Debye screening length of electrolytic solutions from capacitive force measurements using atomic force microscopy[1] BHARAT KUMAR, SCOTT R. CRITTENDEN, Department of Physics and Astronomy, University of South Carolina, Columbia, SC 29208 — We present a method to obtain the Debye screening length of a dilute electrolytic solution by measuring the capacitve force using atomic force microscopy (AFM). A small AC bias voltage of frequency ω was applied between an AFM cantilever and conducting substrate in an electrolytic solution and the resulting capacitive force between them was measured from the cantilever oscillations. The 2ω component of the oscillating force was used to obtain the capacitance gradient between the AFM cantilever tip and substrate as a function of tip-sample distance z. An analytic expression relating tip-sample distance z and capacitance gradient between AFM tip and conducting substrate in an electrolytic solution was derived using the solution of the linearized Poisson-Boltzmann equation. We find that the analytic expression fits well with the experimental data for dilute KCl-water solutions. The fit parameters were further used to calculate the Debye screening length of the electrolytic solution.

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