Supplemental Information

Chain Dimensions and Surface Characterization of Superhydrophilic Polymer Brushes with Zwitterion Side Groups

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1. SLS and DLS

Both SLS and DLS experiments on the free polymers in aqueous NaCl solutions at 298 K were carried out at a scattering angle (θ) ranging from 30° to 150°, using a goniometer system (ALV CGS-3-TAC/LSE-5004, Langen, Germany) using an He–Ne laser (λ = 632.8 nm) with a power of 22 mW. The Rayleigh ratio at a scattering angle of θ = 90° was based on that of pure toluene at a wavelength of 632.8 nm at 298 K.[23] The autocorrelation function was obtained by pseudo-cross-correlation of the signals from two photomultipliers to suppress noise. The samples for SLS and DLS measurements had four different concentrations in aqueous NaCl solutions (C_s = 0–5.0 M) and were contained in quartz cells of diameter 10 mm. The scattering vector (Q) was defined as $(4\pi n_s/\lambda)\sin(\theta/2)$, where n_s is the refractive index of the solvent.

2. AFM

We investigated the swollen thicknesses of PMPC and PMAPS brushes in aqueous solutions with various salt concentrations by AFM (Agilent 5000). The radius of the SiO_2 tip of the cantilever (Sphere Tips, Nanoworld) was 1000 nm. The bending spring constant of the cantilever tip was 0.2 N m^{-1}. The cantilever surface was covered with an n-propyltriethoxysilane monolayer by chemical vapor adsorption. A liquid cell was used for the measurements in deionized water and 0.01, 0.05, 0.5, 1.0, and 5.0 M NaCl aqueous solutions at 298 K. A PMPC brush (M_n = 1.87 × 10^5 g/mol, M_w/M_n = 1.49, σ = 0.081 chains/nm) and a PMAPS brush (M_n = 2.65 × 10^5 g/mol, M_w/M_n = 1.80, σ = 0.085 chains/nm^2) were prepared on Si wafers by surface-initiated ATRP. The brush layer was partially scratched for measurement of the height of the brush layer on the Si surface by AFM.

In the case of PMAPS brush in aqueous NaCl solution, swollen brush thickness by

AFM increased with increasing of C_s with the exponent 1/8 at lower salt concentration (Cs < 0.05 M) and 1/4 at higher concentration (Cs ~ 0.5 - 5.0 M), as shown in Fig. S1.
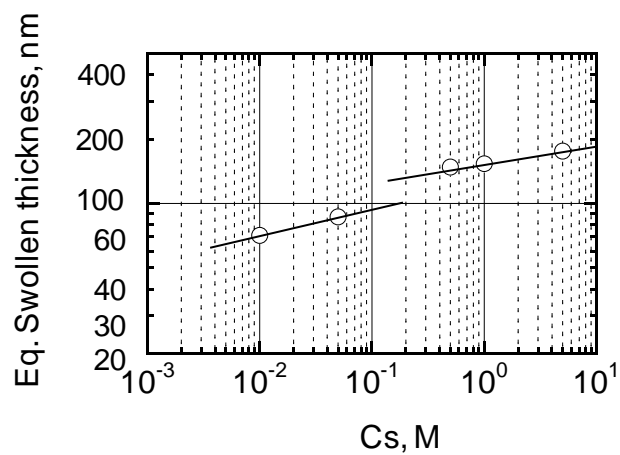

Fig. S1. Equilibrium swollen thickness L_e of PMAPS brush, in aqueous NaCl solutions at 298 K, estimated from L' of the force curve and L_0 determined by contact-mode AFM. (C_s = NaCl concentration)