10.1071/CH12332_AC

Australian Journal of Chemistry 2012, 65(11), 1542-1547

1. Supplementary

Equation 1 VTF Equation for Viscosity

$$\eta = \eta_0 e^{B/(T-T_0)}$$

Table 1 VTF Equation Parameters for Viscosity

Sample	Water added / wt %	η_0 / mPa s	B / K	T_0 / K
$[P_{6,6,6,14}][Cl]$	0	0.079 ± 0.027	1294 ± 101	173 ± 6
	4	0.081 ± 0.037	1202 ± 129	161 ± 8
	8	0.002 ± 0.007	2648 ± 1388	72 ± 64
$[P_{6,6,6,14}][Cl]$ + LiCl	0	0.027 ± 0.012	1616 ± 144	158 ± 7
	4	0.003 ± 0.005	2563 ± 773	92 ± 33
	8	0.039 ± 0.043	1453 ± 371	137 ± 22
$[P_{6,6,6,14}][Cl]$ + $MgCl_2$	0	0.028 ± 0.011	1555 ± 122	163 ± 6
	4	0.015 ± 0.009	1817 ± 199	126 ± 10
	8	0.007 ± 0.014	2127 ± 884	98 ± 45

Equation 2 VTF Equation for Conductivity

$$\sigma = \sigma_0 e^{B/(T-T_0)}$$

Table 2 VTF Equation Parameters for Conductivity

Sample	Water added / wt %	S_0 / S cm^{-1}	B / K	T_0 / K
$[P_{6,6,6,14}][Cl]$	0	0.26 ± 0.29	1959 ± 496	118 ± 27
	4	0.18 ± 0.01	1193 ± 29	153 ± 2
	8	0.12 ± 0.03	777 ± 88	174 ± 9
$[P_{6,6,6,14}][Cl]$ + LiCl	0	0.59 ± 0.83	2137 ± 640	111 ± 33
	4	0.02 ± 0.01	616 ± 49	200 ± 5
	8	0.03 ± 0.02	463 ± 148	206 ± 20
$[P_{6,6,6,14}][Cl]$ + $MgCl_2$	0	0.32 ± 0.06	1848 ± 81	129 ± 4
	4	0.06 ± 0.11	862 ± 612	169 ± 57
	8	0.17 ± 0.08	903 ± 156	161 ± 14

Equation 3 Arrhenius Equation for Diffusion

$$D = D_0 e^{\left(-E_a/RT\right)}$$

Table 3 Arrhenius Equation Parameters for ^{1}H Phosphonium cation Diffusion

Sample	Water added / wt %	D_0 / $m^2\ s^{-1}$	E_a / kJ mol^{-1}
$[P_{6,6,6,14}][Cl]$	0	0.037 ± 0.006	64 ± 1
	8	0.090 ± 0.029	61 ± 1
$[P_{6,6,6,14}][Cl]$ + LiCl	0	0.013 ± 0.003	61 ± 1
	8	0.034 ± 0.020	59 ± 2
$[P_{6,6,6,14}][Cl]$ + $MgCl_2$	0	0.010 ± 0.002	60 ± 1
	8	0.198 ± 0.097	63 ± 1

Table 4 Arrhenius Equation Parameters for ^{1}H Diffusion of water molecules in 8 wt% water samples

Sample	D_0 / $10^{-5}\ m^2\ s^{-1}$	E_a / kJ mol^{-1}
$[P_{6,6,6,14}][Cl]$	3.5 ± 1	33 ± 1
$[P_{6,6,6,14}][Cl]$ + LiCl	4.7 ± 2	35 ± 1
$[P_{6,6,6,14}][Cl]$ + $MgCl_2$	4.9 ± 0.8	35 ± 0.5

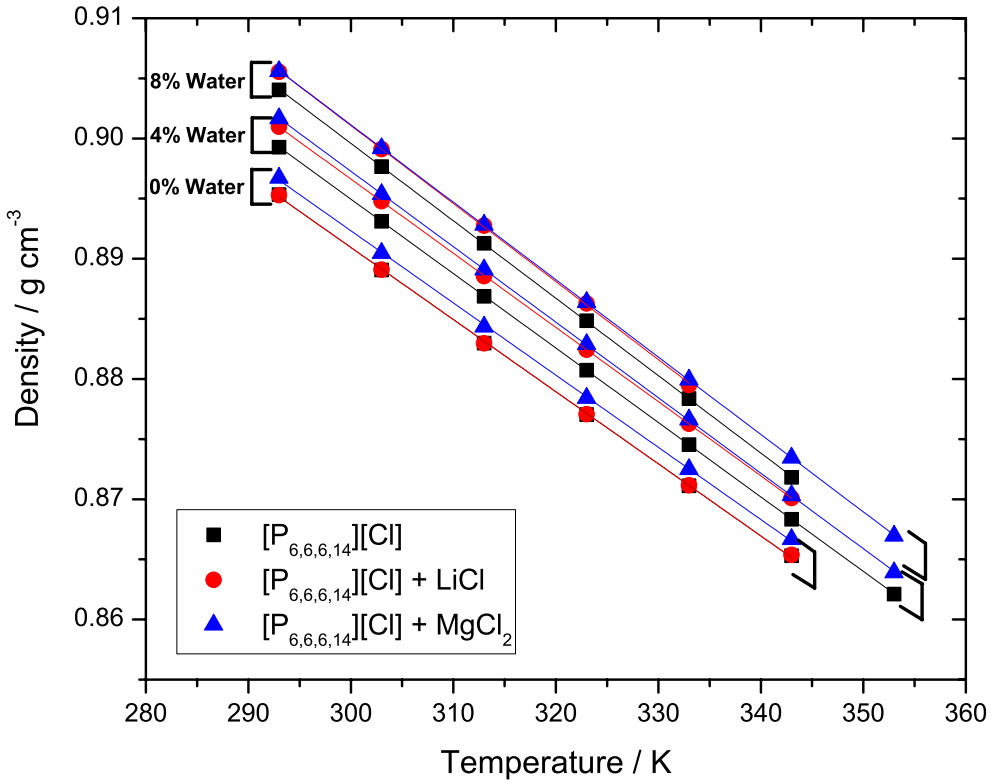

Figure S1 Density of all samples as a function of temperature. The squares represent the IL $[P_{6,6,6,14}][Cl]$, the circles represent the IL saturated with LiCl and the triangles represent the IL saturated with $MgCl_2$.

Equation 4 Arrhenius Equation for Diffusion

$$D = D_0 e^{\left(-E_a/RT\right)}$$

Table 5 Density Equation Parameters for all samples.

Sample	Water added / wt %	a / 10^{-4} g cm^{-3} K^{-1}	b / g cm^{-3}
$[P_{6,6,6,14}][Cl]$	0	6.00 ± 0.04	1.071 ± 0.001
	4	6.19 ± 0.01	1.081 ± 0.001
	8	6.44 ± 0.02	1.093 ± 0.001
$[P_{6,6,6,14}][Cl]$ + LiCl	0	6.00 ± 0.04	1.071 ± 0.001
	4	6.17 ± 0.01	1.082 ± 0.001
	8	6.49 ± 0.05	1.096 ± 0.001
$[P_{6,6,6,14}][Cl]$ + $MgCl_2$	0	6.00 ± 0.04	1.072 ± 0.001
	4	6.28 ± 0.01	1.086 ± 0.001
	8	6.44 ± 0.01	1.094 ± 0.001

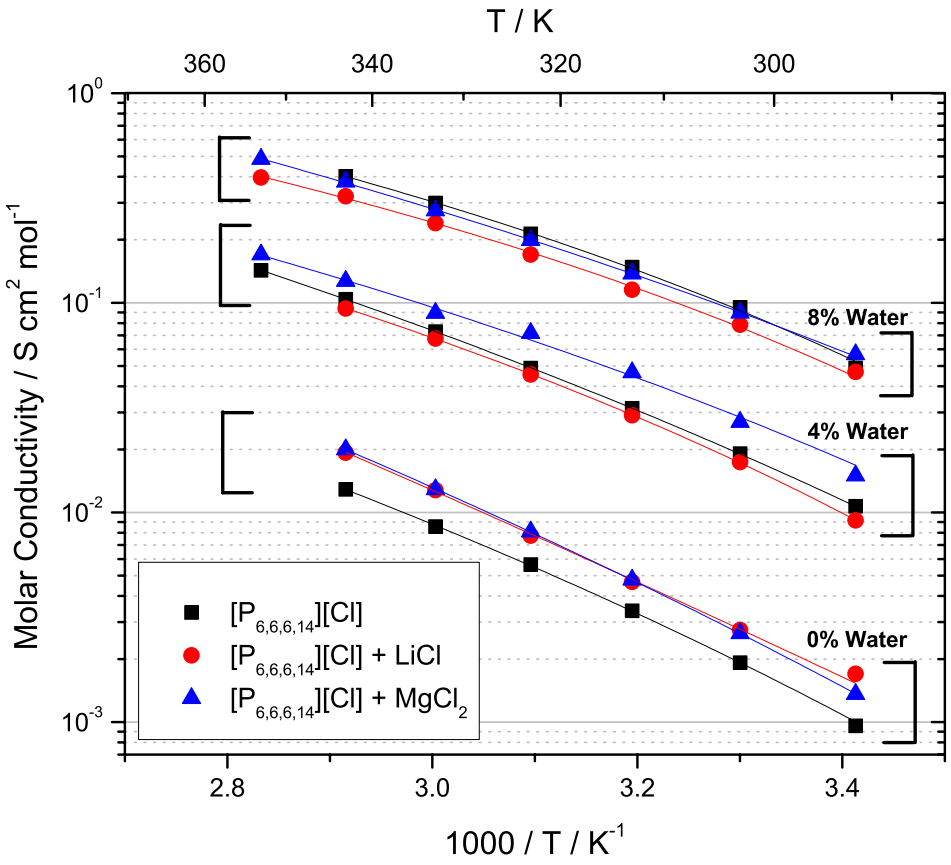

Figure S2 Temperature-dependent molar conductivity of the ionic liquid [$P_{6,6,6,14}$][Cl] with various amounts of water with and without additional metal salts. The squares represent the IL [$P_{6,6,6,14}$][Cl], the circles represent the IL saturated with LiCl and the triangles represent the IL saturated with $MgCl_2$.

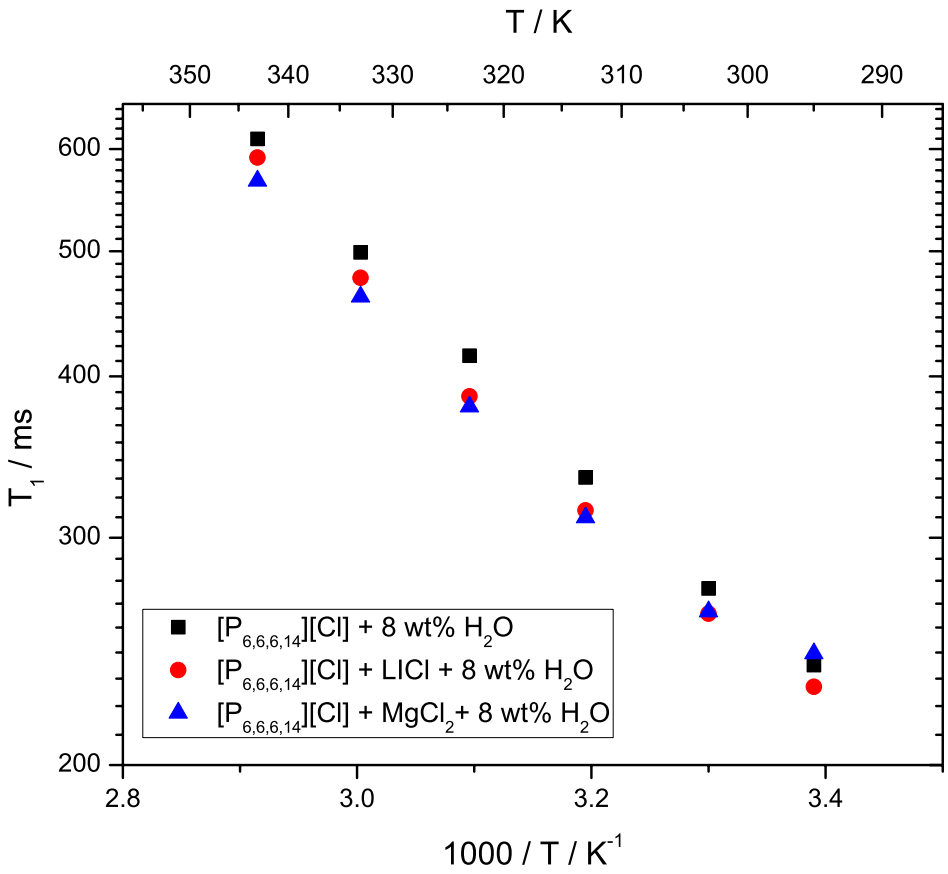

Figure S3 ^{1}H T_1 relaxation time of the water molecules in 8 wt% H_2O samples as a function of temperature; indicating the presence of the salt does not greatly affect the local molecular environment of the water. The squares represent the IL $[P_{6,6,6,14}][Cl]$, the circles represent the IL saturated with LiCl and the triangles represent the IL saturated with $MgCl_2$.