UK Surface Analysis Forum

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UKSAF Winter Meeting

Wednesday 9 January 2008

Advances in Materials and Methods

09.30 - 10.00 Registration

10.00 - 10.10 Welcome & introduction

Dr Dave Sykes, UKSAF Chairman

Professor Simon Gaskell
Vice President of Research, The University of Manchester

10.10 – 10.35 Dr John Walton
Corrosion and Protection Centre, The University of Manchester

XPS Spectromicroscopy: exploiting the relationship between images and spectra

10.35 – 11.00 Dr Sven Schroeder
Molecular Materials Centre, The University of Manchester

In-situ XPS and XAS investigations of complex systems: dynamic overlayer morphologies and interfaces

11.00 – 11.25 Dr Sally McArthur
Department of Engineering Materials, University of Sheffield

Microfluidic devices: surface modification and analysis

11.25 – 11.45 Coffee Break

11.45 – 12.10 Professor Ronan McGrath
Department of Physics, The University of Liverpool

Surface science of quasicrystals and related complex metallic alloys

12.10 – 12.35 Dr Patrick Chapon
HORIBA Jobin Yvon, Longjumeau, France

The Analysis of Multilayered Structures on Advanced Materials by RF-GDOES

12.35 – 13.00 Mr Keith Arnold
European Technical Centre, Pilkington plc

Thin film coatings on glass

13.00 - 14.00 Lunch

14.00 – 14.35 Professor Barbara Garrison
Department of Chemistry, The Pennsylvania State University, USA

A microscopic view of keV particle bombardment of solids

14.35 – 15.00 Dr Nick Lockyer
Surface Analysis Research Centre, The University of Manchester

Progress with C60-SIMS: 2D and 3D imaging and analysis

15.00 – 15.25 Dr Chris Blomfield
Kratos Analytical Limited, Manchester

Organic depth profiling with XPS

15.25 – 15.50 Professor Chris Carr
Textiles & Paper, School of Materials, The University of Manchester

Investigation into the surface chemistry and structure of fibres using ToF-SIMS and 3D-SEM

15.50 – 16.15 Dr Vladimir Vishnyakov
Dalton Research Institute, Manchester Metropolitan University

Applications of the Analytical Scanning Electron Microscope

16.15 – 16.30 Tea Break

16.30 Close

Dr John Walton
Corrosion and Protection Centre, The University of Manchester

XPS Spectromicroscopy: exploiting the relationship between images and spectra

By treating an XPS multi-spectral data set as a series of spectra it is possible to use spectroscopic processing techniques to produce quantified XPS images. However this ignores the three dimensional information contained in these data sets. By utilising this information it is possible visualise spectra from different components without recourse to multivariate curve resolution, improve curve fitting and aid the extraction of in-depth information.

Dr Sven Schroeder
Molecular Materials Centre, The University of Manchester

In-situ XPS and XAS investigations of complex systems: dynamic overlayer morphologies and interfaces

Over the last decade the importance of monitoring surface chemistries and overlayer morphologies as a function of environmental conditions has resulted in the construction of environmental chambers for the in situ analysis by synchrotron XPS and XAS at pressures up to the mbar range. I will describe examples for such studies on practical heterogeneous catalysts and pharmaceuticals, and how ex situ measurements in the home XPS laboratory can be related to the information provided by in situ studies. I will particularly focus on how the properties of support materials and environmental conditions influence the morphology and the electronic structure of coatings, supported nanoparticles and other overlayers.

Dr Sally McArthur
Department of Engineering Materials, University of Sheffield

Microfluidic devices: surface modification and analysis

There are significant limitations inherent in the current technologies used in protein extraction and separation for proteomes larger than 3,000 as this represents the upper limit of protein separation using conventional 2D gels. Gel-free proteomics: High-throughput microfluidic shotgun analysis for complex organisms aims to investigate novel micro-channel processing schemes that will enable spatio-temporal separation of both soluble and insoluble proteins that can subsequently be interfaced with mass spectrometry analysis. The ability to control interactions between biomolecules and micro-channel surfaces is an integral component of this project. This talk will discuss the range of polymeric surface modification techniques currently being investigated in order to control protein/surface interactions, enhance protein separation and influence the flow of fluids within microfluidic channels. In order to understand how the surface properties of a material influence the organization of biomolecules detailed characterization is required. Surface analytical techniques such as X-ray photoelectron spectroscopy (XPS), static secondary ion mass spectrometry (SIMS), and biological assays provide a complementary approach for characterizing these complex systems.

Professor Ronan McGrath
Department of Physics, The University of Liverpool

Surface science of quasicrystals and related complex metallic alloys

The analysis of alloy materials presents numerous challenges to surface science. Quasicrystals are a unique example – they are trimetallic alloys with long-range order but with no translational

symmetry; another way of looking at them is that they can be considered to have a unit cell of infinite dimensions. Somewhat paradoxically, progress made in analysing quasicrystals and their surfaces has provoked new interest in other complex alloys, with large but finite unit cell sizes. There is a vast unexplored phase space of such alloy materials – it is estimated there are some 5,000,000 stable binary alloys and some 40,000,000 ternary alloys. I will discuss the structural and compositional analysis of the surfaces of these materials drawing on several examples from the work of my group at Liverpool and our collaborators.

Dr Patrick Chapon
HORIBA Jobin Yvon, Longjumeau, France

The Analysis of Multilayered Structures on Advanced Materials by RF-GDOES

Patrick Chapon[(1)] Agnès Tempez[(1)], Philippe Belenguer[(2)], Philippe Guillot[(3)], Mihai Ganciu[(4)]

[(1)] HORIBA Jobin Yvon France [(2)] Laplace, Université Paul Sabatier Toulouse France
[(3)] Université JF Champollion Albi France [(4)] NILPRP, Bucharest Romania and LPGP Orsay France

Radio Frequency Glow Discharge Optical Emission Spectrometry (RF GD-OES) is now an established technique capable of Ultra Fast Elemental Depth Profiling of thin films down to the nanometre. As the name suggests, RF GD-OES relies on the sputtering of a large area of a material with a Glow Discharge Plasma capacitively coupled to the sample and the subsequent excitation of the sputtered species in the plasma and their analysis with a spectrometer. It is an extremely rapid technique (erosion rate of several microns/minute), that provides elemental depth profile composition of all elements (including H, N, O, and C) and it is applicable to various types of materials - conductive or non conductive. Several examples on multilayered structures will be shown. Recent results published on ultra thin films have proved that the depth resolution can be even better than the nanometre. Other researches have also revealed the minimal surface damage that the GD plasma induces when compared to ion guns. However several issues are still to be addressed regarding the coupling efficiency especially for the analysis of fragile samples, polymers, or glasses. For such materials the theoretical and experimental characterisations of the RF GD plasma and of the plasma/sample interactions permit some improvements that will be presented.

Mr Keith Arnold
European Technical Centre, Pilkington plc

Thin film coatings on glass

During the course of the past thirty years Pilkington has developed a range of coated glass products to meet the needs of the market for low emissivity and solar control glass, which are used in large volumes to fabricate high performance glazings for buildings (using low emissivity glass for cool climates and solar control glass for warm climates) and vehicles (using solar control glass). The use of coated glass products has grown rapidly in recent years as a result of the need for greater energy efficiency and enhanced levels of comfort demanded by legislation and ever more sophisticated consumers. However, many glass manufacturers and secondary processors are now competing to supply this market and in future competition will almost certainly increase as a result of cheap exports from China. In order to remain profitable it is vital that glass companies leverage their technology to develop and exploit innovative products and emerging markets, such as self-cleaning glass and photovoltaics. The presentation will attempt to show how a wide range of advanced analytical techniques is used by Pilkington to characterise thin film coatings on glass in support of research activities aimed at developing the next generation of coated glass products.

Professor Barbara Garrison
Department of Chemistry, The Pennsylvania State University, USA

A microscopic view of keV particle bombardment of solids

A short overview of the use of molecular dynamics simulations to provide insights into keV particle bombardment of solids such as in sputtering and secondary ion mass spectrometry (SIMS) will be given including animations of various processes.

Dr Nick Lockyer
Surface Analysis Research Centre, The University of Manchester

Progress with C60-SIMS: 2D and 3D imaging and analysis

The application of C60 primary ion beams continues to develop and redefine the analytical capabilities of Secondary Ion Mass Spectrometry. In this talk I will highlight recent progress in our lab using C60-SIMS for surface and sub-surface imaging and analysis of organic/biological materials. In addition I will discuss some of the analytical and theoretical challenges that still need to be addressed.

Dr Chris Blomfield
Kratos Analytical Limited, Manchester

Organic depth profiling with XPS

With the advent of low energy floating ion guns and high sensitivity small area XPS capability, XPS depth profiling through inorganic films and multi-layers is now commonplace. A need exists to have the same capability for organic films, the issue of low energy Ar profiling will be addressed and some new results using low energy O_2^+ will be presented.

Professor Chris Carr
Textiles & Paper, School of Materials, The University of Manchester

Investigation into the surface chemistry & structure of fibres using ToF-SIMS and 3D-SEM

The surface characterisation of fibrous materials is vital in developing and optimising commercial and domestic processes. In this study the effects of chemical and biochemical treatments on proteinaceous fibres is discussed.

Dr Vladimir Vishnyakov
Dalton Research Institute, Manchester Metropolitan University

Applications of the Analytical Scanning Electron Microscope

A new multi-technique Analytical Scanning Electron Microscope for material characterisation was configured and installed. Apart from ubiquitous analytical techniques it has micro-Raman and Cathodoluminescence capability, and samples can be analysed at temperatures down to liquid nitrogen. Micro-Raman analysis coupled with Scanning Electron Microscopy and Cathodo-luminescence shows that catalytical activity of Titania is provided by combination of presented phases, crystallite morphology and oxygen vacancies in the lattice. The combination of techniques also allows measurement of coating uniformity on uneven surfaces. Fully hydrated biological tissues were analysed at low temperatures. Low voltage and current operation allowed imaging of microorganisms and polymeric surfaces with fillers without conductive coatings.