5.3.4 电极电势的应用

判断氧化还原反应进行的程度

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判断氧化还原反应进行的程度

$$\left.\begin{aligned}\Delta_r G_m^\ominus &= -2.303RT\lg K^\ominus \\ \Delta_r G_m^\ominus &= -zFE_{MF}^\ominus\end{aligned}\right\} \longrightarrow 2.303RT\lg K^\ominus = zFE_{MF}^\ominus$$

$$\lg K^\ominus = \frac{zFE_{MF}^\ominus}{2.303RT}$$

T=298.15 K

R=8.314 J·mol^{-1}·K^{-1}

F=96485 C·mol^{-1}

$$\lg K^\ominus = \frac{zE_{MF}^\ominus}{0.0592} = \frac{z\,(E_+^\ominus - E_-^\ominus)}{0.0592}$$

例题

求下列反应在298.15 K时的标准平衡常数$K^{\ominus}$

$Zn + Cu^{2+} = Zn^{2+} + Cu$

$E^{\ominus}(Cu^{2+}/Cu) = 0.340V \quad E^{\ominus}(Zn^{2+}/Zn) = -0.7626V$

z=2

$$E^{\ominus}_{MF} = E^{\ominus}_{+} - E^{\ominus}_{-} = 0.340 + 0.7626 = 1.103V$$

$$\lg K^{\ominus} = \frac{zE^{\ominus}_{MF}}{0.0592} = \frac{2 \times 1.103}{0.0592} = 37.26$$

$$K^{\ominus} = 1.8 \times 10^{37}$$

例题

求下列反应在298 K时的平衡常数K

$$2MnO_4^- + 5Zn + 16H^+ = 2Mn^{2+} + 5Zn^{2+} + 8H_2O$$

$$E^\ominus(MnO_4^-/Mn^{2+}) = 1.51V \quad E^\ominus(Zn^{2+}/Zn) = -0.7626V$$

$$E^\ominus_{MF} = E^\ominus_+ - E^\ominus_- = 1.51 - (-0.7626) = 2.27V$$

$$MnO_4^- + 8H^+ + 5e^- \longrightarrow Mn^{2+} + 4H_2O$$

$$Zn - 2e^- \longrightarrow Zn^{2+}$$

$$\lg K^\ominus = \frac{zE^\ominus_{MF}}{0.0592} = \frac{10 \times 2.27}{0.0592} = 383.45$$

$$K^\ominus = 2.8 \times 10^{383}$$