

THE MATERIALS SCIENCE AND ENGINEERING DEPARTMENT
WINTER COLLOQUIUM SERIES PRESENTS:

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Driving deformation, assembly, and coupled motion of polymers with light

The ability to manipulate materials with light is of interest for controlling untethered vehicles and actuators, as well as for developing active matter systems that exhibit complex emergent dynamics. Our group has recently focused on two main classes of light-addressable polymer composites. In the first case, we employ a platform of temperature-responsive hydrogel nanocomposites adsorbed at air/water interfaces that exhibit a variety of bioinspired non-equilibrium behaviors due to temperature gradients generated by illumination with visible light. Such gradients can induce spatial nonuniformity in both the swelling of the gel, as well as the surface tension, leading to capillary and Marangoni forces between particles that drive self-assembly and a variety of coupled motions. In the second case, we seek to directly translate photon energy into mechanical work through anisotropic deformation of polymers containing aligned crystals of photoisomerizable materials. These include both small molecule crystals grown within polymer matrices, and semi-crystalline polymers containing photo-switchable units in the polymer backbone.

Ryan Hayward is the James and Catherine Patten Endowed Professor of Chemical and Biological Engineering at the University of Colorado Boulder. 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 prior to joining the faculty of Polymer Science and Engineering at UMass Amherst in 2006, where he remained until 2020. His group's work is broadly focused on responsive materials and self-assembly, including the development of new approaches to optically- and electrically-addressable polymers. Ryan received the APS John H. Dillon Medal (2014), the Journal of Polymer Science Innovation Award (2013), the ACS Division of Colloid and Surface Chemistry Unilever Award (2011), and was elected a Fellow of the APS in 2018. He currently serves as an Associate Editor for ACS Macro Letters and Vice Chair of the Division of Polymer Physics of the APS.

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