1. Room temperature ionic liquids are a new class of liquids. Composed of purely ionic liquid states with no solvent. Good electrical and ionic conductivity.

Diffusion coefficients for molecules in ILs are lower than in aqueous solutions due to the much bigger viscosity of the former.

2. Transition from steady-state to transient current shapes is due to the diffusion layer thickness at the different scan rates compared to the electrode radius. At low scan rates, diffusion layer thickness is greater than electrode radius. Under this condition, planar diffusion dominates and current is constant in the near-tangent limited region, independent of scan rate. As scan rate is increased, diffusion layer thickness decreases until it small than radius of electrode. Under this condition, planar diffusion dominates.

\[ E = \left( \frac{2D}{u} \right)^{\frac{1}{2}} = \left[ \frac{D}{n Fu} \right]^{\frac{1}{2}} \text{ where } \tau = \frac{1}{n Fu} \]

where \( u = \frac{RTD}{nFz^2} \) steady-state current predicted - independent of \( u \).

3. Amount to make monolayer electrode radius = 0.01 cm, not acetone.

\[ \frac{RTD}{nFz^2} = \frac{(3.314 \text{ cm} - R)(2.58 \times 10^{-3} \text{ M/L})(1.6 \times 10^{-5} \text{ cm}^3)}{(1) (94,500 \text{ cm}^{-4} \text{ mol}^{-1} \text{ L}^{-1}) (0.01 \text{ cm})^2} = 7.15 \times 10^{-6} \frac{\text{ mol}}{\text{cm}^2} = 2.5 \times 10^{-2} \frac{\text{ mol}}{\text{cm}^2} \]

or 2.5 \mu V/s a low scan rate
4) D value in IL is lower than in aqueous solution because ionic viscosity, \( \gamma \), IL is \( \sim 10^4 \) greater.

\[
D = \frac{k_B T}{(\pi \eta)^{1/2}} \quad D \propto \frac{1}{n}
\]

5) \( \dot{i}_p = \left(2.69 \times 10^5\right) n^{3/2} \eta^{1/2} A D^{1/2} C^4 t^{1/2} \)

\[
\dot{i}_p = \left(2.69 \times 10^5\right) \left(1.9 \times 10^{-6} \text{ cm}^2 \text{s}^{-1}\right) \left(3.8 \times 10^{-7} \text{ cm}^2 / \text{s} \right) \left(1.6 \times 10^{-5} \text{ cm}^2 / \text{s} \right) \left(0.1 \text{ V/cm} \right)^{1/2}
\]

\[
= 8.4 \times 10^{-11} \ A \approx 8.4 \text{ nA}
\]

This is close to the 10nA experimentally measured.

---

Extra

\[
i (t) = n F A D^{1/2} C \quad 1, 2, 3, 4, 5 \text{ s}
\]

\[
A = \pi r^2 = \pi \left(10 \times 10^{-6} \text{ cm} \right)^2 = 3.14 \times 10^{-11} \text{ cm}^2
\]

\[
i (1 \text{ sec}) = \frac{1}{2} \left(9.8 \times 10^{-6} \text{ cm} \text{s}^{-1} \right) \left(3.1 \times 10^{-10} \text{ cm}^2 / \text{s} \right) \left(1 \times 10^{-7} \text{ cm}^2 / \text{s} \right) \left(1.6 \times 10^{-5} \text{ cm}^2 / \text{s} \right) \left(10 \times 10^{-5} \text{ cm}^2 / \text{s} \right)
\]

\[
= \frac{9.5 \times 10^{-11}}{\left(\pi r^2\right)^{1/2}} = 5.3 \times 10^{-11} \ A
\]

\[
i (2 \text{ sec}) = 3.8 \times 10^{-11} \ A
\]

\[
i (3 \text{ sec}) = 3.1 \times 10^{-11} \ A
\]

\[
i (4 \text{ sec}) = 2.7 \times 10^{-11} \ A
\]

\[
i (5 \text{ sec}) = 2.4 \times 10^{-11} \ A
\]

9.0nA vs. 0.02 nA

\[
D^{1/2} = 1.7 \times 10^{-2} \text{ cm}^{1/2} \quad \text{Very high value!}
\]

Current too high for this microscope.