THIN FILM RESEARCH LABORATORY

GCM **NEWSLETTER**

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ÉCOLE POLYTECHNIQUE MONTRÉAL

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A GREAT SUCCESS FOR THE GCM COURSE "SURFACE ANALYSIS FOR THE INDUSTRY: THE MAJOR SPECTROSCOPIC TECHNIQUES"

To meet the demand for training clearly expressed by its industrial customers, the GCM held a one-day course on industrial surface analysis, last April 21. Over 14 participants from Canada and the United States attended the course, taught by Alain Rochefort, Professor at the École Polytechnique and a member of the GCM. The students especially appreciated the emphasis on understanding the basic concepts and applications of surface analysis techniques. Given its success, this course will be offered again next fall. One should note that the course may also be offered, upon arrangement, at your business premises.

THE GCM PARTICIPATES IN THE SOCIETY OF VACUUM COATERS TECHCON IN ORLANDO, FLORIDA

Last April 20 and 21, the GCM presented its analytical services, for the first time, at the Techcon trade fair, held in Orlando, Florida. This prestigious conference of the Society of Vacuum Coaters attracted nearly 800 people from around the world. We thank everyone who visited our booth.

Thin Film Research Laboratory

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ASK A GCM EXPERT A QUESTION!

Have a question about a topic covered in the newsletter, or any other matter relating to thin films, nanotechnology and advanced materials? Email us at jstasse@polymtl.ca, and GCM experts will answer you. We will publish the best questions and answers in the next issue.

RBS: THE *NEW* OLD TECHNIQUE OF THIN FILM ANALYSIS

Rutherford backscattering Spectrometry (RBS) is a technique for analyzing the composition of thin films that is both old and new: old, since it has existed for over 40 years, and new because its historic underuse makes it new for many scientists. Its great advantage lies in its ability to **quantify the elements**, whose atomic masses lie between those of carbon and uranium, as a function of depth in a material.

In the belly of RBS

RBS is the big brother version of the family of ion beam analysis techniques, which also includes two younger brothers, MEIS and LEIS. In an RBS measurement, a beam of low mass ions (helium, for example) collides with a sample. This collision can be modeled by the equations of classical mechanics, a bit like a collision between billiard balls. The energy distribution of backscattered ions is recorded, as shown in Figure 1. One then attempts to obtain the best possible fit between experimental data and theoretical simulations, to obtain information on **the natures and depth distributions of elements in the sample**. The points in Figure 1 show such experimental measurements taken on a copper substrate coated with a layer of silver and a layer of aluminum. Note the very good agreement with the theoretical simulation, illustrated by the blue solid line.

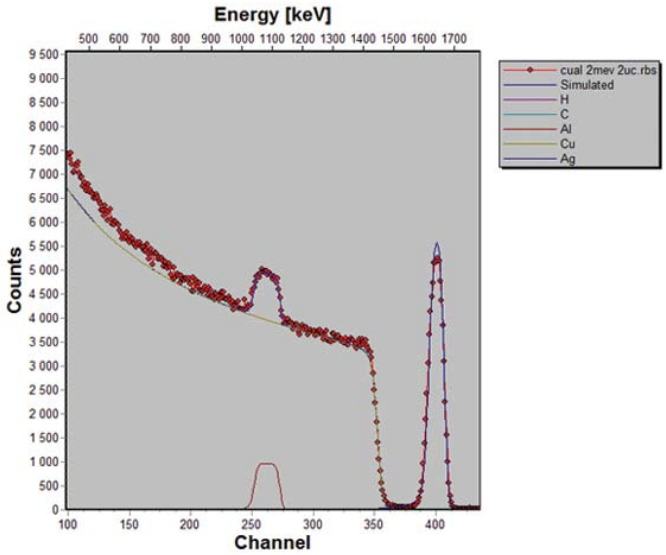

Figure 1

Typical Applications

One may easily understand that RBS is very useful for making **depth profiles up to 2 microns**. In addition, RBS can quantify the elements present without the use of standards, which constitutes a significant advantage compared to other methods, such as secondary ion spectroscopy (SIMS). The detection limit of RBS varies between 0.001% and 10%, depending on the element analyzed and the composition of the thin film. RBS has earned a place in the hearts of scientists working in the field of semiconductor, for the analysis of silicon, InGaAs, InP, etc.

Photo of the GCM RBS setup. This technique has been used by the GCM for the past thirty years.

An example of recent GCM projects includes the use of RBS to study the segregation of manganese (Mn), ionically implanted in indium phosphide (InP). Researchers have demonstrated that Mn segregates to the surface on annealing, in addition to observing a recrystallization of the layer damaged by the implantation (Bucsa IG, Cochrane RW, Roorda S, *Segregation and formation of MnP particle during rapid thermal annealing of Mn-implanted InP and GaP*, Journal of Applied Physics, volume 106, issue 1, article number 013914, July 1, 2009).

Advantages:
- Quantification without standards
- Non-destructive analysis
- Relatively rapid

Applications:
- Thin film analysis
- Depth profiles
- Atomic % concentration determinations