

Functional Colloidal Mesostructures: From Optics to Thermal Transport

Prof. Dr. Markus Retsch

Lichtenberg-Juniorprofessur for Polymer Systems

Physical Chemistry

University of Bayreuth, Germany

Self-assembly is a powerful tool to access well-defined nanostructured materials, which exhibit unique mechanical, optical, or thermal properties. When working with colloidal latex or silica particles structural length scales from a few tens up to few micrometers can be addressed.

In this presentation, I will elaborate on three topics. At first, I will present our latest results on the self-assembly process and nanostructured material fabrication itself. I introduce a new way to break the ever-occurring six-fold symmetry in colloidal monolayers and a new method to access transferable and free-standing nanostructures. Secondly, I will demonstrate how nanohole arrays can be used for deterministic colloid immobilization and as an alternative to ITO in solar cells. In the third part, I will talk about three-dimensional colloidal structures and their thermal transport properties. This is a rather underexplored field, yet, colloidal superstructures are ideally suited to design the thermal properties of nanostructured materials rationally. Our recent results show how to engineer highly insulating materials. First results on switchable anisotropy and programmable temperature-dependent thermal conductivity pave the way towards intriguing thermal devices such as thermal diodes or switches.



Brief Curriculum Vitae Prof. Markus Retsch studied Polymer and Colloid Chemistry at the University of Bayreuth (2001 – 2006) and graduated in 2006 with a diploma thesis in the group of Prof. A. H. E. Müller. He then moved to the Max-Planck-Institute for Polymer Research in Mainz to conduct his PhD thesis in the group of Prof. W. Knoll. There he worked on colloidal assembly structures under the supervision of Prof. Jonas, with research stays at FORTH, Heraklion, Crete. In 2009, Prof. Retsch received his PhD from the Johannes Gutenberg University in Mainz. He then spent 2.5 years as a postdoc at the Massachusetts Institute of Technology, MIT in Cambridge, MA, USA. There he worked in the Department of Materials Science and Engineering with Prof. E. L. Thomas. In August 2012, Prof. Retsch was appointed Juniorprofessor for Polymer Systems at the University of Bayreuth. In 2013 he received a Lichtenberg professorship from the Volkswagen foundation and in 2016 an ERC starting grant. His current research interests lie in the investigation of materials for energy conservation and conversion, accessible with colloidal assembly strategies.