The University of Western Ontario

NANOWESTERN

Western

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For More Information Visit Our Website
www.uwo.ca/fab

- Examples of work
- Contact Information
- Facilities Information
- How to become a NanoUser.
- Find out about services provided

To Become a NanoUser

1. Fill in User Agreement Form on website or in print, and return to Nancy Bell or Rick Glew.
2. Contact Rick Glew for the Nanofab Orientation, an introductory tour, training and project discussion.
3. Receive your keycard and access

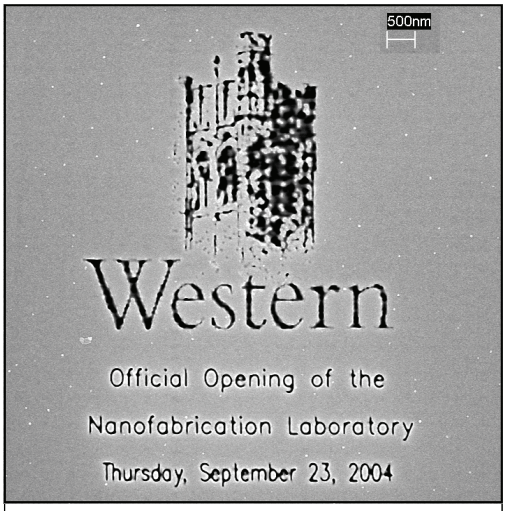
WHAT IS HAPPENING IN THE LAND OF THE SMALL...

It is a pleasure to use this first newsletter, *NANOWESTERN,* as a way to welcome you to the University of Western Ontario's Nanofabrication Laboratory.

Nanoscience is an area of scientific and engineering enquiry that is being pursued vigorously worldwide. It is fuelled by a buoyant optimism that many important new technologies will emerge that exploit the unusual behaviour of material structures at deep submicron length scale, with broad benefit in areas such as information technology, medical and health sciences, materials processing, environmental protection, etc. No less of a driving force has been the emergence of state-of-the-art instruments for synthesizing, patterning, functionalizing, and characterizing these nanoscopic structures. And finally, it is an area of fascination for many physicists, chemists and engineers and their students.

It should be no surprise that a key decision was taken at Western to make a major launch into nanoscience and nanotechnology research. It has done this through the construction of a new facility, Western's Nanofabrication Laboratory (Nanofab), a fully serviced 2300 square foot cleanroom, and installed in it a suite of state-of-the-art instruments to support basic and applied research in this specialized materials area. At the same time, it has engaged a dedicated team – a research scientist, a lab manager and a lab technician – to support the work of investigators. And it has used new hiring opportunities such as the Canada Research Chair program to bring new expertise into the research talent pool on campus.

Today, the Nanofab can respond to requests for advanced lithographies (optical, electron and ion beam) and a range of etching, coating and patterning capabilities. The central customer base is made up of academic researchers, with one of the most visible being the principal investigator group at Western from within the tri-university Ontario Photonics Consortium. As the name suggests, the OPC community has a particular interest in developing new possibilities for harnessing the behaviour of light in solids, especially at and in the near surface. Nanotechnology has a natural and powerful place in this 5-year, 45M$ project.



The Focused Ion Beam was used to "nano-engrave" this commemorative message for the official opening on September 23. The linewidth of the characters in the text is approximately 30 nanometers.

While the primary purpose of the Nanofab is to support the work of academic research work at Western and other campuses, there is flexibility to take up requests from the private sector. Contact names and user fee structures are displayed elsewhere in this letter.

We are determined to "grow" both the Nanofab and *NANOWESTERN* and therefore will be using the pages of this and subsequent newsletters to highlight research activity and accomplishment within its walls, to identify instrument capabilities and to advise upcoming events. We will also provide web links to other organizations, including the recently established Western Institute for Nanomaterials Science and the federally supported organization for linking the Nanocommunity in Canada, NSERC's NanoInnovation Platform.

We want this newsletter to be a vehicle of two-way communication and therefore invite your comments and suggestions for making it and the Nanofab a more effective resource locally, provincially, and nationally.

Dr. Ian Mitchell
Laboratory Director

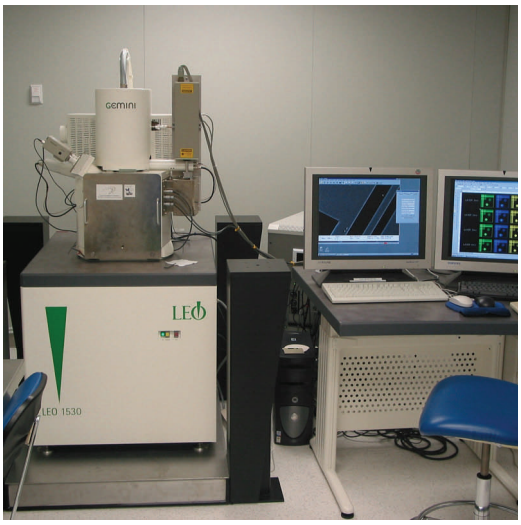
E-Beam Lithography In The Nanofabrication Laboratory

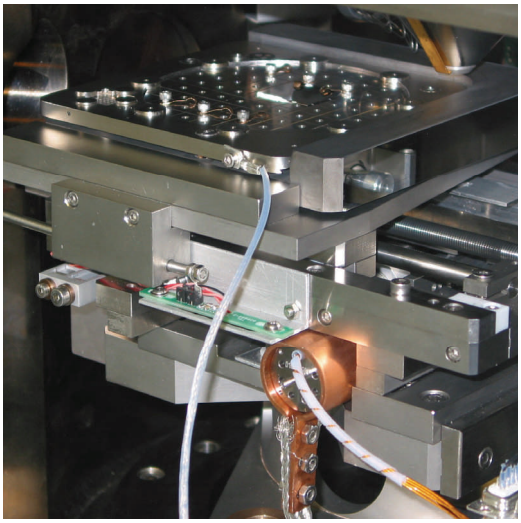
The e-beam lithography system (right) is a LEO 1530 field emission scanning electron microscope (FE-SEM) fitted with a laser interferometer controlled stage (middle right). The system accepts wafers or pieces up to 100mm diameter.

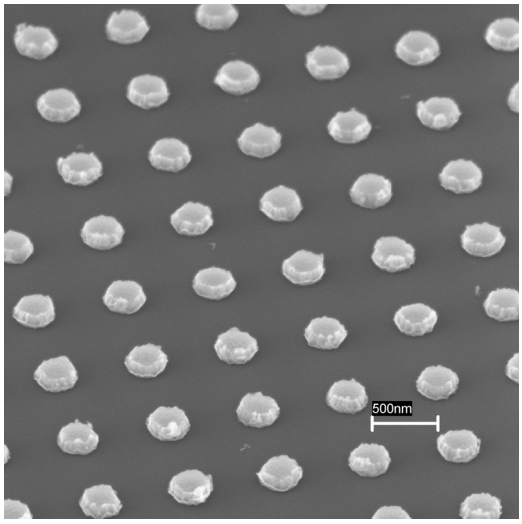
Interferometric measurements are used by the stage calibration route to optimize the placement, size and rotation of the writing field. The lithography process is controlled the NPGS system at speeds up to 5 MHz. Patterns are prepared as a DesignCad drawing and directly written onto PMMA resist coated samples. Writing current, determined by the choice of aperture, ranges from 10pA to 2.5nA.

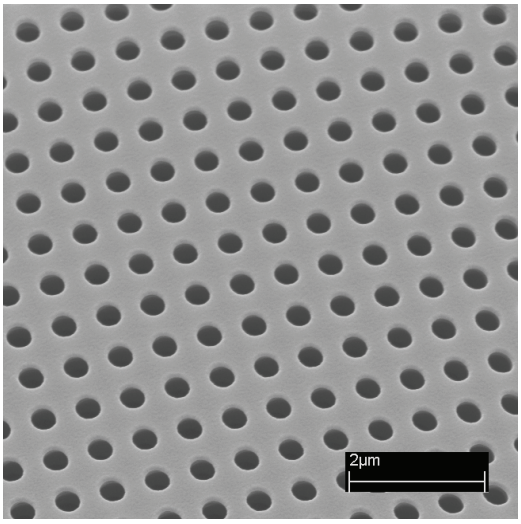
The micrograph (bottom right) shows a square array of 300nm holes on 700nm pitch written in PMMA on silicon. Sub-100nm features are achievable with this system.Also shown is an array of chrome dots on silicon patterned by e-beam lithography and lift-off (below).

The system is also available for user-operated SEM imaging. The microscope's intuitive software interface allows new users to achieve excellent results with minimal training.









The system is also available for user-operated SEM imaging.

Please contact Todd Simpson tsimpson@uwo.ca for further information, training, or scheduling

D.R Hay Prize Awarded to NanoUser Andrew Todd

The Donald R. Hay Prize is awarded each year to the student with the highest standing in the fourth year Honors Research Project. This year, of the 17 students in the course, Andrew Todd and Jamu Alford were selected to share the prize.

Andrew's project *Gold Decoration of Voids in Single Crystal Silicon* was based on research work in the Nanofabrication Laboratory.

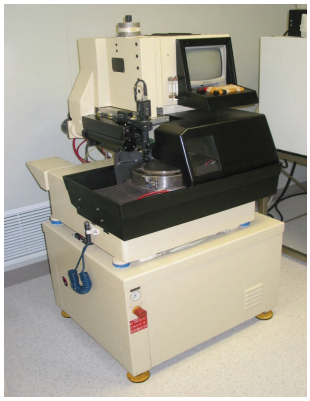
New addition: K&S 780 Dicing Saw

The Dicing saw is a back-end processing tool for cutting wafers into chips for further processing. We have purchased a reconditioned saw that had been previously used for dicing devices in a production environment.

The tool is an integrated semi-automatic computer controlled precision saw. It is menu driven, with a multi axis cutting stage with automatic indexing.

The saw employs an extremely thin diamond impregnated cutting wheel with water cooling. The two inch wheel is mounted on an air spindle which is driven speeds up to 30,000rpm.

The chuck accepts wafers up to six inch diameter and there is a video monitor for online inspection and alignment. The 780 is capable of cutting a wide variety of materials such as silicon, quartz, ferrite, metals, glass, ceramics and sapphire.



NanoUser Claire McCague wins Poster Prize in New Zealand

Post-Doc Claire McCague was the poster prize winner for her poster presentation at AMN-2, the 2nd International Conference on Advanced Materials and Nanotechnology. The conference was in Queenstown, New Zealand in February. The poster entitled "Microfabrication of Interfacial Force Microscope Sensor Components", featured work done in the Nanofabrication Laboratory.

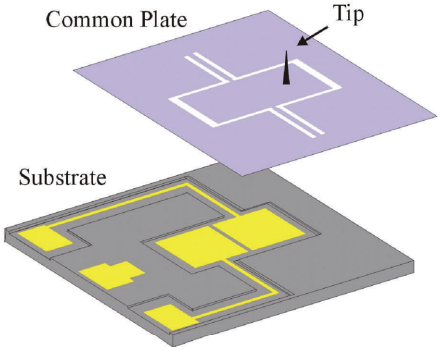
Interfacial force microscopy (IFM) is a scanning probe instrument combining high resolution imaging and quantitative nanomechanical property analysis.

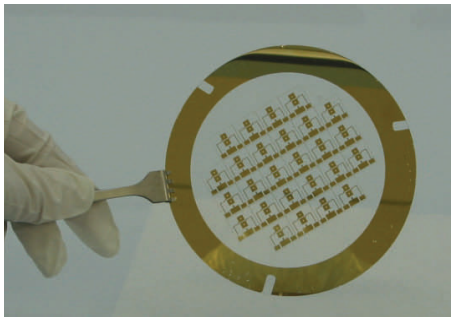
The IFM sensor, a 1cm x 1cm device fabricated from glass and silicon wafers in the Nanofabrication laboratory, is a teeter-totter structure of two parallel plate capacitors connected through an axis of rotation.

The glass substrates have recessed Au/Cr capacitor pads, electrical leads and bonding pads for electrical connections.

The common plate features a teeter-totter structure defined by cuts etched through 100μm thick Si (001) wafer.

To produce a functional sensor, the capacitor pads on the substrate and the teeter-totter structure of the common plate must be very closely aligned and have a gap of 4-13μm between them.





"With the addition of e-beam nanolithography and focused ion beam milling systems to the Nanofabrication facilities at the University of Western Ontario, our work has expanded from batch fabrication of needed components to the development and testing of new component designs. We seek to develop simple, efficient methods for sensor component fabrication and assembly to support our IFM operations and to explore further advances in sensor design."

Reproduced with permission from poster entitled "Microfabrication of Interfacial Force Microscope Sensor Components" by Claire McCague, D.J Munoz-Paniagua, L.L Coatsworth, P.R Norton.

"Our work has expanded from batch fabrication of needed components to the development and testing of new component designs."

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We're on the Web
www.uwo.ca/fab

Western Institute for Nanomaterials Science

NSERC CRSNG NanoIP/PIC

World Year of Physics 2005 — 2005 Année Mondiale de la PHYSIQUE

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How To Become a NanoUser

The Nanofabrication Laboratory is a state of the art "hands-on" facility in The Physics and Astronomy Building. It combines class 10,000 and class 100 cleanroom environments where the users are trained in cleanroom protocol, the use of the tools and performing various processes.

If you wish to become a NanoUser, visit the website www.uwo.ca/fab where you'll find forms and instructions.

To discuss your processing, material and project requirements contact Rick Glew, the Laboratory Manager.

Academic User Fee Schedule

1. Daily Access Fee - $25 per day, maximum $ 200/month
   -access (key card), gowning (gloves, wipes, frocks, shoe covers, caps), all analytical equipment not listed below, and basic laboratory chemicals and reagents (acetone, methanol, isopropyl, ethanol, nitric acid, hydrofluoric acid, DI water), available labware and dishwashing, waste containers and disposal
2. SEM and FIB - $50/hr SEM equipment charge
   -$25/hr FIB surcharge in addition to SEM charges
3. E-beam Lithography – $50/hr equipment charge
4. Alcatel DRIE – $50 setup fee, $2.50/minute of etch, $100 minimum charge
5. Confocal Microscopy- $35/hr
6. Metal Deposition (Standard metals)
   - Au/Pd -$10 per 100 second deposit
   -E-beam Evaporation (Au, Cr, Ti)- $50 per run, $200/micron for Au deposit
   -Sputter Deposition- $50 per run
7. Spin Coating –$20 per substrate, includes standard resists & developers
8. Operator Time – $50/hr. for SEM, FIB, Confocal Microscope, and other operator services
9. Oriel UV Source - $5 per hour

Laboratory Director Dr. Ian Mitchell honoured with Hellmuth

Physicist and Nanofabrication Laboratory Director Ian Mitchell, has been awarded the ninth annual Hellmuth Prize for Achievement in Research.

"The Hellmuth Prize is the University's most prestigious award for research and is recognized as such across the country" says Vice-President (Research) Ted Hewitt in announcing the 2005 recipients.

"The Hellmuth is Western's premier award for research achievement and I'm delighted to be chosen for this honour," says Dr. Mitchell.

"The recognition is surely as much for the many people who have made my research work possible. Materials science research thrives in a collaborative environment. It also needs continual renewal of the supporting infrastructure; something that Western has been willing to do all the way. For me that has been critical."

Dr. Mitchell received his B.Sc. Honors in Physics from the University of Adelaide in 1959 and his Ph.D. in Nuclear Physics in 1964. In 1986, Dr. Mitchell came to University of Western Ontario when he accepted a NSERC Senior Industrial Research Chair. He is Co-Director of Interface Science Western, Interim Director for the Nanofabrication Laboratory and lead investigator for the UWO node of the Ontario Photonics Consortium. His work has resulted in more than 200 journal publications.

The Hellmuth Prize is named in honour of Bishop Issac Hellmuth, founder of the University of Western Ontario. The Prizes for Achievement in Research provide a way for all members of the Western community to appreciate and celebrate research achievement of our most distinguished faculty members. There are two Hellmuth Prizes awarded annually, one in the area broadly defined as the natural sciences and engineering and one in the social sciences and humanities.

Dr. Richard Vernon, a political scientist, was the recipient of the Hellmuth Prize for Achievement in Research in the area of the social sciences and humanities.