

Carnegie Mellon Materials Science and Engineering Seminar Series

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“From Nanoparticles to Materials”

**Friday, October 23, 2009
10 A.M. Seminar in Baker Hall 136A**

This talk will describe the synthesis, characterization and use of functional nanoparticles as well as their assemblies into functional materials using block copolymers as structure directing agents. Particular emphasis on nanoparticle design will be on their use as fluorescent probes in the emerging fields of molecular imaging as well as nanomedicine. The second part of the talk will show how self-assembly concepts developed in the field of polymer science can be successfully employed to structure various inorganic nanoparticles on the tens of nanometer scale. By using thermodynamic principles established for block copolymers, well-defined morphologies are obtained. Burning out of the organic compounds results in nanoporous materials with ordered and uniform pores and hexagonal as well as bicontinuous cubic pore structures. These concepts are applied to aluminosilicates, non-oxide type ceramics stable up to 1500°C, crystalline transition metal oxides, as well as metals (see Figure). The talk will discuss details of the various approaches and will give perspectives of the results in the context of nanomaterials for the life sciences and energy generation and storage applications.

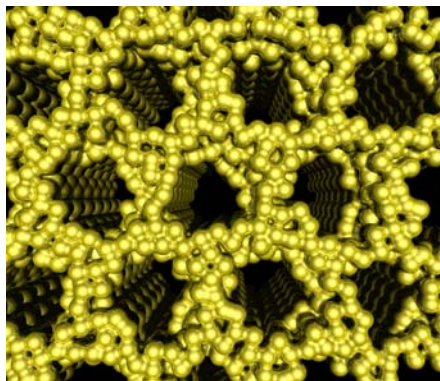


Fig.1. Schematic of metal nano-particle-block copolymer derived nanoporous metals (pore size ~20nm).

Uli Wiesner studied Chemistry at the Universities of Mainz and California, Irvine. He received his Chemistry Diploma in 1988 from the University of Mainz, Germany, and gained his Ph.D. in 1991 with work on the mechanisms of optical information storage in liquid crystalline polymers in the group of Prof. H. W. Spiess at the Max-Planck-Institute for Polymer Research, Mainz. After his Ph.D. he was a postdoctoral fellow at the Ecole Supérieure de Physique et de Chimie Industrielle de la ville de Paris (E.S.P.C.I.), France, with Prof. L. Monnerie studying the morphology and dynamics of aromatic terpolyesters. In 1993 he returned to the group of Prof. H. W. Spiess where he finished his Habilitation in 1998 with work on structure, order, and dynamics in self-assembled block copolymer systems with additional interactions. He joined the Cornell MS&E faculty in 1999 as a tenured Associate Professor and became a Full Professor in 2005. In 2004 he received an offer for an endowed chair position for Macromolecular Silicon Chemistry at the Ludwig-Maximilian University in Munich, Germany, which he declined. In 2006/2007 he spent a full sabbatical year in the Cavendish Laboratories of Cambridge University, UK.

Since his arrival at Cornell he works at the interface between polymer science and inorganic chemistry. The goal of his research is to combine knowledge about the self-assembly of soft materials with the functionality of inorganic materials to generate novel hierarchical and multifunctional hybrids. Uli Wiesner is the author of about 100 articles in peer-review journals and books and is currently an editorial or advisory board member of several scientific journals. Based on work at Cornell in 2003 he co-founded Hybrid Silica Technologies, Inc. (HST), Ithaca, NY, with the goal to provide “green” multifunctional hybrid nanomaterials for life sciences applications and beyond. Uli Wiesner is the recipient of multiple awards, including a Ph.D. Award of the Hoechst AG, the Carl Duisberg Memorial Award of the German Chemical Society, an IBM Faculty Partnership Award and the Mr. & Mrs. Richard F. Tucker’50 Excellence in Teaching Award of Cornell University. Since 2007 he is a member of the Nanotechnology Technical Advisory Group (nTAG) of the President’s Council of Advisors on Science and Technology (PCAST).