Supplementary Information

Probing the surface charge on the basal planes of Kaolinite particles with high resolution Atomic Force Microscopy

N. Kumar[1†], M. P. Andersson[2], D. van den Ende[1], F. Mugele[1] and I. Siretanu[1*]

[1]Physics of Complex Fluids Group, MESA+ Institute for nanotechnology, University of Twente, PO Box 217, 7500 AE Enschede, The Netherlands

[2]Nano-Science Center, Department of Chemistry, University of Copenhagen, Universitetsparken 5, 2100 Copenhagen, Denmark

* Corresponding author, email: i.siretanu@utwente.nl

[†]present address: Delft University of Technology, Department of Chemical Engineering, Van der Maasweg 9, 2629 HZ Delft, The Netherlands

Effect of pH: force and charge maps on gibbsite facet

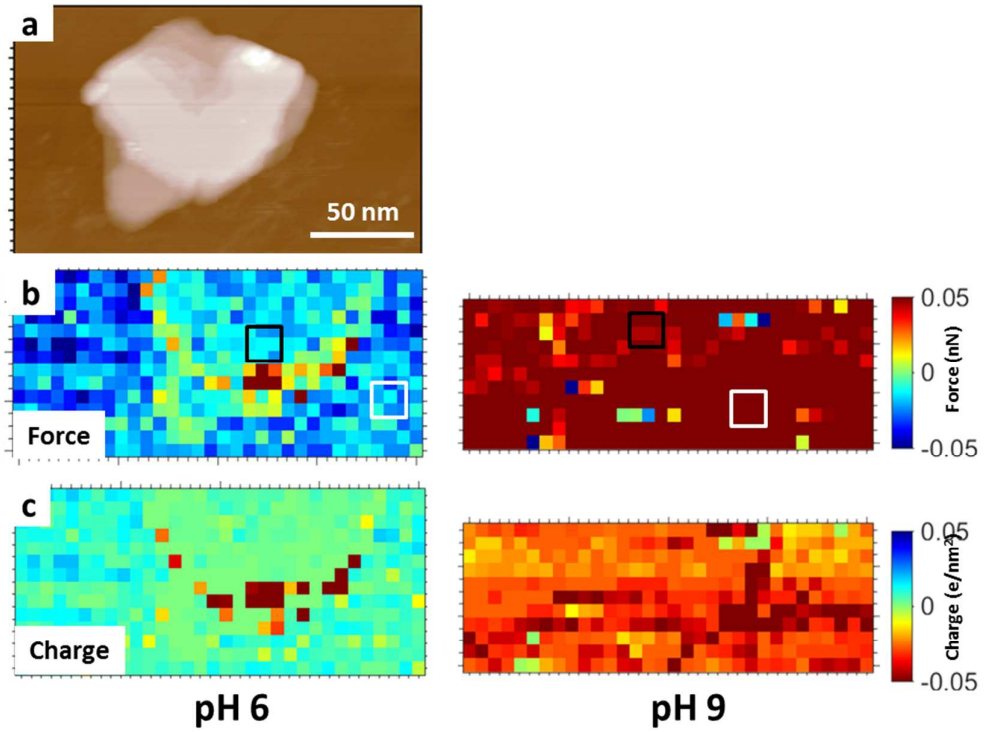

Figure S1 (a) Topography image of kaolinite particle adsorbed on sapphire imaged under 10mM NaCl solution (b) Force maps showing tip-sample interaction forces on kaolinite under 10mM NaCl solution at pH 6 and 9. Note: The maps are shown at 1 nm distance from the surface. (c) Surface charge maps calculated by analysing the tip sample interaction forces with DLVO theory. (Tip parameters: $Q = 2.37$, $f_0 = 17.06$ kHz, $K = 0.448$ N/m, $A_{tip} = 1018 \pm 12.5$ nm^2)

Effect of pH: force and charge maps on gibbsite facet

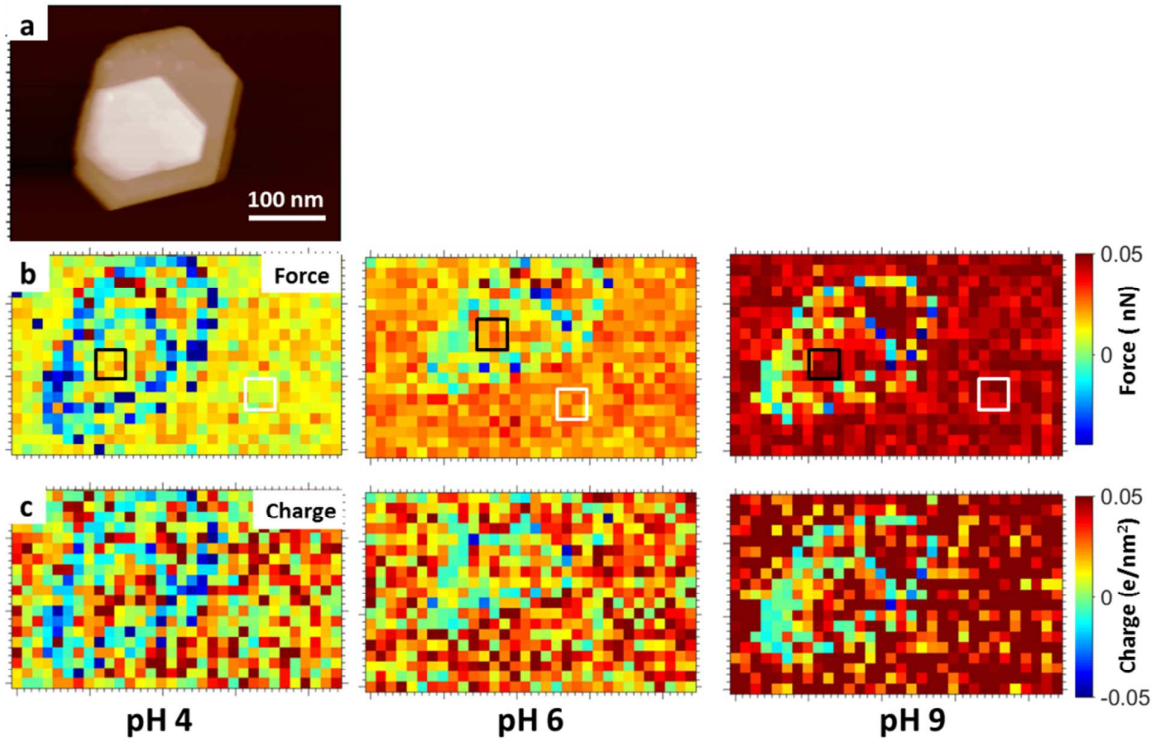

Figure S2 (a) Topography image of kaolinite particle adsorbed on mica imaged under 10 mM NaCl, pH 6 solution (b) Force maps showing tip sample interaction forces on kaolinite under 10mM NaCl solution at pH 4, 6 and 9. Note: The maps are shown at 1 nm distance from the surface. (c) Surface charge maps calculated by analysing the tip sample interaction forces with DLVO theory. (Tip parameters: Q = 2.16, f_0= 16.97 kHz, K= 0.367 N/m, A_{tip} = 531 ± 12.5 nm^2).

Effect of CaCl2 solutions: force and charge maps on gibbsite facet

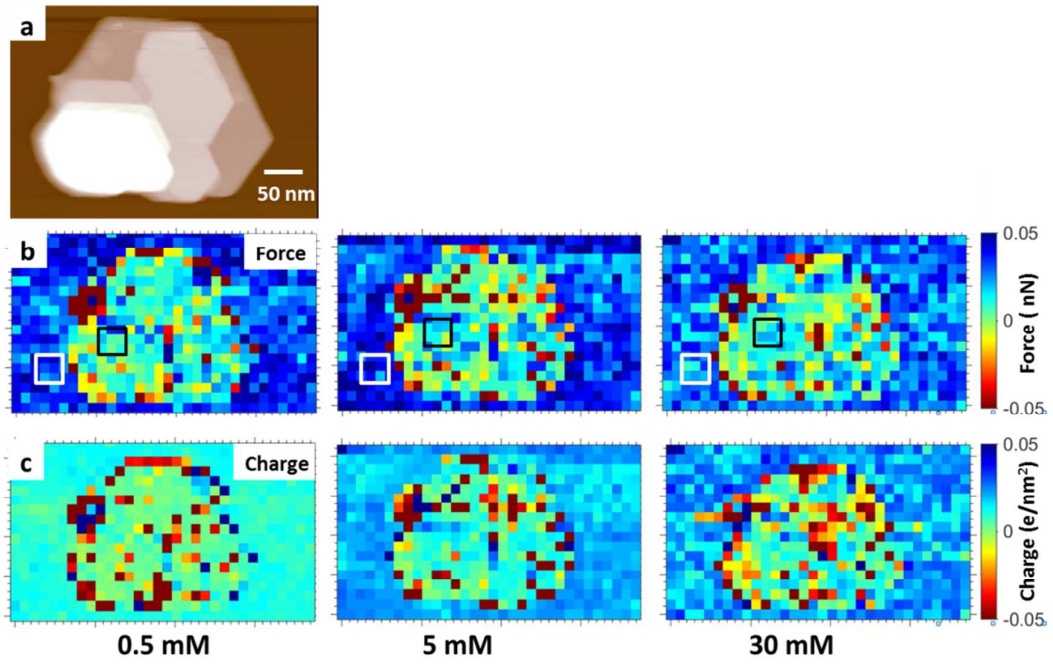

Figure S3 (a) Topography image of kaolinite particle adsorbed on sapphire imaged under 10mM $CaCl_2$ solution (b) Force maps showing tip sample interaction forces on kaolinite under different (0.5, 5, and 30mM) $CaCl_2$ salt concentrations. Note: The maps are shown at 1 nm distance from the surface. (b) Surface charge maps calculated by analysing the interaction force curves with DLVO theory. (Tip parameters: Q = 2.94, f_0= 22,67 kHz, K= 0.71 N/m, A_{tip} = 314 ± 12.5 nm^2)

SEM Images of AFM tips

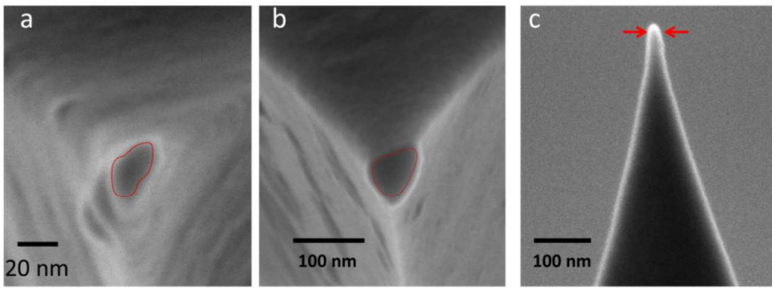

Figure S4 SEM images of the AFM tips used for different experiments. (a) A_{tip} = 531± 12.5 nm^2 for measurements on the silica facet and (b) A_{tip} = 1018± 12.5 nm^2 for measurements on the gibbsite facet of the kaolinite particles.

Surface potential:

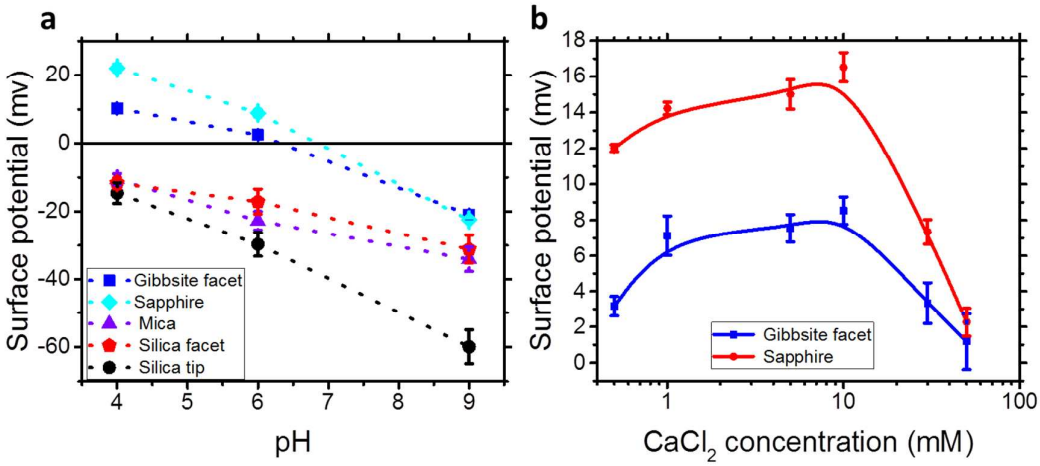

Figure S5: Surface potential of (a) mica, silica tip, sapphire and the two facets of kaolinite particle as a function of pH and (b) Sapphire and the gibbsite facet as a function of $CaCl_2$ salt concentration. Note: These potential values are calculated on the areas marked on the force maps shown in Figure 1, 3, S1, S2, and S3.