

Title: Advancing Materials by Using Functional Polymers – in Bulk, on Surfaces, or at Pore Sites

Abstract: For many decades, nature has inspired scientists/engineers to build materials that can adapt to changing environmental conditions via responding against these changing conditions such as mechanical forces, wetting, light, or pH. In the history of producing such responsive materials, polymer technology has always been the primary choice to make them responsive. This is mainly because the (i) polymers can be easily tailored to respond against a specific stimulus, and (ii) they can be mixed with other compounds easily and change their properties even if the final mixture is not homogenous such as silica filled nanocomposites.

The role of using polymers in three different applications fields will be explained: nanocomposites, surface coatings, and membrane science. In the nanocomposite section, the role of (i) chemical filler/polymer interaction and (ii) polymer chain alignment on the mechanics of the nanocomposites will be explained. In the surface coatings part of the talk, it will be shown how to architect different polysiloxane micro- and nanopatterns to make surfaces (super)antiwetting and introduce a new fluorescence staining method to visualize the interface of these micro- and nanopatterns in contact with water droplets. In the membrane section of the talk, the role of the ligand-binding mechanism will be discussed on ionic transport at the polymer functionalized hybrid membrane nanopores. As the final part of the talk, introduction of the recently won Alexander von Humboldt (Feodor Lynen) Fellowship project will be delivered, which focuses on controlling ionic pore transport of flexible smart-gating membranes by mechano-gating such as stretching or bending.

Bio: Dr. H. Samet Varol received his BSc in Metalurgical and Materials Engineering from Marmara University, Turkey (2009). Between 2009-2012, he attended a master's program in Advanced Materials (Nanomaterials) at Ulm University, Germany. For the master thesis, Samet worked in the Physical Chemistry of Polymers Department of Max Planck Institute for Polymer Research (MPIP-Mainz, Germany) under the supervision of Prof. Katharina Landfester and Prof. Rafael Muñoz-Espí. In 2012, he started his Ph.D. at MPIP-Mainz in the Molecular Spectroscopy Department, working with Prof. Mischa Bonn and Prof. Sapun Parekh. In his Ph.D. work, he studied the non-linear mechanical properties of green nanocomposites from a molecular point of view by using different surface-sensitive spectroscopic methods and microscopy techniques. He obtained his Ph.D. degree in April 2017 and continued working as a postdoctoral fellow in the same department for six more months. In 2018, he moved to the University of Zurich, Switzerland (UZH, Department of Chemistry) as a postdoctoral fellow in the group of Prof. Stefan Seeger. In UZH, he worked on the surface functionalization of various materials by polysiloxane growth and studied their wetting mechanism by confocal microscopy. From 2020 till today, Samet has been working as a postdoctoral fellow in "Smart Membranes Group" led by Prof. Annette Andrieu-Brunsen in TU-Darmstadt, Germany, where he focuses on controlling the ionic transport of polymer functionalized or conductive mesoporous ITO membranes. Samet will soon start his project in TU-Darmstadt with a recently awarded Career Bridging Postdoctoral Fellowship of TU-Darmstadt for half a year. Samet has also recently won a prestigious Feodor Lynen Postdoctoral Fellowship from Alexander von Humboldt (AvH) Foundation to continue his research project at the University of Bologna for the next three years. His AvH research will use mechano-gating to tune the ionic transport at the flexible smart-gating membranes. Samet is the co-author of 10 papers in peer-reviewed journals, including top-ranking journals PNAS, Nature Chemistry, and Nano Letters. H-index = 7, and >250 citations.