

# Nano Research and Facilities

At the University of Ottawa

The University of Ottawa has multiple facilities with capabilities for nano research. Although none of the facilities are dedicated solely to nanotechnology research, the list below identifies facilities, researchers and instruments that are being used in the fabrication and characterization of nano scale devices. Although not all facilities have dedicated staff to operate the equipment at all times, the University would make sure that personnel are available to operate equipment and support industry research needs and timeline.

**Prof Marc Dubé** - <http://profs.engineering.uottawa.ca/dube/>

## OSPRES (Ottawa Site for Polymer Reaction Engineering)

<b>Definition</b>	<p>polymer synthesis and characterization. Polymers synthesized via emulsion polymerization are in the form of nanospheres (i.e., latex particles), a technology that has existed for several decades. Some nanomaterials (e.g., nanostarch, cellulose nanocrystals, nanosilver) are used in polymer syntheses for the creation of nanocomposite materials. While the work is not exclusively focused on the production of nanomaterials, there are capabilities within our facility for the characterization of nanomaterials and the synthesis of nanocomposite materials.</p> <p>Dr. Benoit Lessard, soon to join the Department as CRC, will add significant value, expertise and equipment to this facility. In addition, various faculty members in the Dept. of Chemical and Biological Engineering have “nano” related capabilities from both the synthesis and characterization points of view. However, there is no one claiming to be a “nano” expert at this time – to many, it’s just a scale and all researchers in the lab have the capacity to work at that scale.</p>
<b>Areas of Expertise</b>	<p>Polymer characterization equipment: ATR-FTIR spectroscopy in-line sensor for monitoring reactions, polymer synthesis (2 LabMax reactors, RC1e reaction calorimeter, and various bench scale reactors), near complete facility for polymer characterization (DSC, GPC, IR, DMA, AFM, particle size analysis, Instron tester).</p>
<b>Facility Surface</b>	<p>Two laboratories with equipment interspersed in other labs.</p>
<b>Value</b>	<p>\$1.5 - 2.0 million</p>
<b>Number of HQP using facility</b>	<p>6 PhD students currently, + 1-3 undergraduates per year</p>
<b>Number of Permanent Research staff:</b>	<p>0</p>
<b>User fees:</b>	<p>Not available online</p>
<b>Booking of instruments</b>	<p>Not available online</p>
<b>Capacity for industrial users or collaborators</b>	<p>Yes</p>

**Prof R. Tom Baker- <http://www.catalysis.uottawa.ca/>**

## uOttawa CCRI Materials Characterization Core facility

<b>Definition</b>	The uOttawa Materials Characterization Core facility is housed in the Centre for Catalysis Research and Innovation (CCRI) on the 4 <sup>th</sup> and 5 <sup>th</sup> floors of the Biosciences building. The facility includes a number of state-of-the-art instruments that are uniquely designed for the characterization of nanoparticles and nanostructures including porous and hierarchical materials. Highlights of the facility include a high resolution transmission electron microscope (TEM) equipped with an electron energy loss spectrometer (EELS) and tomography capability for hard materials, a TEM with associated cryomicrotome for soft materials such as polymers and biological samples, a scanning electron microscope for high volume student use, and a high sensitivity X-ray photoelectron spectrometer (XPS) interfaced with an environmental cell that allows interlocked operation between high and ultra-low pressures. The atomic force microscope (AFM)-Raman instrument adds greatly to the CCRI's imaging capabilities while the zetasizer, surface analyzers and porosimeters allow for detailed characterization of particle size and pore size / distribution. A new thermogravimetric analyzer (TGA) with both mass and infrared detectors offers best-of-class thermal analysis capabilities. Several different flow chemistry platforms include microfluidic reactors for use with nanoparticle catalysts.
<b>Areas of Expertise</b>	<ol style="list-style-type: none"> <li>1) Characterization of metal and metal oxide nanoparticle catalysts;</li> <li>2) Synthesis of nanoparticles;</li> <li>3) Testing of nanoparticle catalysts.</li> </ol>
<b>Facility Surface</b>	4 <sup>th</sup> and 5 <sup>th</sup> floors of the uOttawa Biosciences building.
<b>Value</b>	\$12 million
<b>Number of HQP using facility</b>	30 postdocs and graduate students. Facilities are used primarily by 15 of the 37 CCRI faculty participants, as well as other academic, national lab and industry users.
<b>Number of Permanent Research staff:</b>	1 Admin., 1 Facility manager and 5 instrument operators.
<b>User fees:</b>	Available in Annual Report (online)
<b>Booking of instruments</b>	Not available online
<b>Capacity for industrial users or collaborators</b>	Yes

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## Materials Characterization Lab (uOttawa MCL)

<b>Definition</b>	<p>The uOttawa MCL provides an extensive characterization service for analyzing the composition, structure and performance of advanced materials and multi-materials systems, covering the complete scale range from nanometre up to component size. While our clients are welcome to attend at all times, our multidisciplinary team, from the mechanical engineering and chemical and biological engineering departments, performs all aspects of the characterization work, from sample selection and preparation, observation and analysis and results presentation. This efficient approach frees our clients from undertaking any training and enables them to dedicate their time where it matters — integrating the results into the development of new materials and products. Our flexible, itemized hourly-based service allows our clients to proceed with characterization and analysis as required, at competitive and predictable costs.</p> <p>Services include digital tomography scanner, Dynamic fatigue testing, Energy-dispersive spectrometry and electron backscatter diffraction, Hardness test (micro and macro), Variable-pressure scanning electron microscope, Optical microscope, 3D Digital microscope, Corrosion chamber, universal mechanical testing machines, metallurgical preparation.</p> <p>Our facility has also direct access to the uOttawa Cold Spray Laboratory, that specializes in the development of nanocrystalline metallic coatings. This gives direct access to milling equipment for the production of nanocrystalline powders as well as cold spray equipment to produce coatings from these powders.</p>
<b>Areas of Expertise</b>	Materials Characterization
<b>Facility Surface</b>	The facility extends over 5 different rooms but we use only part of each room.
<b>Value</b>	\$3.5 million
<b>Number of HQP using facility</b>	Over 20 /year
<b>Number of Permanent Research staff:</b>	1
<b>User fees:</b>	Not available online
<b>Booking of instruments</b>	Not available online
<b>Capacity for industrial users or collaborators</b>	Yes

**Prof Pierre Berini- <http://www.site.uottawa.ca/~berini/lab.html>**

## Berini Group- Centre for Research in Photonics at the University of Ottawa (CRPuO)

<b>Definition</b>	<p>The group is currently focused on the area of plasmonics. Plasmonics is concerned with phenomena involving surface plasmon-polariton (SPP) waves, which propagate along the interface of a metal and a dielectric at optical wavelengths (for example). Our expertise is in the field of nanostructured materials, including nanomaterials synthesis, characterization and application to energy conversion systems and environmentally important processes.</p> <p>Our research lab houses a modern facility for conducting experimental research in plasmonics, integrated optics and nanostructures. The lab is part of the Centre for Research in Photonics at the University of Ottawa, and as such, is available to the researchers and associates of the Centre.</p> <p>Major equipment items include: broadly tunable lasers, optical spectrum analyzers and spectrometers, a near-field scanning optical microscope, PMD/PDL instrumentation, optical power meters, optical microscopes, thin-film characterization equipment, optics tables, translation stages and other opto-mechanical parts, a lock-in amplifier, a bi-potentiostat, a UV-ozone cleaner, peristaltic pumps, electron-beam lithography, deep reactive ion etching, clean-room access.</p>
<b>Areas of Expertise</b>	Surface plasmons and applications, microwave circuits, nanophotonics
<b>Facility Surface</b>	The CRPuO Nanofab occupies about 235 m <sup>2</sup> of space
<b>Value</b>	\$3 million
<b>Number of HQP using facility</b>	Over 20 / year
<b>Number of Permanent Research staff:</b>	1
<b>User fees:</b>	Not available online
<b>Booking of instruments</b>	Not available online
<b>Capacity for industrial users or collaborators</b>	Yes

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**Prof Elena Baranova- <http://profs.engineering.uottawa.ca/baranova/>**

## Laboratory of Electrochemical Engineering (LEE)

<b>Definition</b>	<p>The group is interested in the fundamental and applied aspects of electrochemistry, electrocatalysis and heterogeneous catalysis. Projects at LEE are related to the electrocatalysis of small organic and inorganic molecules for direct oxidation fuel cells, as well as electrochemical promotion of catalysis (EPOC) for the environmentally important reactions, such as NO<sub>x</sub> reduction from automobile emissions, oxidation of volatile organic compounds (CO, ethylene, propylene, toluene, etc.) and reverse water gas shift reaction (RWGS).</p> <p>Our expertise is in the field of nanostructured materials, including nanomaterials synthesis, characterization and application to energy conversion systems and environmentally important processes.</p> <p>Synthesis of the nanomaterials are done in the lab but the physiochemical characterizations are done at the Centre for Catalysis Research and Innovation with TEM, XPS, SEM, XRD</p>
<b>Areas of Expertise</b>	Synthesis of nanomaterials; electrochemical and catalytic tests of nanomaterials.
<b>User fees:</b>	Not available online
<b>Booking of instruments</b>	Not available online
<b>Capacity for industrial users or collaborators</b>	Yes

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**Prof Vincent Tabard-Cossa- [www.biophysics.uottawa.ca](http://www.biophysics.uottawa.ca) / [www.tcossalab.net](http://www.tcossalab.net)**

## Centre for Interdisciplinary Nanophysics

<b>Definition</b>	<p>dedicated to the development of novel techniques and methods to manipulate and characterize single-molecules using nanofluidic devices, to unravel the basic physics governing the behaviour of biological molecules in nanoconfined geometries, and ultimately to translate these discoveries into new tools for the life sciences.</p> <p>Research Program Goals – While these research efforts are driven by the exploration of unique detection and actuation modalities of nanofabricated devices to probe single-molecule processes, the manipulation and characterization of individual molecules within nanoscale fluidic environments represents an important and largely uncharted regime in which interesting new physics can dominate and enables new quantitative measurements, with exceptional sensitivity and speed, on the structure and behavior of biological molecules. Therefore my research program aims to: 1) Explore the capabilities of nanofabrication by controlled breakdown to form nanopores, nanofluidic channels, and in more advanced structures; (2) Investigate and control the motion of biopolymers and fluidic transport in nanoconfined geometries; (3) Study intermolecular interactions and analyze biomolecules by nanopore-based force spectroscopy.</p>
<b>Areas of Expertise</b>	Atomic Layer Deposition, Solid-state Nanopore Fabrication by Controlled Breakdown, Nanopore-based biosensors.
<b>Facility Surface</b>	12 m <sup>2</sup> / 129 ft <sup>2</sup>
<b>Value</b>	~ \$200,000
<b>Number of HQP using facility</b>	10 per year
<b>Number of Permanent Research staff:</b>	0
<b>User fees:</b>	Not available online
<b>Booking of instruments</b>	available online (through <a href="http://www.Quartzy.com">www.Quartzy.com</a> )
<b>Capacity for industrial users or collaborators</b>	Yes

**Prof Fabio Variola- [www.variolasnl.com](http://www.variolasnl.com)**

## Surface Nanoengineering Laboratory

<b>Definition</b>	Confocal Raman microscope integrated with Atomic Force (AFM) and Near-Field Scanning Optical (SNOM/NSOM) microscopy.
<b>Areas of Expertise</b>	Surface characterization, Surface Science, Nanotechnology
<b>Facility Surface</b>	12 m <sup>2</sup> / 129 ft <sup>2</sup>
<b>Replacement value</b>	~ \$800,000
<b>Number of HQP using the facility per year:</b>	3-5
<b>Number of Permanent Research staff:</b>	0
<b>User fees:</b>	Not available online
<b>Booking of instruments</b>	Not available online
<b>Capacity for industrial users or collaborators</b>	Yes

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