Answers

1] $$J_j(x) = -D_j \frac{\partial C_j(x)}{\partial x} - \frac{z_j F}{RT} D_j C_j \frac{\partial \phi(x)}{\partial x} + C_j v(x)$$

Flux (mol/s-cm^2)

Fick's First Law of Diffusion

Electric Field Gradient

Convection term

2] Migration is a notoriously irreproducible phenomenon in electrochemical cells, thus must be obviated. Generally dissolving a large excess of non-redox active electrolyte, i.e. 100x the redox active species will get rid of migration currents.

3] units of J are mol/cm^2-s and current is coul/s

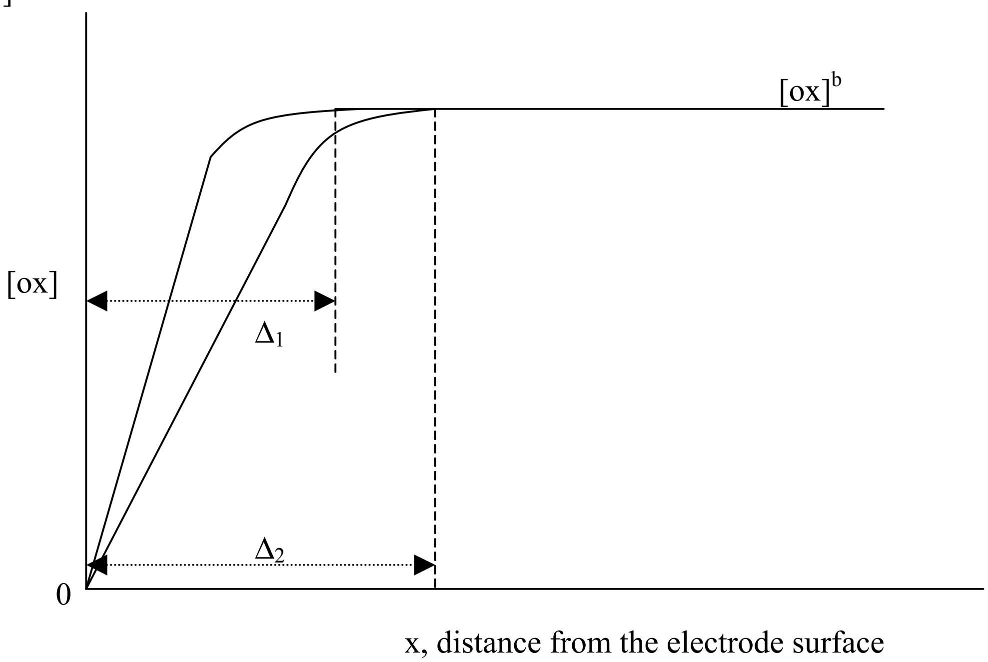
If we assume that every molecule of electroactive species that makes it to the electrode surface undergoes either a reduction or oxidation (diffision-limited kinetics), then the following analysis would apply: Ox + ne- = Red

i (coul/s) = n moles of electrons * F (96484 coul/mol e-) * Area of electrode (cm^2) * J mol/cm^2-s

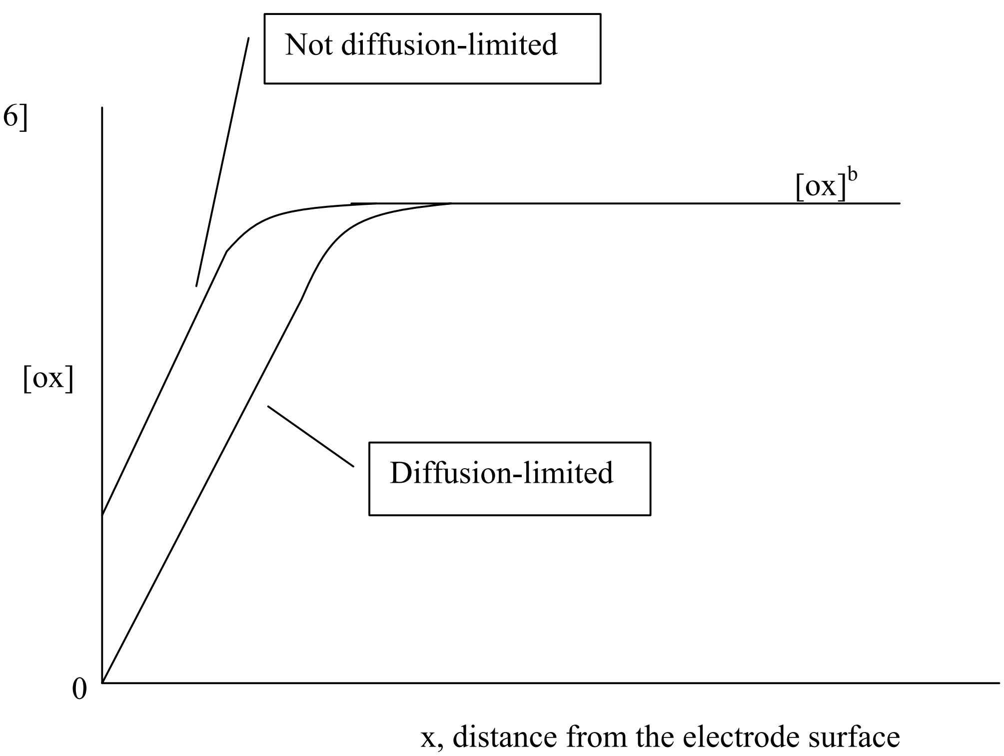
i = nFA J = $nFAD\left(\frac{\partial C(x,t)}{\partial x}\right)_{x=0}$

4] $\Delta = \sqrt{2Dt}$ = (2 * 1.0e-5 cm^2/s * 100 s)$^{1/2}$ = 4.5e-2 cm

5]


[ox]^b
[ox]
Δ1
Δ2
0
x, distance from the electrode surface

6]


Not diffusion-limited
[ox]^b
[ox]
Diffusion-limited
0
x, distance from the electrode surface