Mechanisms of Magnesium Ion Transport in Pyrrolidinium Bis(trifluoromethanesulfonyl)imide-Based Ionic Liquid Electrolytes

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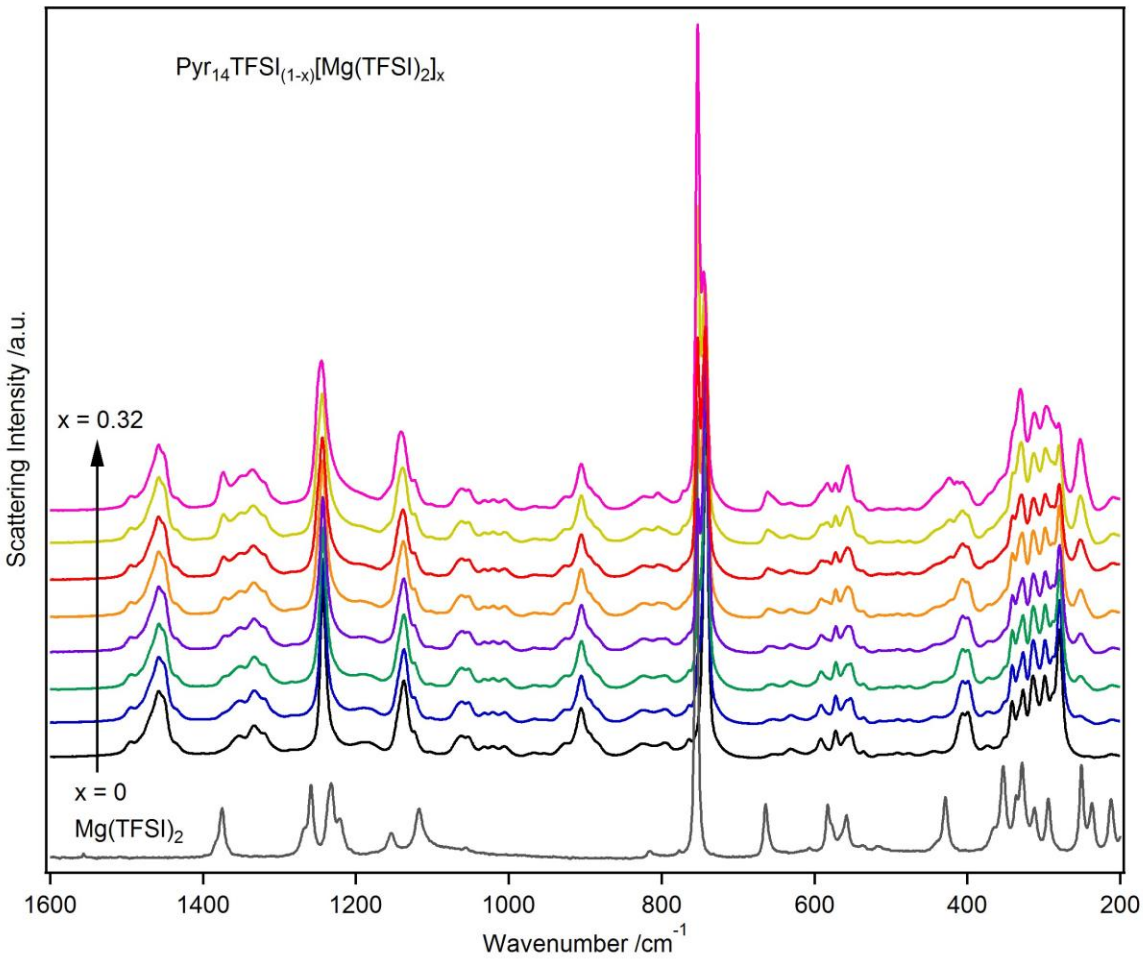

Figure S1. Raman spectra of the Mg^{2+}-$Pyr_{14}TFSI$ electrolytes.

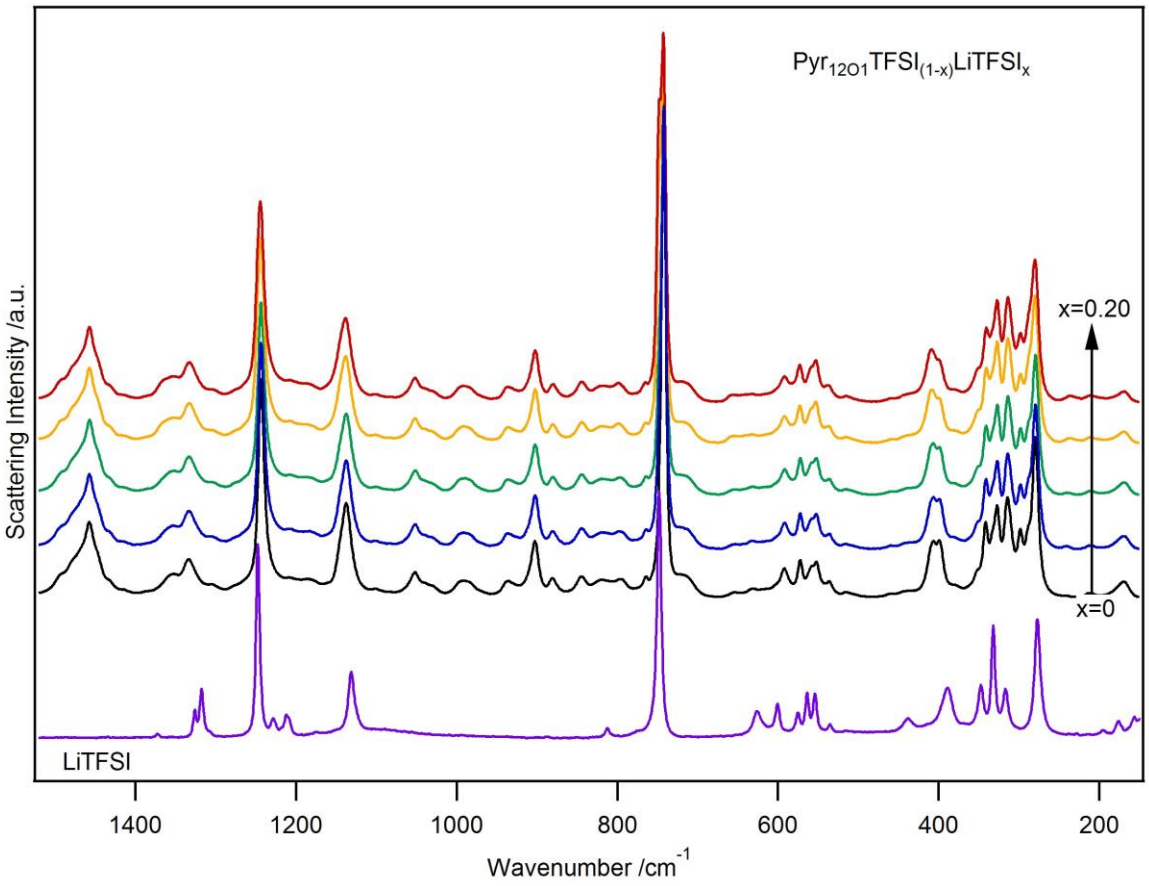

Figure S2. Raman spectra of the Li^+-$Pyr_{12O1}TFSI$ electrolytes.

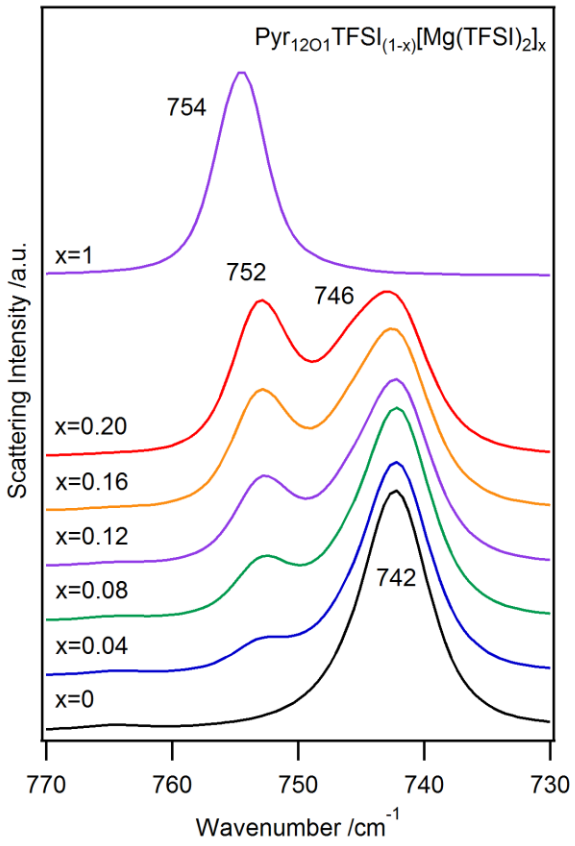

Figure S3. Raman spectra of the Mg^{2+}-$Pyr_{12O1}TFSI$ electrolytes in the 730-770 cm^{-1} region (TFSI expansion-contraction mode).

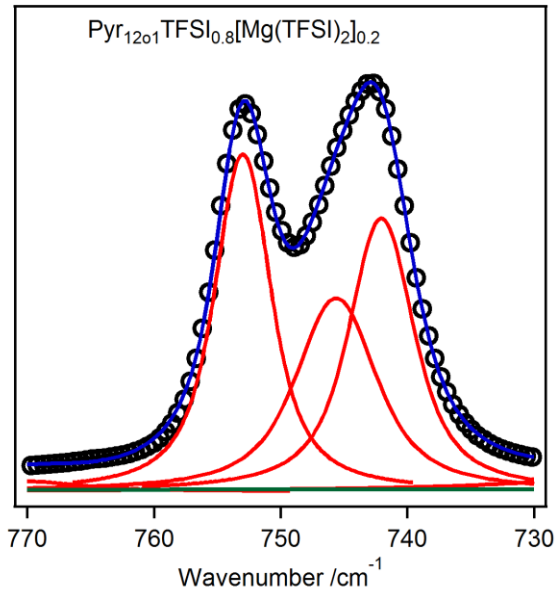

Figure S4. Example of the Voigt fit of the $TFSI^-$ expansion-contraction mode.

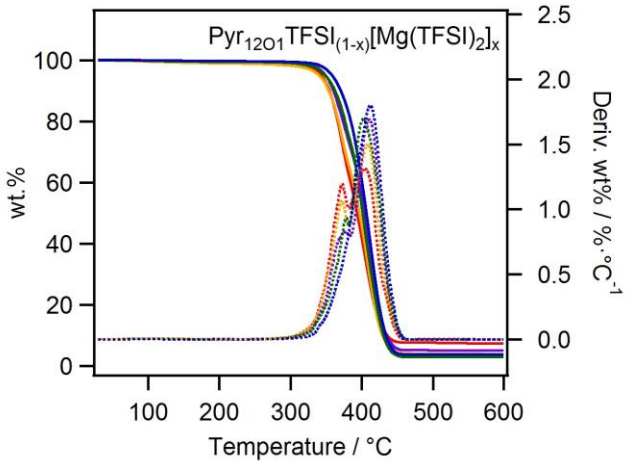

Figure S5. TGA profiles of Mg^{2+}-$Pyr_{12O1}TFSI$ electrolytes.

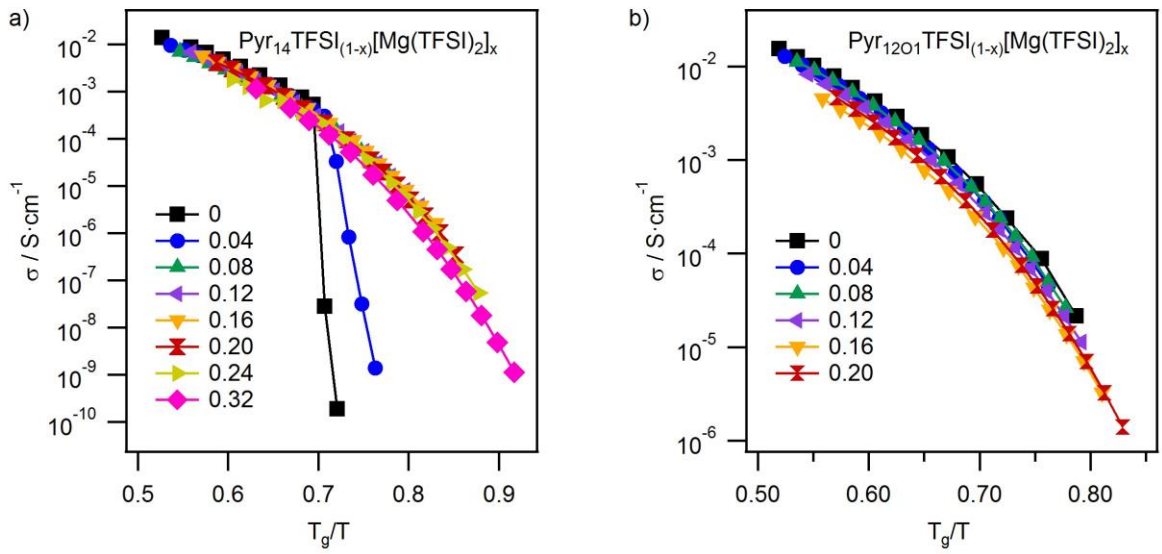

Figure S6. T_g-scaled Arrhenius plot of the conductivity of the Mg^{2+}-IL electrolytes.

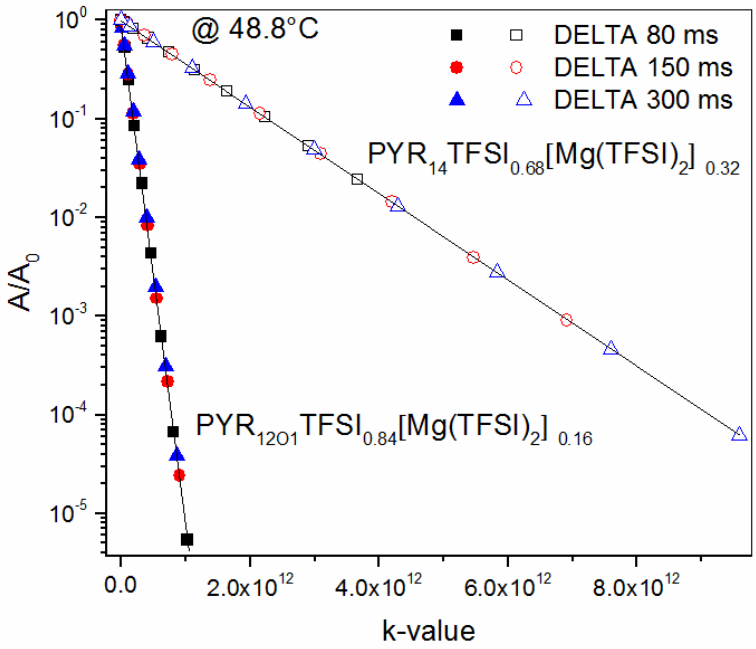

Figure S7. Relative 19F-signal area attenuation for $Pyr_{14}TFSI_{0.68}[Mg(TFSI)_2]_{0.32}$ and $Pyr_{12O1}TFSI_{0.84}[Mg(TFSI)_2]_{0.16}$ electrolytes at specific observation times a) at 30°C b) at 48.8 °C. The same monoexponential behavior was seen in both the 19F and 1H decays for all compositions and all temperatures.

Table S1: VTF parameters $PYR_{12O1}TFSI$ and mixtures. The parameters were determined from the data as plotted in figure 4 with the equation $\sigma = \sigma_\infty e^{\frac{-B}{T-T_0}}$

Mole fraction	A=log σ_∞(S·cm^{-1})	B = $\frac{E_a}{k_B}$	T_0 (K)
0	-0.31 ± 0.03	630 ± 20	170 ± 1
0.04	-0.35 ± 0.2	637 ± 9	173.9 ± 0.7
0.08	-0.28 ± 0.01	689 ± 6	173.7 ± 0.4
0.12	-0.15 ± 0.04	810 ± 20	170 ± 1
0.16	-0.31 ± 0.05	840 ± 20	173 ± 2
0.20	-0.07 ± 0.03	930 ± 20	173 ± 1

Table S2: Table S1: VTF parameters $PYR_{12O1}TFSI$ and mixtures. The parameters were determined from the data as plotted in figure 4 with the equation $\sigma = \sigma_\infty e^{\frac{-B}{T-T_0}}$

Mole fraction	A=log σ_∞(S·cm^{-1})	B = $\frac{E_a}{k_B}$	T_0 (K)
0	-0.22 ± 0.01	692.45 ± 7	169.6 ± 0.6
0.04	-0.40 ± 0.01	661 ± 6	176.1 ± 0.5
0.08	-0.27 ± 0.04	790 ± 20	172 ± 1
0.12	0.02 ± 0.0203	930 ± 10	169.3 ± 0.6
0.16	0.03 ± 0.05	940 ± 30	174 ± 1
0.20	0.23 ± 0.04	1070 ± 20	173 ± 1
0.24	-0.4 ± 0.2	920 ± 70	186 ± 3
0.32	0.9 ± 0.1	1540 ± 70	176 ± 2