MSE 520: SEMINAR SERIES

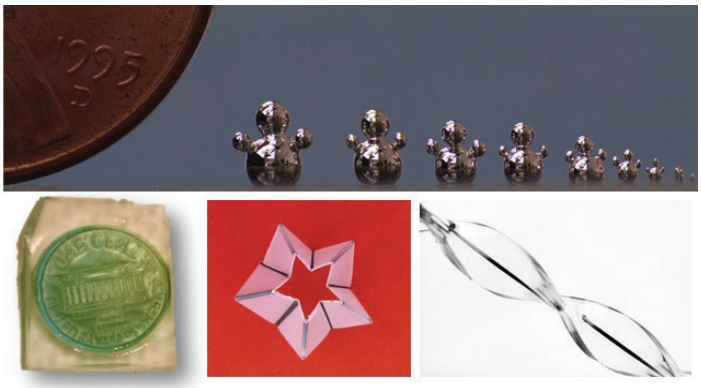
MATERIALS SCIENCE & ENGINEERING | WINTER 2017

MAY 1, 2017 | 241 MARY GATES HALL | 3:30 PM

Soft, Stretchable, and Reconfigurable Materials for Electronics and Actuators

This talk will describe efforts in our research group to control the shape and function of soft materials (liquid metals, polymers and hydrogels) for applications that include stretchable electronics, soft robots, and self-folding polymer sheets. The research harnesses interfacial phenomena, micro fabrication, patterning, and thin films. The talk will discuss the underlying fundamental science motivating active areas of research in our group, which include:

- Ultra-stretchable wires, sensors, antennas, and microelectrodes composed of liquid metal alloys based on gallium. The metal is a liquid at room-temperature with low-viscosity (water-like) and can be micromolded due to a thin, oxide skin that forms rapidly on its surface. The metal can be patterned in a number of ways including injection into microchannels or by direct-write 3D printing. Recently, we discovered that the oxide may be the best surfactant ever reported and can be removed or deposited using electrochemistry in electrolyte as a new method to control the shape of the metal.
- Self-folding polymers sheets that change shape in response to light. These sheets are a form of shape memory polymers that are compatible with 2D patterning techniques including lithography, inkjet printing, and roll to roll processing. The appeal of this work is converting 2D patterns into 3D shapes (similar to origami) in a hands free manner.
- New methods for patterning ions in hydrogels. This reversible process can imprint topography in the hydrogel using modest voltages, tune its local mechanical properties to create physically-reinforcing exoskeletons, and generate stresses sufficient to actuate or fold hydrogels over large distances within seconds.



Top: 3D printed liquid metal microstructures, Bottom (L to R): Gel patterned with ions, self-folding polymer sheets, stretchable antennas composed of liquid metal in micro-channels.

Michael Dickey

Professor, Department of Chemical and Biomolecular Engineering, NC State University

Michael Dickey received a BS in Chemical Engineering from Georgia Institute of Technology (1999) and a PhD in Chemical Engineering from the University of Texas at Austin (2006) under the guidance of Professor Grant Willson. From 2006-2008 he was a post-doctoral fellow in the lab of Professor George Whitesides at Harvard University. In August 2008, he joined the Department of Chemical & Biomolecular Engineering at NC State University where he is currently a Professor. Michael's research interests include patterning and actuating soft materials by studying and harnessing thin films, interfaces, and unconventional fabrication techniques.

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