

## AFM adhesion imaging for comparison of polyelectrolyte complexes and polyelectrolyte multilayers

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**Materials.** Polyallylamine hydrochloride (PAH, cationic) with a molecular weight of 15,000 Da and polyacrylic acid (PAA, anionic) with a molecular weight of 5000 Da (both according to supplier) were purchased from Sigma-Aldrich (USA) and used as delivered. Cationic polyacrylamide (CPAM) with a molecular weight of approximately 150,000 Da and colloidal silica particles (anionic) with an approximate diameter of 5 nm (both according to supplier) were supplied by Eka Chemicals (Sweden) and used as delivered.

**PEC preparation.** PECs was prepared using high-speed jet mixing. The technique and procedure are described in detail elsewhere<sup>1</sup>. Briefly, two jets, one of each of the two polyelectrolyte solutions, are collided in a mixing chamber at an angle of 180° to each other, leading to rapid polyelectrolyte mixing and the formation of polyelectrolyte complexes. The polycations and polyanions were dissolved in MilliQ water containing 10 mM NaCl; the pH of the solutions was adjusted to 7 before mixing. The charge ratios of the complexes, defined as the ratio between the number of anionic charges and the number of cationic charges when fully dissociated, were 0.8 and 0.3 for PECs and PPECs, respectively. The hydrodynamic diameter and zeta potential values for the resulting PECs were analysed using dynamic light scattering (Zetasizer Nano ZS from Malvern Instruments, UK).

**Surface preparation.** P-type silicon wafers, used as adsorption substrate for all studied systems, were purchased from MEMC Electronic Materials, Italy. The substrates were rinsed with MilliQ water, ethanol, and MilliQ water (in that sequence), blown dry with nitrogen gas, and finally treated in a plasma cleaner for 30 s. The adsorptions were made by dipping the substrates in 50 mg L<sup>-1</sup> solutions of PEC or polyelectrolyte for 5 min, and thereafter in a rinsing solution of 10 mM NaCl in water for 5 min; the surfaces were then blown dry using nitrogen gas. The pH of all solutions was adjusted to 7.

**AFM measurement procedure.** For the AFM measurements, a Dimension Icon atomic force microscope (Bruker AXS, USA) equipped with ScanAsyst cantilevers having SiO<sub>2</sub> tips with a radius of curvature close to 2 nm was used. The cantilever normal spring constant was calibrated using the thermal noise method, and the inverse optical lever sensitivity was calculated from force curve measurements towards a sapphire surface. Height and adhesion images were captured in PeakForce QNM mode, and the individual force curves were measured in point-and-shoot mode after the complete QNM images were captured.

### Notes and references

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1. C. Ankerfors, S. Ondaral, L. Wågberg and L. Ödberg, *J. Colloid Interface Sci.*, 2010, **351**, 88.