

Porous Stimuli-Responsive Polymer Architectures as Optical Sensing Materials and Smart Membranes

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Invited Seminar in the Hatton Group
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In the last decade stimuli-responsive block copolymers and core-shell particles have proven their utility for a range of important applications.^{1,2} These polymers are capable of changing their conformation, solubility, or even of breaking or forming covalent bonds upon, for instance, a change of temperature or pH value, light irradiation, electrochemical stimuli or the presence of an electrical or magnetic field, or combinations thereof.³⁻⁶ The presentation will focus on materials, which contain at least one selectively addressable segment, either chemically or physically. Functional porous nanostructures obtained by block copolymer self-assembly as well as recent advances in inverse opal films prepared by using the so-called melt-shear organization technique will be highlighted and discussed in more detail.⁷⁻¹⁰ In the case of soft colloidal crystal and inverted structures, which are also referred to as *polymeric opals*, external triggers additionally lead to a remarkably fast and reversible change of their intriguing optical properties (**Fig.1**). A great benefit of opal structures by the melt-shear organization is their inexpensive and convenient preparation giving a good optical performance with iridescent reflection colours caused by Bragg diffraction. The talk will give some recent examples for the rational design of functional pure organic as well as hybrid porous materials with hierarchical architectures. Some of the highlighted polymer or polymer-templated structures can be advantageously used for direct conversion into ordered ceramic or carbonaceous materials. Herein presented preparation strategies will pave the way for a manifold of applications in the field of sensing and robust membrane technologies.

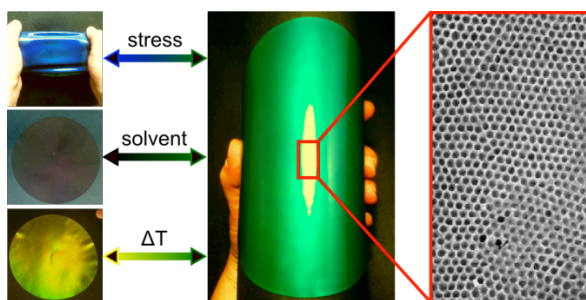


Figure 1. Switching capabilities of stimuli-responsive inverse opal structures.

¹M.A.C. Stuart, W.T.S. Huck, J. Genzer et al. *Nature* **2010**, 9, 101.²F.H. Schacher, P.A. Rugar, I. Manners *Angew. Chem. Int. Ed.* **2012**, 51, 7898. ³M. Appold, M. Gallei et al. *Polym. Chem.* **2017**, 8, 890. ⁴C. Rüttiger, M. Gallei et al. *Polym. Chem.* **2016**, 7, 1129. ⁵C.G. Schäfer, M. Gallei, et al. *Chem. Mater.* **2013**, 25, 2309. ⁶D. Scheid, M. Gallei et al. *J. Mater. Chem. C* **2014**, 2, 2583-2590. ⁷S. Schöttner, M. Gallei et al. *Macromolecules* **2016**, 49, 7286. ⁸C.G. Schäfer, M. Gallei et al. *Macromol. Rap. Commun.* **2014**, 35, 1852. ⁹C.G. Schäfer, T. Winter, M. Gallei et al. *J. Mater. Chem. C* **2015**, 3, 2204. ¹⁰ S.Vowinkel, M.Gallei et al. *J. Mater. Chem. C* **2016**, 4, 3976.

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Personal History:

2001 - 2006 Studies of chemistry
2007 - 2010 Doctoral studies, German Institute of Polymers (DKI)
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Research interests: stimulus-responsive polymers, controlled and living polymerizations, porous materials

