SPRING ISSUE 2020

VINSE NEWSLETTER

Spring Issue Index

SAVE THE DATE

NOVEMBER 20TH

21ST ANNUAL NANODAY!

VINSE

A Note from the Director

On behalf of all the VINSE staff, I hope everyone is doing well during these extraordinary times. While the VINSE core facilities are currently closed, the VINSE staff remain available to discuss current and future research projects. The VINSE pilot funding initiative is ongoing and we encourage you to apply for pilot funding if appropriate to help launch the new ideas you may be considering while working from home. Pilot funding will continue throughout FY21. More details on pilot funding and highlights from current pilot projects can be found on page 2. VINSE short courses on Microfluidics and TEM have been postponed from early June to late August. Please check out the descriptions of the short courses on page 3 and send an email to vinse@vanderbilt.edu if you are interested in participating. We will finalize dates for the short courses in the coming weeks in consultation with those who express an interest in participating. Please know that VINSE is still here to support you in whatever capacity we can. Stay safe.

Sharon Weiss

Pilot Funding

VINSE IS CURRENTLY ACCEPTING PILOT FUNDING APPLICATIONS

While VINSE facilities are closed, we are continuing to review and award pilot funding during this time. The award start dates will be set once our facilities reopen. Please contact our technical staff to discuss project ideas and capabilities. Visit the VINSE website for more details and to apply for this funding (https://www.vanderbilt.edu/vinse/pilot-funds.php).

VINSE pilot funding initiative WILL continue in FY21

The VINSE pilot funding initiative will continue in FY21. Since the September 2019 launch of pilot funding, VINSE has awarded over $10,000 to eleven research groups spanning a wide range of research in the School of Engineering, College of Arts and Science, School of Medicine, and VUMC. A full list of funded projects can be found on the VINSE website.

Pilot funding is available on a competitive basis to provide Vanderbilt investigators the opportunity to utilize VINSE tools to obtain preliminary results for new research initiatives prior to submitting grant applications. Applications from users interested in demonstrating the feasibility of a new process or measurement are encouraged, and all necessary staff support will be provided. Typical awards range from $500 to $2000 for up to 6 months with all funds dedicated to VINSE user fees. Proposals will be judged based on scientific merit, likelihood for success, and the potential impact VINSE will have on the project. The number of awarded projects is subject to the availability of funds. Proposals are accepted throughout the year and are reviewed at the end of each month.

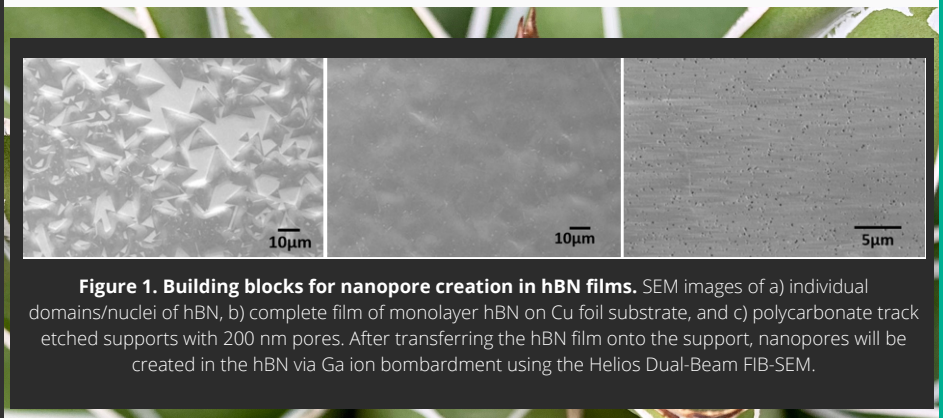


Figure 1. Building blocks for nanopore creation in hBN films. SEM images of a) individual domains/nuclei of hBN, b) complete film of monolayer hBN on Cu foil substrate, and c) polycarbonate track etched supports with 200 nm pores. After transferring the hBN film onto the support, nanopores will be created in the hBN via Ga ion bombardment using the Helios Dual-Beam FIB-SEM.

Figure 2. Sub-30 nm holes fabricated by focused ion beam milling. SEM image of series of single pixel holes (<30 nm in size) milled into an evaporated gold surface using the Helios Dual-Beam FIB-SEM.

Pilot Project Highlights

Kidambi Group

Nanopore Creation in Atomically Thin Ceramic Membranes using Ga Ion Bombardment

The goal of this pilot is to create nonporous atomically thin hexagonal boron-nitride (h-BN) membranes for molecular separations. Monolayer h-BN synthesized via chemical vapor deposition on Cu foil is initially transferred onto polycarbonate supports with ~200nm pores. Subsequently, Ga ion bombardment is used to introduce nanopores in the h-BN film using the Helios Dual-Beam FIB-SEM in the VINSE Advanced Imaging core. (Fig. 1)

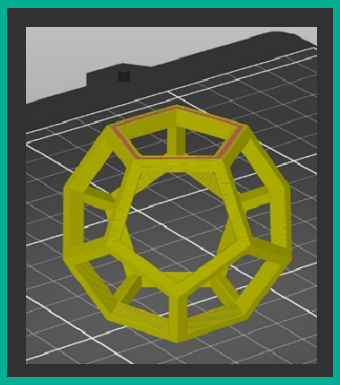
Caldwell Group

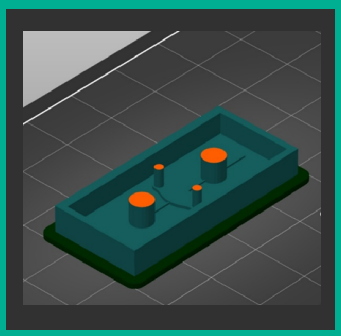
Extreme Sub-diffraction Imaging and Nanophotonics using Focused Ion Beam Milling

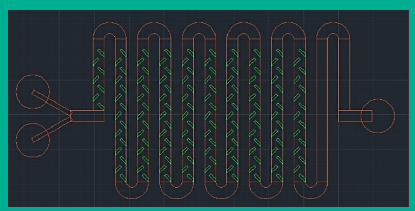
The goal of this pilot project is to fabricate nanoscale patterns to test the resolution and material sensitivity of hBN hyperlenses. Processes are being developed to achieve ultra-high-resolution patterning using the Helios Dual-Beam FIB-SEM in the VINSE Advanced Imaging core. To date, sub-30nm holes have been milled in different substrates (Fig. 2). Near-field microscopy will be used to image these patterns after hBN flakes are transferred onto the milled substrates.

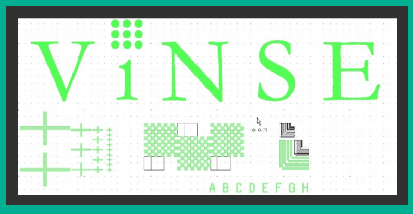
CAD & Printing Services

Need to design a pattern, photomask or 3D object? VINSE has CAD software to assist you. The design PC in pre-gown has AutoCAD and L-Edit available and is free to use for VINSE facility users. Additionally, VINSE has information and tutorials available for photomask design using these software. 3D design tutorials will be available in the summer 2020. Once your design is complete, contact VINSE to have your photomask printed using our Bungard Filmstar Photoplotter or Heidelberg uPG101 Laser Writer. 3D designs can be printed using our Prusa SL1 or Prusa i3 MK3s 3D printers.









Short Courses

Microfluidic Device Fabrication

Microfluidic devices can enable "labs on chips" that consume less reagents and have faster analysis times than similar experiments performed in a traditional lab environment. Applications of microfluidic devices include portable sensors for point-of-care analysis, molecular and cell biology studies, and high-throughput, multiplexed assays. This short course will introduce the techniques behind the fabrication of microfluidic devices. It will be structured to assume no prior knowledge of the technologies by the participants. It will include an overview of microfabrication and microfluidics, photolithography, soft lithography, polymers, microfluidic device design, and microfluidic device applications. Students will fabricate a PDMS-glass microfluidic device inside the VINSE cleanroom with sessions broken down into SU-8 mold fabrication, PDMS mixing and pouring, and device cutting, bonding and testing.

Cost
$150 Vanderbilt Users; $150 External Academic and Non-Profit Users; $600 Industry and For-Profit Users

Transmission and Scanning Transmission Electron Microscopy (TEM/STEM) for Material Science

Transmission electron microscopy is an invaluable technique used to characterize materials at the nanoscale. Beyond lattice imaging, the modern TEM is capable of chemical imaging, 3D reconstructions and performing a variety of in situ experiments. While the day-to-day operation of the TEM has become far more accessible, it is necessary to possess a sound understanding of the mechanisms behind image formation and how to best utilize the microscope to solve material science problems. This short course will blend accessible lectures with hands-on experience operating the Tecnai Osiris advanced analytical TEM/STEM. After completing this course, users will know how to correctly acquire and interpret bright field and dark field images as well as how to collect diffraction patterns. Further, participants will learn how to access the STEM mode of the Osiris to collect and quantify STEM-EDS maps.

Cost
$75 Vanderbilt Users; $75 External Academic and Non-Profit Users; $200 Industry and For-Profit Users

Who to Contact

Sarah Ross, Program Manager
Budgets, IMS Graduate Program, Reporting, External Partnerships, Website

Alisha McCord, Program Coordinator
Events, REU, Colloquium, Guest Travel, Publicity/Social Media, Purchasing

Kurt Heinrich, Alice Leach & Bill Martinez
Cleanroom

Dmitry Koktysh
Analytical Lab, Bruker AFM, Merlin SEM

James McBride
Helios FIB SEM, Osiris S/TEM

VINSE Leadership
Sharon Weiss, Director; Jason Valentine, Deputy Director