Probing temperature-responsivity of pNIPAM microgels by super resolution microscopy and numerical simulations

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Abstract

Super resolution microscopy can observe microgel morphologies at the nanometer scale and monitor their response to temperature changes in situ, which opens exciting opportunities to design and precisely control the behavior of microgels for various applications [1]. In this context, direct stochastic optical reconstruction microscopy (dSTORM) is a well-established tool used to investigate colloidal systems e.g. poly(N-isopropylacrylamide) (pNIPAM) microgels [2].
When performing advanced microscopy experiments, interactions between the particle and the environment are vital. Often microgels are deposited on a substrate since they have to remain still for several minutes during the experiment. This study uses dSTORM and molecular dynamic (MD) simulations to investigate how individual microgels anchored on hydrophilic and hydrophobic surfaces change morphology with temperature. Super resolved images of individual microgel particles at different swelling stages are analyzed, and we obtain their density profiles numerically and experimentally. The results suggest that the anchoring parts of the microgel stick to the surface as the temperature increases. We find the experimental data and the MD simulations in excellent agreement. Our study is essential to establish a high-resolution monitoring technique as a platform for investigating more complex systems, where molecules of interest can be encapsulated in the microgel network and controllably released with temperature.

Keywords: super resolution microscopy, dSTORM, interface, pNIPAM microgels.

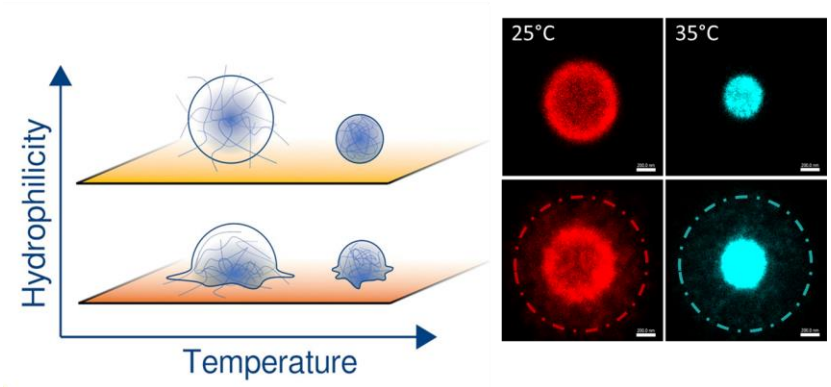

Figure 1: Schematic representation (left) and averaged dSTORM images (right) of microgels below and above LCST (left to right) and at two different surface treatment (bottom to top).

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References

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