doi:10.1351/goldbook.T06343

thickness of electrical double layer

The length characterizing the decrease with distance of the potential in the double layer = characteristic Debye length in the corresponding electrolyte solution = κ^{-1}:

$$\frac{1}{\kappa} = \sqrt{\frac{\varepsilon_\mathrm{r}\,\varepsilon_0\,R\,T}{F^2 \sum_i c_i\,z_i^{\,2}}}$$

(rationalized four-quantity system)

$$\frac{1}{\kappa} = \sqrt{\frac{\varepsilon_\mathrm{r}\,R\,T}{4\,\pi\,F^2 \sum_i c_i\,z_i^{\,2}}}$$

(three-quantity electrostatic system)

where ε = static permittivity = $\varepsilon_\mathrm{r}\,\varepsilon_0$, ε_r = relative static permittivity of solution; ε_0 = permittivity of vacuum, R = gas constant, T = thermodynamic temperature, F = Faraday constant, c_i = concentration of species i, z_i = ionic charge on species i.

Source:
PAC, 1972, *31*, 577 *(Manual of Symbols and Terminology for Physicochemical Quantities and Units, Appendix II: Definitions, Terminology and Symbols in Colloid and Surface Chemistry)* on page 619

