Microgel based smart surface coatings and free-standing nano-membranes

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Stimuli-responsive surfaces are in the focus of interest for a multitude of applications such as sensors[1], anti-fouling coatings [2] and cell culture substrates [4]. For the latter, coatings made of thermoresponsive poly-(*N*-isopropylacrylamide) pNIPAm microgels have been found to allow reversible switching of cell adhesion upon heating and cooling [3-5]. In these works the microgel layer had to be deposited on the substrate intended for use by printing or spin-coating. Hence, the dimensions and material properties of the substrate can strongly influence the adsorption of the microgel particles. The present contribution will review our efforts in this area.

Moreover, the preparation of free standing transferable membranes from cross-linkable microgels will be presented. Such membranes can be transferred to different surfaces and overcome problems arising from direct deposition of microgels. The approach is based on the deposition of microgels, containing aromatic moieties, by spin-coating the particles on a sacrificial metal layer.

During this work the monomer *N*-Benzhydrylacrylamide, for copolymerization with NIPAm was synthesized. In a precipitation reaction using a solvent mixture copolymer particles from NIPAm and the aromatic comonomer were obtained, with different comonomer concentration from 1 mol-% to 30 mol-%. To confirm the incorporation of the aromatic component into the microgel structure the purified particles were analyzed with FTIR-spectroscopy. The microgels itself were characterized using Photon correlation spectroscopy (PCS) and UV/Vis-turbidity measurements.

Monolayers of the copolymer microgels were spin-coated onto a silicon-wafer covered with a polyelectrolyte. Atomic force microscopy (AFM) was used to study the surface coverage, topography and the thickness in addition to ellipsometry measurements. The layers are subsequently cross-linked by e-beam irradiation and the obtained free-standing membranes transferred into a microfluidic device for conductivity measurements. We can show that the conductivity drastically changes at the volume phase transition of the membranes.

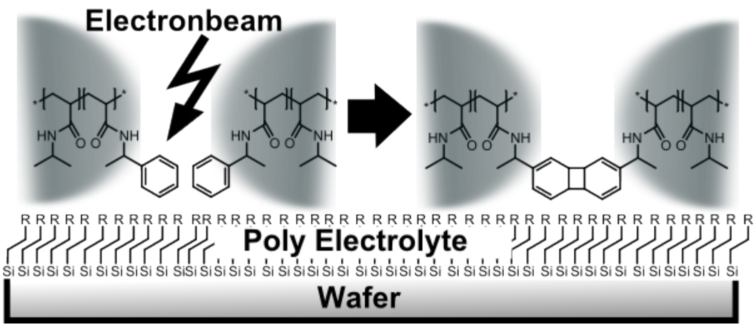

Figure 1: Schematic drawing of the principle of electron-beam-cross-linking between two functionalized microgel particles adsorbed at a surface.

[1] C. D. Sorrell, M. J. Serpe, *Adv. Funct. Mater*., **2011**, *21*, 425.
[2] J. L. Dalsin et al., *Materials Today*, **2005**, *8*, 38.
[3] J. Yang et al, *Controlled Release*, **2006**, *116*, 193.
[4] S. Schmidt et al., *Adv. Func. Mater*., **2010**, *20*, 3235.

[5] K. Uhlig et al., Biomacromolecules, **2016**, *17*, 1110