DREXEL UNIVERSITY
Materials Science and Engineering
College of Engineering

Spring Seminar Series

Directed Self-Assembly and Crystallization of Polymeric Colloids

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PISB 104

The self-assembly and crystallization of colloidal particles into well-defined architectures is of great interest for potential applications in biomaterials, catalysis, and photonics. In contrast to atoms and molecules, the number and symmetry of structures that self-assemble from colloidal particles is restricted by the absence of directional specific bonds. We have introduced a general method for creating the colloidal analogs of atoms with valence: colloidal particles with chemically functionalized patches that can form highly directional specific bonds.1,2 The valences of these new "colloidal atoms" possess all the common symmetries characteristic of hybridized atomic orbitals, including sp, sp2, sp3, sp3d, sp3d2, and sp3d3. Because the bonds between these new colloidal atoms are highly directional and fully reversible, they open up the possibility of building new low-coordinated open structures, both amorphous and crystalline, which is emerging as a key design feature for assembling colloids with photonic band gaps. The presentation will expand on these results by introducing colloids fabricated from polymers and polymer-inorganic hybrids. It will describe supramolecular assembly routes engineered in our group to drive these colloidal particles into precisely-assembled architectures via the exploitation of directional noncovalent dynamic interactions such as metal coordination,3 host-guest complexation,5 and DNA hybridization.2,4 The design principles are based upon the engineering of functional colloidal particles bearing surface-exposed functional groups such as amidines, carboxylic acids, and/or azides that undergo programmable click-like conjugation with hydroxylated block copolymers or cyclooctyne-terminated DNA.

Professor Weck received his education in Germany and the United States. He earned his Diplom in 1994 from the Johannes Gutenberg Universität Mainz under the tutelage of Professor Helmut Ringsdorf. In 1992, Professor Weck went for two quarters to the University of California at Irvine as a Deutscher Akademischer Austauschdienst (DAAD) exchange student. In January of 1995, he started his graduate work under the supervision of Professor Robert H. Grubbs at the California Institute of Technology and received his Ph.D. in the fall of 1998. After a two-year postdoctoral stay at Harvard University with George M. Whitesides, he joined the faculty at the Georgia Institute of Technology in 2000 as an Assistant Professor and was tenured and promoted to Associate Professor in 2005. In 2007, he moved to NYU where he is currently a Full Professor in the Department of Chemistry, since 2017 the director of the Materials Research Science and Engineering Center (MRSEC), and the Associate Director of the Molecular Design Institute. The main foci of his group are in supported catalysis and the introduction of complexity through the use of orthogonal functionalization methods and to synthesize polymers, organized assemblies, biomaterials, and nanostructures.