University of Minnesota

nanoTECHNOLOGY news

from the University of Minnesota

Fall 2020

NNCI and AccelNet Awards

Welcome back to Fall Semester. The Nano Center enjoyed three major successes over the summer. We will discuss two in this section and the third later in the newsletter. The first was the renewal of the support of the National Science Foundation (NSF) through its National Nanotechnology Coordinated Infrastructure (NNCI) program. MNC will continue to work with other leading universities such as Stanford, Cornell, and Harvard. According to Dr. Dawn Tilbury, Assistant Director for the Directorate for Engineering at the NSF, NNCI will "help scientists and engineers in diverse fields solve challenging convergent research problem. Research and education through NNCI will continue to yield nanotechnology innovations -- from interconnects for quantum systems to high-resolution imaging to brain-implanted sensors -- that bring economic and societal benefits to us all."

In an era of flat budgets at NSF, the Minnesota node, MiNIC (Midwest Nano Infrastructure Corridor) was able to secure a significant increase in funding and bring the Characterization Facility into the node. Support from NSF will allow us to recruit more users and therefore keep the usage cost as low as possible. The $5,000,000 renewal covers the period from September 2020 to August 2025 and includes research Focus Areas on Quantum Information Sciences and Bio-Nano. The Principle Investigator for the award is Stephen Campbell (ECE). Co-Investigators are Steven Koester (ECE) and Theresa Reineke (Chemistry).

The second major success was an NSF award funded through the Accelerating Research through International Network-to-Network Collaborations (AccelNet) program. The award, entitled "Global Quantum Leap (GQL)," will create a strategic alliance between the NNCI and international networks working on quantum information sciences. Initial partners include networks in the US, Japan and Europe. By linking these networks, the GQL will lay the foundation to fundamentally influence the overall trajectory for quantum manufacturing and help to build a globally-aware workforce. The PI on the program is Steven Koester (ECE), and co-PIs include Vlad Pribiag (Physics) as well as partners at the University of Chicago, Cornell, and Georgia Tech. The $2,000,000 / 5 year program will fund networking activities such as educational bootcamps, workshops, and student exchanges.

ACKNOWLEDGEMENT REMINDER

If your work uses the Minnesota Nano Center, please add the following in the acknowledgements section of any publications: "Portions of this work were conducted in the Minnesota Nano Center, which is supported by the National Science Foundation through the National Nanotechnology Coordinated Infrastructure (NNCI), under Award Number ECCS-2025124."

Nanotechnology News from the University of Minnesota is published by the University of Minnesota's Nano Center and made possible by:

National Nanotechnology Coordinated Infrastructure

characterization FACILITY news

CharFac Director,
Greg Haugstad

This issue reports on the state of activity in the CharFac as of late summer. Since reopening to users in late May, some 180 individuals have completed access requirements. In July-August the number of monthly users averaged 113, which is 74% of the averages in January-February (pre-covid closure) but only 54% of the averages in July-August 2019 (summer being a busy time of year for researchers in normal times).

Almost all of CharFac's instruments are not subject to restricted usage, reflecting the fact that many are isolated in dedicated labs or share space in large rooms providing substantial distance between operators and under good ventilation. Two pairs of physically adjacent AFMs (in Hasselmo and Shepherd) and three pairs of adjacent XRDs (Shepherd) are not allowed to be used pairwise at the same time. The second AFM per pair is mostly backup with redundant capabilities. The XRD pair schedules are effectively managed by the staff such that reduced available hours have not been an issue.

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Greg Haugstad, Director

Please feel free to contact me or any of the lab managers if you have concerns about distancing or any other safety/health issue. We are eager to accommodate more users.

Training of new users re-started in early July on select instruments. We have implemented remote training via Zoom and webcam (where amenable to equipment and software), supplemented by short stints of in-person instruction under physical distancing, and expanded total time covered by fixed training fees. But in other cases, a need for lengthy periods of side-by-side instruction impedes the training of new users; in particular, many electron microscopes (EM) are currently open only to previously trained users. As such, staff members have been performing analytical work for some user projects (in various labs, not only EM); most are able to handle further work. Please consider engaging staff scientists as an (even superior) option to in-person training, even in the absence of pandemic.

Another obvious option is to engage one's colleagues. Indeed, trained group members performing analytical work for untrained groupmates may be the best option in some cases. If nevertheless seeking introductory training, please discuss with individual instrument managers to help assess what options are possible and what actions may be enabling. Common sense should dictate that the more one knows about a method before arriving to the lab – whether fundamentals one can learn on the web or in library books, or practical info one can glean from one's colleagues (perhaps aided by photos/movies from their sessions) or from downloadable operating procedures and installable data processing software – the less in-person instruction will be needed. Now is not the time to seek comprehensive, "blank slate" instruction and face-to-face/side-by-side interpersonal interaction for multi-hour sessions.

In summary we are capable and eager to serve many more users than we have this past summer, and have avenues available to do so.

MINNESOTA nano CENTER news

MNC Director,
Stephen Campbell

In addition to the NNCI and AccelNet awards, the Nano Center successfully competed for an award in the Research Infrastructure Investment competition sponsored by the Office of the Vice President for Research. This award will allow the Center to purchase an ultrahigh vacuum thin film deposition system. With a base vacuum below 10^{-9} torr, the system will allow users to sputter (six sources) or evaporate (six sources) extremely pure thin films. The system will also have a low energy ion gun so that users can clean the surface of their sample *in-situ* prior to deposition. The system is targeted for the Quantum Information Science research, but will be of interest to a wide variety of users that need these unique capabilities. We are currently in the acquisition phase. We expect that the system will become available to users in the summer of 2021.

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Steve Campbell, Director
Greg Cibuzar, Lab Manager

New Nanoparticle Analyzer

The Nano Center has acquired a new system to measure the size distribution and electrostatic properties of nanoparticles. The Malvern Zetasizer Nano is an industry-standard analyzer based on dynamic light scattering (DLS) technology. As such, the Zetasizer complements our existing Microtrac Flex DLS system and provides size measurements for particles in the 3 nanometers to 6 micrometers range. The Zetasizer is also a platform for measuring nanoparticle zeta potential, the electrostatic charge that develops on the surfaces of particles immersed in a liquid. For both size and zeta potential measurement, the Zetasizer is well suited to analyzing very small analyte volumes (as little as 25 microliters), which can be important for working with novel, expensive, or difficult to synthesize samples. If you are interested in learning more about the Zetasizer, please contact Jim Marti in the Nanomaterials Lab (jmarti@umn.edu).

MNC COVID-19 Operations

MNC cleanrooms and labs are open for research by both UM researchers as well as others from outside the university. However, there have been significant modifications to our operating procedures and safety policies due to the COVID-19 pandemic. The changes we have implemented are based on guidance from several sources, including the Minnesota Department of Health, the Centers for Disease Control, and the University of Minnesota's Sunrise Plan.

The change impacting operations the most is the physical distancing requirement. This limits the concurrent number of researchers in all spaces. We have not yet seen these limits significantly impact research, but as more people return to campus and restart their use of MNC facilities, this will be closely monitored. Other changes involve the required use of face coverings in all UM buildings and labs, changes to equipment training and new user orientation sessions, and open hours are 7AM to 10PM daily, closed overnight.

We welcome returning and new researchers to contact us at mnc@umn.edu with any questions, and look forward to working with them in the future.

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Minnesota Nano Center and the National Nanotechnology Coordinated Infrastructure

The MNC is a state-of-the-art facility for interdisciplinary research in nanoscience and applied nanotechnology. The Center offers a comprehensive set of tools to help researchers develop new micro- and nanoscale devices, such as integrated circuits, advanced sensors, microelectromechanical systems (MEMS), and microfluidic systems. The MNC is also equipped to support nanotechnology research that spans many science and engineering fields, allowing advances in areas as diverse as cell biology, high performance materials, and biomedical device engineering.

In September 2015, the National Science Foundation funded the National Nanotechnology Coordinated Infrastructure (NNCI). MNC is part of this initiative, along with our partner facility at North Dakota State University. The NNCI aims to advance research in nanoscale science, engineering and technology by enabling NNCI sites to provide researchers from academia, small and large companies, and government with access to university user facilities with leading-edge fabrication and characterization tools, instrumentation, and expertise within all disciplines of nanoscale science, engineering and technology. The NNCI framework builds on the National Nanotechnology Infrastructure Network (NNIN), which enabled major discoveries, innovations, and contributions to education and commerce for more than 10 years.

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Published by the University of Minnesota's Nano Center.
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