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Interrogating the kinetics of a thermoresponsive PNIPAM brush utilising neutron reflectometry

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While it is well known that sugars play an important role in biological systems, they also act as osmolytes. For example, glucose, can destabilise bio- and synthetic macromolecules through osmolyte-type behaviour at elevated concentrations.[1] Despite the ubiquity of these molecules, there is a lack of mechanistic and structural studies of these systems. Exploring these mechanisms is crucial for understanding complex biological systems and may lead to an exploitation of the osmolyte effect for therapeutic purposes.[2]
To understand the osmolytic properties of sugars, synthetic polymers can be employed to study the driving forces that give rise to their effects in comparatively simpler systems. One such polymer is poly(N-isopropylacrylamide) (PNIPAM), a well-know thermoresponsive polymer that undergoes a temperature induced phase transition at its lower critical solution temperature. PNIPAM brushes are excellent model systems due to their well-defined swollen-to-collapsed transition allowing the internal structure and conformation of the brush to be examined in both good and poor solvent conditions.[3, 4]
We have investigated the influence of sugars on the temperature induced transition of a PNIPAM brush using neutron reflectometry. The use of neutrons to interrogate these systems enabled subtle variation in the brushes internal structure to be elucidated, highlighting variations directly related to molecular volume, conformation and concentration. Exploring these mechanisms using a PNIPAM brush is a crucial first step in understanding significantly more complex biological systems. Equilibrium and kinetic measurements were performed on the world-leading D17 reflectometer at the ILL. The use of D17 enabled this study to probed the PNIPAM brush conformational changes with unparalleled time resolution throughout rapid changes in solvent quality driven by either temperature change or glucose concentration.
[1] P. Narang, S. B. Vepuri, P. Venkatesu, M. E. Soliman, JCIS, 2017, 504, pp. 417–428.
[2] N. Kushwah, V. Jain, D. Yadev, Biomolecules 2020, Vol. 10, (1), pp. 132-143.
[3] T. J. Murdoch, B. A. Humphreys, J. D. Willott, K. p. Gregory, S. W. Prescott, A. Nelson, E. J. Wanless, G. B. Webber, Macromolecules, 2016, 49, 16, pp 6050-6060.
[4] B. A. Humphreys, E. C. Johnson, E. J. Wanless, G. B. Webber, Langmuir, 2019, 35, 33, pp 10818–10830.

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Thin films and interfaces in soft matter and materials science

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