Tuesday Morning, October 21, 2008

Exhibitor Workshops
Room: Exhibit Hall - Session EW-TuM

Exhibitor Workshops
Moderator: R. Langley, Consultant

10:00am **EW-TuM1 RFG Vacuum System PC/PLC Controller**, ***C. Malocsay***, Semicore Equipment Inc.

A full featured vacuum sequencer for pump, vent & vacuum interlocking for semi-automated process control. The RFG is a PC based graphical user interface (GUI) with VGA touch screen. Vacuum sequencing and input / output controls are provided by an embedded PLC. The RFG integrates easily with a host of industry proven power supplies, vacuum gauges and deposition instruments.

10:20am **EW-TuM2 New High Performance Vacuum Gauge Controller**, *S. Palmer, B. Langellotti,* ***S. Raczelowski***, Varian, Inc.

Varian's new vacuum gauge controller provides unprecedented capacity, performance and flexibility in a cost effective, standard half-rack package. A single controller can simultaneously operate up to four hot filament (or four cold cathode) gauges and four convection gauges, up to five ionization gauges, or up to twelve convection gauges. Expansion or re-configuration in the field is easy to do. Serial communications (RS-232 or RS-485), eight set points, and universal voltage compatibility are standard in all units. A programmable dot matrix LCD provides display flexibility, and simple screen organization and navigation makes the unit extremely easy to use. Drop down gauge selection automatically sets the emission current, sensitivity and overpressure. The screen displays up to eight gauges and pressures simultaneously, and permits the user to label each gauge. A large-font feature provides visibility from 20 feet.

Exhibitor Workshops
Room: Exhibit Hall - Session EW-TuL

Exhibitor Workshops
Moderator: R. Langley, Consultant

12:20pm **EW-TuL1 Combining AFM and Instrumented Nanoindentation for Mechanical Characterization of Materials at the Nanoscale**, ***A. Bonilla***, Asylum Research

Nanoindentation applications have been a popular technique for characterizing a wide range of materials at the nanoscale. This workshop will discuss the Asylum Research NanoIndenter for true quantitative measurements. Unlike other commercially-available cantilever-based (AFM), the NanoIndenter drives the indenting tip perpendicular to the sample. The force is computed as the product of the spring constant and the measured indenter flexure displacement. This measurement is done by converting the vertical flexure displacement into an optical signal measured at the standard MFP-3D photodetector. Because the two quantities of indentation, depth and force, are computed based on displacements measured with AFM sensors, the indenter has unprecedented resolution. The NanoIndenter is also the first commercially-available instrumented nanoindenter that allows high voltage piezoresponse force microscopy (PFM) measurements. The NanoIndenter can operate, as well, when the sample is heated up to 300° C and under fluid. The technology and operation will be discussed along with current application examples including PFM.

12:40pm **EW-TuL2 Manipulation and Characterization of Nanoobjects in SEM**, ***H. Koop***, attocube systems AG, Germany

Ultra-high precision spatial positioning of objects is of prime importance in the emerging field of nanotechnology. attocube systems, a German company located in Munich, manufactures and provides ultra-high precision spatial positioning systems and complete probing tools which are particularly suitable for extreme environmental conditions such as cryogenic temperatures (10 mK – 300 K), high magnetic fields (+31 T) and ultra high vacuum environments (5 x 10-11 mbar). attocube systems' ultra-compact positioning devices enable linear, angular and rotational movement of samples or probes. They are offered in different sizes, as well as materials, and feature an unprecedented variety of applications particularly suitable for extreme environmental conditions. This represents a revolutionary advancement in the field of nano-positioning, leading to new research possibilities in many areas. Applications for these outstanding nanopositioning devices, well-known in many labs around the world, include, amongst other methods, SPM techniques such as confocal microscopy, scanning force microscopy, scanning tunneling microscopy, near-field optical microscopy, and scanning electron microscopy. Due to the unique working principle attocube's nanopositioners are dedicated for usage in challenging application areas where the combination of high accuracy on one hand and large positioning range on the other one is required. Their excellent performance makes them consequently highly suitable for Scanning Electron Microscope (SEM) applications. The necessity of specific SEM tools and equipment for new fields for research and application becomes more important, particularly as the progress on nanofabrication moves the critical dimensions below the optical resolution limit. There is already a wide range of applications available using attocube's SEM tools. One highly sophisticated system is an SEM probe station allowing the manipulation of nanoobjects on sub-nm level as well as the characterization of electrical properties under SEM conditions, simultaneously. The highest level of usability and flexibility offers attocube's new Atomic Force Microscope (AFM) fully integrated into SEM. By combining major advances of these complementary systems, it is possible to run all AFM applications having full visible access to the tip position with respect to sample. For further technical information concerning attocube systems' products, please visit the website www.attocube.com.

1:00pm **EW-TuL3 Momentum Microscope for Angular and Time Resolved Imaging of Valence Band Electron States**, *B. Krömker,* Omicron Nanotechnology GmbH, Germany, *M. Escher,* FOCUS GmbH, Germany, *D. Funnemann,* Omicron Nanotechnology GmbH, Germany, *D. Hartung, H. Engelhard,* Max-Planck-Institut für Mikrostrukturphysik, Germany, ***K. Winkler,*** Omicron Nanotechnology GmbH, Germany, *J. Kirschner*, Max-Planck-Institut für Mikrostrukturphysik, Germany

We demonstrate the application of a novel design of a photoelectron microscope in combination with an imaging energy filter for momentum resolved photoelectron detection. We image the complete momentum distribution of photoexcited electron states in an energy plane through the Brillouin zone. The basic concept of the microscope is to project the momentum image from the back focal plane of the objective lens of a Photoelectron Emission Microscope (PEEM) through an energy filter onto an image detector. Our design is based on a PEEM with an imaging energy filter. The spherical (α^2) aberrations of the imaging energy filter are strongly reduced by a novel analyzer design. Together with a time resolved imaging detector it is possible to combine spatial, momentum, energy and time resolution of photoelectrons within the same instrument. The time resolution of this type of energy analyzer can be reduced to below 100 ps. The complete ARUPS pattern of a Cu(111) sample excited with He I, is imaged in parallel and energy resolved up to the photoelectron emission horizon (at ±90°). Excited with a Mercury light source ($h\nu$ = 4.9 eV) the Shockley surface state at the energy threshold is imaged clearly in k-space. With the high transmission and time resolution of this instrument, possible new measurements are discussed: Time and polarization resolved ARUPS measurements, probing changes of bandstructure due to chemical reactions, in-situ thin film growth and investigation of phase transitions e.g. melting or martensitic transformations.

1:20pm **EW-TuL4 Combined Mechanical and Optical Analysis Methods for Surfaces and Coatings**, ***J. Powell***, CSM Instruments

In the matter of materials development and device design, the optimization of material properties is instrumental to success of a coating system or surface functionality. CSM Instruments, a company specializing in advanced mechanical surface characterization, offers a wide range of mechanical contact-based testing instruments at the micro- and nano-scale for this purpose. This includes indentation testers for hardness, elastic modulus, creep, and fatigue behavior, tribometers for coefficient of friction and wear measurement, and advanced scratch testing tools for analysis of coating adhesion, scratch resistance, and viscoelastic recovery. To fully characterize a materials' behavior, these tools can be integrated with atomic force (scanning probe) or confocal microscopy to "complete the picture", allowing you to quantify pileup volume and height, indentation depth and width, scratch track width and angle, and spall (chip) size and shape, amongst other deformation features. This presentation will discuss how mechanical and optical tools can be easily combined on a single testing platform. A number of interesting examples from materials research and industrial design centers will also be presented, with explanation of what can be learned from each capability.

Exhibitor Workshops
Room: Exhibit Hall - Session EW-TuA

Exhibitor Workshops
Moderator: R. Langley, Consultant

3:20pm **EW-TuA1 Deposition Tolerant Langmuir Probe**, *D. Gahan, B. Dolinaj,* ***M.B. Hopkins***, Impedans Ltd.

In a standard Langmuir probe system the monitoring of plasma parameters during plasma deposition is limited by the effects of probe surface contamination. A number of issues arise: i) A Langmuir probe immersed in the plasma during deposition processes is subjected to the deposition of a layer resulting in a large disturbance of the probe characteristic. Surface contamination changes the work function, resulting in a shift of the probe characteristic and/or in hysteresis in the I-V Characteristic. The formation of dielectric layers causes the slope of the characteristic to become shallow and eventually reduce the current to zero. This problem is addressed in current Langmuir probe systems based on electron or ion cleaning but limits the probe operation to plasma with low deposition rates. ii) A poor ground return path for the electron current causes shifts in the plasma potential. While this problem is addressed in modern probe systems by using a floating reference probe to compensate for low frequency effects, in deposition plasmas the reference electrode cannot be cleaned by electron bombardment and may be become insulating. The poor electron ground return is made worse by insulating coatings on the wall. In order to produce a Langmuir probe that can operate well in deposition plasma we have introduced a high frequency swept probe. The probe attains a dc bias negative relative to the plasma potential and draws a net current close to zero. The probe records the ac IV characteristic or complex impedance of the sheath and determines the plasma parameters. This technique is valid even in the case of a fully insulating layer forming on the probe surface. The probe draws little net current and minimal ground return is required. We show that the plasma to ground sheath capacitance provides sufficient current during the electron collection period. A unique feature of the probe is the ability to attain a bias voltage above the plasma potential even when coated with a non-conducting layer. We show results of the system in an O2/N2 plasma and compare the swept probe with a standard Langmuir probe.

3:40pm **EW-TuA2 Latest Developments and Application of the Qtac100 for High Sensitivity LEIS**, ***N. Havercroft***, ION-TOF USA, Inc., *E. Niehuis, T. Grehl*, ION-TOF GmbH, Germany

The new high sensitivity and high resolution Low Energy Ion Scattering (LEIS) instrument, the Qtac^3, delivers quantitative top atomic layer characterization. It is able to quantitatively analyze the outermost atomic layer of a solid and gain in-depth information in a non-destructive way. The surface is bombarded with low energy (up to 8 keV) noble gas ions that scatter from individual surface atoms. The energy of the ions after scattering is characteristic of the mass of the surface atom. If the scattering event occurs below the surface, an additional depth dependent energy loss can be measured, providing information about the composition of the sample up to 10 nm deep ("static depth profiling"). With its unique energy analyzer, the scattered ions are detected with high sensitivity, while simultaneous high mass resolution allows unambiguous elemental identification. With a pulsed ion beam and time-of-flight filtering, the background of sputtered ions can be resolved from the scattered ions, improving the detection limits for light elements and for trace element detection. Together, this allows an application of the Qtac to many technologically relevant fields. We will present the latest developments of the Qtac100, and show the benefit of the instrument to a variety of applications from traditional surface science to industrial uses. Among these, semiconductor materials (e.g. thin films, layer growth) and heterogeneous catalysts (e.g. Au/Pt nano-clusters, determination of poisoning sites) are the most prominent ones, but other fields that require quantitative top atomic layer characterization will also be addressed.

Exhibitor Workshops
Room: Exhibit Hall - Session EW-WeM

Exhibitor Workshops
Moderator: R.A. Childs, MIT

10:00am **EW-WeM1 New Premium Line of Turbomolecular Pumps by Oerlikon Leybold Vacuum, TURBOVAC SL 80 - 300 – 700**, *M. Sydow*, ***B. Rock***, Oerlikon Leybold Vacuum

Oerlikon Leybold Vacuum as a leading supplier of vacuum technology with the largest product offering has recently introduced the new premium line of turbomolecular pumps, the TURBOVAC SL line. This family has been developed to generate high vacuum in the most economic way for most simple operation. The pumps are available in models with pumping speeds of 70 to 700 l/s generated by computer designed rotor devices. The high precision mechanical ball bearing systems are made out of industrial proven material, a combination of ceramics and stainless steel. They are lubricated by high efficiency grease for optimum lifetime. The pumps are manufactured with the latest technology of CNC machines to provide the high level quality standard which the high tech users expect. The quality of each pump is controlled automatically by frequency analysis before leaving the factory. For minimum footprint the TURBOVAC SL pumps can be equipped with the box controller mounted on the pump body at multiple sites as well as separated from the pump. This allows the user to optimize the available space in the vacuum system. The new "anybus" interface concept offers the choice between RS232, 485, Ethernet, profibus or 24V type. The new family of TURBOVAC SL turbomolecular pumps has been designed to provide proven quality in combination with highest flexibility in installation and communication. This makes the pump family the best solution for the use in analytical instruments, research labs in universities and industry and industrial production, i.e. thin film coating application.

10:20am **EW-WeM2 New Advances in Raman Microscopy Instrumentation**, ***M.H. Wall***, Thermo Fisher Scientific

Raman microscopy provides valuable and important information about the molecular composition of a material under investigation. This information is complementary to other recognized techniques for material analysis such as SEM and XPS and as such augments the information provided by these and other technologies. This presentation will highlight the recent advances in Raman micrsocopy instrumentation that have yielded instruments that are no longer instruments for only dedicated Raman researchers but are analytical tools that can also be effectively used by the non expert. Examples will also be presented that displays the applicability and importance of Raman microscopy in the field of materials characterization.

Wednesday Lunch, October 22, 2008

Exhibitor Workshops
Room: Exhibit Hall - Session EW-WeL

Exhibitor Workshops
Moderator: R.A. Childs, MIT

12:40pm **EW-WeL1 Characterization and Optimization of Polyatomic Ions for XPS Depth Profiling of Organic Materials**, ***C.J. Blomfield****, S.C. Page, D.J. Surman, S.J. Hutton, A.J. Roberts, S.J. Coultas*, Kratos Analytical Ltd, UK

X-ray Photoelectron Spectroscopy (XPS) depth profiling of inorganic materials has become a standard analytical technique. Results can be obtained relatively quickly with good interface resolution while maintaining chemical information. It has become desirable to achieve the same performance on organic materials however there are several well known problems associated with sputter depth profiling which has limited the application. In recent years there has been significant development in the TOF-SIMS community of the use is polyatomic ion sources and in particular C60 for the generation of molecular species from organic materials. This use of C60 has been extended to XPS depth profiling and for some materials has shown good promise. This paper discusses the characterization and optimization of other polyatomic species in addition to C60 that are also showing considerable promise for XPS depth profiling of organic materials.

1:00pm **EW-WeL2 State-Of-The-Art Software and Surface Analysis at Thermo Fisher Scientific**, *R.G. White,* ***P. Mack***, Thermo Fisher Scientific, UK

State-of-the-art XPS instruments require state-of-the-art software for system control and data processing. If the software is not easy to use whilst at the same time being powerful and flexible, then the high performance offered by the hardware may not be realised in everyday usage. Additionally, the increased sample throughput afforded by high sensitivity data acquisition can be compromised if time is then wasted during data processing or reporting. Thermo Scientific's Avantage software combines advanced XPS instrument control and data processing, creating an integrated workflow from data acquisition to data reporting. The high level of integration between instrument control and data processing offered by Avantage allows recipes to be created which automate both the acquisition and processing of XPS data. Avantage recipes can be programmed with the knowledge and experience of an expert user, allowing repetitive, but complex, tasks to be fully software controlled. Workflows with advanced data acquisition and peak fitting protocols, for example, can be created which automatically reduce vast XPS datasets to a set of pass-fail parameters. These expertly crafted recipes can be used by both novice and advanced users. Avantage features a wide variety of data processing tools which enable the user to move from raw XPS data to useful real-world parameters quickly and easily.

1:20pm **EW-WeL3 XPS Sputter Depth Profiling and Surface Cleaning with C60 Sputter Ion Beams**, ***J.F. Moulder****, S.N. Raman, J.S. Hammond*, Physical Electronics

C60 sputtering has emerged as a standard method for XPS depth profiling of polymer, organic, and biomaterial thin films. Several years of exploratory use of C60 ions for sputter cleaning and depth profiling has shown C60 sputter cleaning can be successfully applied to a very broad range of materials with good success and that C60 depth profiling, while not universally applicable, has been successfully used to study a number of important and commonly used materials systems. We will present an overview of our experience with C60 sputtering as it relates to XPS and highlight the strengths and limitations of this new surface characterization method. Experimental results from inorganic, polymer, and biomaterials will be presented to illustrate the application potential for XPS and C60 sputtering.

Exhibitor Workshops
Room: Exhibit Hall - Session EW-WeA

Exhibitor Workshops
Moderator: R.A. Childs, MIT

3:20pm **EW-WeA1 The What, Why and How of Self-Assembly of Alkanethiols: A Practical Tutorial*, D.J. Graham***, Asemblon Inc.

Alkanethiols are used in an ever increasing number of applications throughout a wide range of fields. These applications span from simple control of surface chemistry to the elaborate dreams of nanotechnology. Almost equal to the variety of their uses are the methods employed to create alkanethiol SAMs. This presentation will provide an overview tutorial of practical information on how to use alkanethiols to create homogenous, mixed, and patterned SAMs using methods such as solution assembly, microcontact printing, and other patterning methods. Learn about the what, why and how of using alkanethiols and avoiding some of the common pitfalls of creating SAM surfaces.

3:40pm **EW-WeA2 Real Time Film Thickness Monitoring on Roll to Roll Coaters*, E. Teboul***, HORIBA - Jobin Yvon Inc.

Flexible substrates have been increasingly used to support deposition of thin films for packaging, pharmaceutical and solar industries where cost efficient production and consistent quality coatings are the drivers. Real time thickness monitoring of the deposited layers present several challenges such as mechanical alignment, unrolling speed of the substrate and complex material properties of the substrate, that need to be overcome in order to perform a successful measurement. HORIBA Jobin Yvon has developed an in-line configuration of its UVISEL spectroscopic ellipsometer that address the measurements difficulties encountered on a roll to roll coater. The UVISEL is capable of measuring a spectral range from 190 nm to 880 nm in just fifty milliseconds (50 ms) that makes it suitable for most rolling speed currently used. New fitting algorithms have been developed in order to characterize accurately complex substrate materials. Example of real time dielectric film thickness and optical constants deposited on moving Polyethylene Terephthalate (PET) and Aluminum (Al) flexible substrates are presented.

Thursday Morning, October 23, 2008

Exhibitor Workshops
Room: Exhibit Hall - Session EW-ThM

Exhibitor Workshops
Moderator: R.A. Childs, MIT

10:00am **EW-ThM1 SPR Imaging in Biosensor Development**, *V. Kodoyianni*, ***T.G. Burland***, GWC Technologies Inc.

Surface biosensors have potentially broad applications in areas ranging from research to diagnostics to environmental testing, among others. Rapid increases in our knowledge of protein biology, together with increases in protein engineering capabilities, are expanding the opportunities to develop useful biosensor devices. However, implementing surface sensors based on proteins can be challenging, as a given surface immobilization method can have profoundly different impacts on the activity of different proteins. We will present examples of how SPRi (Surface Plasmon Resonance Imaging) can be used as a tool to identify and solve surface sensor fabrication problems, and how such sensors can be used to detect a wide range of biological targets.

Authors Index

Bold page numbers indicate the presenter