Western Science

Research Theme

Materials and Biomaterials

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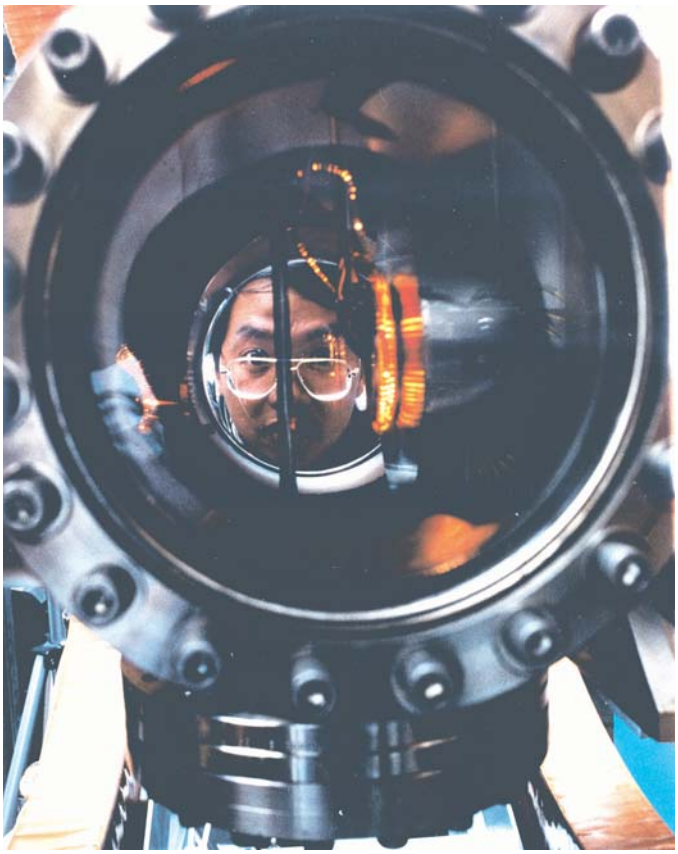


Major initiatives in materials research at Western include Surface Science Western, Interface Science Western, the Nanofabrication Lab, the Ontario Photonics Consortium and SHARCNET. Because of the wide range of materials and biomaterials research within the Faculty of Science and across Western, the Faculty of Science has created the Western Institute for Nanomaterials Science (WINS) to harness, facilitate and promulgate the collective potential of this area. The Institute now plays a leading role in coordinating opportunities and in catalyzing multidisciplinary research and teaching in materials and biomaterials across Western and beyond the University.

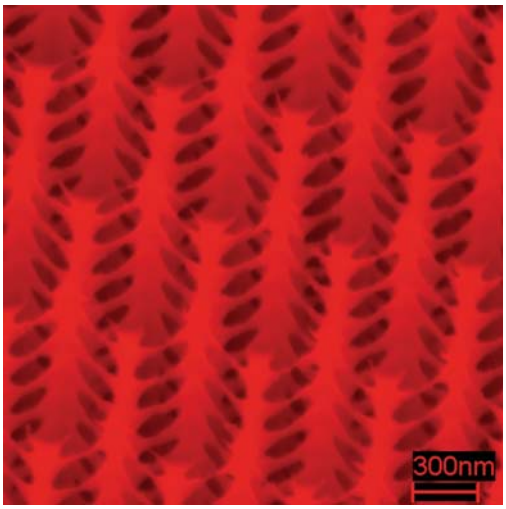
Materials research involves the synthesis, characterization and properties of materials. Areas of interest at Western include semiconductors, polymers (such as metallopolymers, biopolymers, dendrimers, organic electronic materials, and silicates), supramolecular assemblies, organometallic clusters, ceramics, natural materials, spectroscopy, microscopy and imaging techniques, and the growth and formation of new materials. Western is a leader in the study of the interactions of radiation with materials and the modification of semiconductors and metals by ion and positron beams. Substantial expertise also exists in the field of soft materials, including complex fluids and biological materials, using optical techniques, scanning probe microscopy, rheometry, and other techniques. There is also strength in the theory of condensed matter, including its applications to polymers, optical, electronic, and magnetic properties of thin films, nanostructured materials and biomaterials, tribology and granular materials. Properties of metals, semiconductors and insulators, including silicates, under the high pressure and temperature conditions of the Earth's interior are a major focus. The Faculty of Science is also building up research strength in medical physics. This is a natural extension of existing collaborations with the Robarts Research Institute, the London Regional Cancer Centre and the Lawson Health Research Centre.

Western researchers have been Canadian leaders in the development and application of synchrotron radiation to materials science and played an important role in the creation of the Canadian Light Source at the University of Saskatchewan. Synchrotron radiation is used to study a range of materials including electronic materials and semiconductors. Future plans extend to natural materials such as silicates and glasses. Interface Science Western houses one of the largest accelerator complexes for materials science in Canada. Together with the broad range of tools available in Surface Science Western, these facilities are used to investigate surfaces, interfaces, tribology, and defects in materials ranging from semiconductors to minerals.

The burgeoning fields of nanomaterials and photonics are of increasing strategic importance, with tremendous technological implications. Western's substantial investment in this area includes the establishment of WINS, the construction and equipping of the Nanofabrication Laboratory in 2004, the clustering of Canada Research Chairs and the creation of the multi-university Ontario Photonics Consortium. Together, these provide a unique opportunity to foster and enrich research across the University and in the wider community on materials structured on the Angstrom to the micron length scales, such as quantum dots, quantum wires, photonic band gap materials and crystals, and their applications in optical devices.

Computational materials modeling offers novel ways to explore complex structures and processes that are of direct interest to industry, as well as the research community. The Faculty of Science has built significant strength in this area, with emphasis on amorphous solids, biomaterials, membranes, polymers, complex fluids, catalysts, nanostructured materials, and tribology. This work was the driving force behind the creation of SHARCNET, and researchers in this area continue to make extensive use of its facilities.

Materials science engages many of our most distinguished researchers. In Chemistry, R.J. Puddephatt holds a Tier 1 CRC in Materials Synthesis with a focus on the preparation of novel organometallic complexes and polymers. Y. Huang has received a Tier 2 CRC in Materials Characterization for the application of vibrational and solid-state NMR spectroscopy to zeolites and related materials. The conformational dynamics of biomolecules forms the basis for a Tier 2 CRC in Protein Folding and Biological Mass Spectrometry held by L. Konermann. A Tier 2 CRC in Biomaterials/ Nanotechnology, joint with the Faculty of Engineering, is being pursued. T.K. Sham holds a Tier 1 CRC in Materials and Synchrotron Radiation. In Physics, S. Mittler holds a Tier 1 CRC in Photonics of Surfaces and Interfaces. B. Chronik has taken up a Tier 2 CRC in Medical Physics; his research concerns materials and devices applied to magnetic resonance imaging. We are in the process of hiring a Tier 1 CRC in Nanomaterials/(Bio)photonics to strengthen further our research efforts in this burgeoning area. A planned Tier 1 CRC in Geophysics will complement our existing research strengths.



Western has attracted three NSERC Industrial Research Chairs who together make Western a leading university in nuclear power research. Two of these are in Science: D.W. Shoesmith supported by Ontario Power Generation, working on the application of electrochemical techniques to surfaces and solids in nuclear waste containment; J.C. Wren, supported by Atomic Energy of Canada Ltd, working on in the chemical kinetics of material degradation in nuclear reactors; and a third in Engineering- J. Jiang, supported by UNENE, working on control, instrumentation and electrical systems in nuclear power plants.
In addition to the many essential general purpose materials characterization facilities, Western is home to a number of laboratories with unique capabilities including high-temperature/ high-pressure measurements, stable isotope studies, and ultra high resolution surface analysis by XPS. The Faculty of Science is committed to continued development and growth of materials science at Western which will require continued selective investment in people, space and technical infrastructure.