Core-Shell Microgel Particle Morphology Investigated by Super-Resolution Microscopy

Pia Madeleine Otto[1], Oliver Wrede[1], Stephan Bergmann[2], Thomas Hellweg[1] and Thomas Huser[2]

[1] *Physical and Biophysical Chemistry, Department of Chemistry, Bielefeld University, Bielefeld, Germany*
[2] *Biomolecular Photonics, Department of Physics, Bielefeld University, Bielefeld, Germany*

Polyacrylamide-based microgels are crosslinked, porous particles in a size range up to 10 µm with a variable swelling behavior in water.[1] These microgels belong to the so-called smart materials, because they show a stimuli-responsive behavior. Upon changes of temperature, pH or pressure the particle size is reduced or increased.[1] Especially core-shell microgels, due to their very interesting swelling behavior, are promising candidates for various applications, e. g. drug delivery, smart surface coatings or switchable catalytic environments.

For all these applications an understanding of the structure-property relationships of the particles is crucial. With our approach utilizing a freely diffusing dye with super-resolution microscopy (direct stochastical optical reconstruction microscopy; *d*STORM) a straightforward lab-based way to investigate the morphology of microgel particles was established. With this technique the fluorescent dye gets excited and the so-called "blinking" of a single fluorophore is recorded to locate them with nanometer precision. By this a 2D reconstruction image with highly increased resolution is generated.[2]

In this work a core-shell system with a poly(*N*-isopropylmethacrylamide) (PNIPMAM) core and a *N*-*n*-propylacrylamide (PNnPAM) shell was used.[3] The morphology of these core-shell particles were investigated by *d*STORM with the fluorescent dye Rhodamine 6G. We found out that the fluorophores are mostly located in the particle shell and do not penetrate into the core section.

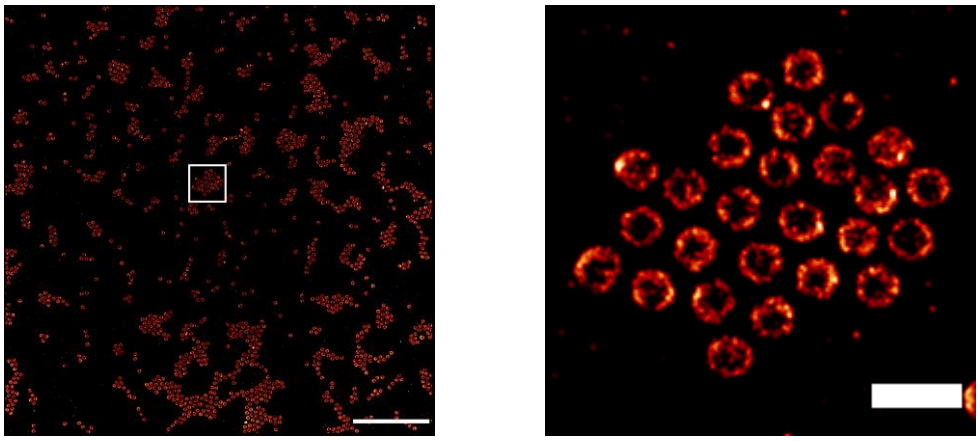

Figure 1. Super-resolution microscopy image of core-shell microgels labelled with Rhodamine 6G (left, scale bar 10 µm) and a magnification (right, scale bar 1 µm).

[1] S. Nayak and L. A. Lyon, *Chem. Mater*., **16** (2004), 2623.
[2] S. Bergmann, O. Wrede, T. Huser and T. Hellweg, *Phys.Chem.Chem.Phys.,* **20** (2018), 5074.
[3] M. Zeiser, I. Freudensprung and T. Hellweg, *Polymer* **53** (2012), 6096.