Effect of molecular weight and its asymmetry on the formation of polyelectrolyte multilayers
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Polyelectrolyte multilayers (PEMs) of polyanions and polycations are self-assembled systems which are under investigation since 20 years but still attracting great interest due to their high versatility and to their relatively easy control of the structural properties by tuning proper parameters. Not only the structure of the constituent polyelectrolytes influences the resulting multilayer, but also the preparation conditions, like the dipping time or the ionic strength of polymer solutions. One of the basic questions is which parameters decide about the formation and dissolution of PEMs, when polyelectrolyte chains are adsorbing at the PEM surface. One of the parameters is the molecular weight, and also the asymmetry of the molecular weights of polyanion and polycation might be important.

Here, we compare polyelectrolyte multilayers prepared from poly(sodium styrene sulfonate), PSS, and poly(diallyl dimethyl ammonium chloride), PDADMAC, both of low and high molecular weight. This is provided through the results obtained from ellipsometry and atomic force microscopy measurements, together with the description of surface dynamics and viscoelastic properties derived by fluorescence recovery after photobleaching (FRAP) and quartz-crystal microbalance (QCM-D), respectively. A strong effect both of the molecular weight and the symmetry/asymmetry of the molecular weight is observed.

Our attempts for preparing stable low molecular weight multilayers and gaining knowledge about their properties and behaviour is fuelled by the perspective of potential future applications which require, for example, easily penetrable layers or materials which can be fast degraded.