THIN FILM RESEARCH LABORATORY

GCM **NEWSLETTER**

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EDITOR'S NOTE

We are very proud to send you this first edition of the Thin Film Research Lab (GCM) newsletter. This monthly bulletin results from our will to inform the companies of the latest advances in materials analysis. It also aims to explain the working principles and uses of many modern apparatus for materials fabrication and characterization. In this newsletter, we will put the emphasis on industrial applications by presenting case studies in many domains. Please rest assured that we have obtained the authorization of the company involved before publishing each case study.

The GCM is a unique research center devoted to the study of thin films and advanced materials. Our facilities are located at University of Montreal and École Polytechnique. We offer materials fabrication and characterization services to the academic and industrial communities. Last year, more than 370 users have benefitted from our cutting edge facility.

To conclude, this newsletter aims first and foremost to inform you on topics that interest you. Please do not hesitate to send us any comments or suggestions.

Sincerely,
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AMSI2009 IS A HUGE SUCCESS

The Fall season has been particularly exciting at the GCM with the first edition of the event AMSI "Materials analysis: solutions for the industry", that attracted more than 60 people from the industrial world. During a full day, professors and members of the GCM and partner laboratories have presented the state of the art in materials analysis. Many presenters from the industry also showed how materials analysis enables them, on a daily basis, to solve the most demanding technical challenges. The extremely enthusiastic response of the participants will certainly lead the GCM to organize similar events focused on the industrial needs.

TENFOLD INCREASE IN RESOLUTION FOR ONE OF GCM'S AFM

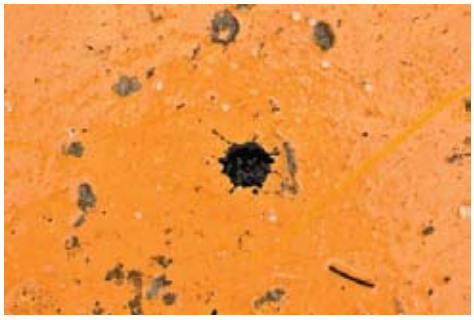
Last November, the Thin Film Research Lab (GCM) made a major upgrade to its Veeco Dimension 3100 Atomic Force Microscope (AFM) by **increasing its resolution by a factor of 10** and significantly enhancing its capabilities for adhesion force measurements. Indeed, the new fully digital Nanoscope® V controller boosts the maximal resolution to **5120 x 5120 pixels**, from 512 x 512 pixels previously. Its **fast electronics** (frequencies up to 50 MHz) enables one to record and analyse data of events at the nanometer scale with speeds previously unavailable (frequencies then limited to 500 kHz). This feature is particularly useful for **adhesion force experiments** because 50 000 plots of force vs distance can be generated per second, enabling the separation of adhesion components and mechanical properties. In addition, the new software automatically adjusts the scanning parameters and provides high quality images of most samples in *Tapping*™ mode. During image acquisition, it is now possible to record simultaneously and in real time up to eight channels of scanning data of numerous sample properties. This apparatus is available for operation by a GCM professional as well as for self-use.

CONTAMINANT IDENTIFICATION BY XPS

X-ray Photoelectron Spectroscopy (XPS), also known as Electron Spectroscopy for Chemical Analysis (ESCA), is nowadays used in a whole number of industrial sectors such as electronics, metallurgy, paintings and semiconductor to identify surface contaminants. The main strength of this technique resides in its capacity to quantify all the elements of the periodic table except hydrogen and helium.

XPS adapted to different "industrial flavours"

Contaminant issues occur in many industries. For instance, in microelectronics, it is necessary to avoid any compound that could adversely affect the conductivity of a semiconductor, such as metals (gold, aluminum, etc), polymers (PDMS) or salts. XPS proves very useful to identify such contaminants because it can determine chemical bonds (i.e. differentiate oxidation states like Al and Al^2O^3). In the manufacturing sector, plastic parts or metals often go through a series of production steps to change their shape or to modify their tribological, chemical or mechanical properties. Sometimes, the final product shows surface stains, from unknown origin. An XPS analysis might reveal the composition of the stain, that can be for example an oil or a lubricant coming from a forming machine. The company can then put in place corrective action in its process or in the handling to avoid the formation of this contaminant.



Paint stains that can be analyzed by XPS.

In another domain, one can sometimes see a halo on an optical piece such as a lens. An XPS analysis might confirm the hypothesis that this halo comes from an epoxy used in the manufacturing of the optical component.

How does it work?

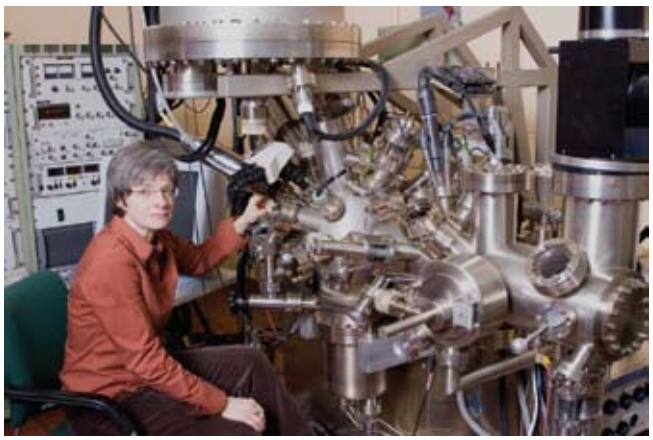
X-Ray Photoelectron Spectroscopy can detect all the elements heavier than helium. In a high-vacuum system, the samples are excited thanks to a X-ray source, that allows for the emission of photoelectrons coming from the atoms on the surface. The photoelectron binding energy is characteristic of the chemical composition of the compounds of the first atomic layers (about 1 to 10 nm in depth).

Benefits

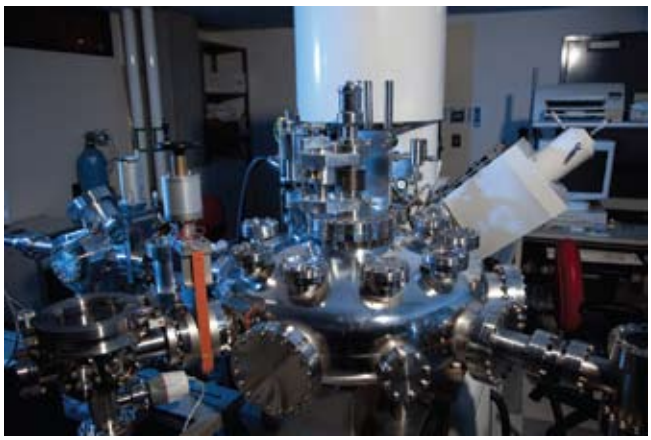
- Quantify organic and inorganic materials
- Determine chemical bonds and oxidation states
- Detect all elements except hydrogen and helium
- Chemical mapping (lateral resolution : 8-150 µm)
- Detection threshold : about 0.1%
- Simple sample preparation

Applications

- Thin film characterization
- Nanotechnologies, MEMS
- Aerospace
- Automotive industry
- Polymers
- Semiconductor
- Optics
- Biomaterials



ESCALAB 3 MKII XPS from VG Scientific.



Axis Ultra XPS from Kratos.