Adhesion studies of thermoswitchable ligand receptor interactions via Soft Colloidal Probe adhesion assay

Alexander Strzelczyk[1], Melina Feldhof[1], Florian Malotke[2] and Stephan Schmidt[1]

[1] *Institute for Organic and Macromolecular Chemistry Heinrich-Heine-Universität Düsseldorf, Universitätsstraße 1, 40225 Düsseldorf, Germany*
[2] *Institute for Organic Chemistry Universität Duisburg-Essen, Universitätsstraße 7,45141 Essen, Germany*

Adhesive processes in aqueous solution are essential in nature. In addition, the control of those processes in aqueous media plays a significant role in technology, e.g. in development of adhesives or for cleaning processes [1]. The established methods for the measurements of adhesive interactions are for example quartz crystal microbalance (QCM), which is an indirect measurement, or atomic force microscopy (AFM) as a direct method. The problems with these methods is that QCM only measures the amount of adhered material and not the adhesion energy and AFM is a quite expensive and slow methods for the measurement of adhesion energies. As a result, a new fast method has been developed for the measurement of adhesive interactions. The method utilizes a soft hydrogel based sensor (soft colloidal probe, SCP) which allows the determination of adhesive energies by optical microscopy and evaluation with JKR model [2].
Adhesion energies for different systems, e.g. between ligands and receptors or polymers, can be determined by the SCP method [3]. Using this method, ligand bearing LCST polymers can be characterized on their switchable adhesion properties towards receptors (figure 1). The Aim is to identify the ideal material properties of thermosensitive polymers like ligand presentation and swelling degree for stimulus control over specific interactions.

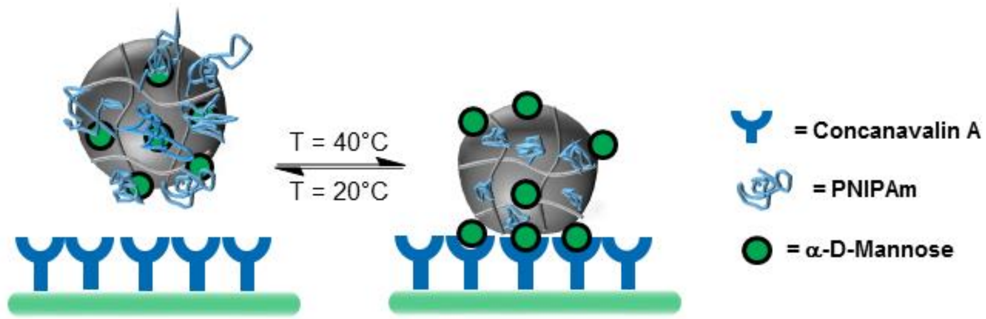

Figure 1. Behaviour of ligand bearing thermosensitive polymers on colloidal probe surface and switchable adhesion to receptor bearing glass surface (left) below the lower critical solution temperature (LCST) without adhesive contact and (right) above LCST with presentation of ligands and adhesive interaction between ligand (Mannose) and receptor (Concanavalin A).

[1] A. Arora, T. Arora, *Mater. Technol.* **2004**, 19, 153.
[2] D. Pussak et al., *Soft Matter* **2012**, 8, 1664-1672.
[3] A. Strzelczyk et al., *Gels* **2017**, *3*(3), 31

Acknowledgement: The authors acknowledge funding from the Henkel AG & Co KGaA.