Dynamic Self-Assembly of Life-like Colloidal Materials

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Abstract:

Living organisms harness flows of matter and energy to perform remarkable feats of engineering: they assemble dynamic multiscale materials; they capture and convert energy into complex motions; they replicate their structures and processes in exponential fashion. Our research seeks to characterize and control colloidal matter outside of thermodynamic equilibrium to enable new materials and technologies with capabilities that rival those of living organisms. This talk will outline the challenges of colloidal self-assembly under equilibrium and nonequilibrium (dissipative) conditions as well as the opportunities for achieving smart materials capable of actuating, sensing, adapting, self-repairing, and even self-replicating. Specific examples from our research will be highlighted including adaptive nanoparticle amphiphiles, electrically powered colloidal machines, and collective dynamics in active colloids.

Biosketch:

Kyle Bishop received his PhD in Chemical Engineering from Northwestern University (2009) under the guidance of Bartosz Grzybowski for his work on nanoscale forces in self-assembly. Following his PhD, Dr. Bishop was a post-doctoral fellow with George Whitesides at Harvard University, where he developed new strategies for manipulating flames with electric fields. In 2010, he joined the Department of Chemical Engineering at Penn State University where he is currently the Dorothy Quiggle Career Development Assistant Professor. Dr. Bishop is the co-author of more than 60 refereed publications and the recipient of the 3M Non-tenured Faculty award and the NSF CAREER award. His research seeks to discover, understand, and apply new strategies for organizing and directing colloidal matter through self-assembly and self-organization far-from-equilibrium.