Contribution ID: **21** Type: **not specified**

Diffussion kinetics of H2O and D2O in cross-linked PNIPAM microgel thin films followed with in-situ neutron reflectivity

Wednesday, 21 June 2017 11:15 (15 minutes)

Strong volume shifts of polymer thin films due to small modifications of an external stimulus like temperature are desired for a number of applications such as thermoresponsive nanoswitches or drug delivery in medicine. In this context the polymer which received most attention so far is poly(N-isopropylacrylamide), PNIPAM. The volume shift arises due to the collapse transition of the polymer at a lower critical solution temperature (LCST) which manifests in a swelling or deswelling of the polymer with water from its surroundings. To further our understanding of the kinetics of water uptake, release and exchange and the induced changes of the polymer properties, microgel thin films from a PNIPAM homopolymer with varying amounts of N,N'-Methylenebisacrylamide cross-linkers are prepared. In-situ neutron reflectometry in time of flight (TOF) mode is used to investigate the uptake and exchange kinetics of H2O with D2O and vice-versa for these films at temperatures below the LCST of PNIPAM.

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Session Classification: Parallel Session