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University of Minnesota
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Nanotechnology News from the University of Minnesota

Fall 2011

Governor Dayton and Legislature Approve the New Physics and Nanotechnology Building

As you may already know, Governor Dayton and the State Legislature approved funding for the new Experimental Physics and Nanotechnology Building as part of a capital investment bill this summer. Construction on the new building is expected to begin in November 2011. We expect to move in late in 2013. The building will include a new clean room, office area, and lab space for the Nanofabrication Center that will greatly improve our ability to serve our users. We would like to thank the University leaders, business community leaders and many legislators, who worked to make this building possible.

The new clean room will be somewhat different that the current facility. The figure shows a similar clean room. It is taken from a non-clean or chase location. This type of facility begins with a large two-story shell in the building. The clean room bays are placed in the space with all of the clean room support equipment easy to access and reconfigure. The bays do not extend the full length of space, leaving a non-clean corridor (see figure).The yellow ladder in the figure allows NFC staff to walk on top of the bay to perform maintenance. Not only does this allow the use of lower cost pre-manufactured clean room components that are simply assembled on site, it is a facility that will be easy to facilitate for new equipment and reconfigure as needs change.

The new facility will include five bays, one of which will be dedicated to nanobio applications. We have begun the process of raising money to equip the new lab. We look forward to working with all of our users during the planning and construction process to try to meet everybody's needs.

7th Annual Minnesota Nanotechnology Workshop

REGISTER NOW! The 7th Annual Nanotechnology Workshop is November 15-16, 2011. Topics will include Nano-scale Materials for Next Generation Application, Nano Energy, Nano Medicine and Photonic Sensors. Facility tours as well as introductory short courses will be offered at both the Nanofabrication Center and Characterization Facility. And 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. Visit www.nano.umn.edu/workshop2011 for details and information on registering. 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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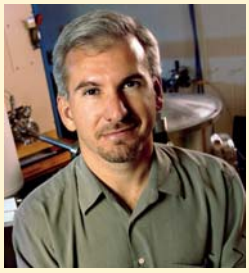
Characterization Facility News

CharFac Director's Message



CharFac Director, Greg Haugstad

CharFac staffing changes are foremost in the news this fall. In July Drs. Ozan Ugurlu and Jinping Dong finished their time with us as CharFac staff members. We thank them for their tireless efforts benefitting CharFac users and faculty research programs. Ozan has joined FEI, an electron microscopy company, and Jinping has taken a position at Cargill; we wish both the best in their new endeavors. We are excited to welcome postdoctoral associate Jason Myers, who is responsible for transmission electron microscopy in our Shepherd Labs site, including advanced methods. Recently finishing his Ph.D. work in materials chemistry at the University of Minnesota under Prof. Lee Penn, Jason's doctoral studies focused on cobalt oxyhydroxide nanoparticles including such issues as surface reactivity and ligand-assisted dissolution.

With the exodus of Jinping, staff member Dr. Bing Luo's emphasis has evolved to include vibrational spectroscopies (Raman/FTIR) as well as microcontact angle analysis, in addition to his continuing work with electron spectroscopies (XPS/Auger). This provides very good complementarity in chemical analysis of materials, both near-surface (XPS) and over 3D volumes (confocal Raman microscopy). Bing *(continued, top right)*

CharFac at the University of Minnesota

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Greg Haugstad, Director

continues to be active in materials research including both analytical and synthetic work.

Given the earlier departure of Maria Torija, at this writing the CharFac is expecting to add two more technical staff members: 1) a shared postdoc with expertise in small-angle X-ray scattering as well as scanning electron and probe microscopies (SEM/SPM). The technical focus of this position will include cryo-SEM and soft materials research. 2) a BS-level staff member active in X-ray diffraction and other miscellaneous techniques, and serving in a technician/troubleshooting/safety role across the CharFac's Shepherd Labs site.

Administrative staffing changes are also news. We welcome Joel Overlander, who has taken on duties in financial and human resources administration. Joel has a longer history with the University of Minnesota, having held a financial management role in the Chemistry department before a more recent stint at the Veterans Administration. Please direct general administrative inquiries to Joel. Alice Ressler's meta-role now emphasizes external client relations and marketing as well as cross-staff coordination; she is additionally active in technical work at our Hasselmo site, primarily in biospecimen prep. Greg Haugstad remains the principal contact for policy issues, general technical inquiries (cross technique) and research collaboration. All staff contact information is available at www.charfac.umn.edu/staff.

Postdoc Associate Jason Myers, Transmission Electron Microscopy.

Joel Overlander, Financial and Human Resources Administration at CharFac.

We are pleased to report that Prof. Andre Mkhoyan's I3 proposal was selected for funding. With considerable matching funds from the CSE dean's office, this will enable the installation of a next-generation, aberration-corrected transmission electron microscope. The system will be ready for usage within a one-year time frame. A new 2D X-ray microdiffractometer will be available soon; check our home page for further details.

Nanofabrication Center News

NFC Director's Message

NFC Director, Steve Campbell

NFC participated in the I3 competition sponsored by the Office for the Vice President for Research. I3 provided capital equipment to multi-user core labs that serve the University in one of three focus areas. I am pleased to report the NFC was awarded funds to buy a new mask writer. The company that built the current system has gone out of business and so parts and service range from scarce to nonexistent. We have begun the process of acquiring a new Heidelberg 200 laser writer. Heidelberg is the dominant supplier of these tools; virtually every school with a functioning facility has one. We expect the system to be faster, have higher resolution (down to 600 nm), and write much smoother and more sharply defined features, including curves and circles, than the current system. In addition to making masks, it can also write directly on wafers without a mask. It is also capable of 3D lithography. Finally, the user interface is far friendlier than our current tool. We hope to be able to allow experienced users to run the tool themselves, reducing mask costs. We expect the system to be delivered in early 2012.

Focused Ion Beam Technology

The Quanta 200 3D is a Dual Beam (FIB/ SEM) system with a tungsten electron column which can be used to section, image and analyze a wide range of conducting and non-conducting samples. FIB systems are similar to scanning electron microscopes (SEM) except that gallium ions are used instead of electrons. The gallium beam can be focused down to a very small spot (10nm size at 30KV acceleration voltage) and can be scanned across the sample. The large mass difference between Ga ions and electrons causes an effect that is not seen in SEMs, namely material removal. Another name for this removal process is ion milling, and whenever the Ga beam is contacting the surface, some surface material is being removed. By focusing the Ga beam to desired areas, controlled removal of material can be accomplished, resulting in the formation of structures with dimensions in the range of nanometers. The process is purely physical, meaning that no chemical effects are involved, so any material can be milled using the Ga beam. In addition to the milling process, introducing an organic-metallic compound containing Pt near the Ga beam impingement site leads to the controlled deposition of Pt metal. The Pt metal will contain some organic residue, and thus is not as conductive as pure Pt. However, the ability to selectively deposit Pt in areas as small as 50nm is a useful feature for nanofabrication. Common uses for FIB technology include TEM sample preparation, device cross-sectioning for failure analysis, and selective deposition of small Pt conducting lines.

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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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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