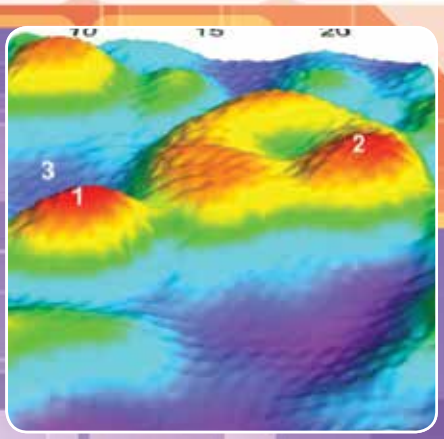
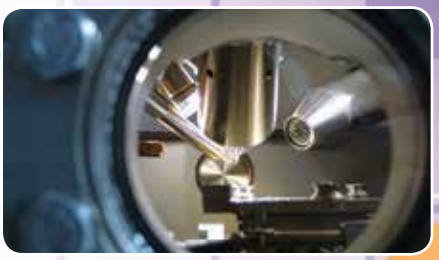
GRADUATE STUDIES | Department of Chemistry

Materials: Design, Function and Characterization





Western Science

WESTERN SCIENCE

Department of Chemistry

The Department of Chemistry at Western University offers a large and vibrant, research-intensive environment for more than 100 graduate students.

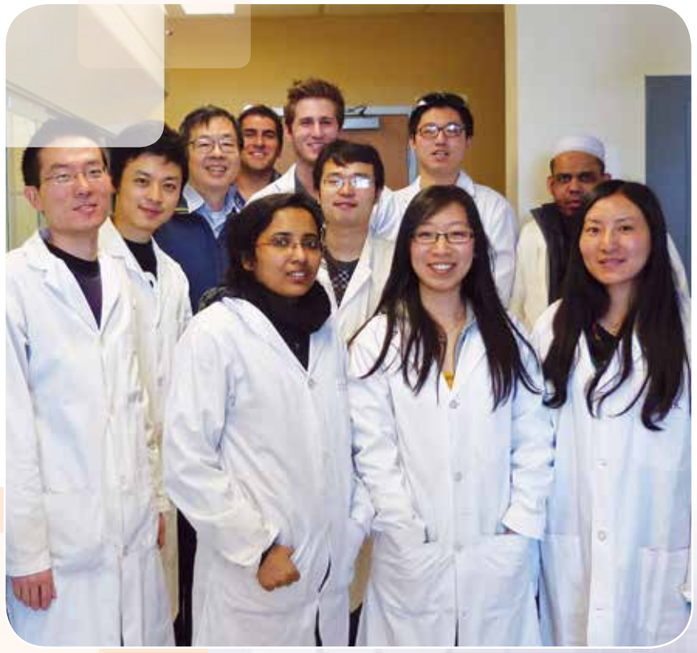
Taking a modern view of the chemical sciences, the four main research themes reflect Western's open-minded and multidisciplinary approach to research. These themes include: Chemical Biology and Biomaterials; Synthesis, Catalysis and Molecular Materials; Materials: Design, Function and Characterization; and Theory and Computation.

We are proud to boast over 25 NSERC-funded researchers, some of whom are Tier I and II Canada Research Chairs and Industrial Research Chairs with numerous links to academic and industrial partners, and some of the finest research facilities in Canada.

Our researchers play leading roles in organizations within Western, including: The Centre for Advanced Materials and Biomaterials Research (CAMBR), Surface Science Western, and the Western Nanofabrication Facility, and publish regularly in top tier peer-reviewed journals. Graduate students can expect their results to be disseminated globally. They may also receive opportunities to conduct applied research in collaboration with industrial partners.

Materials: Design, Function and Characterization

The "Materials: Design, Function and Characterization" research theme involves the synthesis and characterization of materials for energy conversion and storage; catalysis; the fabrication of sensors for high sensitivity optical detection; the development of advanced characterization techniques (synchrotron radiation spectroscopy, spectroscopy under extreme conditions, solid-state NMR and scanning probe microscopies); and the study of radiation-induced chemical processes and corrosion phenomena associated with nuclear energy. A number of applications ranging from photovoltaic solar cells, plasmonics, and biosensors are being developed within this research theme through the utilization of our unique access to the facilities available at Western. A wide variety of materials are also being synthesized and modified to create new molecular architectures with unprecedented functionality.



The Ding Group

Zhifeng Ding, Professor

PRIMARY RESEARCH FOCUS

There are three main aspects to the Ding Group's research interests but they all centre on electrochemical properties of materials and compounds.

Electrogenerated chemiluminescence, ionic liquids, scanning electrochemical microscopy coupled with spectroscopy and solar cells are all studied with electrochemistry to optimize and make efficient processes that could affect the future of many. Everything from solar power to LEDs, live cell detections, materials surface characterization or supercapacitors/batteries can be the final result of these research areas.

INDUSTRIAL, ACADEMIC AND OTHER COLLABORATORS

Among our industrial collaborators are Rosstech Inc., CIS Inc., and S.U.N. Solar Energy Co. Ltd.

RECENT PUBLICATIONS

M. S. M. Li, F. P. Filice, Z. Ding* "A Time Course Study of Cadmium Effect on Membrane Permeability of Single Human Bladder Cancer Cells using Scanning Electrochemical Microscopy" *J. Inorg. Biochem.* **2014**, *136*, 177–183.

T. J. Stockmann, J. Zhang, A.-M. Montgomery, Z. Ding* "Electrochemical Assessment of Water/Ionic Liquid Biphasic Systems towards Cesium Extraction from Nuclear Waste" *Anal. Chim. Acta* **2014**, *821*, 41–47.

K. N. Swanick, S. Ladouceur, E. Zysman-Colman, Z. Ding* "Correlating Electronic Structures to Electrochemiluminescence of Cationic Ir Complexes" *RSC Adv.* **2013**, *3*, 19961–19964.

D. Vaccarello, A. Tapley, Z. Ding* "Optimization of the Cu_2ZnSnS_4 Nanocrystal Recipe by means of Photoelectrochemical Measurements" *RSC Adv.* **2013**, *3*, 3512–3515.

A. Tapley, D. Vaccarello, J. Hedges, F. Jia, D. A. Love, Z. Ding* "Preparation and Characterization of $CuInS_2$ Nanocrystals for Photovoltaic Materials" *Phys. Chem. Chem. Phys.* **2013**, *15*, 1431–1436.

"Dr. Ding's lab is conducive to cutting-edge research and prepares you with practical techniques that are much in demand in the workforce. He allows his students to participate in various international events, learning and collaborating with other innovative researchers, while maintaining his status as the top in his field."

– Daniel Vaccarello, PhD student

ACCOMPLISHMENTS AND PAST GRADUATES

T. J. Stockmann is now a postdoctoral researcher at EPFL in Lausanne, Switzerland. Jigang Zhoud is now a postdoctoral researcher at CLS in Saskatchewan, Canada.

FOR MORE INFORMATION

http://publish.uwo.ca/~zfding/
or contact zfding@uwo.ca

The Huang Group

Yining Huang, Professor

PRIMARY RESEARCH FOCUS

The Huang Group's research is directed towards the investigations of various porous materials including zeolites, $AlPO_4$ based molecular sieves, metal-organic frameworks (MOFs) and mesoporous materials as well as pillared lamellar solids. These materials have many current and potential applications in industry as ion exchangers, molecular sieves, catalysts, sensors, ceramics, semiconductors and energy storage materials. Current efforts emphasize vibrational and, in particular, solid-state NMR spectroscopy.

"Dr. Huang pushes me out of my comfort zone to foster my professional development."

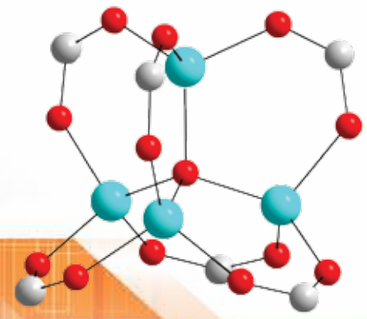
– Andre Sutrisno, PhD

OUTSTANDING FACILITIES, TOOLS AND TECHNOLOGIES

We are well equipped to do various solid-state NMR experiments using in-house 400 and 600 MHz spectrometers. We also have access to a 900 MHz solid-state NMR spectrometer at the National Ultrahigh Field NMR Facility for Solids (Ottawa, Canada).

FOR MORE INFORMATION

http://publish.uwo.ca/~yhuang/research.html
or contact yhuang@uwo.ca



Academic Snapshot

30
full-time faculty

100+
full-time graduate students

Over 7,500
students taught annually

2,500th BSc
by 2014

200th PhD
by 1986

475th PhD
by 2014

A Tradition of Research

Average annual research revenue
$4,000,000

FIRST
publication in 1915

100
publications by 1962

1,000
publications by 1975

2,000
publications by 1985

6,000
publications by 2012

The Lagugné-Labarthet Spectroscopy and Nanophotonics Group

François Lagugné-Labarthet, Associate Professor

PRIMARY RESEARCH FOCUS

The Lagugné-Labarthet Group's research involves the use of photon sources to reveal the intimate properties of nanomaterials and biomaterials. Advanced optical microscopy techniques based on vibrational spectroscopy and lifetime fluorescence imaging are used in conjunction with nanofabrication capabilities to characterize materials with nanometer resolution, design plasmonic surfaces for enhancing the sensitivity of optical sensors and to study chemical exchanges at the level of individual cells.

INDUSTRIAL, ACADEMIC AND OTHER COLLABORATORS

Our research group is supported by Canadian Fund for Innovation and Natural Science and Engineering Research Council of Canada.

RECENT PUBLICATIONS

M. Tabatabaei, F. Caetano, S. Vedraine, S. Ferguson, P. Norton, F. Lagugné-Labarthet* "Directing GPCR-transfected Cells and Neuronal Projections with Nano-scale Resolution" *Biomaterials* **2013**, *34*, 10065–10074.

N. Kazemi-Zanjani, H. Chen, H. Goldberg, G. Hunter, B. Grohe, F. Lagugné-Labarthet * "Label-Free Mapping of Osteopontin Adsorption to Calcium Oxalate Monohydrate Crystals by Tip-Enhanced Raman Spectroscopy" *J. Am. Chem. Soc.* **2012**, *134*, 17076–17082.

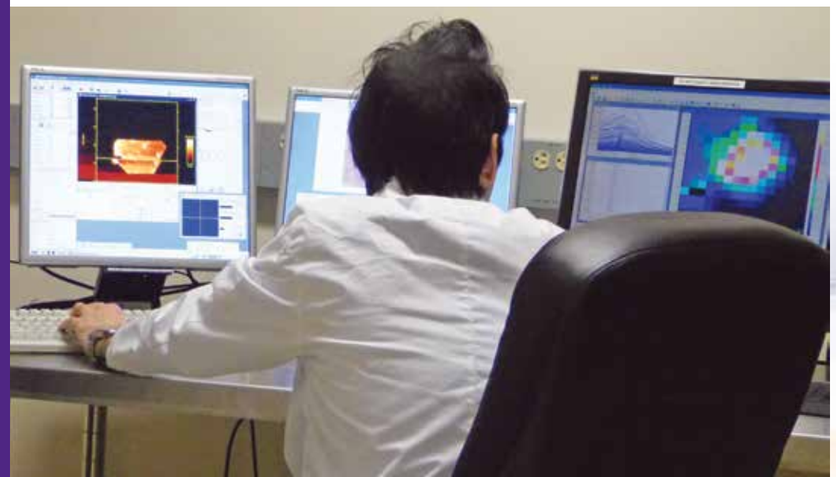
"I am using nanostructured metallic surfaces to enhance sensitivity and specificity of spectroscopy measurements. This is extremely important to probe the molecular binding onto surfaces with applications ranging from pollutant monitoring and catalysis to biochemical exchanges at the single cell level. The use of plasmonic platforms provides the molecular fingerprints of molecules with unprecedented sensitivity."

– Gregory Q. Wallace, PhD student

ACCOMPLISHMENTS AND PAST GRADUATES

Former graduate students work in industry with Imperial Oil and in academia as lab managers and as a professor at the University of Ottawa.

FOR MORE INFORMATION
http://publish.uwo.ca/~flagugne/
or contact flagugne@uwo.ca



The Semenikhin Group

Oleg Semenikhin, Associate Professor

PRIMARY RESEARCH FOCUS

The Semenikhin Group focuses its research on design and characterization of novel materials for energy conversion and storage; nanotechnology; solar cells; photovoltaics; electrochemistry; batteries and fuel cells.

INDUSTRIAL, ACADEMIC AND OTHER COLLABORATORS

Our industrial and academic collaborators include: the University of Pierre and Marie Curie, France; Moscow State University, Russia; École Politechnique de Montréal, Canada; and MW Canada Ltd.

OUTSTANDING FACILITIES, TOOLS AND TECHNOLOGIES

Semenikhin Group members have access to cutting-edge tools and technologies including atomic force microscopes, intensity modulated photocurrent spectroscopy, electrochemistry equipment, and a vacuum setup for preparation of carbon-based semiconductor materials.

"The equipment within the department is excellent, with the demands of each research group being met without too much competition for time for specialized equipment."

– David Pipher, MSc

ACCOMPLISHMENTS AND PAST GRADUATES

Former graduates can be found in both industry and academia as a senior research scientist at Trojan Technologies, Canada and a Postdoctoral Fellow at Pierre and Marie Curie University (European Union, England)

FOR MORE INFORMATION
http://www.uwo.ca/chem/people/faculty/semenikhin_oleg.htm
or contact osemenik@uwo.ca

The Sham Functional Materials with Enabling Photon Technology Group

Tsun-Kong Sham, Professor and Canada Research Chair

PRIMARY RESEARCH FOCUS

The Sham Group focuses on the design and fabrication of functional materials for energy, light emission and drug delivery as well as the development and application of capabilities at synchrotron light sources.

INDUSTRIAL, ACADEMIC AND OTHER COLLABORATORS

Our industrial and academic collaborators include:

- Canadian Light Source
- Advanced Photon Source
- Advanced Light Source
- Soochow University
- Li Phostech
- Ballard
- General Motors

OUTSTANDING FACILITIES, TOOLS AND TECHNOLOGIES

Sham Group researchers have access to three beamlines at the Canadian Light Source covering 10 eV–10 keV with photoemission, X-ray absorption, fluorescence, X-ray excited optical luminescence (energy and time) and a microprobe.

ACCOMPLISHMENTS AND PAST GRADUATES

Graduates are sought by national and international industry and academia:

- Dongniu (David) Wang (PhD 2013), SWC PDF, Canadian Light Source
- Matthew Ward (PhD 2013), PDF, CHESS Cornell University
- Lijia Liu (PhD 2012), Associate Professor Soochow University
- Peter Ko (PhD 2010), Staff, CHESS Cornell University
- Michael Murphy (PhD, 2010), Staff, DESY Photon Sciences, Hamburg
- Jigang Zhou (PhD, 2007), Industrial Scientist, Canadian Light Source

FOR MORE INFORMATION
http://publish.uwo.ca/~tsham/
or contact tsham@uwo.ca

The Shoesmith Electrochemistry and Corrosion Science Group

David Shoesmith, Professor

PRIMARY RESEARCH FOCUS

The primary focus of the Shoesmith Group is on industrial materials problems. We apply a wide range of electrochemical, spectroscopic and surface analytical techniques to a range of materials projects. These experimental studies are coupled with the development of computational models to predict/assess materials behaviour in a range of industrial situations.

INDUSTRIAL, ACADEMIC AND OTHER COLLABORATORS

The industrial and academic collaborators of the Shoesmith Group include:

- Royal Institute of Technology, Sweden
- McGill University
- McMaster University
- University of Toronto
- Korean Atomic Energy Research Institute
- Swedish Nuclear Fuel Company
- General Motors
- NOVA Research and Technology (Calgary)
- US Department of Energy

“Upon joining Dr. Shoesmith’s lab in 2010, my peers stressed the excellent level of supervision given to our group. I couldn’t have asked for a better scenario: an opportunity to work on industrially relevant projects, having the freedom to advance the project as I see fit and an available and knowledgeable supervisor to discuss any issues that arise.”

– Matthew Asmussen, PhD

ACCOMPLISHMENTS AND PAST GRADUATES

Graduates work in industry and academia, in particular at:

- AECL Canada
- Nuclear Waste Management Organization (Toronto)
- NOVA Research and Technology (Calgary)
- Kinectrics (Toronto)
- CANMET (Hamilton and Calgary)
- Southwest Research Institute (San Antonio, TX, USA)
- Blade Energy (Houston, TX)
- Surface Science Western (UWO)
- Cameco (Port Hope)

FOR MORE INFORMATION

http://sun.chem.uwo.ca/ and www.surfacesciencewestern.com
or contact dwshoesm@uwo.ca

The Song Research Laboratory

Yang Song, Associate Professor

PRIMARY RESEARCH FOCUS

Research in the Song Group involves interdisciplinary frontier areas in physical chemistry, inorganic chemistry and materials science, specialized in spectroscopy and application of synchrotron techniques. Chemistry and materials under extreme conditions far beyond ambient condition, in particular, is the theme of our research program and has profound scientific and applied significance for specific applications in energy and sustainability.

OUTSTANDING FACILITIES, TOOLS AND TECHNOLOGIES

Our lab houses state-of-the-art infrastructure dedicated to materials study under extreme conditions including optical microscopes, cryogenic stations, glove box, customized Raman and IR spectroscopic systems.

RECENT PUBLICATIONS

Y. Song “New Developments of Hydrogen Storage Materials by High-Pressure Approach” *Phys. Chem. Chem. Phys.* **2013**, *15*, 14524–14547. (invited review, front cover)

Y. Hu, Z. Liu, J. Xu, Y. Huang*, Y. Song* “Evidence of Pressure Enhanced CO_2 Storage in ZIF-8 Probed by FTIR Spectroscopy” *J. Am. Chem. Soc.* **2013**, *135*, 9287–9290.

“Dr. Song gives me enough freedom to try my ideas for my research projects, and he is always there whenever I need help.”

– Zhaohui Dong, PhD

ACCOMPLISHMENTS AND PAST GRADUATES

A recent PhD graduate is now a research scientist at Shanghai Synchrotron Radiation Facility, Shanghai, China.

FOR MORE INFORMATION

http://publish.uwo.ca/~ysong56/
or contact yang.song@uwo.ca

The Workentin Functional Organic Materials Group

Mark Workentin, Professor

PRIMARY RESEARCH FOCUS

The main research interest of the Workentin Group is directed towards addressing fundamental aspects of interfacial organic reactions and utilizes the knowledge gained to design and synthesize new materials and to demonstrate potential functional applications.
The group’s expertise spans the areas of physical organic chemistry, photochemistry, electrochemistry, radical ion chemistry and materials science.

OUTSTANDING FACILITIES, TOOLS AND TECHNOLOGIES

We are fully equipped for organic synthesis and materials preparation and characterization and have facilities for organic photochemistry and electrochemistry, partnering with Surface Science Western and the Nanofabrication facility.

RECENT PUBLICATIONS

P. Gobbo, S. Novoa, M. C. Biesinger, M. S. Workentin* “Interfacial strain-promoted alkyne-azide cycloaddition (I-SPAAC) for the synthesis of nanomaterial hybrids” *Chem. Commun.* **2013**, *49*, 3982–3984.

P. Gobbo, M. C. Biesinger, M. S. Workentin* “Facile Synthesis of Gold Nanoparticle (AuNP) Decorated Carbon Nanotube (CNT) Hybrids through an Interfacial Michael Addition Reaction” *Chem. Commun.* **2013**, *49*, 2831–2833.

“Why join the Workentin Group? Simply because it is the most dynamic scientific experience a student can have: from the synthesis, reactivity and characterization of novel nanomaterials to their applications in energy storage and nanomedicine.”

– Pierangelo Gobbo, PhD student and Vanier Graduate Scholar

ACCOMPLISHMENTS AND PAST GRADUATES

Our group boasts a 100% post-graduate placement success rate with opportunities in academia, national research labs (NRC, NINT), and industry (Naeja Pharmaceuticals, LANXESS, Multi-Chem C-Silitech, Imperial Oil, AMRI).

The Workentin Group is comprised of some of the best students in the field, with three of the 18 Paul De Mayo Awards for Best PhD theses awarded to our student researchers.

FOR MORE INFORMATION

http://publish.uwo.ca/~mworkent
or contact mworkent@uwo.ca

The Wren Radiation–Assisted Materials Performance Science Group

Clara Wren, Professor

PRIMARY RESEARCH FOCUS

The Wren Group focuses on radiation-assisted materials performance in three areas: electrochemistry and corrosion, aqueous and colloid chemistry, and ionic liquid and phase separation.

OUTSTANDING FACILITIES, TOOLS AND TECHNOLOGIES

Among the outstanding tools and technologies available to our researchers include Gammacell 220, Bruker Vertex V70 FTIR, Solatron Electrochemical Analysis Instruments, and High-Temperature High-Pressure Autoclave Systems.

“In the lab we have a wide range of instruments at our disposal, which has provided me with the tools necessary to answer a variety of interesting research questions.”

– Quintin Knapp, PhD

ACCOMPLISHMENTS AND PAST GRADUATES

Wren Group graduates are employed at research institutes and within industry including:

- Atomic Energy of Canada Ltd.
- Gamry Instrument International, Warminster, PA, USA
- Bruce Power, Tiverton, ON
- National Research Council, London, ON
- State Nuclear Power Research Institute in Shanghai, China

FOR MORE INFORMATION

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