

## GENERAL INFORMATION

All sessions will provide a thorough theoretical background on the four techniques studied (chromatography, light scattering, rheology, and fluorescence) followed by real world applications. Participants are encouraged to discuss their own examples and interact with the lecturers. The lecturers have taught this material and made intensive use of these techniques for their own research for more than 20 years. The examples used represent state-of-the-art applications.

### COURSE FEES

The cost per person is \$1,500.00 (USD). The course fee includes registration, course notes, beverage breaks, drinks on Monday, **June 20<sup>th</sup>**, and dinner on Tuesday, **June 21<sup>st</sup>** at the University Club. Special discounts exist if two or more participants from the same company register for the course. Upon receipt of intent to register, further information will be sent regarding payment options.

### COURSE NOTES

Course notes will be provided and their cost is included in the cost of registration. Copies are available for purchase by non-participants for \$500.00(USD). Notes will be given to participants just before lectures start.

### LOCATION

The course will be held at:  
University of Waterloo  
200 University Avenue West  
Waterloo, ON Canada N2L 3G1  
Tel: 519/884-0220, Fax: 519/884-0321  
Toll-free: 800/361-4708

## FURTHER INFORMATION

### YOU MUST MAKE YOUR OWN HOTEL RESERVATIONS

A block of rooms at special rates has been set aside (until **May 13, 2016**) for course participants. When contacting the Delta Hotel, in order to obtain the special rate, please indicate that you are reserving for the Institute for Polymer Research course.

### TRANSPORTATION/OTHER DETAILS

For ground transportation or any other details regarding your visit to Waterloo, please contact the Conference Coordinator:

Colleen Mechler, Tel: 519.888.4789

Fax: 519/746-4979, Email: [ipr@uwaterloo.ca](mailto:ipr@uwaterloo.ca)

### FUNDING FOR ONTARIO-BASED COMPANIES

Canada-Ontario Job Grant provides funding for Ontario-based companies to cover the fees of this course.

### IN-HOUSE COURSES

The Institute for Polymer Research at University of Waterloo has more than 30 years' experience in conducting in-house courses specifically tailored to your needs and requirements. Non-disclosure agreements could be signed permitting the consideration of highly relevant material.

### Further information on this course or other courses may be obtained from:

Professor J. Duhamel at:

Institute for Polymer Research  
Department of Chemical Engineering  
University of Waterloo

Waterloo, Ontario, Canada N2L 3G1

Tel: 519.888.4767, ext. 35916

Fax: 519.747.0435

Email: [jduhamel@uwaterloo.ca](mailto:jduhamel@uwaterloo.ca)

Web: [uwaterloo.ca/institute-polymer-research](http://uwaterloo.ca/institute-polymer-research)

35th North American  
Intensive Short Course

## POLYMER CHARACTERIZATION

A Molecular Approach:  
Chromatography, Light  
Scattering, Rheology, and  
Fluorescence

Directed by:

### Professor Jean Duhamel, PEng

Director of the Institute for Polymer Research  
Department of Chemistry  
University of Waterloo

### Professor Michael Tam

University Research Chair  
Department of Chemical Engineering  
University of Waterloo

### Professor Mario Gauthier

Associate Chair for Graduate Studies and Research  
Department of Chemistry  
University of Waterloo

Hosted by:

Institute for Polymer Research  
University of Waterloo  
Waterloo, Ontario  
CANADA

To be held at:  
University of Waterloo  
Waterloo, Ontario  
CANADA

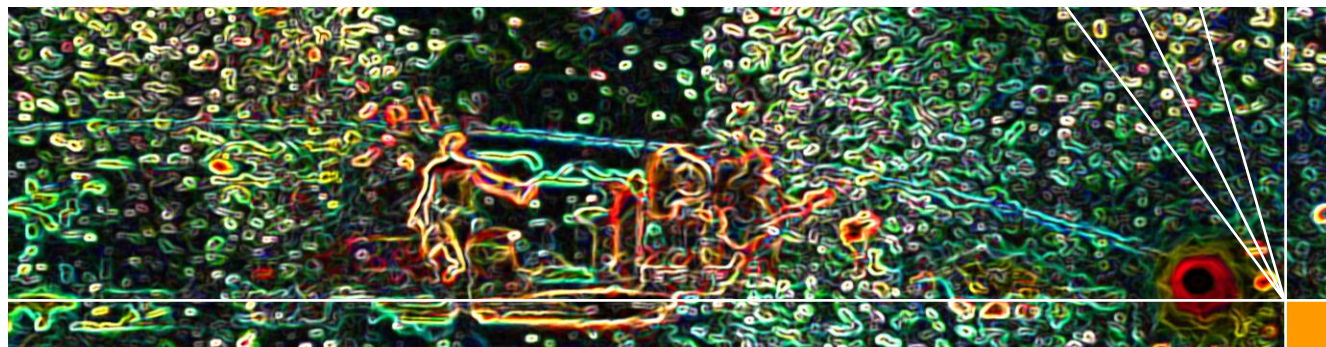
## REGISTRATION

Registration will take place electronically at <https://uwaterloo.ca/institute-polymer-research/events>

For further information, see also our website (check under "Events" section) at: [uwaterloo.ca/institute-polymer-research](https://uwaterloo.ca/institute-polymer-research)

## WHO SHOULD ATTEND?

Engineers and chemists interested in characterizing complex polymeric systems at the molecular level. Special emphasis will be placed on the characterization of the level of macromolecular branching and extent of polymer modification, the strength of intermacromolecular associations in solution or in the bulk, polymeric networks and their implications for the viscoelastic properties of the polymer solution, the level of hydrophobicity/ hydrophilicity of a given macromolecular system, polymer diffusion in solution or in the bulk, the size and local viscosity of polymeric microdomains in solution. The lecturers have more than 50 years of accumulated experience in polymer synthesis and characterization. All topics are highly practical and have been tested and re-evaluated repeatedly over the last 25 years and during numerous interactions with industry members.



## POLYMER CHARACTERIZATION PROGRAMME

### Session 1 Monday, June 20 (8:30 am - 12:30 pm) (MG)

Principles of Gel Permeation Chromatography (GPC); types of columns and detectors and their specific purpose; quantitative analysis of GPC data to determine the absolute molecular weight distribution (MWD); characterization of chemically modified macromolecules; determination of the level of branching of branched macromolecules.

### Session 2 Monday, June 20 (2:00 - 5:00 pm) (MT)

Principles of Dynamic Light Scattering (DLS); comparison of different set ups (multi-angle, right angle, or zero-angle DLS) and their advantages/disadvantages; analysis of the autocorrelation function to determine the hydrodynamic diameter of polymer particles in solution; application to the characterization of associative phenomena between macromolecules in solution.

### Session 3 Tuesday, June 21 (9:00 am - 12:30pm) (JD)

Principles of fluorescence; description of a spectrofluorometric and illustration of classic artefacts; solvent effects; fluorescence quenching (static and dynamic); Fluorescence Resonance Energy Transfer (FRET); fluorescence anisotropy; pyrene excimer fluorescence; application of fluorescence to probe the hydrophobicity, size, and local viscosity of polymeric microdomains, polymer diffusion in solution or in the bulk.

### Session 4 Tuesday, June 21 (2:00 - 5:00pm) (MT)

Principles of rheology; description of a rheometer and tensile test instrument; types of experiments (creep, stress relaxation, tensile test); models used to analyze rheological data; application to characterize the rheology of polymers and solutions of associative thickeners.

### Session 5 Wednesday, June 22 (9:00 am - 12:00 pm)

Mario, Michael, and Jean will address questions from participants from the list of special topics or specific cases from current situations in the industry?

#### List of Special Topics:

Troubleshooting with particle size and molecular weight distributions; proper calibration of GPC instrument. Polymer property characterization techniques; GPC, particle size, density, spectroscopic technique; branching level detection; rheological measurements; case studies and examples with application properties; Recent advances in the use of fluorescence to probe polymer diffusion in latex films, measure the viscosity and size of micelles, the level of interpolymeric interactions between viscosity index improvers in oil, the hydrophobicity of polymeric micelles.

