DREXEL UNIVERSITY
Materials Science and Engineering
College of Engineering

Spring Seminar Series

Directing Shape, Assembly, and Motion of Responsive Polymer Sheets

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Wednesday, May 15, 11:00 a.m.
Hill Seminar Room (LeBow 240)

Spatially non-uniform stresses within thin elastic structures can be used to define a wide variety of buckling modes that provide control over the three-dimensional (3D) shapes of materials. By incorporating stimuli-responsive polymer networks within such constructs, it is possible to prepare materials with dynamically reconfigurable shapes and properties. Our group has focused on the preparation of single- and multi-layer films of polymer gels that undergo swelling-induced buckling into well-defined 3D forms. Although this approach is now well-established as a route to tailor geometrical forms, we have recently addressed the largely unsolved challenge of designing robustly self-folding materials that can reliably select desired pathways in configuration space and thereby avoid trapping in metastable states. Moving beyond materials with a single pre-defined shape transition, we also seek to develop materials with shapes that can be rapidly and continuously reprogrammed. In particular, we focus on photothermal actuation of nanocomposite gels, which allows for 'real time' reconfiguration of shape and self-assembled structures, as well as for directed motion of shape-programmable materials.

Ryan Hayward is a Professor of Polymer Science and Engineering at the University of Massachusetts Amherst. He received degrees in Chemical Engineering from Princeton University (B.S.E, 1999) and the University of California, Santa Barbara (Ph.D., 2004), and was a post-doctoral fellow in Engineering and Applied Sciences at Harvard University from 2004-2005. His group's research covers a variety of topics in polymers and soft materials, with a focus on thin films and interfaces. Recent areas of interest include swelling-induced deformation of constrained and micro-patterned stimuli-responsive gels, and self-assembly of polymer and particle-based nanostructures. Ryan has received several awards, including the Presidential Early Career Award for Scientists and Engineers (PECASE), the 2013 Journal of Polymer Science Innovation Award, and the 2014 John H. Dillon Medal of the American Physical Society. He serves as Associate Editor for the journal ACS Macro Letters.