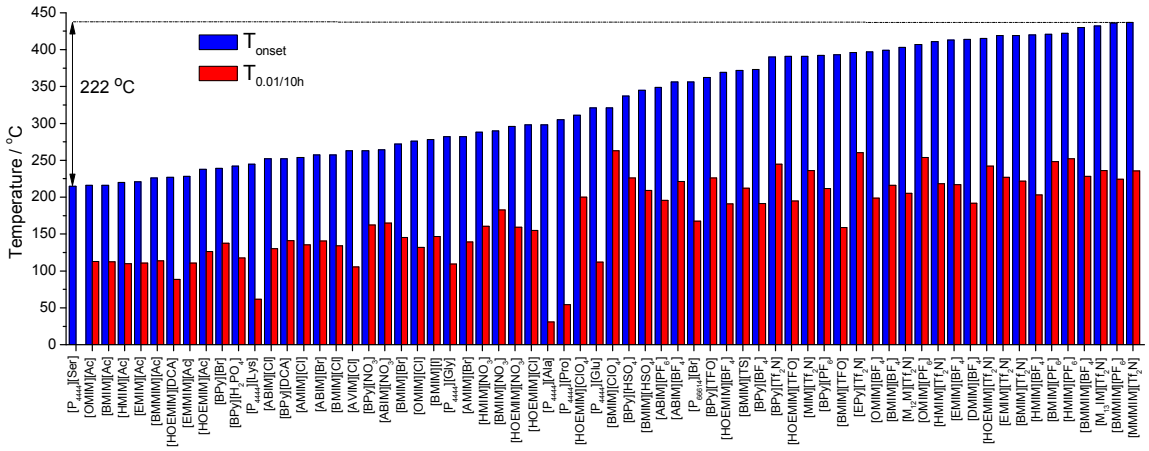

Figure. S1 An overview of thermal stability of 66 ILs ordered as T_{onset}. Note: the $T_{0.01/10h}$ of [P_{4444}][Ser] is not available due to its low thermal stability.

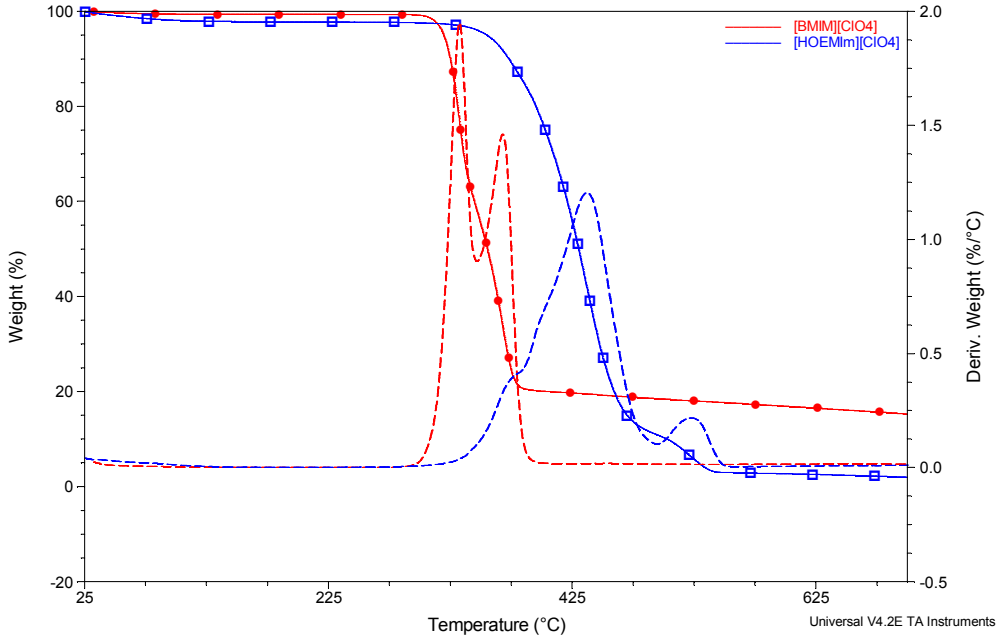

Figure. S2 TG and DTG curves of [BMIM][ClO_4] and [HOEMIm][ClO_4] with two peaks in the DTG curves.

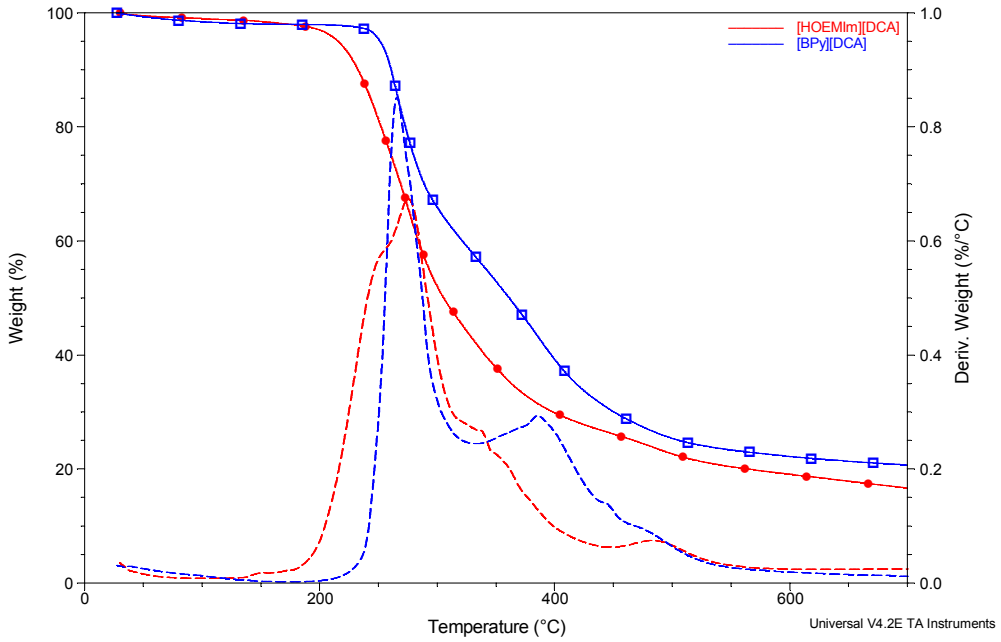

Figure. S3 TG and DTG curves of [HOEMIm][DCA] and [BPy][DCA] with two peaks in the DTG curves.

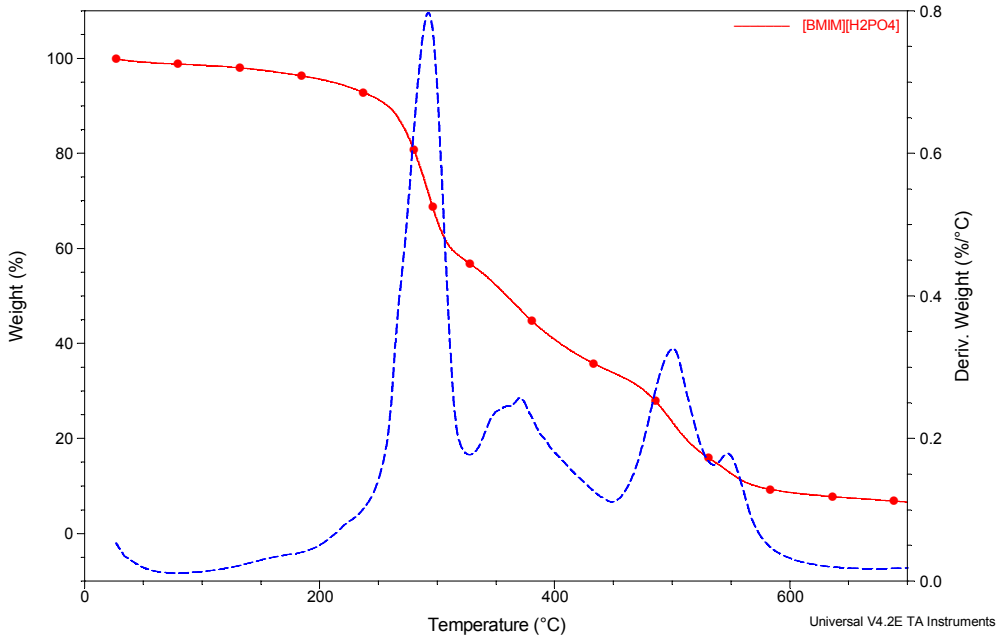

Figure. S4 TG and DTG curves of [BMIM][H_2PO_4] with two peaks in the DTG curves.

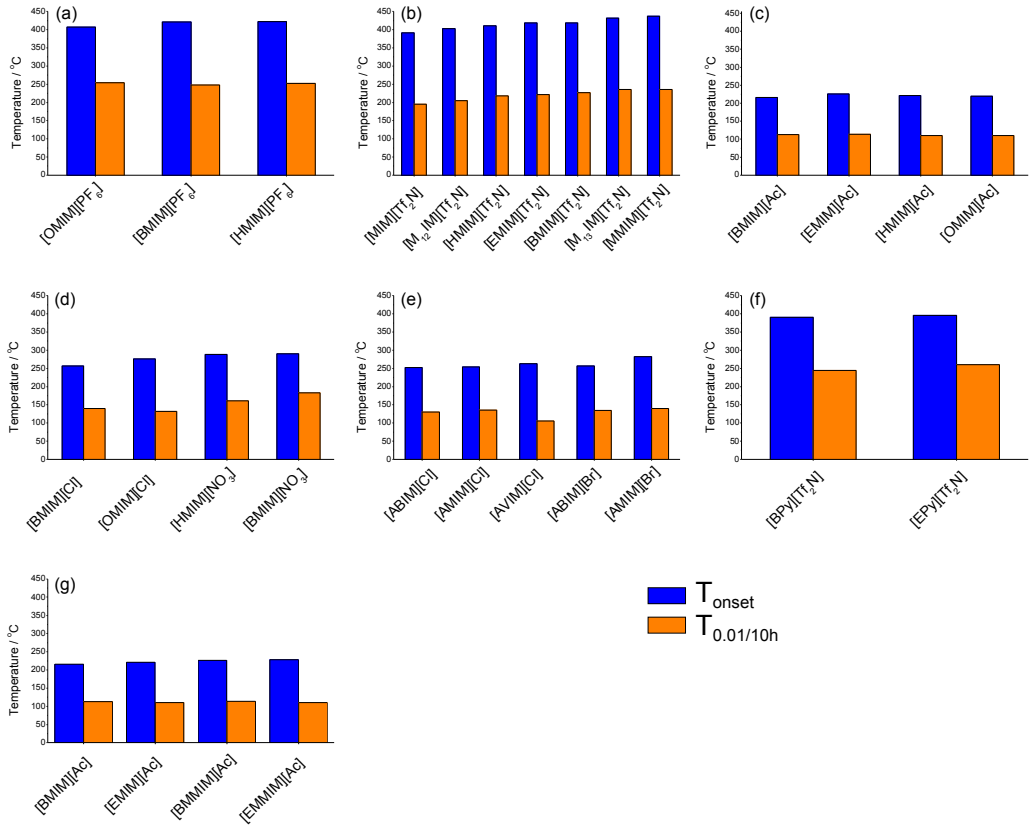

Figure. S5 Effect of chain length, substituent number and C2 methylation (g) on thermal stability of ILs ordered as T_{onset} with anion $[PF_6]$ (a), $[Tf_2N]$ (b), [Ac] (c), [Cl]/$[NO_3]$ (d), [Cl]/[Br] (e) and $[Tf_2N]$ with pyridinium cation (f).

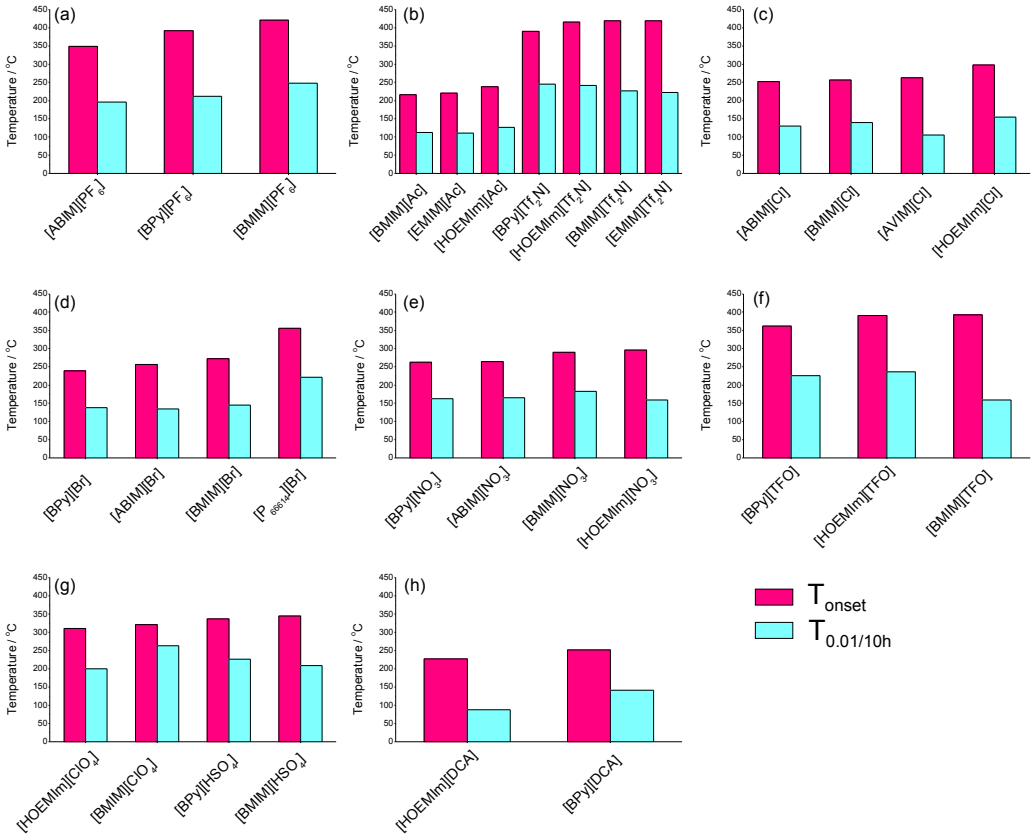

Figure. S6 Effect of cation type on thermal stability of ILs ordered as T_{onset} with anion $[PF_6]$ (a), $[Tf_2N]$/[Ac] (b), [Cl] (c), [Br] (d), $[NO_3]$ (e), [TFO] (f), $[ClO_4]$/$[HSO_4]$ (g), and [DCA] (h).

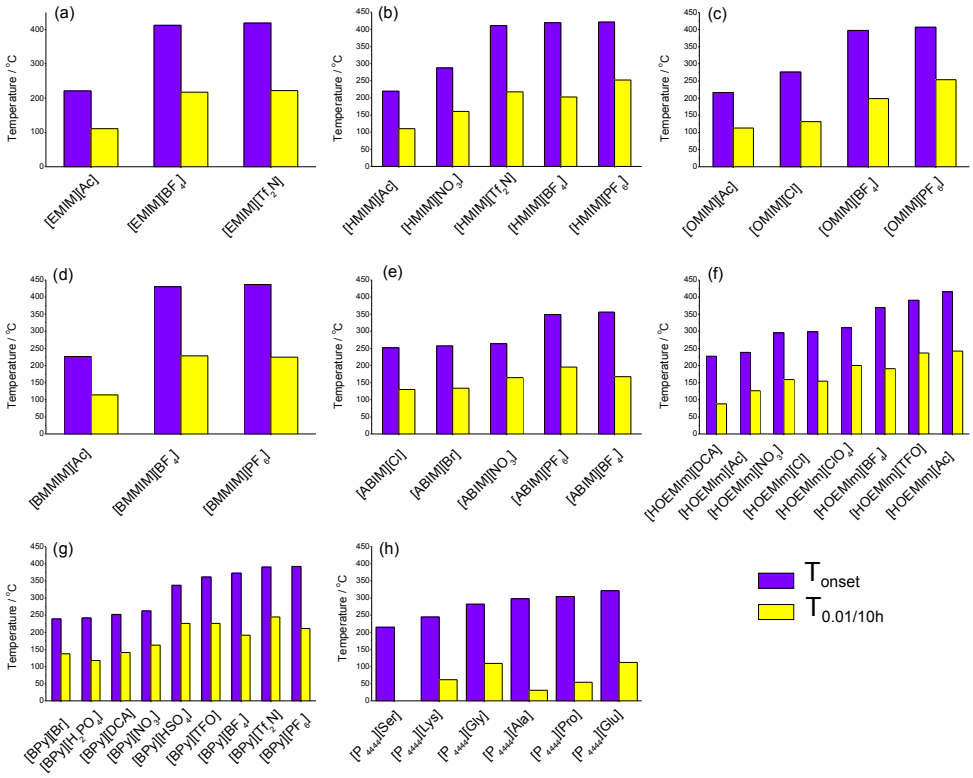

Figure. S7 Effect of anion type on thermal stability of ILs ordered as T_{onset} with cation [EMIM] (a), [HMIM] (b), [OMIM] (c), [BMMIM] (d), [ABIM] (e), [HOEMIm] (f), [BPy] (g), and [P_{4444}] (h).

■ REFERENCE

(1) Zaitsau, D. H.; Paulechka, Y. U.; Kabo, G. J., The kinetics of thermal decomposition of 1-butyl-3-methylimidazolium hexafluorophosphate. *J. Phys. Chem. A* **2006,** *110*, 11602–11604.

(2) Villanueva, M.; Coronas, A.; García, J.; Salgado, J., Thermal stability of ionic liquids for their application as new absorbents. *Ind. Eng. Chem. Res.* **2013,** *52*, 15718-15727.

(3) Clough, M. T.; Geyer, K.; Hunt, P. A.; Mertes, J.; Welton, T., Thermal decomposition of carboxylate ionic liquids: trends and mechanisms. *Phys. Chem. Chem. Phys.* **2013,** *15*, 20480-20495.

(4) Fox, D.; Gilman, J. W.; De Long, H.; Trulove, P., TGA decomposition kinetics of 1-butyl-2, 3-dimethylimidazolium tetrafluoroborate and the thermal effects of contaminants. *J. Chem. Thermodyn.* **2005,** *37*, 900-905.

(5) Kamavaram, V.; Reddy, R. G., Thermal stabilities of di-alkylimidazolium chloride ionic liquids. *Int. J. Therm. Sci.* **2008,** *47*, 773-777.

(6) Peng, J.; Hao, Y.; Hu, S. W.; Li, J. G.; Zhai, M. L., Thermal decomposition of allyl–imidazolium–based ionic liquid studied by TGA–MS analysis and DFT calculations. *Thermochim. Acta* **2010,** *501*, 78–83.

(7) Arellano, I. H. J.; Guarino, J. G.; Paredes, F. U.; Arco, S. D., Thermal stability and moisture uptake of 1-alkyl-3-methylimidazolium bromide. *J. Therm. Anal. Calorim* **2011,** *103*, 725–730.