

# Chemistry Webinar

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## Functional Nanoporous Materials From “Hairy” Nanoparticles

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Ilya Zharov is a Professor at the Chemistry Department, University of Utah. He obtained his BS in 1990 from Chelyabinsk State University, his MS in 1994 from the Technion – Israel Institute of Technology, and his PhD in 2000 from the University of Colorado, Boulder. In 2000-2003 he was a Beckman Postdoctoral Fellow at the Beckman Institute for Advanced Science and Technology, University of Illinois at Urbana-Champaign. His research focuses on novel nanoporous materials, ion conductive membranes, and on theranostic agents. Among his awards are Camille and Henry Dreyfus Foundation New Faculty Award, the National Science Foundation CAREER Award and Robert W. Parry Teaching Award. He was named an Emerging Investigator by the Royal Society of Chemistry and serves on the Editorial Board of Current Smart Materials.

We developed a new approach for the preparation of functional membranes using polymer brush nanoparticles (“hairy” nanoparticles, HNPs). We design these membranes with molecular and ionic transport controlled by the pore size, polymer structure and environmental conditions. Our approach provides novel types of functional membrane materials with applications in separations, fuel cells and lithium batteries. In this talk, I will describe the preparation and properties of several responsive membranes, including gated silica membranes pore-filled with temperature-responsive poly(*N-isopropylacrylamide*) brushes and pH-responsive poly(2-dimethylaminoethyl methacrylate) brushes, and ultrafiltration membranes reversibly assembled from HNPs carrying poly(2-hydroxyethyl methacrylate) brushes. I will then focus on our results in developing charged responsive nanoporous membranes assembled using HNPs carrying polyelectrolyte brushes. I will describe the different mechanisms of transport selectivity in charged HNP membranes as well as polymer-polymer interactions in these materials that lead to their formation and stability. Finally, I will discuss our current work towards the preparation of HNP monolayers.

