

## National Nanotechnology Infrastructure Network Vol.4 # 1

### A Periodic Newsletter of NNIN News and Announcements

March, 2008

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## NNIN

The National Nanotechnology Infrastructure Network consists of 13 nanotechnology user facilities at 13 major academic institutions. Funded by the National Science Foundation, our facilities are available to the national user community on an open basis. We provide accessible resources across the entire breadth of nanotechnology. To this end, each site has specialized areas of expertise within the network, ranging from biology and chemistry to materials characterization and traditional microfabrication. Complete information on NNIN sites, resources and access is available via the web site at [nnin.org](http://nnin.org)

## Facilities Highlights

### New Cleanroom Opens at Harvard

The Center for Nanoscale Systems (CNS) at Harvard University has officially opened the cleanroom in the newly constructed Laboratory for Integrated Science and Engineering (LISE). Much of the equipment purchased in the last year intended for the Center's new, improved space in LISE has arrived and is already online and ready for use. Major new nanofabrication tools include:

- Veeco NanoMan VS AFM
- Elionix ELS-7000
- STS Inductive Coupled Plasma RIE System

These are just a tiny sampling of the dozens of new instruments and capabilities available in the new CNS labs in LISE. The Fall07/Winter08 edition of the CNS newsletter, The NanoWire, contains much more detail regarding the new CNS tools. For pictures and descriptions of much of the latest in CNS capabilities, please go to the URL:

[http://www.cns.fas.harvard.edu/about/cns\\_nanowire.php](http://www.cns.fas.harvard.edu/about/cns_nanowire.php)

## New Equipment Highlights

### Michigan Acquires New ALD System

The Michigan Nanofabrication Facility has acquired an Oxford Instruments OpAL atomic layer deposition (ALD) system with both thermal and remote plasma source capabilities. The OpAL ALD system can be used to grow ultra-thin, highly conformal metal, metal oxide, metal nitride, and insulating films on substrates ranging from small wafer pieces up to 200 mm diameter

wafers. Currently, the system is being configured to deposit Al<sub>2</sub>O<sub>3</sub>, ZnO, and HfO<sub>2</sub>.

### **Agilent Technologies Donates 5500 Atomic Force Microscope to Stanford**

The Stanford Nanofabrication Facility has received a generous grant from Agilent Technologies of a model 5500 atomic force microscope:

<http://www.home.agilent.com/agilent/product.jsp?cc=US&lc=eng&nid=-35708.426382>

The system is equipped with a noise and vibration chamber. It also includes both lithography and nanomanipulation software and a 10 micron STM scanner. Finally, it includes a controlled temperature plate that will allow measurements to be performed at temperatures from -30 degrees Celsius up to 250 degrees Celsius. This instrument will greatly extend SNF's capability for AFM measurements. When using the large, multipurpose scanner over a 90 um by 90 um field the vertical noise is rated at 0.05 nm RMS. The vertical noise falls to < 0.02 nm RMS with the small 9 um x 9 um scanner.

### **New Additions to Penn State Equipment Inventory**

The Penn State Nanofabrication Facility is installing a GCA 8000 i-Line Stepper that will be available in February 2008 for patterning small parts through 6 wafers. It is capable of 0.65 m lines and spaces and smaller isolated lines. The field size is 11.3mm square and overlay alignment is better than 0.15 m. It uses standard 5 x 5 reticles (masks) and has a 5x reduction lens.

The Penn State Nanofabrication Facility has replaced the Karl Suss MA6 contact liner with a newer MA/BA6 which adds back side alignment capabilities as well as additional chuck sizes.

The Penn State Nanofabrication Facility has installed a KLA-TENCOR FLEXUS 2320. The 2320 is a dual wave length tool used for thin film stress measurement system. It measures the changes in the radius of curvature of the substrate caused by the deposition of a stressed thin film on the substrate. It is equipped with a heated chuck and it is capable of Temperature controlled scans. Therefore, it can also measure the Elastic constant and thermal expansion coefficient of a thin film, if the thickness of the film and the substrate are known.

## **Workshops and Conferences**

### **CNF Workshop, The Commercialization of Nanotechnology**

Thursday, April 10th, 2008

On Thursday, April 10th, the CNF will host a workshop on "The Commercialization of Nanotechnology." The workshop will address a broad range of issues associated with the commercialization of nanotechnology. The one day program will include success stories from nanotechnology ventures, an introduction to regional nanotechnology facilities, a primer on intellectual property issues, and an overview of funding opportunities with an emphasis on small business grants and venture capital. A reception will provide ample networking opportunities. Our intended audience includes nanotechnology researchers interested in starting a company, as well as small companies interested in leveraging Cornell's nanotechnology capabilities. Please join us!

For more information: [http://www.cnf.cornell.edu/cnf\\_commercialization.html](http://www.cnf.cornell.edu/cnf_commercialization.html)

Contact Ms. Melanie-Claire Mallison at [mallison@cnf.cornell.edu](mailto:mallison@cnf.cornell.edu) or 607-254-4858

### **Penn State's Materials Day 2008 Emphasizes Energy and the Environment**

Materials Day 2008, held April 14-15 at the Penn State Conference Center on Penn State University Park campus, features tours of the Materials Research Institute's characterization and nanofabrication facilities, interactive poster sessions, industry table-top exhibits, and plenary lectures from leaders in industry, government, and academia on the general topic of Materials for Energy Technologies. Materials Day 2008 will emphasize the role of new materials in the quest for energy independence and environmental sustainability. New this year are tutorials by faculty experts on materials characterization, nanofabrication, polymer actuators and sensors, metamaterials, energy storage and high power capacitors, fuel cells, and flexible electronics. Materials Day is Penn State's premier event for materials research and attracts many of the world's leading materials-based companies. Visit [www.mri.psu.edu/events/materialsday](http://www.mri.psu.edu/events/materialsday) for more information.

### **SAME-TEC Conference 2008, Metrology Workshop at MRC UT-Austin**

July 28-31, 2008

During the SAME-TEC pre-conference day, UT experts will demonstrate the need of Atomic Force Microscopy (AFM), Profilometer, Scanning Electron Microscopy (SEM), Optical Microscope, Transmission Electron Microscopy (TEM), and Ellipsometer, to explore the micro to nanoscale material properties. Participants will compare analysis performed on AFM vs. Profilometer and SEM vs. Optical Microscope on patterned wafers. Participants will have the opportunity to see deeper (down to atomic level) with the MRC's TECNAI TEM. Ellipsometry will reveal the optical property of film as thin as a few nanometers. The participants, under the supervision of a UT expert, will manipulate equipments and make their own SEM images of carbon nanotubes.

For more information: <http://www.matec.org/convention/index.htm>

Contact Angela Obolsky at [angela.obolsky@domail.maricopa.edu](mailto:angela.obolsky@domail.maricopa.edu)

### **Hands On Nanofabrication Workshop for Educators**

The Center for Nanotechnology Education and Utilization at Pennsylvania State University will be holding the next offering of the Hands-On Nanofabrication Workshop for Educators on May 13-15, 2008. This three day workshop is an exploration of the world of nanotechnology. Participants will learn about the growing applications of nanotechnology in many industries including the biotechnology, MEMS, optoelectronics, chemical, and nanoelectronics industries. The basics of nanofabrication processes and tools will be covered and emphasized through processing labs held in the class 10 cleanrooms of the Penn State Nanofabrication Facility along with the CNEU Educational Cleanroom. This three-day workshop is broken down into daily morning lectures by nationally recognized Penn State researchers and engineering staff and into afternoon lab sessions in nanofabrication.

For more detailed information or to register for this workshop, please go to [www.cneu.psu.edu](http://www.cneu.psu.edu).

For more information: <http://www.cneu.psu.edu>

Contact Bob Ehrmann at [bobehrmann@psu.edu](mailto:bobehrmann@psu.edu) or 814-865-7558

## **Workshop on X-ray Energy Dispersive Spectrometry with the EDAX Genesis System**

March 18-20, 2008

The University of Michigan is offering a 3-day course on the fundamentals of X-ray energy dispersive spectrometry (EDS) and its implementation with EDAX systems. The featured speaker will be Dr. Robert Anderhalt of EDAX who has taught the training courses at EDAX since 1997.

The workshop will provide an overview of the EDS technique, covering both theory and instrumentation issues. The program includes lectures and hands-on experience with EDS analysis using EDAX hardware and EDAX Genesis software.

For more information: <http://www.mnf.umich.edu/Events.aspx?id=91>

Contact Sandrine Martin at [sandrine@eecs.umich.edu](mailto:sandrine@eecs.umich.edu) or 734-763-6719

## **Education and Outreach**

### **Georgia Tech Participates in Splash Day**

The Georgia Tech site participated in the Georgia "Splash Day", an event where GA lawmakers toured selected Georgia middle and high schools. An HD polycom system was set up in the GT facility and a direct, high speed line was connected between GT and a Barrow County School to carry the audio and video between sites. A lithography demonstration was performed for the students and a long question and answer session followed.

### **MRS Spring 2008 Symposium - The Role of Lifelong Education in Nanoscience and Engineering**

March 24-26, 2008

Investments in nano-education efforts currently exceed a billion dollars a year globally. Programs to prepare the nano work force of the future include university, government, and agency efforts to effect graduate and undergraduate education. Industry is searching for solutions to the nano-work-force needs with innovative approaches. Networks of informal education venues have collaborated to address the growing need of motivating enough students to enter science, technology, engineering, and math careers. Nanotechnology is creating a challenging synergy of collaboration across all disciplines of engineering and science. Yet questions remain to be answered about who will implement the nanotechnology in factories, make informed decisions about nanometer-scale products, and create the services needed to make them useful. It is critically important for everyone to become aware and active participants in the preparation of a nano-ready work force.

The goal of this symposium is to encourage forums that exchange and analyze information, explore best practices, and elaborate recommendations for life-long education in nanoscience and engineering. In particular, the education and work-force needs to support interdisciplinary research and industrial innovation will be addressed, along with the needs to duly inform and engage citizens.

Session topics will include:

- How developing nanoscale science knowledge should be included in nano-education efforts
- Current and developing methodologies at colleges, universities, and informal science venues
- Current perspectives and methods at government and industry centers and facilities
- Global integration of programs developed for nanoscale science education

Invited speakers include: Maria-Isabelle Baraton (Univ. of Limoges, SPCTS-UMR CNRS 6638, France), Ray W. Carpenter (Arizona State Univ., School of Materials), Katherine Chen (California Polytechnic State Univ.), Vivian Dang (Boeing Co.), Nancy Healy (Georgia Inst. of Technology, National Nanotechnology Infrastructure Network), Meyya Meyyapan (NASA Ames Research Ctr.), Ron Sandler (Northeastern Univ., Nanotechnology and Society Research Group), Kshitij Aditeya Singh (Inst. Of Nanotechnology, United Kingdom ), Chris Toumey ( Univ. of South Carolina , Citizens' School of Nanotechnology ), Jeff Welser (Semiconductor Research Corp., Nanoelectronics Research Initiative), and Robert Westervelt ( Harvard Univ. , NSEC, Ctr. For Nanoscale Systems and their Device Applications). For more information:

<http://www.mrs.org>

Contact Diana Palma at [diana.palma@mirc.gatech.edu](mailto:diana.palma@mirc.gatech.edu) or 404-894-1541

### **National Science Teachers Association Annual Meeting 2008**

March 27-29, 2008

The NNIN will have an exhibit booth (#2232) at the NSTA Annual meeting to be held at Boston, MA. The exhibits will be open March 27-29 at the Boston Conference and Exhibition Center . Stop by the booth to meet the NNIN Research Experience for Teachers and get information, resources, and materials on how to include nanotechnology in secondary science classes.

For more information: <http://www.nsta.org/conferences/2008bos/>

Contact Nancy Healy at [nancy.healy@mirc.gatech.edu](mailto:nancy.healy@mirc.gatech.edu)

NNIN is a network of open user facilities. All resources at member facilities are available equally to users from Academia, industry, and government. Contact information and facility details are available via the NNIN web site at <http://www.nnin.org>.