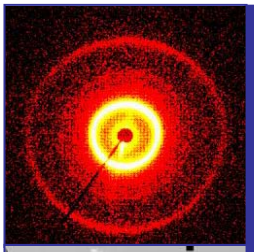
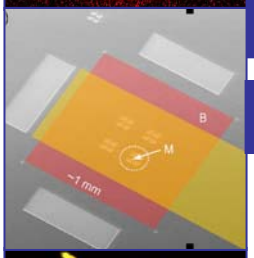
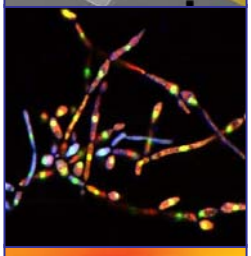
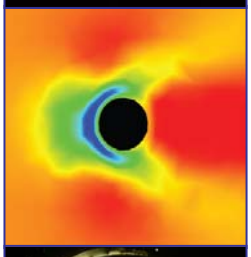
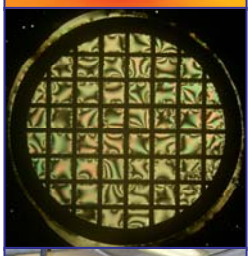
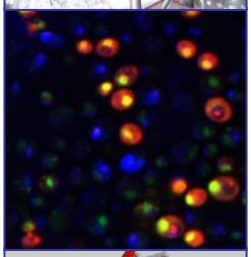
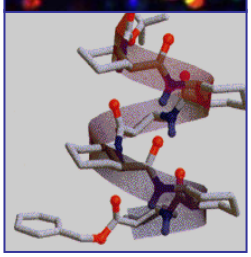






UWAMIC NEWSLETTER

Winter 2008, Volume 2, Issue 3

A Message from the Directors

Welcome to the Winter 2008 UWAMIC Newsletter!

This year's Annual Meeting was held Tuesday, October 7th and Wednesday, October 8th in Engineering Hall. The meeting was another success, with over 30 industrial attendees and 60 student posters. This year included our first presentation from a member company, R J Lee Group. We hope to include more member contributions in future meetings. For those of you who missed the meeting, a section of this newsletter contains the agenda along with several pictures. We appreciate you sharing this newsletter and our website information with colleagues you think may be interested in knowing more about our program.

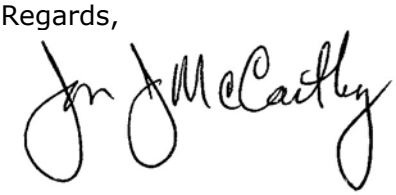
An important change will occur this month in our membership fee renewal process. In 2009 we will move all memberships to a calendar basis. Current memberships that overlap year end will be renewed on a prorated basis in 2009. This will help us be more efficient in our invoicing and have a renewal discussion with members at the annual October meeting.

Since we haven't had a lot of response, I would like to repeat my request that you visit the website www.uwamic.wisc.edu and register for member privileges. It is important that you create your own login account so we can allow you to have access to the "Members Only" sections. More members only links are on their way, including a member job posting site, plus archives of past meetings and research publications.

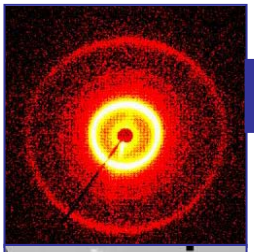
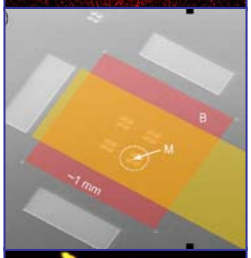
Katie DeBruin remains the primary contact for the website (gathering data, updating the sites), as well as making arrangements and coordinating information for UWAMIC events (annual meetings, membership renewal, etc.). Katie's phone number is (608) 262-0112, her email is kedebruin@wisc.edu, and she is located in 3033 Engineering Hall. Please contact her or me for help of any kind.

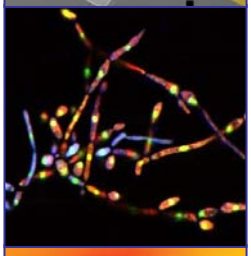
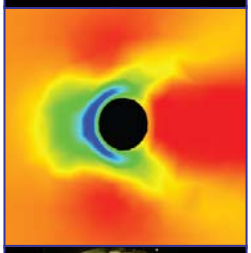
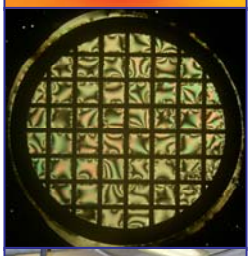
We hope you enjoy this issue of the newsletter, and, as always, we welcome your feedback as to how we can improve your consortium and the newsletter. Feel free to contact me or Katie with your input or questions.

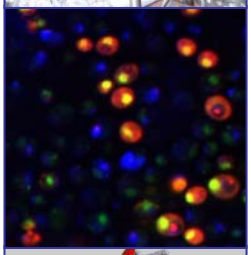
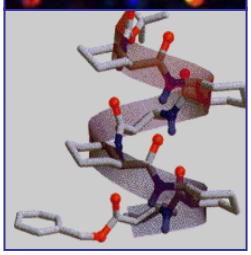
Regards,



Co-Director, Development

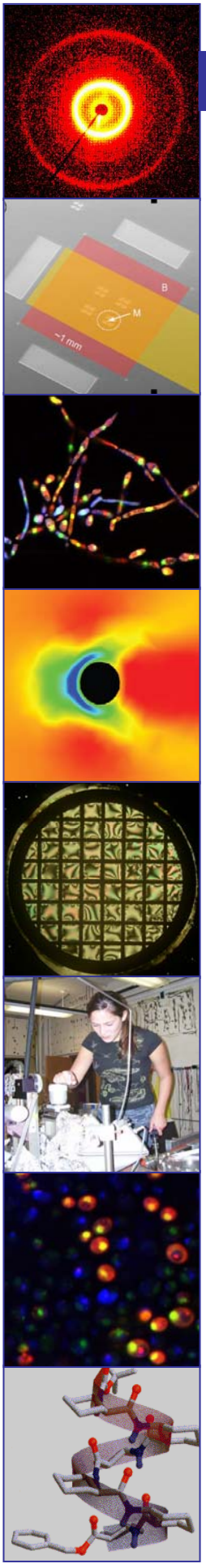




2008 Annual Meeting Agenda

UW Advanced Materials Industrial Consortium
Annual Meeting Agenda
October 7-8, 2008
Engineering Hall, Room 1610 and Lobby

Tuesday, Oct 7		
2:00 PM	Advisory Board Meeting	*1610 Engineering Hall*
3:00 PM	One on One Meetings with Faculty	*As arranged*
3:00 PM	Lab Tours: Materials Science Center, Wisconsin Center for Applied Microelectronics, Soft Materials Laboratory	
6:30 P.M.	Informal Reception & Poster Session	EH Lobby
Wednesday, Oct 8	*AM Sessions*	*1610 Engineering Hall*
8:00 AM	Continental Breakfast	*EH Lobby*
8:25 AM	Welcome	Jon McCarthy
8:30 AM	College of Engineering Welcome	Dean Paul Peercy
8:40 AM	Wisconsin Institutes for Discovery	Chancellor John Wiley
9:00 AM	Materials Research Science & Engineering Center (MRSEC) Highlights	Juan de Pablo
9:20 AM	Nanoscale Science & Engineering Center (NSEC) Highlights	Paul Nealey
9: 40 AM	Consortium and Facilities Update	Jon McCarthy
10:00 AM	Break/ Poster Session	*EH Lobby*
11:00 AM	Electronic Materials & Devices	Paul Evans
12:00	Lunch/ Student Posters	*EH Lobby*
Wednesday, Oct 8	*PM Sessions*	*1610 Engineering Hall*
1:00 PM	Polymers & Soft Materials	Padma Gopalan
2:00 PM	Biological Materials & Processes	Sean Palecek
3:00 PM	Break	*EH Lobby*
3:15 PM	Advancing the Application of Nanotechnology	Bob Hamers Gary Casuccio, R J Lee
4:45 PM	Break/ Poster Session	*EH Lobby*
6:00 PM	Dinner	*Great Dane Hilldale*

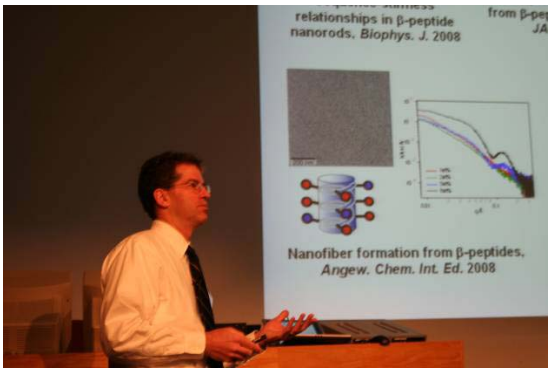


2008 Annual Meeting Photo Highlights

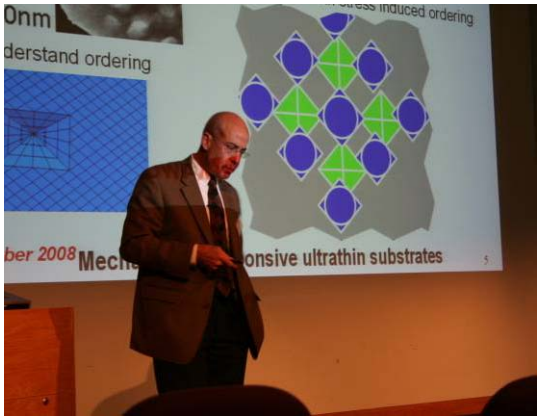
Welcome from Dean Paul Peercy

Sheri, Katie and JoAnn: The Get It Done Team

Industrial Advisory Board Meeting

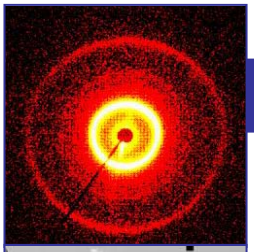
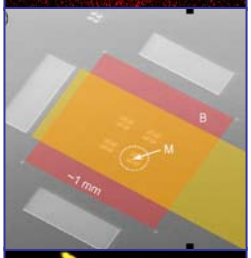
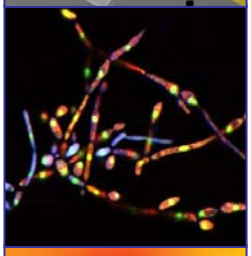
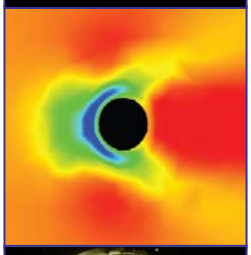
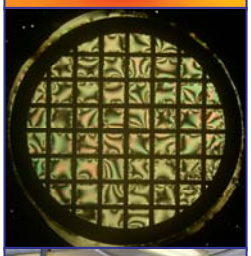


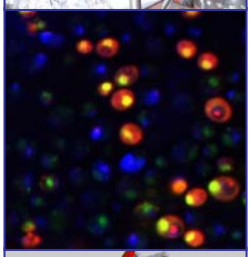
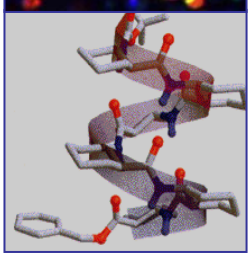
Overview of NSEC by Paul Nealey



Overview of MRSEC by Juan de Pablo

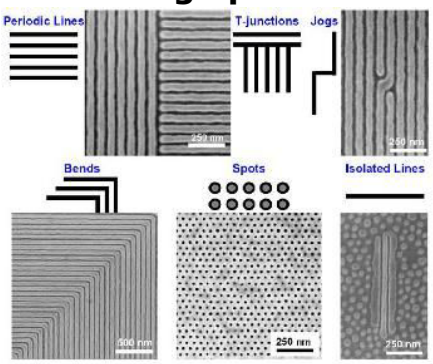
A busy evening poster session!

What's New in the UWAMIC?

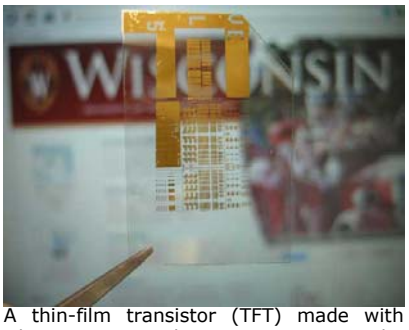
Self-assembling polymer arrays improve data storage potential



A new manufacturing approach holds the potential to overcome the technological limitations currently facing the microelectronics and data-storage industries, paving the way to smaller electronic devices and higher-capacity hard drives.

"In the past 20 to 30 years, researchers have been able to shrink the size of devices and the size of the patterns that you need to make those devices, following the use of the same types of lithographic materials, tools and strategies, only getting better and better at it," says **Paul Nealey**, Director of the University of Wisconsin-Madison Nanoscale Science and Engineering Center (NSEC).
http://www.news.wisc.edu/15484

Stretching silicon: A new method to measure how strain affects semiconductors



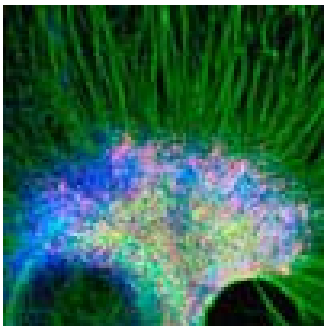
A thin-film transistor (TFT) made with silicon nanomembranes. TFTs are the basis for flexible electronics.

UW-Madison engineers and physicists have developed a method of measuring how strain affects thin films of silicon that could lay the foundation for faster flexible electronics.

Silicon is the industry standard semiconductor for electronic devices and silicon thin films have the potential to produce faster, more flexible electronics. Researchers have long known that inducing strain into the silicon increases device speed, yet have not fully understood why.

Developed by a team of researchers led by **Max Lagally**, the Erwin W. Mueller and Bascom Professor of Materials Science and Engineering at UW-Madison, the new method enables the researchers to directly measure the effects of strain on the electronic structure of silicon. The group published its findings in the Oct. 10 online edition of Physical Review Letters, and the paper will soon appear in the journal's print edition.
http://www.news.wisc.edu/15879

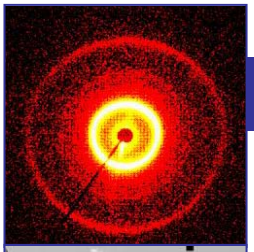
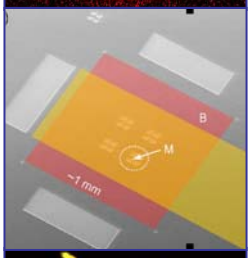
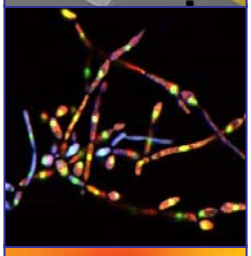
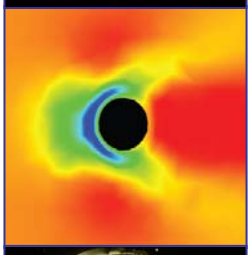
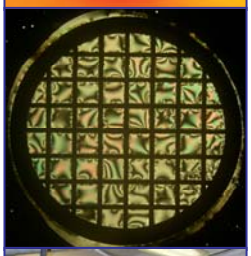
Research on human embryonic stem cells marks 10-year milestone

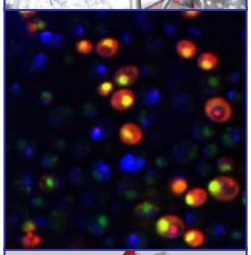
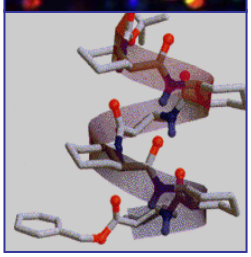


A cluster of neural cells were derived from human embryonic stem cells.

Ten years ago (Nov. 6, 1998), the publication in the journal Science of a short paper entitled "Embryonic Stem Cell Lines Derived from Human Blastocysts" rocked biology — and the world — as the all-purpose stem cell and its possibilities were ushered into the limelight.

Since then, the cells have become a household word, a source of hope for the afflicted, and a boon to biologists and biology everywhere. The cells, which in nature exist for only a fleeting period before marching down different development pathways to become any of the 220 types of cells of the human body, had been shown by Wisconsin developmental biologist **James Thomson** to be controllable in the lab dish.
http://www.news.wisc.edu/15920

UWAMIC in the News

Paul Nealey featured in the October issue of *Chemical & Engineering News*

Paul Nealey was featured in an article entited "Molecular-Scale Lithography: Advances in block copolymer self-assembly may lead to applications in microelectronics".

An excerpt:
Block copolymer lithography takes advantage of spontaneous self-assembly processes to create arrays of molecular-scale features whose size is dictated by the chemistry of block copolymers. Typically, the process relies on diblock copolymers, which are covalently linked chains of two different polymers. The two chains that make up the diblock copolymer would "separate at a very large length scale if they weren't tied together at the molecular length scale," says Paul F. Nealey, a chemical engineering professor at the University of Wisconsin, Madison.
http://pubs.acs.org/cen/email/html/cen_email_cen_86_i42_8642sci2.html

Manos Mavrikakis selected for 2009 Emmett Award in fundamental catalysis

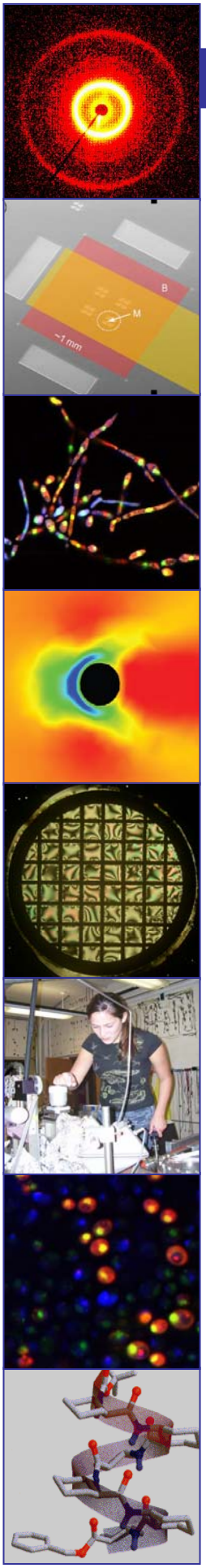
Professor of Chemical and Biological Engineering **Manos Mavrikakis** has been selected for the 2009 Paul H. Emmett Award in Fundamental Catalysis. The purpose of the Award is to recognize and encourage individuals (under the age of 46) and their contributions in the field of catalysis with emphasis on discovery and understanding of catalytic phenomena, proposal of catalytic reaction mechanisms and identification of and description of catalytic sites and species.
http://www.nacatsoc.org/news.asp?NewsID=136

Irena Knezevic Receives AFOSR YIP Award

Electrical and Computer Engineering Assistant Professor **Irena Knezevic** has received a 2009 Air Force Young Investigator Research Program (YIP) award for her proposal, "Semiconductor nanowire and nanoribbon thermoelectrics: A comprehensive computational study". Knezevic will use this three-year, $395,190 award to study nanostructured thermoelectric (TE)elements that offer tremendous potential for refrigeration and conversion of heat waste into electricity. Knezevic will perform a large-scale, comprehensive computational study of the TE properties on semiconductor nanowires and nanoribbons over a large parameter space of materials compositions, dimensions, surface roughness parameters, doping densities, and temperatures, with focus on SiGe and GaN-based structures. Knezevic is among 39 researchers chosen for their exceptional ability and promise for conducting basic research while still in the first five years of their careers.

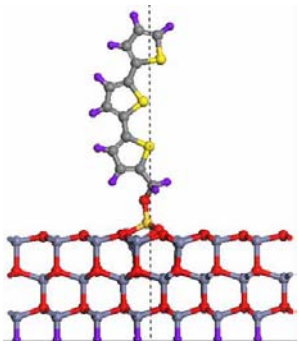
Max Lagally lends expertise to the *Chicago Tribune*

Erwin W. Mueller Professor and Bascom Professor of Surface Science in Materials Science and Engineering **Max Lagally** lent his expertise to the "Chicago Tribune" for an August 6 story about an eyelike camera developed at the University of Illinois in collaboration with Northwestern University. The camera uses a curved screen rather than typical lenses, granting a wider field of view while reducing distortion. Lagally has collaborated with the project PI, John Rogers of the University of Illinois, on several occasions, and envisions applications beyond consumer digital cameras. "I won't be surprised if [Rogers] comes up with something really magical in short order," Lagally said.
http://archives.chicagotribune.com/2008/aug/06/local/chi-eye-camera-webaug07



Research Highlights

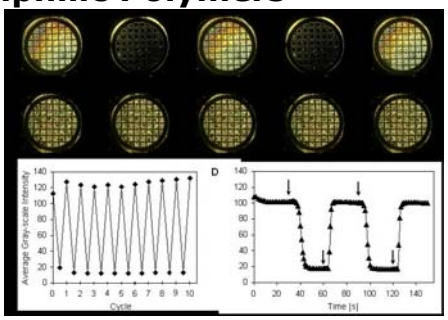
Functionalized Inorganic/Organic Interfaces



Functionalizing interfaces between organic and inorganic semiconductors can improve the performance of organic solar cells, light emitting diodes, and transistors and yield new functions.

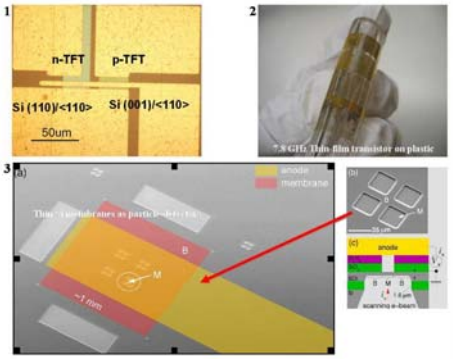
The design of interfaces between the inorganic semiconductor ZnO and the molecule terthiophene includes density functional theory predictions of structure (at left), electronic configuration, and stability of molecules at interfaces. Peng et al., have found that the large dipole of the terthiophene/ZnO interface will dramatically change electronic transport through the interface and provide a means for improving charge separation in devices.
http://mrsec.wisc.edu/MR--Nugget.php?ID=13

Reversible Control of Ordering Transitions at Aqueous/Liquid Crystal Interfaces Using Functional Amphiphilic Polymers

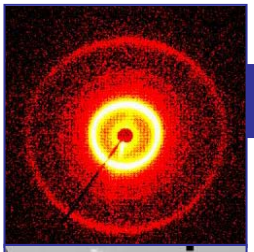
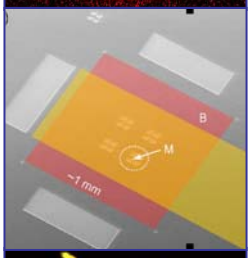
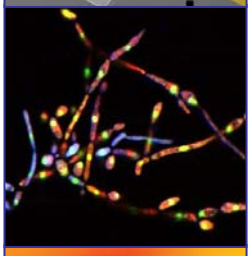
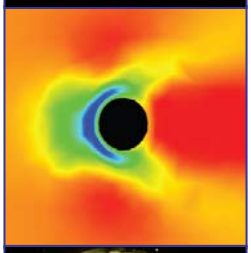
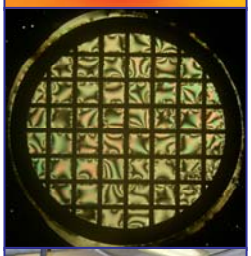


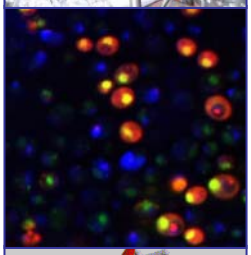
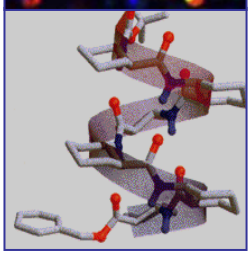
Materials and interfaces with properties governed by weak intramolecular interactions form the basis of systems designed to sense, respond to, or report on changes in their environments. For example, polymers, surfaces, and fluids that respond to changes in temperature, pH, ionic strength, light, or electric fields have been exploited to develop sensors, actuators, and myriad other "smart" materials. Here, we report the design of a functional amphiphilic polymer that assembles at interfaces between a nematic liquid crystal and immiscible aqueous solutions and triggers ordering transitions in the liquid crystal. We demonstrate further that appropriately designed polymer-functionalized aqueous/liquid crystal interfaces respond reversibly to changes in the pH of aqueous phases in ways that couple the order of the liquid crystals to changes in the physico-chemical properties of their aqueous environments. The results of this investigation suggest principles and approaches that could be used to tailor the interfacial properties of liquid crystalline systems and design fluid interfaces that respond actively or reversibly to a broad range of environmental stimuli.
http://mrsec.wisc.edu/MR--Nugget.php?ID=14

Thin Silicon Membranes



1. A complementary thin-film transistor on plastic using hybrid-orientation Si nanomembranes.
2. Macroscale image of such transistor arrays attached to a flexible plastic substrate.
3. Si nanomembranes placed in groups of four on a sample holder for testing detector applications: (a) overview with the red area (B) indicating the total membrane area and the golden area showing the gating electrode. (b) Magnification of an actual device region with four membranes (M) forming a pixel. (c) Experimental configuration: the backside of the sample is scanned with an electron beam, while the direct current is probed by the emitted electrons collected in the anode.
http://mrsec.wisc.edu/MR--Nugget.php?ID=12

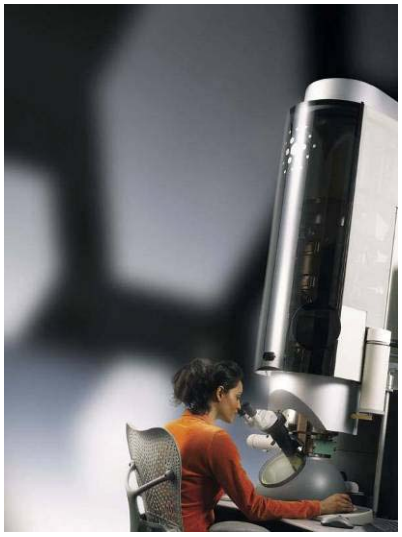






Instrumentation News

Titan Aberration Corrected Analytical STEM Update

Installation of our Titan STEM is a bit behind schedule. In order to meet laboratory specifications, we had to do more remodeling to the Material Science Building HVAC than expected. The remodeling has started and we expect completion in Quarter 2 of 2009. This machine will be unique in the upper Midwest and will both enable significant new advances in research in nanomaterials, nanobiology, and energy and the environment, and also enhance training of future scientists, engineers, and EM technicians with new material on STEM. In addition, all the STEM (and TEM) capabilities will be operable via the Internet.


FEI Titan STEM

WCAM Completes Installation of Nikon I-Line Stepper

In September, Nikon completed the installation of a refurbished Nikon Body 8 photolithography tool in the Wisconsin Center for Applied Microelectronics (WCAM). This tool is a donation from Intel, with additional support from the College of Engineering and the College of Letters and Science.

This tool allows WCAM to do lithography with much smaller feature sizes (CD < .5 micron) and to do step and repeat exposures on 2 inch, 3 inch and 4 inch wafers and pieces of material.

During acceptance testing, the tool repeatably demonstrated feature size in the 400nm range.

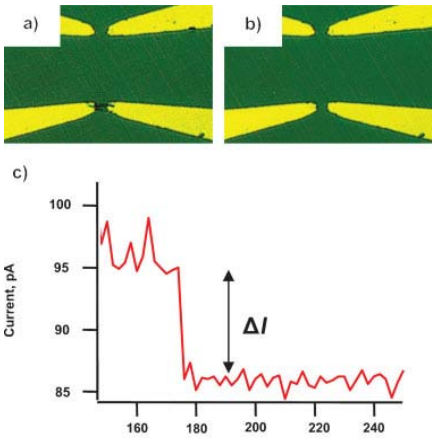
WCAM is a cost recovery facility and is open to both internal and external customers. If you have a need for prototyping structures or limited production runs, don't hesitate to contact us!

Recent Publications

Chemoselective nanowire fuses: Chemically induced cleavage and electrical detection of carbon nanofiber bridges

B. Li, L. Shang, S. M. Marcus, C. T. Lasseter, E. Perkins, R. J. Hamers
Small **4** (6), 795-801 (2008)

Abstract:
A new type of nanoscale bioswitch based on the electrical detection of chemically induced cleavage of chemical bonds, which bind individual nanowires across a pair of electrodes is demonstrated. Carbon nanofibers are manipulated using dielectrophoresis to form single-nanowire bridges across microelectrode junctions, and are anchored through a biomolecular interaction. Once in place, chemically induced cleavage of a recognition site along the bonds linking the nanowire to the electrodes allows the nanowire to be easily removed by a flow of fluid; this removal can be detected in real time via changes in the AC electrical response. This form of sensing is inherently digital in nature as the removal of a single nanowire produces a sudden decrease in the current between electrodes and is essentially a chemoselective fuse. These results suggest that this sensing principle could be a general method for digital chemical and/or biological sensing using individual nanowires.



Optical microscopy images showing a) a single carbon nanofiber bridging a microelectrode gap and b) the same sample after cleavage of the disulfide linkages and removal of the nanowire. c) Real-time measurement of current while the carbon-nanofiber bridge is chemically cleaved from its position across the electrode gap.

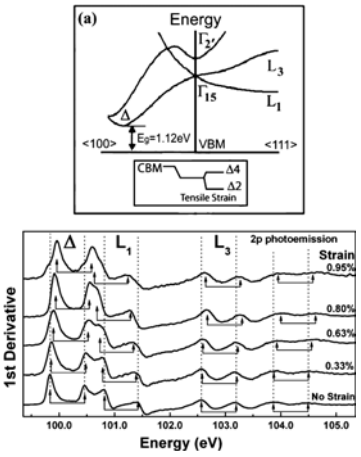
http://www3.interscience.wiley.com/journal/119816482/abstract

Influence of strain on the conduction band structure of strained silicon nanomembranes

C. Euaruksakul, Z. W. Li, F. Zheng, F. J. Himpsel, C. S. Ritz, B. Tanto, B., D. E. Savage, X. S. Liu, M. G. Lagally
Physical Review Letters **101**, 147403 (2008)

Abstract:
The influence of in-plane biaxial strain on the conduction bands of Si is explored using elastically strained Si(001) nanomembranes and high-resolution x-ray absorption measurements with electron yield detection. The strain-induced splitting of the conduction band minimum and the energy shifts of two higher conduction bands near L_1 and L_3 are clearly resolved. The linear increase of the splitting of the conduction band minimum with increasing strain and the nonlinear shift of the L_1 point toward the conduction band minimum agree quantitatively with current theories.

http://scitation.aip.org/getabs/servlet/GetabsServlet?prog=normal&id=PRLTAO00010100001414740300000 1&idtype=cvips&gifs=yes



Effect of strain on the conduction bands of Si: (a) Illustration of the band structure of unstrained Si showing the global minimum along Δ and local extrema at L_1 and L_3, after. The inset shows how in-plane tensile strain modifies the conduction band minimum (CBM). (b) Derivative x-ray absorption spectra. The $2p \rightarrow \Delta$ and $2p \rightarrow L_3$ transitions increase in energy while the $2p \rightarrow$ L1 transition decreases. The arrows for Δ mark the center of gravity of the split Δ_2, Δ_4 bands. All features are duplicated because of the spin-orbit splitting of the $2p$ core level into $2p_{3/2}$ and $2p_{1/2}$. All spectra are normalized with x-ray intensity and offset so they do not overlap each other.

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