Smart Membranes by Electron-beam Cross-linking of Copolymer Microgels

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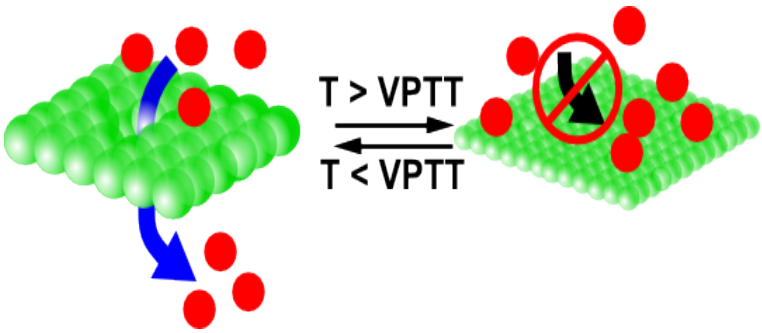
Stimuli responsive microgels based on acrylamides undergo a volume phase transition (VPT) in response to an external stimulus e.g. temperature and/or pH. This behavior makes these particles interesting as smart surface coatings and the ability to produce designed surfaces based on microgels with tailor-made properties. [1] For the production of such coatings the spin-coating process offers a fast and easy to use method.[2]

A major disadvantage of such surfaces is that these coatings are not transferable. Therefore non flat and rough substrates cannot be coated with such a thermoresponsive layer. Hence, in the present work we will address this issue and describe an approach leading to free-standing linked microgel films which can be transferred on different substrates or which can be used as responsive membranes. This has been achieved via electron-beam cross-linking of a microgel monolayer. Such a free standing monolayer would give access to a wide variety of new applications for thermoresponsive coatings. Including the coating of 3-D substrates and the use as a thermoresponsive membrane for temperature controlled diffusion of molecules.



The in this work presented novel comonomer *N*-Benzylhydrylacrylamide (NBHAM) allows for electron-beam cross-linking of microgel monolayers and hence the production of free-standing membranes. Our membranes provide a tunable mesh or pore size that is determined by the swelling ratio of the polymer network. [3]

[1] A. Burmistrova, M. Richter, M. Eisele, C. Üzüm, R. v. Klitzing, *Polymers,* **2011***, 3, 1575.*
[2] S. Schmidt, M. Zeiser, T. Hellweg, C. Duschl, F. Fery, and H. Möhwald, *Adv. Funct. Mater.,* **2010***, 20, 3235.*
[3] R. Bernstein, E. Anton and M. Ulbricht, *Journal of Membrane Science*, **2013**, 427:129-138.