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UNIVERSITY OF MINNESOTA
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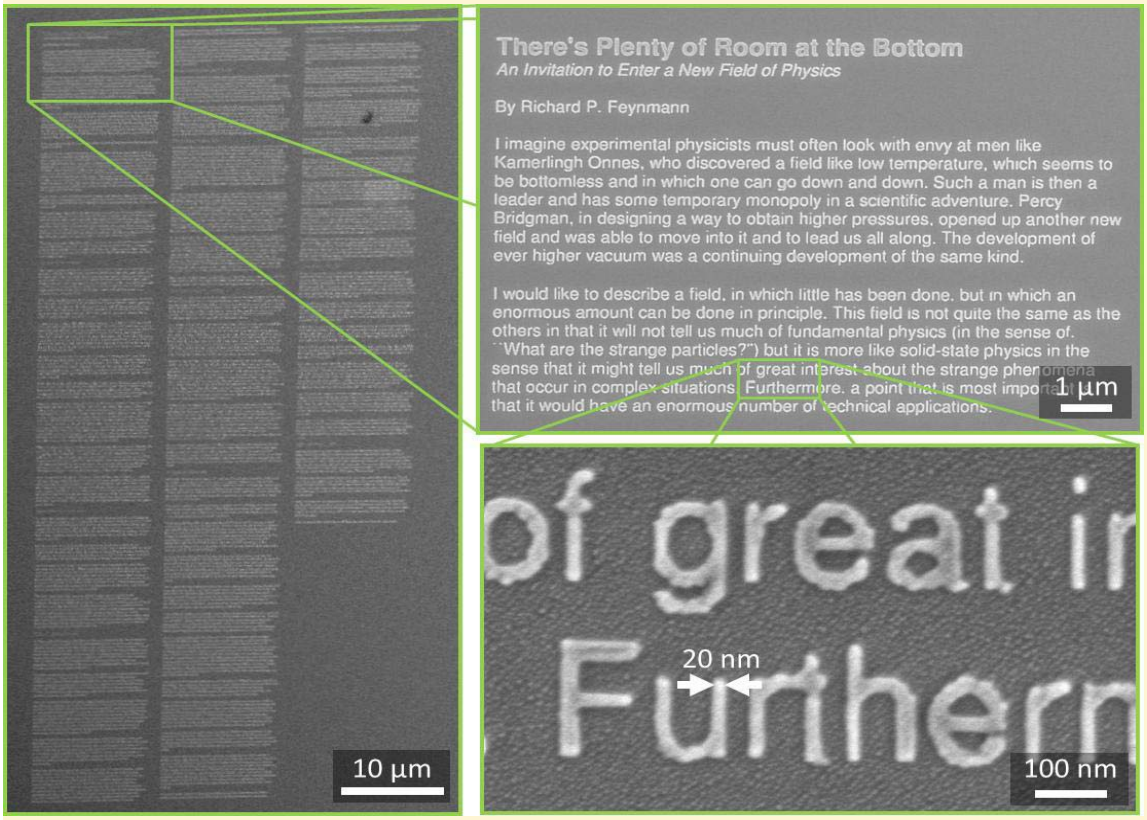
NANOTECHNOLOGY NEWS FROM THE UNIVERSITY OF MINNESOTA

SUMMER 2011

Vistec EBPG5000+ Electron Beam Lithography System at the Nanofabrication Center



An example of the Vistec's ability to write features at the nanoscale. The text of Richard Feynman's prescient 1959 talk, "There's Plenty of Room at the Bottom", was written in a hydrogen silsesquioxane resist using the 50 MHz EBPG5000+ e-beam lithography system. The write time for this entire pattern is about three minutes.

BioMEMS & Microfluidics Short Course

Interested in becoming involved in the microfluidics field, but need a basic outline of what is possible and how the devices are designed and built? This hands-on workshop will provide an understandable overview of microfluidics for biomedical applications and get you in the lab to build basic structures. New this year: participants who are new to the NFC will **receive a small fee waiver** to allow them to apply the short course principles to ideas of interest.

www.nano.umn.edu/biomems11

7th Annual Minnesota Nanotechnology Workshop

SAVE THE DATE! The 7th Annual Nanotechnology Workshop is coming this fall, November 15-16, 2011. Topics will include Nano-scale Materials for Next Generation Application, Nano Energy, Nano Medicine and Photonic Sensors. This workshop typically attracts 150 – 200 attendees from academia and industry throughout the region. As always, we will host a Reception and Poster Session on the evening of November 15 which is a great opportunity to network and talk to researchers one on one. We hope you can join us this year!

Reminder: If your work uses the Nanofabrication Center please add the following in the acknowledgements section of any publication: "Parts of this work were carried out in the University of Minnesota Nanofabrication Center which receives partial support from NSF through the NNIN program."

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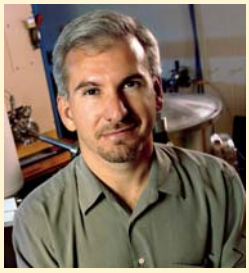
COLLEGE OF Science & Engineering

Characterization Facility News

CharFac Director's Message



CharFac Director, Greg Haugstad

Further Grant-in-Aid (GIA) successes and other appropriations for capital equipment improvements are recent news in the CharFac. The FEI Tecnai Spirit Bio-Twin TEM recently installed in Moos Tower (NIH MRI grant, lead PI staff member Wei Zhang) benefits from a local vibration isolation apparatus funded by a GIA (PI Zhang again). Secondly, a variable sample temperature stage will be purchased for use with the Shepherd Labs TEMs; the majority of funding derives from a GIA (lead PI Andre Mkhoyan) with some matching provided by the MRSEC. Thirdly, the MRSEC has provided substantial funding to purchase a new X-ray generator for the CharFac's second microdiffractrometer. The older, workhorse microdiffractometer has seen more down time in the past year, begging a fully functional second system. The newer microdiffractometer is further equipped with a translation stage that can be used for mapping across a given sample as well as automated positioning of several samples.

(continued, top right)

CharFac at the University of Minnesota

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Greg Haugstad, Director

Mike Manno of the CharFac and CEMS department here at the University of Minnesota.

X-ray scattering underwent staffing changes in March. Maria Torija left to pursue an opportunity with NVE Corporation, based in Eden Prairie, Minnesota. We wish Maria the best in her new endeavors. We are excited to welcome postdoctoral associate Mike Manno, who has taken a position jointly with the CharFac and the Department of Chemical Engineering and Materials Science. Recently finishing his Ph.D. work at the University of Minnesota under Chris Leighton, Mike brings a broad knowledge in wide-angle X-ray scattering / diffraction, having spent significant time at the CharFac during his doctoral studies. With experience in using the PANalytical X'pert and the Bruker microdiffractometer to study polycrystalline and single crystalline films and bulk crystals, Mike has a particular expertise in high resolution X-ray diffraction, grazing incidence X-ray reflectivity, and two-dimensional X-ray diffraction. Other staff members active within the broad suite of X-ray scattering tools include Bing Luo (microdiffractometer, D8), Linda Sauer (part time, contracted) and undergraduate Alex Pongratz (D5005 trainings).

CharFac is currently undergoing some administrative re-organization. A portion of Alice Ressler's emphasis is reverting to technical activity and coordination at our Hasselmo site, the remainder being external client relations and marketing. Oversight of financial accounting activity will become the responsibility of a new hire, ending the contracting of other departments for financial services. Forces behind these changes include the challenges of the University's EFS accounting system, increased requirements for documentation, and cuts to a contracted department's administrative staffing. Secondly, as the CharFac has expanded (instrumentation, sites, education/outreach) and the roles for IT systems have become correspondingly more complex, IT expertise also has become critical. Our most recent staff addition is Matt Lowe, who like IT specialist John Schafer shares his time with the Nanofabrication Center. Matt's emphasis is on PC, network and vendor-database systems, whereas John's is on web site and user-database systems including session logging/ billing. Please direct general administrative inquiries to Greg Haugstad.

Nanofabrication Center News

NFC Director's Message

NFC Director, Steve Campbell

The current phase of building design for the proposed Experimental Physics and Nanotechnology Advancement building will be completed this summer. The actual construction drawings will be completed by November. The new cleanroom, along with offices for NFC/CNA will take up most of the ground level. If we are successful in developing State support in this session, site excavation would actually begin near the end of summer 2011. More information on the building can be found at: http://physicsnano.umn.edu/mn.html.

A view of the proposed Physics and Nano building as seen from Keller Hall.

The new AJA sputtering system and the new STS etch tool have now both been installed, after longer than expected installation processes. The vendors will be out in mid-May for equipment start-up and we expect to begin training users shortly thereafter. The new etch system has been configured for methane. This can be used to etch some heavy metals by forming volatile metal organics or carbonyls. In particular, we expect that it will be useful for etching magnetic materials such as Ni, Co, and Fe. We will be working with Professor Jianping Wang to bring up prototype processes. Contact Lage von Dissen or Kevin Roberts if you want more information.

Soft Lithography Capabilities

Soft lithography refers to a group of non-photolithographic methods that can be used to fabricate or replicate structures, using polymers such as Polydimethylsiloxane (PDMS). Examples include micro contact printing, replica molding, micromolding in capillaries and microtransfer molding. Many of these techniques were developed by George Whitesides at Harvard University. Applications include fabrication of microfluidic devices, patterning on non-planar surfaces, fabrication of complex optical surfaces, and stamps for selective application of biological materials. At the Nanofabrication Center we have a soft lithography capability centered around SU-8 molding of PDMS. SU-8 is a commonly used molding material for PDMS, and can be formed into structures of a wide range of sizes and shapes. These masters can be made with nanoscale feature sizes using our new Vistec electron beam lithography system, or with larger sizes using conventional photolithographic processing. Please contact us if you are interested in learning how we can help you with soft lithography.

Nanofabrication Center at the University of Minnesota

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Steve Campbell, Director
Greg Cibuzar, Lab Manager

Safety Training

NFC is offering safety training for new users twice each month. On the first Thursday of every month, the training sessions begin at 1:00PM, and on the third Thursday of the month sessions begin at 10:00AM. The training includes watching our safety video and taking a brief quiz. Also, a NFC staff member provides a tour showing some of the safety related equipment and the gowning process used for the NFC cleanroom. Finally, there is training on using the Coral lab software. The safety training takes about two hours to complete, and must be done before users will be granted access to NFC facilities.

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Contact: Becky von Dissen at vondi001@umn.edu or 612-625-3069

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Center for Nanostructure Applications

The primary mission of the Center for Nanostructure Applications is to seed interdisciplinary nano research projects that will go on to attract external support. Active nanostructures include applications of nano as diverse as energy conservation and production, large area displays and lighting, printed electronics, smart fabrics, electronic noses, drug delivery, cancer therapy, and new types of medical imaging.

These applications often require significant participation across traditional disciplines and the Center is designed to foster the cross-disciplinary research necessary to bolster the nano applications area at the University.

The Center also organizes workshops, speaker series, and short courses, as well as serving as a focal point for nano at the University.

For more information, visit http://www.nano.umn.edu/

The National Nanotechnology Infrastructure Network

The National Nanotechnology Infrastructure Network (NNIN) is an integrated networked partnership of user facilities, supported by the National Science Foundation, serving the needs of nanoscale science, engineering and technology. The mission of the NNIN is to enable rapid advancements at the nano-scale by efficient access to nanotechnology infrastructure. The NNIN supports the Nanofabrication Center at the University of Minnesota. As a node in NSF's National Nanotechnology Infrastructure Network (NNIN), the NFC provides access to advanced multi-user facilities to both industry and academic researchers, the latter at a subsidized rate.

For more information, visit www.nnin.org