Supporting Information for

Electrochemical Oxidation and Sensing of Methylamine Gas in Room Temperature Ionic Liquids

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To be submitted: J. Phys. Chem. C

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Figure legends

Figure S1: CV for the oxidation of 1.3 % methylamine on an a) 8.3 µm radius Pt electrode and b) 10.9 µm radius Au electrode in [C_4mpyrr][NTf_2] at varying scan rates from 0.01 V/s to 4 V/s

Figure S2: (-) CV for the oxidation of methylamine gas, (-) the oxidation of methylamine and ammonia gas combined and (-) the oxidation of ammonia gas on a 8.3 µm radius Pt electrode at a scan rate of 0.1 V/s in [C_4mpyrr][NTf_2]. Note the concentrations are not fixed due to the difficulties in mixing the two toxic gases safely. This is purely to show additive behaviour.

Figure S3: Plot of 1.3 % methylamine oxidation currents vs square root of scan rates in the six RTILs, a) [C_2mim][NTf_2], b) [C_4mim][NTf_2], c) [C_6mim][FAP], d) [C_4mpyrr][NTf_2], e) [C_4mim][BF_4], and f) [C_4mim][PF_6] on a Pt microelectrode (diameter 8.3 µm)

Figure S1

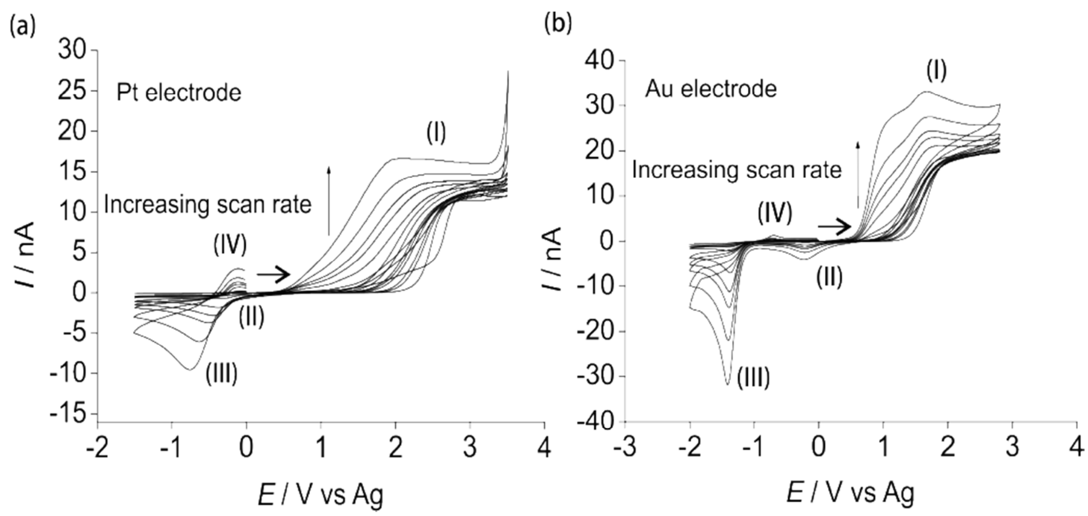


Figure S2

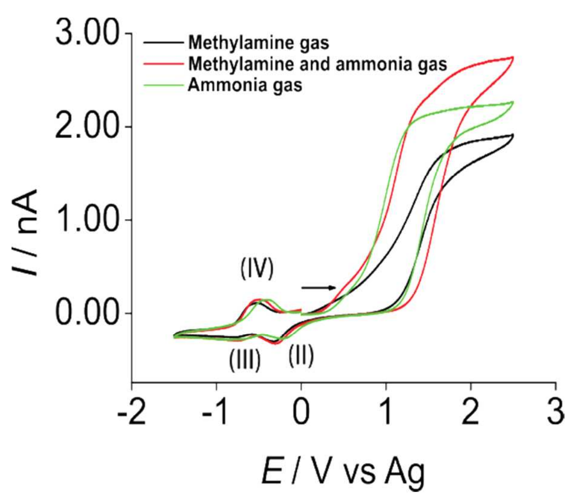
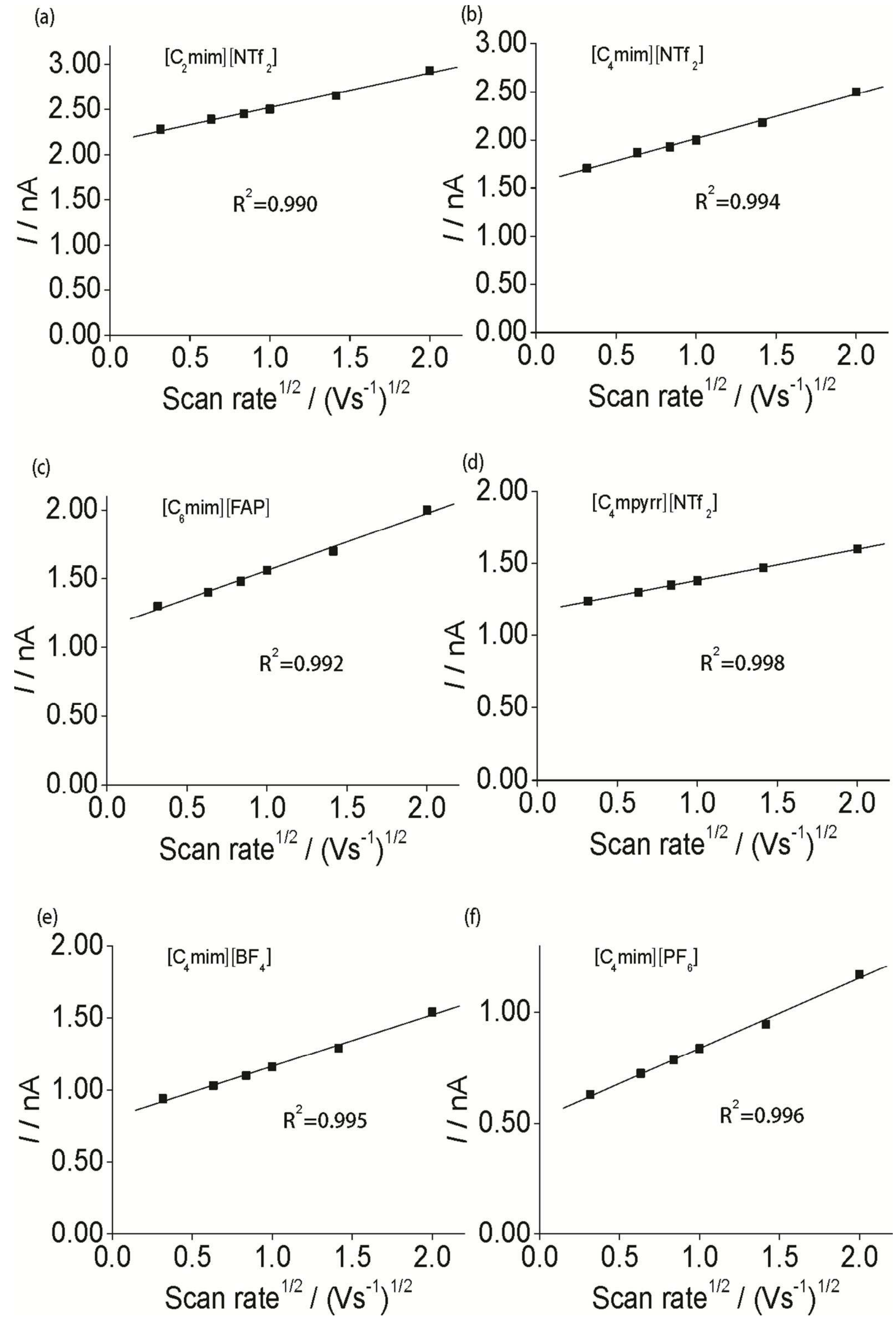


Figure S3



(a)
[C2mim][NTf2]
R2=0.990
I / nA
Scan rate1/2 / (Vs-1)1/2
(b)
[C4mim][NTf2]
R2=0.994
(c)
[C6mim][FAP]
R2=0.992
(d)
[C4mpyrr][NTf2]
R2=0.998
(e)
[C4mim][BF4]
R2=0.995
(f)
[C4mim][PF6]
R2=0.996

NOTE (Figure S3): Voltammetry at microelectrodes in RTILs is known to give rise to behaviour somewhere in-between pure microelectrode (radial diffusion) and pure macroelectrode (linear diffusion), as discussed in the following review article (Barrosse-Antle et al. Chem. Asian J., 2010, 5, 202-230). For true steady-state behaviour to apply, the following inequality must be met:

$$v \ll \frac{RTD}{nFr^2}$$

Where v is the scan rate, R is the universal gas constant, and T is the absolute temperature, D is the diffusion coefficient, n is the number of electrons, F is Faraday's constant and r is the radius of the disk.

In this work, if we take r to be 8.3 µm and D to be 4.5×10^{-10} m^2s^{-1} for methylamine/ammonia in $[C_2mim][NTf_2]$, the scan rate must be less than 75 mVs^{-1} for true steady-state behaviour. Since the range of scan rates employed in this work is 10-4,000 mVs^{-1}, this is in the intermediate range for pure micro- or pure macro-electrode behaviour, and the plots of current vs square root scan rate do not pass through the origin.