THIN FILM RESEARCH LABORATORY

GCM **NEWSLETTER**

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ÉCOLE POLYTECHNIQUE MONTRÉAL

Université de Montréal

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EDITOR'S NOTE

For this second GCM newsletter, I thought of answering a question I get asked often : how does the GCM work? The GCM has two main parts: a research branch and a service branch. The research branch consists of all the research activities carried out by professors and students, like in any university-based research group. The service branch, on the other hand, comprises about $50 millions of equipment serving the researchers and the companies. These instruments are under the technical supervision of so-called research associates (or research agents) who typically specialize in one or two techniques. The research associates constitute the core of GCM technical expertise, because they work full-time on the fabrication and analytical tools. Accordingly, they are in charge of making measurements for researchers and companies, of developing new fabrication and analysis methods and of training students on these instruments. They are the ones that you interact with to perform an analysis.

This structure in which the research associates are each responsible for a small number of instruments allows them to develop a very high level of expertise, while at the same time maintaining the technical knowledge of the GCM. Indeed, most of the research associates have been with the GCM for more than 4 or 5 years, and even more than 20 years in some cases.

Best wishes,
Jean-Sébastien Tassé, Business Development Manager - industry

NEW FUNDS FOR UNIVERSITY-INDUSTRY PARTNERSHIPS

Good news about the funding programs for university-industry cooperation! The National Science and Engineering Research Council of Canada (NSERC) has reoriented the focus of its regional offices to facilitate the industry-academic partnerships. In this perspective, new programs have been launched :

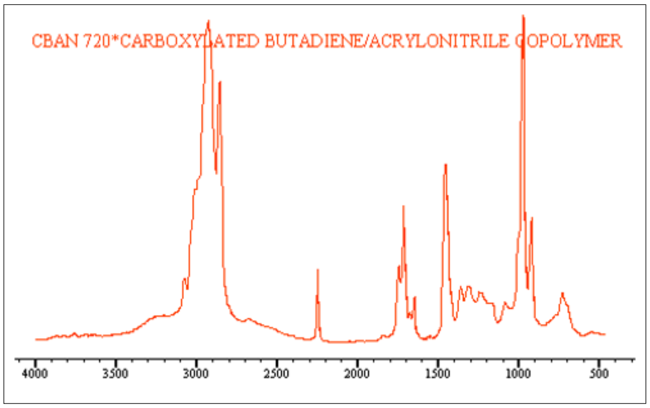
In Canada:

- Engage Grants Program : up to $25 000
  www.nserc-crsng.gc.ca/Professors-Professeurs/RPP-PP/Engage-Engagement_eng.asp
- Interaction Grants Program : up to $5 000 of funding to cover travel expenses to allow academic researchers and industrial partners to meet in order to identify potential research projects
  www.nserc-crsng.gc.ca/Professors-Professeurs/RPP-PP/Interaction-Interaction_eng.asp
- Strategic Workshops Program : up to $25 000 of funding for workshops aimed at fostering university-industry partnerships
  www.nserc-crsng.gc.ca/Professors-Professeurs/RPP-PP/SWP-PAS_eng.asp

The GCM can act as university partner for all these programs. Do not hesitate to contact us to discuss a project you have in mind.

ANALYSE THE CORE OF MATERIALS WITH FOURIER-TRANSFORM INFRARED SPECTROSCOPY (FTIR)

Fourier transform infrared spectroscopy makes use of the infrared region of the electromagnetic spectrum. This spectroscopic technique is mainly used to **determine with accuracy the composition of materials** (bulk and surface analysis). Certain configurations of new FTIR systems (like FTIR microscopy and grazing-angle FTIR spectroscopy) are especially suitable for the analysis of materials surfaces and chemical mapping/imaging. FTIR is very useful for the **analysis of many types of materials (organic compounds, polymers, etc)** because this instrument gives molecular information on the compound.



Copolymer FTIR spectrum measured by the ATR technique

Working principle

Infrared spectroscopy exploits the fact that molecules vibrate at specific frequencies that correspond to discrete energy levels (vibrational modes). These vibrational modes are specific to each molecule, which can be used to identify them accurately.

Fourier-transform infrared spectroscopy consists in passing through a sample a beam containing many infrared optical frequencies or in reflecting the beam off the sample surface, and simultaneously measuring the light absorbed at each frequency. The infrared signal detected is an interferogram. If needed, this process can be repeated a few times to improve the signal quality and the signal-to-noise ratio of the final spectrum. An algorithm called the Fourier transform is then used to transform the raw data (interferograms) in a graph (i.e., FTIR spectrum) showing the absorption as a function of the wavenumber. This spectrum contains the "molecular fingerprint" of the sample, which is unique for each material. A comparison of the experimental spectrum with database spectra can then be used to identify or classify the sample.

Industrial applications

FTIR is widely available in the private sector due to its reliability and versatility to analyse many types of samples (solids, liquids, gels, powders). As a matter of fact, FTIR is often the first instrument used to identify a polymer or an unknown organic compound. In electronics and optics, FTIR can identify resins, residues or powders on printed circuits or on lens. In the field of surface coatings, FTIR can confirm the molecular structure of a coating.

Benefits:

- Analyse any type of sample (solids, liquids, gels, powders)
- Bulk and surface analysis
- Gives the molecular composition

Applications:

- Identify unknowns
- Analyse contaminants
- Determine the presence of organic compounds
- Quantitative analysis of concentrations and sample thickness
- Quality control

Samir Elouatik, research associate for the GCM, on a Digilab FTS7000 FTIR