Persistence Length of Cationic Dendronized Polymers From AFM Images

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Abstract The persistence length (PL) of dendronized polymers adsorbed on substrates was investigated by atomic force microscopy image analysis. Cationic dendronized polymers from generation 1 to 4 (PG1 - PG4) were prepared in solutions with different electrolyte concentrations and subsequently adsorbed on mica, silica, gold, and highly oriented pyrolytic graphite (HOPG). The adsorbed polymers were imaged in the respective electrolyte solutions with a Cypher AFM in amplitude-modulation (AC) mode. The PL of the adsorbed polymers was determined with an image analysis software, whereby the backbones of the polymeric chains were traced and their lateral coordinates recorded (Figure 1). Our measurements show that the PL increases with increasing polymer generation and decreases when raising the salt concentration (Figure 2). When the polymers are adsorbed on mica, PG1 and PG2 show a stronger variation with ionic strength if compared to PG3 and 4. One can rationalize this behavior by assuming that the efficiency of screening the electrostatic interactions between the charged groups at the polymer backbone might be reduced as the generation is increased and the nature of the surface is changed. While consistent results are obtained from mica, silica, and gold, noticeable differences are observed when polymers are adsorbed on HOPG. Since this surface is weakly charged and highly hydrophobic, the electrostatic contribution to the persistence length is smaller. On HOPG, specific molecule-surface interactions might play an important role.

Figures

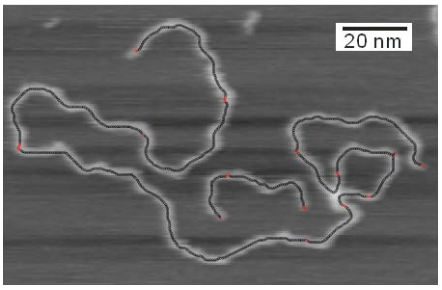

Fig 1. AFM topography of two PG3 molecules adsorbed on mica at pH 4 and at 1 mM KCl concentration. Black lines represent the tracings of the backbones.

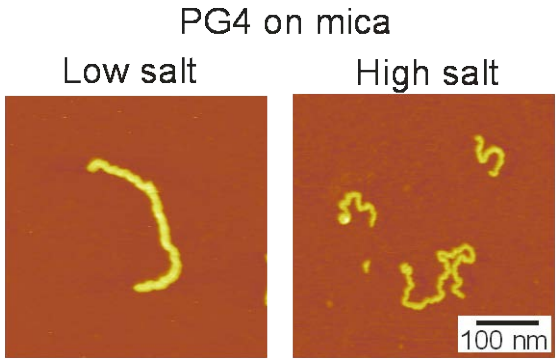

Fig 2. PG4 adsorbed at low (left) and high (right) salt levels. At low salt level, the electrostatic repulsion between the charged groups on the dendrons results in a more stretched configuration.