MRL
FREDERICK SEITZ MATERIALS RESEARCH LABORATORY
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Advancing the science of materials (e-brief)

# Rogers assumes leadership of the Materials Research Laboratory

**John A. Rogers**, the Lee J. Flory-Founder Chair in Engineering at the University of Illinois, has been named director of the Frederick Seitz Materials Research Laboratory (MRL). As a key resource for the University, government agencies, and industry, the MRL brings together world-class researchers and students in condensed matter physics, materials chemistry, and materials science in a highly collaborative research environment. **Catherine J. Murphy**, a professor of chemistry, will serve as MRL's associate director.

"I am very pleased that Professor Rogers has agreed to serve as MRL director," explained Michael B. Bragg, interim dean in the College of Engineering. "As one of the lab's key researchers, John's work epitomizes MRL's multi-disciplinary nature and the translation of science to products."

MRL boasts an exceptional array of research facilities, including the Center for Microanalysis of Materials, the Micro/Nanofabrication Facility, the Laser and Spectroscopy Facility, and the Center for Computation. These research activities are supported by the Department of Energy's Office of Basic Energy Sciences, Materials Sciences and Engineering Division (DOE BES\DMSE); the Department of Defense (DOD) agencies and DARPA; the National Science Foundation (NSF); other federal agencies; industry; and the University of Illinois.

"It's that culture of shared resources at MRL that makes the lab truly unique," **Rogers** explained. "We're designed to be interdisciplinary, and we are the largest supplier of scientists and engineers educated in the use of advanced instruments for the materials sciences—hundreds of new users are educated each year. Any instrument housed here—electron microscopes, scan probe microscopes, surface microanalysis equipment, spectroscopic equipment—might be only one of a few like it in the world."

"In addition to educating scientists and engineers in the broadly defined discipline of materials science, we work to transfer science and technology developed at MRL to other DOE National Laboratories and to U.S. industry via research collaborations, mutually supportive interactions, and hiring of our outstanding students and post-doctoral researchers," **Rogers** said.

Renowned for his pioneering work with transient semiconductor materials and flexible, stretchable electronics, **Rogers** has applied his expertise to devise technology solutions across such broad fields as solar power, biointegrated electronics, sensing, thin film metrology, and fiber optics. He succeeds **Jennifer A. Lewis**, the Hans Thurnauer Professor of Materials Science and Engineering, who had served as MRL director since July 2007.

*Rick Kubetz, writer/editor Engineering Communications Office.*

*The FSMRL gratefully acknowledges financial support from the DOE/BES Division of Materials Sciences and Engineering.*

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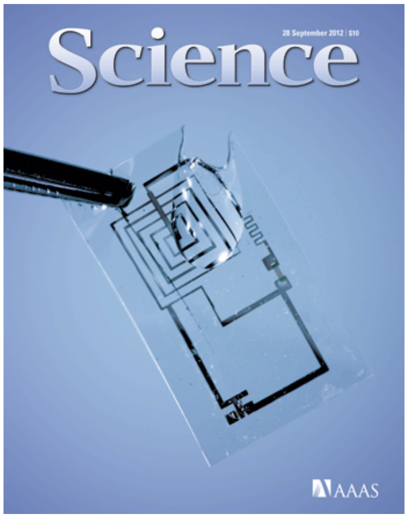
# MRL to develop Dynamic Environmental TEM

A multidisciplinary team consisting of **Jian-Min Zuo**, **Ralph Nuzzo**, **Xiuling Li**, **Shen Dillon**, and **William L. Wilson** has been awarded an NSF Major Research Instrumentation grant to develop a dynamic environmental transmission electron microscope. The DE-TEM will contribute immensely to the understanding of phase transformations and chemical interactions in a wide range of material systems impacting research topics at the forefront of chemistry, physics, and materials science. The $1.8M award will enable development of in-situ electron microscopy techniques to study dynamic processes with temporal resolution from millisecond to ultrafast regimes. The instrument will become one of the featured tools in the MRL Center for the Microanalysis of Materials and will contribute to the Illinois materials research 'ecosystem' integrating first principle materials design, nano-fabrication, nano-characterization and computation.

## Transient Electronics: Soft, dissolvable electronics for biomedical applications




Physicians and environmentalists alike could soon be using a new class of electronic devices: small, robust and high performance, yet also biocompatible and capable of dissolving completely in water or bodily fluids.

"We refer to this type of technology as transient electronics," said **John A. Rogers**, the Lee J. Flory-Founder Professor of Engineering at Illinois, who led the multidisciplinary research team in collaboration with Tufts University and Northwestern University. "From the earliest days of the electronics industry, a key design goal has been to build devices that last forever – with completely stable performance. But if you think about the opposite possibility – devices that are engineered to physically disappear in a controlled and programmed manner – then other, completely different kinds of application opportunities open up."

The researchers have demonstrated a new type of biodegradable electronics technology that could introduce new design paradigms for medical implants, environmental monitors and consumer devices. The devices are encapsulated in silk, whose structure determines the rate of dissolution – from minutes, to days, weeks or, potentially, years.

"The different applications that we are considering require different operating time frames," **Rogers** said. "A medical implant that is designed to deal with potential infections from surgical site incisions is only needed for a couple of weeks. But for a consumer electronic device, you'd want it to stick around at least for a year or two. The ability to use materials science to engineer those time frames becomes a critical aspect in design."

Since the group uses silicon, the industry standard material for integrated circuits, they can make highly sophisticated devices in ways that exploit well-established designs by introducing just a few additional tricks in layout, manufacturing and supporting materials. As reported in the Sept. 28 issue of the journal ***Science***, the researchers have already demonstrated several system-level devices, including a fully transient 64-pixel digital camera and an implantable applique designed to monitor and prevent bacterial infection at surgical incisions, successfully demonstrated in rats.

"It's a new concept, so there are lots of opportunities, many of which we probably have not even identified yet," **Rogers** said. "We're very excited. These findings open up entirely new areas of application, and associated directions for research in electronics."

This work was supported by the Defense Advanced Research Projects Agency, the National Science Foundation, the Air Force Office of Scientific Research, the National Institutes of Health, and the U.S. Department of Energy.

*UI News Bureau Physical Sciences Editor Liz Ahlberg contributed to this article.*

## Granick recognized with 2013 ACS colloid science award

**Steve Granick**, Founder Professor of Engineering in the Department of Materials Science and Engineering, has been recognized as the 2013 recipient of the Colloid and Surface Chemistry Award of the American Chemical Society, the highest honor in colloid science in the United States. It is awarded annually to recognize outstanding accomplishment and excellence of contributions in colloid and surface chemistry research. The award, sponsored by Procter & Gamble, recognizes and encourages outstanding scientific contributions to colloid and/or surface chemistry in North America.

**Granick**, who is also a professor of chemistry, of physics, of biophysics, and of chemical and biomolecular engineering, specializes in the field of soft materials – fluid membranes, liposomes, polymers, colloids, and other structured liquids, and presently focuses on their behavior at surfaces. He will be presented the award at the 245th ACS National Meeting in New Orleans, LA in April.

## Lewis recognized as 2012 MRS Medalist

The Materials Research Society has named **Jennifer A. Lewis** as a 2012 MRS Medalist. She was cited for "pioneering contributions in the design of viscoelastic inks composed of colloidal, polymeric, and organometallic building blocks and their directed assembly into planar and 3D functional architectures." **Lewis**, former MRL Director and the Hans Thurnauer Professor of Materials Science and Engineering, is an MRS Fellow and the first woman to receive an MRS Medal.

In the past 10 years, **Lewis** has made major contributions in the areas of direct-write assembly of soft functional materials and the design of complex fluids with tunable phase behavior, structure, and rheological properties. Her research focuses on engineering the flow behavior and structure of soft matter composed of colloidal, polymeric, and molecular building blocks where she applies her expertise to the design of functional inks for planar and three-dimensional printing. Recently, she and her research group have produced highly conductive electrode inks for printed electronic and solar devices, scaffolds for tissue engineering, and lightweight structural materials.