

RHEOLOGY OF IONIC LIQUIDS

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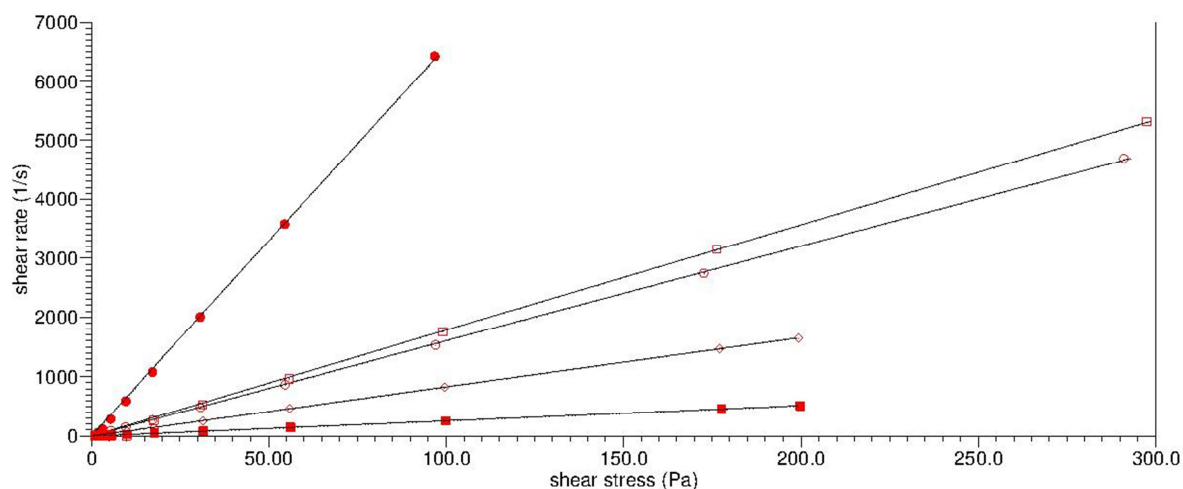
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Background: As part of project PTDC-QUI-66826-2006 the ionic liquids 1-butyl-3-methylimidazolium bis[(trifluoromethyl)sulfonyl]imide ([C4MIM] [NTf₂], CAS 174899-83-3), 1-butyl-3-methylimidazolium dicyanamide ([C4MIM][DCA], CAS 448245-52-1), 1-ethyl-3-methylimidazolium ethylsulfate ([C2MIM][EtOSO₃], CAS 342573-75-5), trihexyltetradecylphosphonium dicyanamide ([P6,6,6,14][DCA]), N,N-dihexyl-N',N'',N''',N''-tetramethyl-guanidinium dicyanamide; [(di-h)TMG][DCA] and methyltrialkyl (C8,C8,C10) ammonium dicyanamide ([Aliquat®336][DCA]), considered to be suitable candidates for technological liquid storage media and heat transfer fluids, were in house synthesized and characterised as previously reported [1].

Of the properties more significant to the design of new equipment: density, heat capacity and viscosity, the first two were previously measured and presented [1] and herein we present the last one.

Experimental: Rheological measurements were made using a TA Instruments AR1500ex controlled shear stress/strain/rate rheometer with cone/plate and plate/plate geometries. Water content was measured with a Metrohm 831KF coulometer calibrated with standard reference material, Hydranal 100 ppm (mass) Water Standard (NIST SRM 2890 traceable). A specially made environmental chamber was built to accommodate the rheometer geometries under a small flow of dry nitrogen.

Results:



- C2MIM EtSO4-0012f, Flow Step
- C2MIM EtSO4-0012f, Flow Step - Newtonian
- BmimDCA-0033f, Flow Step
- BmimDCA-0033f, Flow Step - Newtonian
- BMIM NTF2 -0022f, Flow Step
- BMIM NTF2 -0022f, Flow Step - Newtonian
- P6,6,6,14 DCA-0029f, Flow Step
- P6,6,6,14 DCA-0029f, Flow Step - Newtonian
- ◇ TMGC4 NTF2 -0027f, Flow Step
- TMGC4 NTF2 -0027f, Flow Step - Newtonian

Conclusions: Rheological measurements were performed and they show that these ionic liquids have Newtonian behaviour in the temperature range 260 to 400 K for shear rates up to 50,000 s⁻¹ thus allowing almost all type of engineering applications.

References:

1. C. A. Nieto de Castro *et al.*, Studies on the density, heat capacity, surface tension and infinite dilution diffusion with the ionic liquids [C4mim][NTf2], [C4mim][dca], [C2mim][EtOSO3] and [aliquat][dca]", *Fluid Phase Equilibria* 294 (2010) 157-179.