The effect of chain length, architecture and confinement on the structuring of aqueous polyelectrolyte solutions

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In this contribution, the structuring of aqueous polyelectrolytes having various architectures and chain lengths is discussed. Colloidal probe AFM and small angle x-ray scattering (SAXS) techniques were used to study the structuring in confined geometry (thin film) and in the bulk respectively. AFM force measurements of the polyelectrolyte solutions lead to oscillatory force curves in a certain concentration range. These oscillatory curves can be used to better understand the interactions between the polyelectrolyte chains. SAXS on the other hand, shows structure peaks originated from the anisotropic packing of either polyelectrolyte networks or coils. It was observed that the length (molecular weight) of the polyelectrolyte chains determines the overlap concentration. This leads to a transition from a packing of polymer coils to a semi-dilute network structuring as longer chains are used in a mono-dispersed solution. The architecture of the chains was surprisingly found to change the microscopic structuring only slightly. Viscosity measurements however, show that the polymer branching remarkably affects the macroscopic properties. In all cases, the structuring is found to be independent of the presence or type of the confinement [1, 2].

Oscillatory curves obtained from colloidal probe AFM measurements. Force curves correspond to 0.04M (monomer concentration) solutions of NaPSS with different molecular weights.