Electronic Supporting Information to

Streaming potential with ideally-polarizable electron-conducting substrates

Andriy Yaroshchuk[1,2] and Emiliy Zholkovskiy[3]

[1]ICREA, pg. L. Companys 23, 08010 Barcelona, Spain
[2]Department of Chemical Engineering, Universitat Politècnica de Catalunya - BarcelonaTech, av. Diagonal 647, 08028, Barcelona, Spain
[3]F.D.Ovcharenko Institute of Bio-Colloid Chemistry, National Academy of Sciences of Ukraine, Vernadskiy blvd.42, 03142 Kyiv, Ukraine

Charge regulation with weakly-acidic ionogenic groups

Within the scope of popular charge-regulation model [1], the surface charge is described by the so-called Langmuir-Stern isotherm, which gives

$$\sigma(\zeta) = \frac{\sigma_0}{1+Kexp(-Z_p\zeta)} \qquad \text{(S1)}$$

where Z_p is the charge (in proton-charge units) of potential-determining ions (H^+ in this case), σ_0 is the maximum surface-charge density corresponding to full deprotonation. Constant K is proportional to the bulk concentration of H^+ ions and, thus, is a function of solution pH. The term with the exponent in denominator reflects the fact that the surface concentration of ions is different from their bulk concentration due to electrostatic repulsion/attraction. Thus, for instance, an increase in the negative surface-charge density with increasing pH is accompanied by intensification of electrostatic attraction of H^+ ions, which somewhat reduces the degree of dissociation. Fig.S1 shows a comparison of pressure dependence of streaming potential calculated for the case of charge regulation using Eqs(6,19) with the case of constant charge (Eqs(6,15)). The maximum surface-charge density in the case of charge regulation, σ_0, is assumed to give rise to the same “zero-flow” dimensionless zeta-potential as in the case of constant charge.

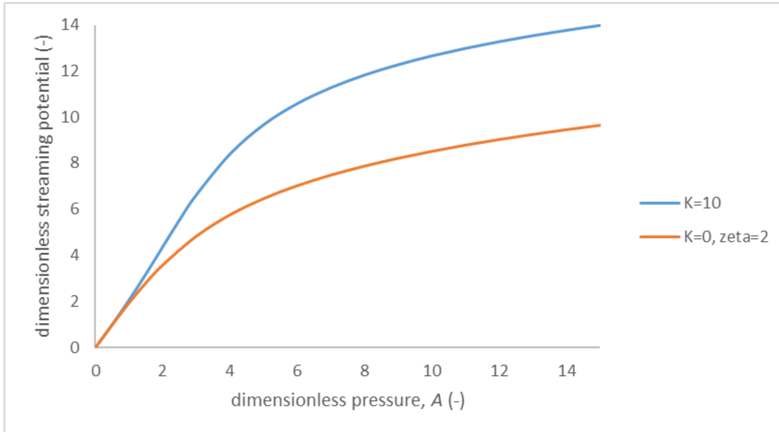

Fig.S1. Dimensionless streaming potential vs dimensionless pressure for charge regulation (blue) and constant charge density (orange)

Schematic of side evaporation

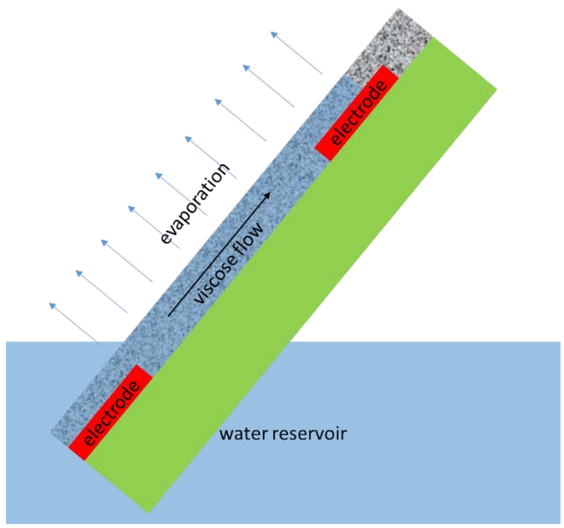

Fig.S2. Schematic of systems with "side" evaporation (not to scale).

[1] J. N. Israelachvili, *Intermolecular and Surface Forces*, 3rd ed. (Elsevier, 2011).