Interdiffusion in polyelectrolyte multilayers

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Using neutron reflectivity, the internal structure of polyelectrolyte multilayers is described on a molecular scale. Each film consists of a deuterated and a protonated block, built from x protonated and y deuterated polycation/polyanion bilayers, respectively. The number of bilayers $N=x+y$ is kept constant, the position of the interface between the blocks is varied systematically [1]. The number of polycation/polyanion bilayers $N=x+y$ is kept constant; the position of the interface between the blocks is varied systematically. The polyanion is Poly (styrene sulfonate) (PSS), the polycation Poly (allylamine hydrochloride) (PAH) or Poly (diallyldimethyl ammoniumchloride) (PDADMAC). Always, the first four to five bilayers are thinner than the average bilayer thickness; sometimes the three terminating bilayers are thicker. In the core zone, the bilayer thickness is constant. The internal roughness is smallest next to the film/air interface and increases with the number of bilayers away from the film/air interface. This suggests that each deposition step promotes the interdiffusion of the supporting layers. At the selected preparation conditions, the internal roughness increases more for PDADMAC/PSS than for PAH/PSS, the deduced diffusion constants differ by two orders of magnitude.

![Fig. Right: schematic scattering length density profile of the polyelectrolyte multilayer consisting of PC (polycation) and PSS. Left: square of the internal roughness $\sigma_{\text{int}}$ as function of number of bilayers beneath the film/air interface. The PC/PSS pairs and the salt conditions of the preparation solution are indicated.](image)