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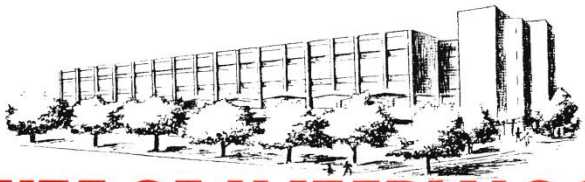

INSTITUTE OF MATERIALS SCIENCE

POLYMER PROGRAM SEMINAR

"Foldable, Responsive Soft Metamaterials from Microstructured Polymers"

Prof. Shu Yang
University of Pennsylvania

Friday, March 11, 2016
11:10 AM, IMS Room 20

ABSTRACT

Reconfigurable soft metamaterials that can bend, fold, or transform the shape in response to external stimuli have attracted significant interests in design of actuators, sensors, and smart materials and devices. We fabricate a variety of microstructured polymer networks, including tilted and straight polymeric pillar arrays and porous membranes with different size, shape and arrangement from poly(dimethylsiloxane) (PDMS), poly(2-hydroxyethyl methacrylate) (PHEMA) based hydrogels, and epoxy based shape memory polymers (SMPs).[1-7] By exploiting mechanical instabilities in these material systems, we investigate dynamic tuning of the microstructures in respond to environmental cues, such as pH, heat, light, and mechanical stretching, for potential applications such as tunable dry adhesion, water shedding, and switching of optical properties for smart windows.[3,7-10]

In a separate line, we design and synthesize a new type of nematic liquid crystal monomer (LCM) system with strong dipole-dipole interactions, resulting in a stable nematic phase and strong homeotropic anchoring (i.e. in perpendicular orientation) on silica surfaces. Upon photopolymerization, the director field can be faithfully "locked", allowing for direct visualization of the LC director field and defect structures by scanning electron microscopy (SEM) in real space with 100 nanometer resolution. From SEM images, we calculate the elastic constants and bending energy of LCs along the defect line as we move from the bulk towards the boundary. Building upon similar chemistry, we prepare nematic liquid crystal elastomers (NLCEs) with internal strains for actuation and folding. Using surface patterns and surface chemistry, we demonstrate precise control of the alignment of LCMs within the patterns, allowing us to pattern topological defects.

*See references on the following page

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**For further information, please contact YH Chudy at younghee.chudy@uconn.edu.*

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