

SEMINAR SERIES

Wednesday, April 26th, 2023

Seminar Presentation: 11:00am - 12:00pm

SME room 248*“Nanostructured Polymer Muscles”***Dr. Robert J. Hickey, PhD***Associate Professor
Pennsylvania State University*

Abstract: Advances in functional soft material muscles (i.e., actuators) that contract, expand, or rotate when triggered with an external stimulus are necessary to realize the future of new robotic assemblies with superior biologically relevant functions. Current research efforts are focused on synthesizing new soft materials to mimic natural muscles from a performance perspective, but neglect the impact of chemical composition and structure, which are core features for the exceptional actuation properties of human muscles. Recently, a new class of fiber actuators have been reported that contract or rotate when triggered by heat or hydration. The fibers, termed “strain crystallized actuators” (SCAs), are produced by combining solution-phase block copolymer self-assembly and strain-programmed crystallization. The strained fibers consist of highly aligned nanoscale structures with alternating crystalline and amorphous domains, resembling the ordered and striated pattern of mammalian skeletal muscles. The presentation will first cover the necessary macromolecular parameters for creating hydrogel fibers using amphiphilic block copolymers and then the nanoscale self-assembly mechanism during straining that gives rise to the actuation properties. The versatility and recyclability of the polymer fibers, combined with the facile fabrication method, opens new avenues for creating soft actuators.

Biosketch: Prof. Robert Hickey is currently an Associate Professor in the Department of Materials Science and Engineering at The Pennsylvania State University. He received his B.S. and Ph.D. in Chemistry at Widener University (2007) and the University of Pennsylvania (2013), respectively. As a postdoctoral researcher, he worked in the labs of Profs. Frank Bates and Tim Lodge at the University of Minnesota where his research focused on fundamentally understanding the self-assembly and phase behavior of polymer materials, as well as on applying these principles to ternary polymer electrolyte systems. The Hickey group investigates non-equilibrium chemical and self-assembly methods to create hierarchically ordered polymeric materials. Robert has been awarded the NSF CAREER Award and the Air Force Office of Scientific Research Young Investigator Prize, and recognized as an ACS PMSE Young Investigator.