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Investigation of solvent uptake of salt containing PNIPMAM thin films

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Stimuli responsive polymers gained lot of attention in the past due to their unique properties. If polymer thin films exhibit a reversible volume change upon exposure to external stimuli such as temperature, light, pH, or solvents, they become promising candidates for applications such as nanoswitches or sensors. Poly(N-isopropyl methacrylamide) (PNIPMAM) is a lower critical solution temperature (LCST) type thermoresponsive polymer with a LCST in water at around 44℃ and is able to absorb water molecules when it is exposed to water rich atmospheres. Due to low swelling times and strong volume changes upon water incorporation PNIPMAM thin films are of special interest. In this work, the influence of different salts on the swelling behavior of PNIPMAM thin films is explored. In situ time-of-flight neutron reflectometry measurements are performed to investigate the macroscopic swelling behavior of the salt containing polymer thin films. By fitting the obtained reflectivity patterns, information about the distribution of the compounds vertically through the thin films can be deduced. To gain further insights on a molecular level and to understand the underlying hydration mechanism, additional in situ Fourier-transform infrared spectroscopy measurements are performed. Our studies showed, that the addition of different salts highly influences the swelling behavior as well as the hydration mechanism of PNIPMAM thin films depending on the salt additive.

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