

Supporting Information

Understanding the Microscopic Behavior of Binary Mixtures of Ionic Liquids Through Various Spectroscopic Techniques

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Supporting Information

Table S1. Fitting Parameters for Viscosity Measurements

Systems	A_0	A_1	R^2
[BMIM] [BF ₄]	-4.40 ± 0.16	2030.13 ± 50.62	0.99
[BMIM] [PF ₆]	-4.52 ± 0.19	2011.13 ± 59.16	0.99
[BMIM] [NTF ₂]	-3.81 ± 0.12	1652.01 ± 36.44	0.98
Mix I (A)	-2.09 ± 0.22	1254.77 ± 68.66	0.98
Mix I (B)	-4.29 ± 0.22	1921.16 ± 67.45	0.99
Mix I (C)	-5.96 ± 0.09	2423.41 ± 29.86	0.99
Mix II (A)	-1.76 ± 0.03	1081.91 ± 10.89	0.98
Mix II (B)	-1.57 ± 0.23	1025.02 ± 70.35	0.99
Mix II (C)	-4.09 ± 0.15	1945.86 ± 40.46	0.98
Mix III (A)	-3.79 ± 0.23	1652.40 ± 34.11	0.99
Mix III (B)	-3.67 ± 0.12	1633.86 ± 36.32	0.98
Mix III (C)	-3.73 ± 0.23	1655.01 ± 46.99	0.99

Table S2. Fitting Parameters for Density Measurements

Systems	A_2	$A_3 \times 10^{-3}$	R^2
[BMIM] [BF ₄]	1.37 ± 0.01	-0.91 ± 4.12	0.99
[BMIM] [PF ₆]	1.40 ± 0.01	-0.77 ± 3.56	0.98
[BMIM] [NTF ₂]	1.66 ± 0.01	-0.76 ± 3.05	0.99
Mix I (A)	1.69 ± 0.007	-1.48 ± 2.30	0.98
Mix I (B)	1.57 ± 0.01	-1.01 ± 4.61	0.99
Mix I (C)	1.80 ± 0.01	-1.66 ± 5.03	0.99
Mix II (A)	1.78 ± 0.04	-1.41 ± 1.56	0.98
Mix II (B)	1.86 ± 0.03	-1.62 ± 1.02	0.99
Mix II (C)	1.70 ± 0.02	-0.98 ± 2.30	0.98
Mix III (A)	1.85 ± 0.005	-1.82 ± 1.67	0.99
Mix III (B)	1.67 ± 0.01	-1.15 ± 5.03	0.99
Mix III (C)	1.79 ± 0.01	-1.46 ± 5.03	0.98

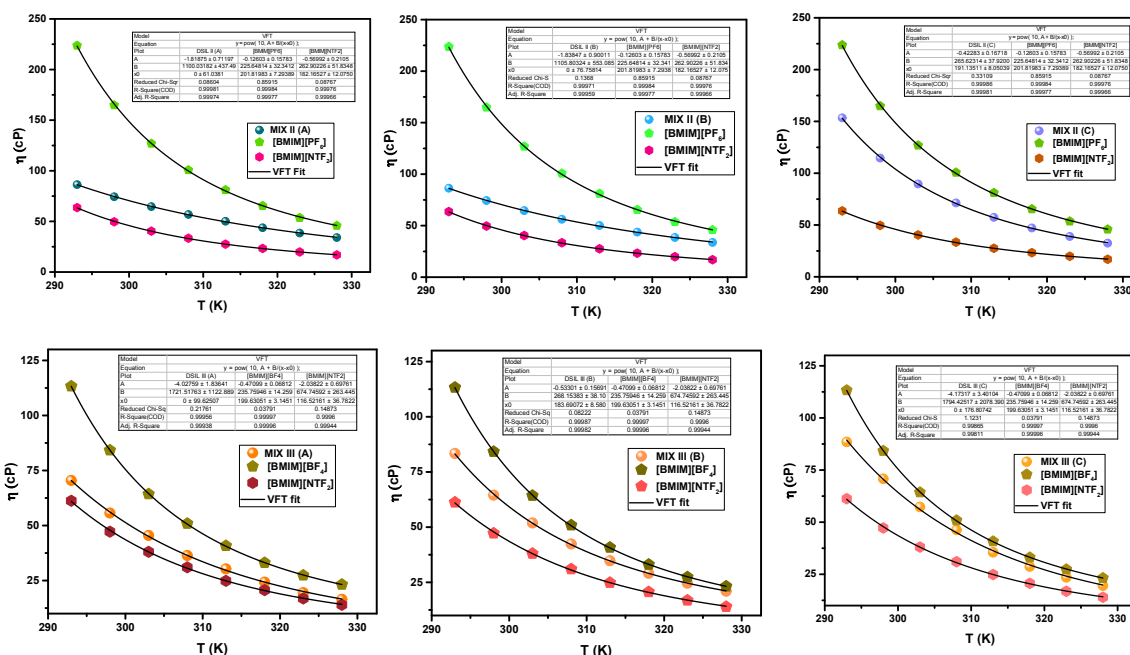


Figure S1. Variation of the bulk viscosity of [BMIM][BF₄], [BMIM][PF₆], [BMIM][NTF₂], Mix II(A), Mix II (B), Mix II (C), Mix III(A), Mix III (B) and Mix III (C) with temperature and its fitting with VFT equation.

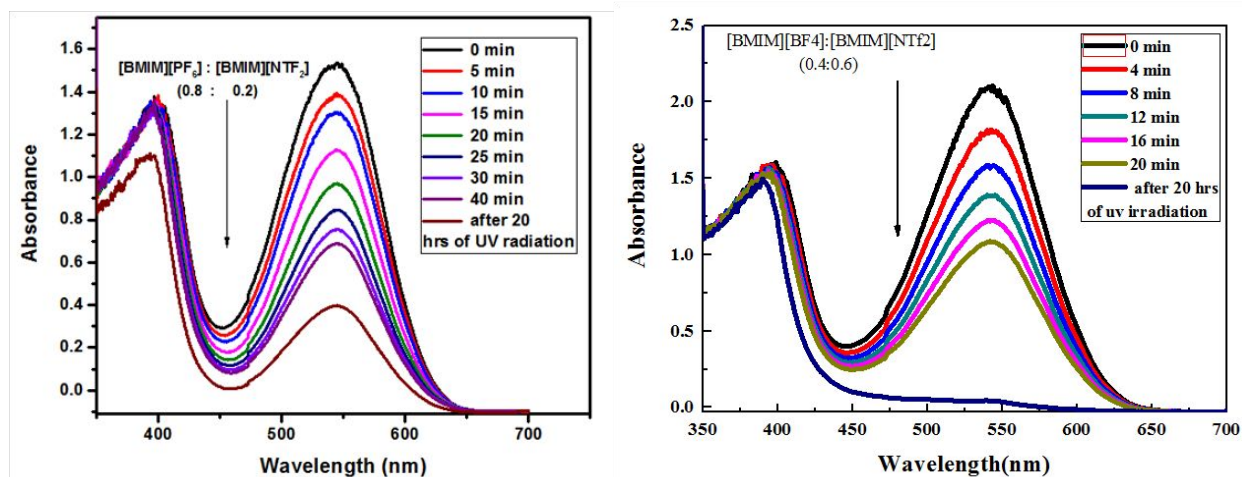


Figure S2. Overlay spectra illustrating the thermal decay of a solution of SP in Mix II and Mix III after exposure to UV irradiation.

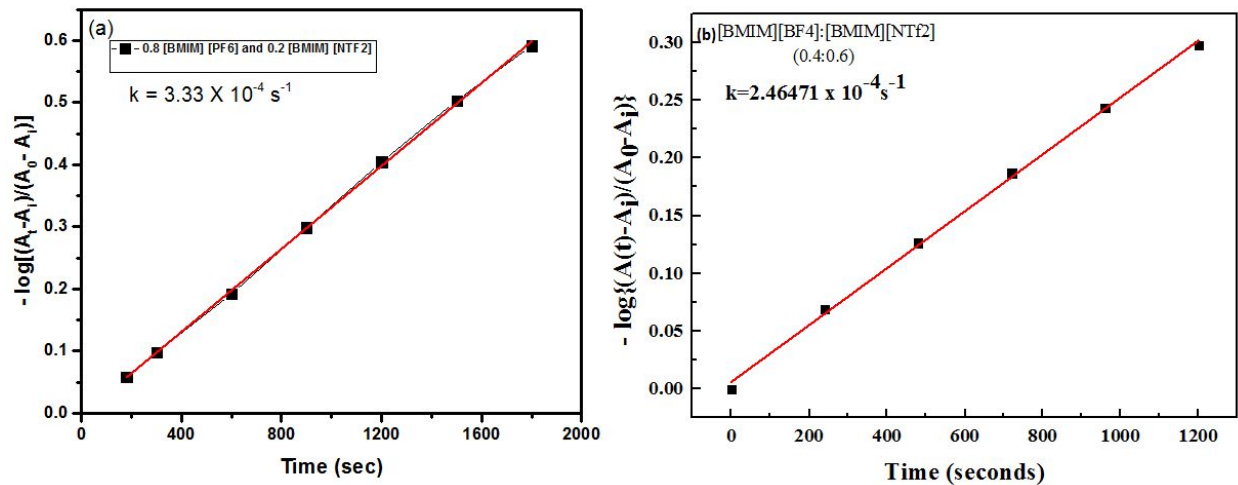


Figure S3. First-order kinetic plot for the thermal relaxation of the SP isomer in a) Mix II b) Mix III after 5 min UV irradiation.

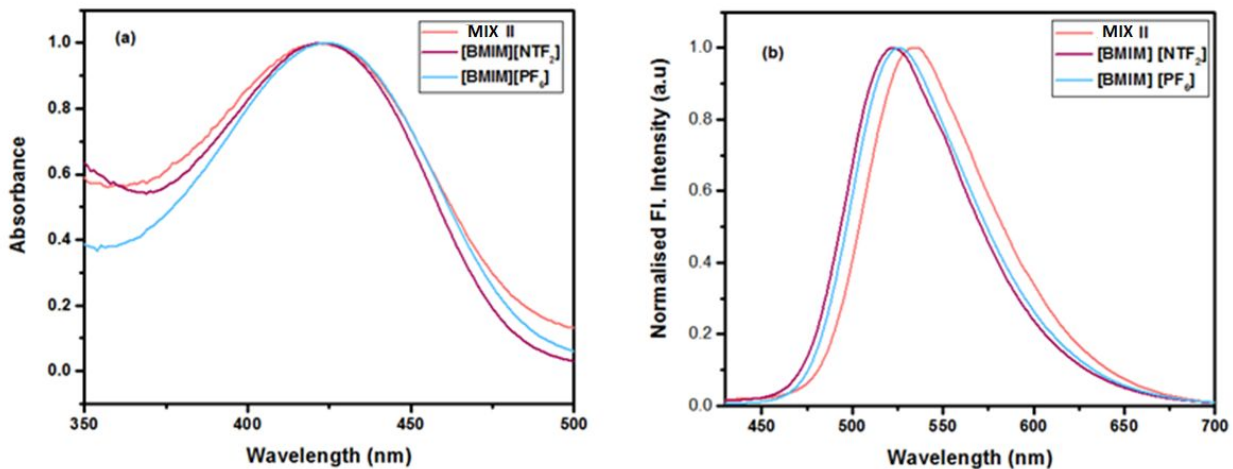


Figure S4. Normalised (a) absorption and (b) emission ($\lambda_{\text{exc}} = 375 \text{ nm}$) spectra of C153 in Mix II, [BMIM][NTF₂] and [BMIM][PF₆].

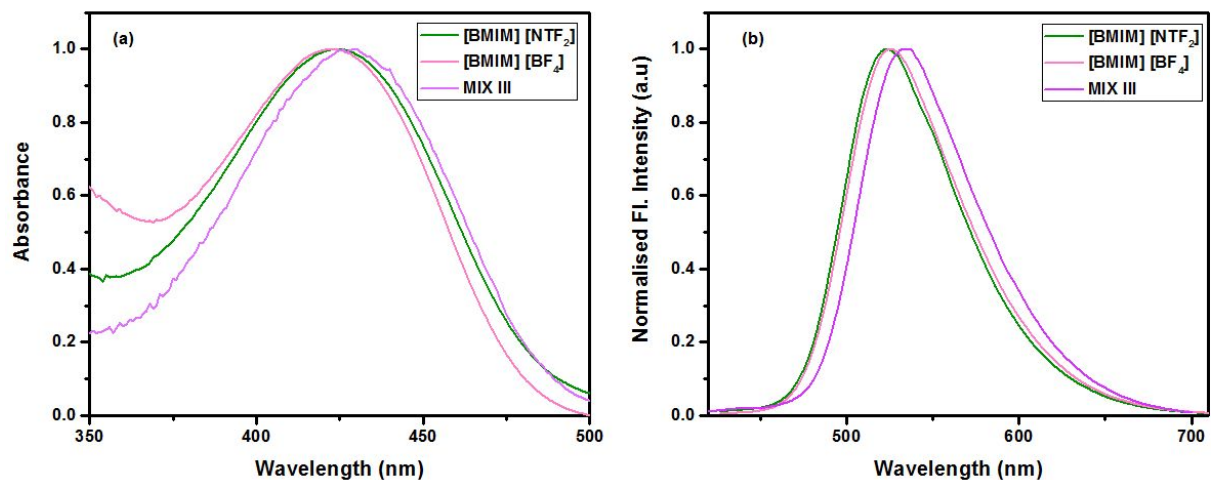


Figure S5. Normalised (a) absorption and (b) emission ($\lambda_{\text{exc}} = 375$ nm) spectra of C153 in [BMIM][NTF₂], [BMIM][BF₄] and Mix III.

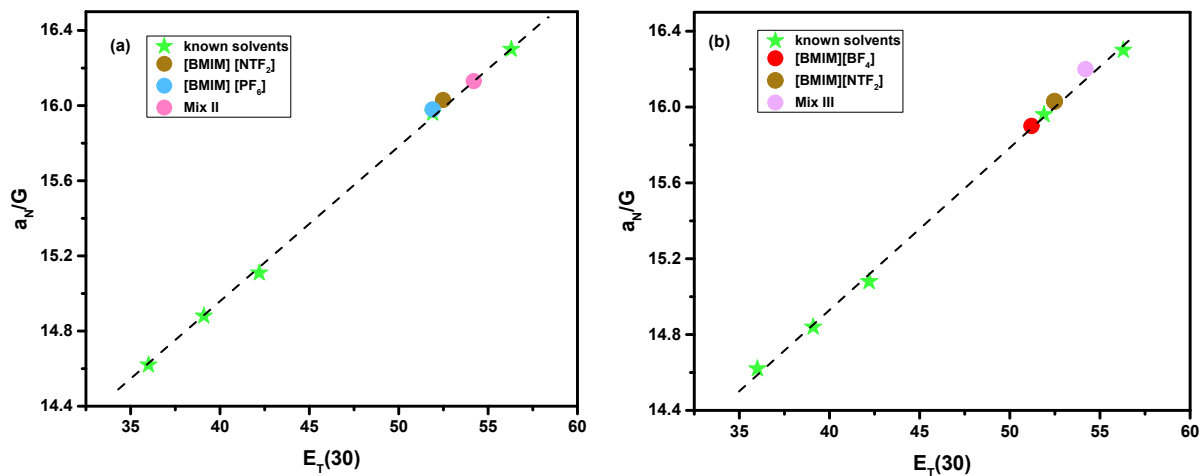


Figure S6. Plot of a_N/G value of TEMPO in a) [BMIM][NTF₂], [BMIM][PF₆] and Mix II (C) b) [BMIM][BF₄], [BMIM][NTF₂] and Mix III (B). The green stars indicate the values corresponding to the known solvents.

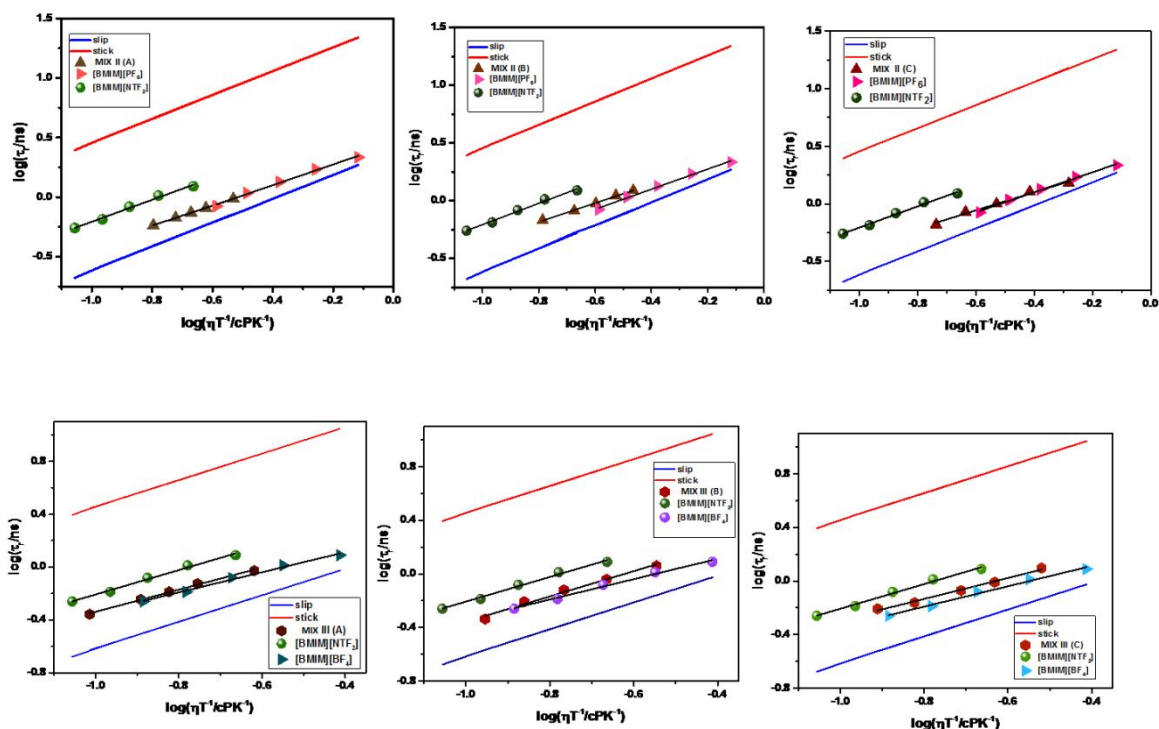


Figure S7. $\log(\tau_r)$ vs. $\log(\eta/T)$ plot of perylene in (a) Mix II and (b) Mix III with stick and slip boundary condition limits. The solid black lines indicate the fit to the data points. The composition of (IL+IL) mixtures are Mix II (A) : $[\text{BMIM}]\text{PF}_6]_{0.4}[\text{NTF}_2]_{0.6}$, Mix II (B) : $[\text{BMIM}]\text{PF}_6]_{0.6}[\text{NTF}_2]_{0.8}$, Mix II (C) : $[\text{BMIM}]\text{PF}_6]_{0.8}[\text{NTF}_2]_{0.2}$, Mix III (A) : $[\text{BMIM}][\text{BF}_4]_{0.4}[\text{NTF}_2]_{0.6}$, Mix III (B) : $[\text{BMIM}][\text{BF}_4]_{0.6}[\text{NTF}_2]_{0.4}$ and Mix III (C) : $[\text{BMIM}][\text{BF}_4]_{0.8}[\text{NTF}_2]_{0.2}$.

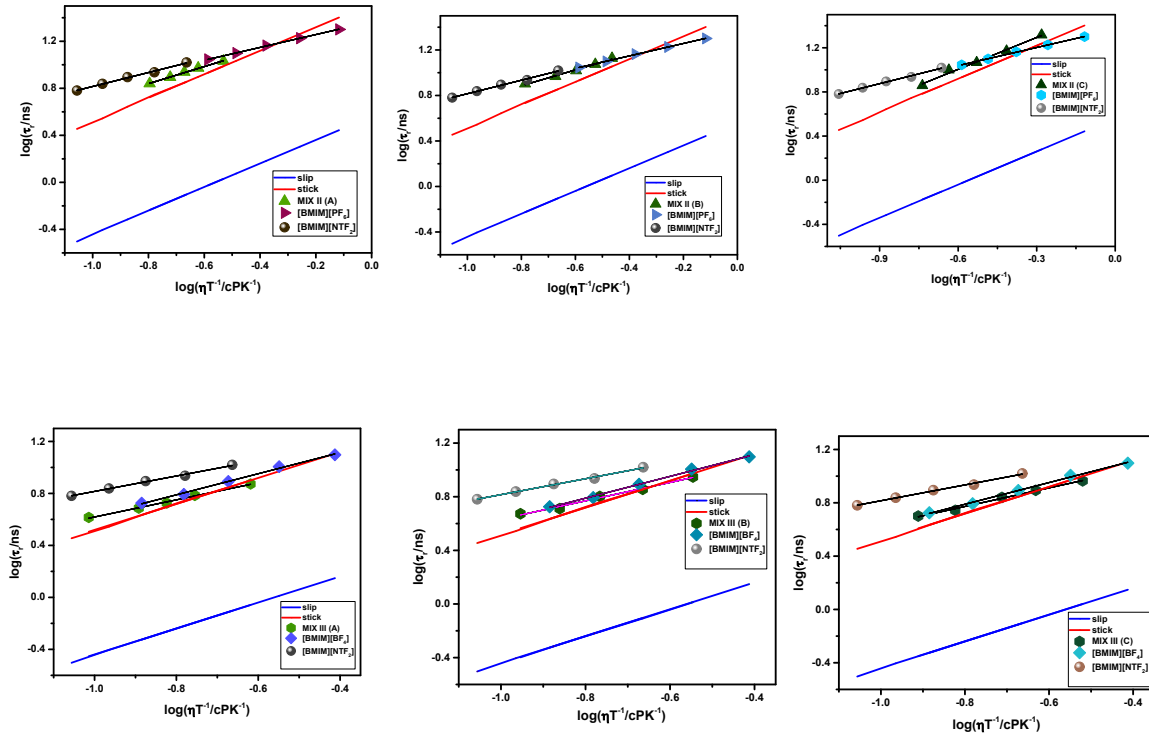


Figure S8. $\log(\tau_r)$ vs. $\log(\eta/T)$ plot of MPTS in (a) Mix II and (b) Mix III with stick and slip boundary condition limits. The solid black lines indicate the fit to the data points. The composition of (IL+IL) mixtures are Mix II (A) : $[\text{BMIM}]\text{PF}_6]_{0.4}[\text{NTF}_2]_{0.6}$, Mix II (B) : $[\text{BMIM}]\text{PF}_6]_{0.6}[\text{NTF}_2]_{0.8}$, Mix II (C) : $[\text{BMIM}]\text{PF}_6]_{0.8}[\text{NTF}_2]_{0.2}$, Mix III (A) : $[\text{BMIM}][\text{BF}_4]_{0.4}[\text{NTF}_2]_{0.6}$, Mix III (B) : $[\text{BMIM}][\text{BF}_4]_{0.6}[\text{NTF}_2]_{0.4}$ and Mix III (C) : $[\text{BMIM}][\text{BF}_4]_{0.8}[\text{NTF}_2]_{0.2}$.