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# Water swelling and exchange kinetics in multi-stimuli responsive PNIPAM-based block copolymer thin films

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Multi-stimuli responsive polymers can react with a strong change in volume towards small changes of an external stimulus, which makes them promising materials for a wide variety of applications. [1-3] While the underlying mechanisms of such polymers in solution are well understood, less is known about thermoresponsive polymers in thin film morphology. Regarding this context, the most studied thermoresponsive polymer is poly(N-isopropylacrylamide) (PNIPAM) that exhibits a lower critical solutions temperature (LCST) at 32°. In order to increase the pool of studied thermoresponsive polymers, we focus on the analysis of the swelling and exchange kinetics of a newly synthesized block copolymer. This copolymers consists of a PNIPAM block and a zwitterionic poly(sulfobetaine) (PSB) block that exhibits an upper critical solution temperature (UCST). Time-of-flight neutron reflectometry is used to follow in-situ the swelling and exchange behavior in D2O and H2O atmosphere. This sophisticated technique enables a large qz range in combination with a high time resolution of 30 seconds. The kinetic swelling and exchange processes are evaluated with a theoretical model. Detailed insights about the underlying mechanisms are obtained which help to take the next step of implementing such responsive thin films in our daily life.

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[2] W. Wang, et al., Macromolecules, 43, 2444 (2010)
[3] A. C. C. Rotzetter, et al., Adv. Mater., 24, 5352 (2012)

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