Figure 7.20 Understanding the shape of a cyclic voltammogram. Comparison of the concentration profiles under conditions of steady state mass transport and non-steady state diffusion. The profiles are labelled with the potentials shown on the voltammograms.
Figure 4.7  Energy level diagrams for: (a) and (b) the equilibrium potential, (c) a positive overpotential and (d) a negative overpotential. Here $E_{\text{Fermi}}$ and $E_{\text{redox}}$ are, respectively, the energies of the Fermi level and a solution energy level equivalent to the equilibrium potential of the couple O/R in solution.
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Point of zero charge = $E_{pzc}$

Potential at the plane of closest approach = $\varphi_2$

Figure 1.2.4  Potential profile across the double-layer region in the absence of specific adsorption of ions. The variable $\phi$, called the inner potential, is discussed in detail in Section 2.2. A more quantitative representation of this profile is shown in Figure 12.3.6.
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What happens (current flow) when the electrode potential is stepped from one potential to another in a supporting electrolyte?

$$E = E_R + E_C$$

$$i = \frac{E}{R_S} \exp \left( -\frac{t}{R_S C_{dl}} \right)$$

Ex.) If $R_S = 1 \ \Omega$ and $C_{dl} = 20 \ \mu F$, then $\tau = 20 \ \mu s$ and charging is 95% complete in about 60 $\mu$s.

37% of max value = 1 $\tau = R_S C_{dl}$

95% of max value = 3 $\tau$
What happens (current flow) when the electrode potential is scanned from one potential to another in a supporting electrolyte?

\[ Q = CE \]
\[ \frac{\partial Q}{\partial t} = C \left( \frac{\partial E}{\partial t} \right) = i \]
\[ i_{ch} = AC_{dl} \nu \]

Figure 1.2.10  Current-time behavior resulting from a linear potential sweep applied to an \( RC \) circuit.
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Figure 1.2.11 Current-time and current-potential plots resulting from a cyclic linear potential sweep (or triangular wave) applied to an RC circuit.
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\[ \text{Cu}^{2+} + 2e \rightarrow \text{Cu} \]

\[ \text{Cu(CN)}_4^{2-} + 2e \rightarrow \text{Cu} + 4\text{CN}^- \]

\[ \text{Cu(CN)}_2 + 2e \rightarrow \text{Cu} + 2\text{CN}^- \]

(a) \( i = i_d + |i_m| \)

(b) \( i = i_d - |i_m| \)

(c) \( i = i_d \)

**Figure 4.3.1** Examples of reduction processes with different contributions of the migration current: (a) positively charged reactant, (b) negatively charged reactant, (c) uncharged reactant.

\[ i_{\text{net}} = i_{\text{tot}} = i_d + |i_m| \]
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\[ i_{net} = i_{tot} = i_d + |i_m| \]

\[ i_{m,j} = z_j FA u_j C_j \frac{\partial \phi}{\partial x} \quad u_j = \frac{|z_j| FD_j}{RT} \]

Mobility of an ion, cm\(^2\) V\(^{-1}\) s\(^{-1}\)

\[ i_{m,tot} = \sum_j i_j = \frac{FA \Delta E}{\ell} \sum_j |z_j| u_j C_j \]

\[ t_j = \frac{i_j}{i_{m,tot}} = \frac{|z_j| u_j C_j}{\sum_k |z_k| u_k C_k} \]

Transference number