University of Minnesota

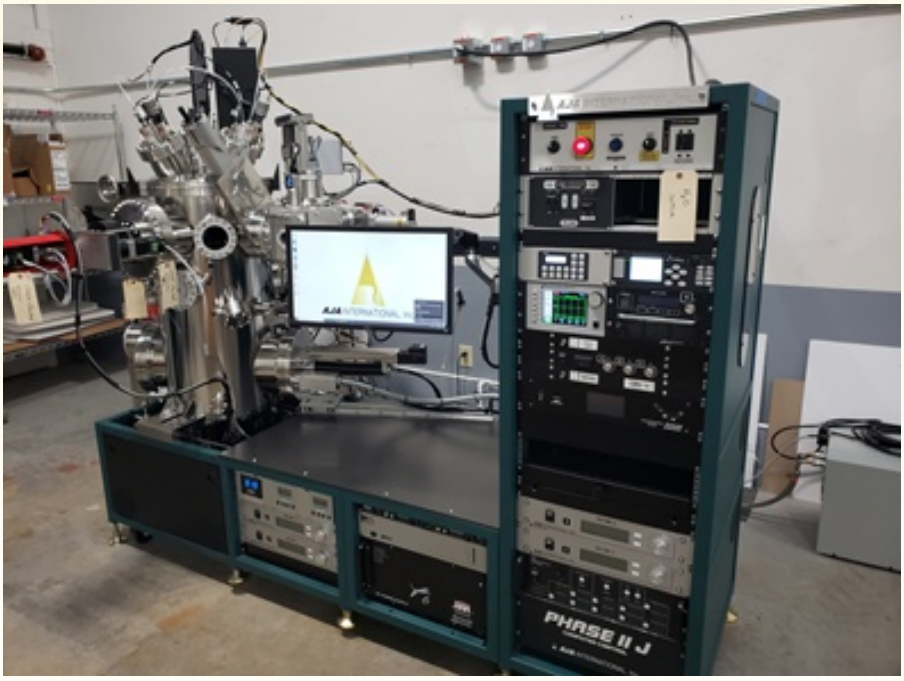
nanoTECHNOLOGY news

from the University of Minnesota

Summer 2021

New AJA Ultrahigh Vacuum Deposition System at the Minnesota Nano Center

The Nano Center is pleased to announce that its new ultrahigh vacuum deposition system will be shipped in late June. The system, made by AJA, is expected to have a base vacuum close to 1e-10 Torr. Samples can be moved through an arc to access multiple stations. One station is exposed to five confocal sputter guns that will use the same 3" targets as AJA 1 and AJA 2. A second station exposes the substrate to a six pocket evaporator. The system also has a high-rate sputter station for extremely high purity deposition. Finally, it has an ion mill station capable of being operated at a few tens of Volts for very gentle cleaning of a surface prior to deposition or between deposition steps, wth a SIMS system for endpoint detection. We expect the machine to be available for users near the end of the summer.



UHV AJA system in final factory checkout.

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, Award Number ECCS-2025124."

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National Nanotechnology Coordinated Infrastructure

characterization FACILITY news

CharFac Director,
Greg Haugstad

We are overdue to report on some outreach/marketing developments. As stated on our home page and mentioned in the Fall 2020 edition of this newsletter, CharFac is now partnered with MNC to receive 5-year funding from the NSF NNCI (National Nanotechnology Coordinated Infrastructure) program. This funding defrays partial staffing costs in support of nine instrumentation systems (in two sites): JOEL 6500 SEM; FEI Titan and F30 TEMs; Bruker D8 Discover micro/2D-XRD; Phi Versaprobe III XPS/UPS; and four AFMs, the Keysight 5500's (2) and Bruker Icon and NanoIR3. (The list will expand to include other systems in the second year of the grant.) Under NSF-NNCI funding, **external academic users may access these capabilities at internal-to-UMinn charging rates** for both instrument and staff time. In 2004-9 the CharFac was similarly supported by the NSF-NNIN program and thereby saw marked growth in its external academic usership. The intervening decade saw an erosion of this usership; thus we hope to get back up to, even exceed, the level of external usership at the end of NNIN support. Please feel free to mention this opportunity for reduced charge rates to collaborators at US academic institutions.

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Greg Haugstad, Director

The other part of the preceding development is Explore Nano, our recent solicitation of proposals for external academic users to tap into the CharFac via credited funding (award number ECCS-2025124). Awardees can receive up to $2,000 of training and facilities use. Participants (i) must not have used CharFac since June 2019 and (ii) plan to continue CharFac usage beyond the award period. We have now reached the end of the call for proposals and have begun to discuss projects. (The intention is to repeat this program in the second year of NNCI funding.)

In staffing news, we are sad to report the exodus of Dr. Jason Myers, our lead analytical/high-res TEM expert. As all who have worked with Jason over his past 10 years in CharFac know, he is a multi-talented researcher on top of being a wonderful colleague and teacher. We wish him the best as he heads down a new career path. At this writing CharFac is in the process of seeking a permanent replacement.

In equipment news, our Bruker NanoIR3 AFM-IR system has been upgraded to enable the control of (i) polarization state of the irradiating IR laser and (ii) sample environment (humidity programmatically variable from 15-85%), as funded by our MRSEC. It is also being moved into a shared room (1-214 Hasselmo) with our two Keysight environmental AFMs (which feature controlled humidity, sample heating/cooling, and robust liquid cells). The vacated space in 1-206 is part of a major renovation to accommodate a Thermo Fisher Scientific Talos F200C TEM, which is being installed late this summer (a cryo TEM further capable of *in situ* plasma-grown nanoparticle research as described in our last newsletter). These developments continue to build CharFac-Hasselmo's emphasis on nanoscale spectroscopic imaging and environmental/cryo/*in situ* methods.

MINNESOTA nano CENTER news

MNC Director,
Stephen Campbell

This newsletter marks my final column. As of July 1st, I will no longer be the Director of MNC. It is a time to look back and remember. When I began this experience, Bill Clinton was President. The organization that became MNC served about a quarter of the users that it does now. In the lithography area, we had no stepper or e-beam lithography and only rudimentary mask making. For thin film deposition we mostly relied on evaporation since our sputtering system was archaic, and we had no ALD capability. The etchers were a mixed bag with several being mostly unusable. We had no high-density plasma systems of any kind. The furnaces ran on 9" floppy drives and the lab ran on homebrew software.

We have come a very long way. MNC is now one of the best university-based nano facilities in the world and is an influential member of the NSF-sponsored National Nanotechnology Coordinated Infrastructure (www.NNCI.net). These changes are a result of outstanding support from the Deans of our College and the Vice Presidents for Research of our University. It is also a result of tremendously creative and innovative faculty and researchers that have made the most of MNC's capabilities to win hundreds of grants and awards. Mostly, it is a result of the MNC staff who did not view their position as just a job, but a commitment to our user community. I have been very honored to work with them. Under the new leadership of Professor Steven Koester, I am certain that the best is yet to come. My best wishes to all of the MNC family.

Steve

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Steve Campbell, Director
Greg Cibuzar, Lab Manager

MNC New Silicon Deep Etch Capability

Back in November 2019 MNC lost our deep silicon etch capability when our 20+ year old Plasmatherm etch tool finally died. The process of replacing this capability was significantly affected by the COVID-19 issues, but now we have good news. Earlier this spring MNC finished the installation and startup of our new Rapier etcher from SPTS Technologies. This new tool is a state-of-the-art etch system for high aspect ratio etching of silicon, and is capable of high etch rates (>15 microns/min) as well as high-aspect-ratios. The etch selectivity to photoresist is very good, allowing resist to be used for masking for most applications. Our tool is set up for 100-mm silicon substrates, but smaller pieces can be done as well if bonded to a carrier wafer. The etcher is located in bay 1 of the PAN cleanroom and is ready for researchers (both local and remote). Contact us at mnc@umn.edu if you have any questions or are interested in using the etcher.

MNC has hired a new process staff member to support lab operations. Emma Jore, who has been a student staff worker for MNC over the past 2 years, graduated in May with a degree in Chemistry, and was hired in mid-May. Emma will be working in the photolithography and ALD technical areas. She will be doing equipment training as well as process development and characterization.

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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.

The CharFac is a three-site set of labs that provide instrumentation, education, services and collaboration in the characterization of engineering, earth and biological materials. Its analytical capabilities include microscopy via electron beams, force probes and visible light; elemental and chemical imaging including depth profiling; elemental, chemical and mass spectrometry; atomic and molecular structure analysis via X-ray, ion or electron scattering; nanomechanical and nanotribological probes; and other tools for surface and thin-film metrology. It is staffed entirely by experts in these characterization methods.

MNC and CharFac are part of the National Science Foundation's National Nanotechnology Coordinated Infrastructure (NNCI). 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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Contact: Becky von Dissen at vondi001@umn.edu or 612-625-3069

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