Hydrophobic Polyelectrolytes: Combined Small-angle Neutron and X-ray Scattering Studies

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The structure of salt-free aqueous solutions of highly charged hydrophobic polyelectrolytes was investigated using high-resolution small-angle neutron and X-ray scattering. The choice of one technique rather than another was driven by the contrast between the solvent (H_2O and/or D_2O) and the species (macroions and/or counterions) we want to look at. Various architectures of sulfonated polystyrene macroions with distinct sulfonation rates as well as distinct counterions were considered.

We will present scattering results that show strong evidence for the existence of necklace conformations with dense charged aggregates connected by stretched chain parts. Such conformations have been predicted on the basis of scaling arguments for weakly charged polyelectrolytes under poor solvent conditions [1] and have been confirmed by low-resolution small-angle X-ray scattering studies [2] and molecular dynamics simulations [3]. They result from the balance between the tendency to precipitate, the electrostatic repulsion and the entropic degrees of freedom. It was however suggested that fluctuations should impose a severe obstacle in observing these necklace structures [4]. Here, we are more concerned with quenched polyelectrolytes and the non-sulfonated sequences may form microdomains. The resulting shape could therefore be similar, though the physical case is not the one theory was made for.

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