Physico-Chemical Hydrodynamics of Electrolyte Solutions

Electro-Convective Instability in Concentration Polarization and Over-Limiting Conductance

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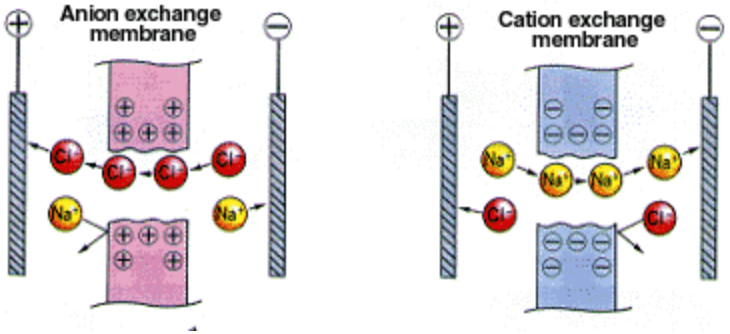
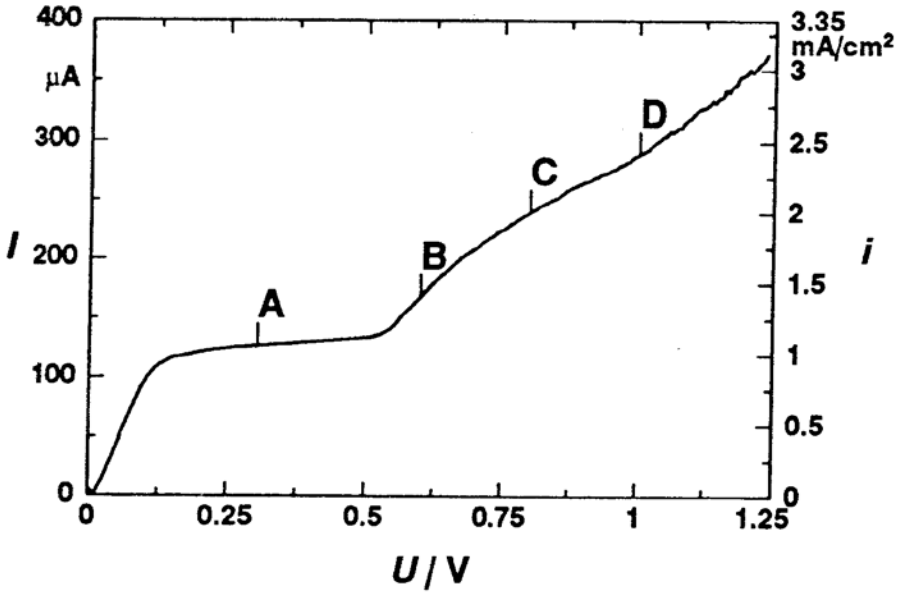
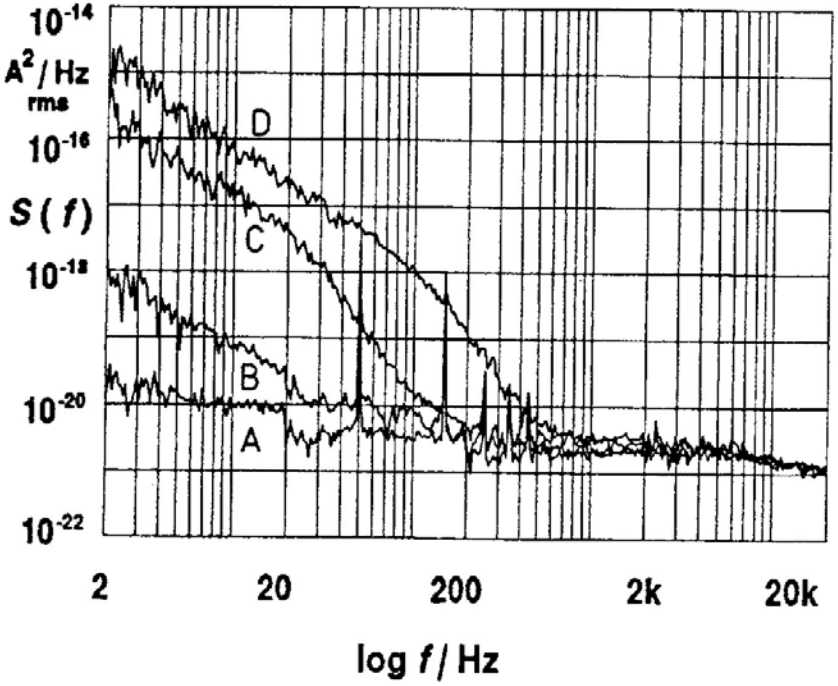
Ion Exchange Membranes, Electrodyalysis





Voltage-current curve of a C-membrane



Current power spectra

TWO TYPES OF ELECTRO-CONVECTION IN STRONG ELECTROLYTES

Bulk electro-convection | **Electro-osmosis**

$$c_t^+ + \mathrm{Pe}\vec{v}\ \nabla c^+ = D\nabla(\nabla c^+ + c^+\nabla\varphi) \quad 0 < y < 1, \quad -\infty < x < \infty$$

$$c_t^- + \mathrm{Pe}\vec{v}\ \nabla c^- = \nabla(\nabla c^- - c^-\nabla\varphi)$$

$$\varepsilon^2\Delta\varphi = c^- - c^+$$

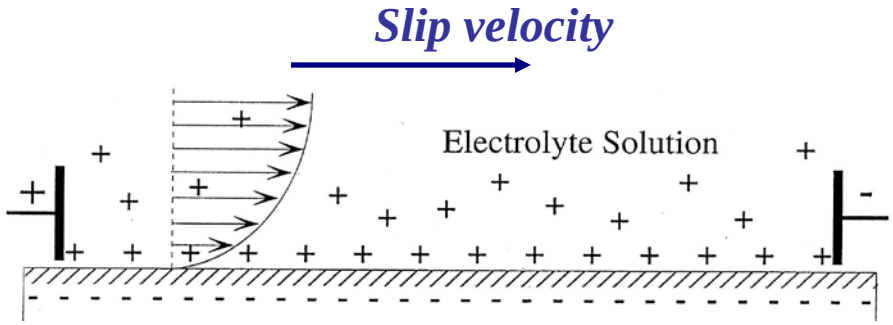
$$0 = \Delta\vec{v} + \Delta\varphi\nabla\varphi - \nabla p$$

$$\nabla\vec{v} = 0$$

$$y = 1: \quad \vec{v} = 0, \quad c^+ = p_1, \quad \varphi = -V, \quad c_y^- - c^-\varphi_y = 0$$

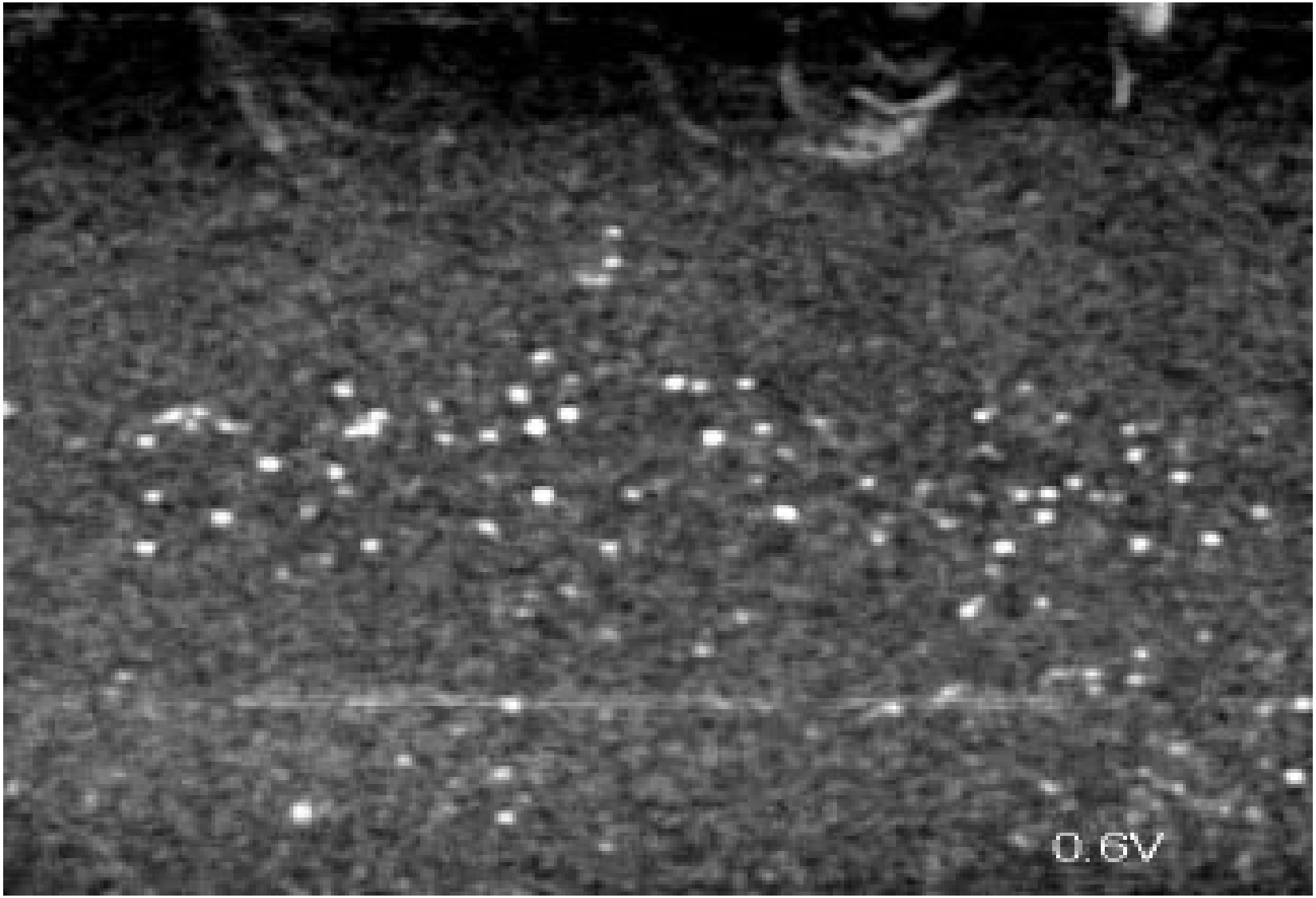
$$\mathrm{Pe} = \frac{v_0 L}{D_-} = \left(\frac{RT}{F}\right)^2 \frac{d}{4\pi\eta D_-} \approx 0.5, \quad D = \frac{D_+}{D_-}$$

$$\varepsilon = \frac{(dRT)^{1/2}}{2F(\pi c_0)^{1/2} L}, \quad 10^{-12} < \varepsilon^2 < 10^{-5}$$



$\varepsilon \ll 1$ – OUTER SOLUTION: BULK ELECTRO-CONVECTION

INNER SOLUTION: ELECTRO-OSMOTIC SLIP


0.6V