8. Transference number

1 Review

→ Ion-ion interaction & Ion-solvent interaction → activity ($a = \gamma \cdot c$)

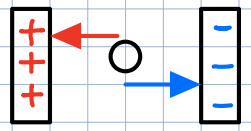
→ Debye-Hückel limiting law (DHL)

2 mobility & Ionic conductivity

→ mobility (u_i , $[cm^2 V^{-1} s^{-1}]$)

↳ $u_i = \frac{|z_i| e}{6\pi\eta r}$

↳ Why? :



steady-state velocity 도달시 ($f_{drag} = f_{electric}$)

$6\pi\eta r v = |z_i| e \xi$ (η : viscosity, r : radius of ion, ξ : E-field strength)

$\frac{v}{\xi} = \frac{|z_i| e}{6\pi\eta r} = u_i$

→ Ionic conductivity (κ , $[\Omega^{-1} cm^{-1} = S cm^{-1}]$)

↳ $\kappa = F \sum_i |z_i| u_i c_i$

↳ Why? : solution current는 개별 ionic species의 독립적인 movement로 생성

3 transference number (= transport number , t_i)

→ 총 conductivity에서 특정 species가 갖는 contribution

→ $t_i = \frac{|z_i| u_i c_i}{\sum_j |z_j| u_j c_j}$

→ equivalent conductivity (Λ)

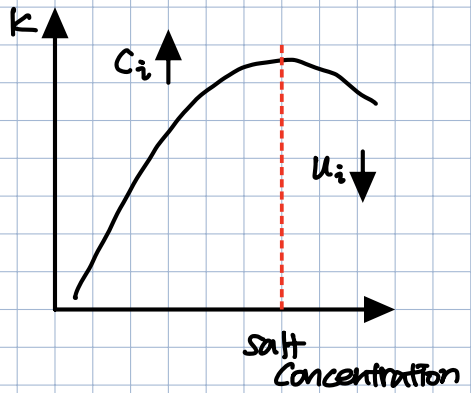
↳ simple electrolyte (ex: NaCl, HNO_3, KCl, ···)의 경우

↳ 단위 charge concentration 당 conductivity

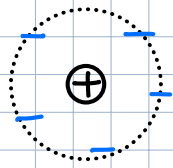
↳ $\Lambda = \frac{\kappa}{c|z|} = \frac{u_i}{u_+ + u_-} = \lambda_+ + \lambda_- = F(u_+ + u_-)$

Ionic conductivity & salt concentration

→



[Why?]

① Relaxation effect:  더 right하게 밀림

② electrophoretic effect : $u_i = \frac{|z_i| e}{6\pi\eta r}$

$\kappa = F\sum_i |z_i| u_i c_i$