Tuesday Morning, November 14, 2006

Exhibitor Workshop
Room Exhibit Hall - Session EW-TuB

Exhibitor Workshop
Moderator: R.A. Childs, MIT

10:00am **EW-TuB1 Biomaterial Characterization and Problem Solving with Surface and Microanalytical Techniques***, I. Mowat,* Evans Analytical Group
Surface and microanalysis techniques have a wide range of applications for biomaterials. In research and development, understanding surface chemistry can help to shorten development cycles & provide ways to compare the effectiveness of new materials early in the process. This can make it possible to bring products to market more quickly. In production, analysis techniques are valuable tools for quality assurance and quality control processes. In both R&D and production, as well as in dealing with returned or faulty product, failure analysis techniques can provide essential information to better understand what went wrong. Examples of how various surface analysis techniques can be used to address these areas will be covered in this talk.

10:20am **EW-TuB2 Novel Mass Spectrometer Design with Intuitive User Interface for Helium Leak Detection***, J.D. Geist,* Varian Vacuum Technologies Inc., US*; P. Williams,* Arizona State University*; S.J. Yamartino, J.H. Diep,* Varian Vacuum Technologies Inc.
Mass spectrometers tuned to detect the lighter gasses have been used for many years to quantify leaks in various materials and joints. As the technology advanced, so did the desire to detect smaller leaks (<1 X 10@super -11@ Atm-cc/Sec). Efficient, contamination-free ion production and the ability to measure smaller ion current are key elements in the successful detection of smaller leaks. Through the use of selective ionization, the ion stream would contain a mix of ions that could effectively be discerned by the magnetic sector. By precisely shaping and positioning the electrodes in the ion source to maximize the ion beam cross section in the gap, the number of detected ions would be maximized. A novel approach to spectrometer design including an efficient, contamination-rejecting hot filament ion source, novel ion optical design and robust ion detection without the use of an electron multiplier will be presented. Mass spectrometers are often used by operators who have minimal training and who are not experts in leak detection. Many instruments overwhelm the users with an array of buttons, lights and user information. A new paradigm in the user interface experience now provides the user with the necessary functions while allowing access to the more advanced functions via a color touch screen. This touch screen interface has incorporated graphical functions that allow the brain to process the information faster than if the information was in written text. Additionally, since all information is embedded into the screen, functions that could not be provided using "hard buttons" are possible while providing a truly global model supporting multiple languages including English, French, Spanish, German, Chinese, Japanese and Korean.

Exhibitor Workshop
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12:20pm **EW-TuL1 Applications of a New TOF-SIMS Tool for 300 mm Wafer Inspection**, *E. Niehuis,* ***R. Moellers,*** *T. Grehl, D. Rading, F. Kollmer,* ION-TOF GmbH, Germany

We have developed a new fully automated and cleanroom compatible TOF-SIMS tool with FOUP loading for 300 mm wafer inspection. The instrument and its automation is designed to apply a variety of recipes for various analytical tasks. We will describe the instrument performance and discuss various applications of this tool in semiconductor industry like trace metal detection, detection of organic contaminants, analysis of gate dielectrics and ultra-shallow implant dosimetry.

12:40pm **EW-TuL2 Advantages of the Delay-Line Dector for XPS Imaging**, ***C. Blomfield****, S. Page,* Kratos Analytical

The delay-line detector, comprising a multi-channel plate stack above a delay-line anode, is used for photoelectron detection in both spectroscopy and imaging mode. With over 100 detector channels the DLD can also be use to acquire unscanned or 'snapshot' small spot spectra in a matter of seconds. Genuine pulse counting in 2D imaging mode means that quantitative parallel images can be generated to allow greater insight into the lateral distribution of chemical species at the surface. The ability to obtain a fast parallel chemical image which can be used as a reference to perform spectroscopic analysis is an integral part of the AXIS XPS instruments. The incorporated electrostatic deflection system allows easy multi-point analysis to be carried out from within the imaged field of view. The real time imaging capability of the Axis intruments reduce sample setup time and significantly reduces the image acquisition time. This ultimately leads to improved data quality and a greater sample throughput.

1:00pm **EW-TuL3 A New End-Hall Ion Source with Improved Performance**, *L. Mahoney, D. Burtner, D. Siegfried,* ***C. Dale,*** Veeco Instruments Inc.

End-Hall ion sources have been used for almost 20 years in the optical coating industry for ion assisted deposition (IAD) and substrate pre-clean. In these applications, end-Hall ion sources have several desirable performance characteristics. They produce a large current of low energy ions, and they distribute the ions uniformly over a large coverage area. The sources can operate on either argon or oxygen, and maintenance requirements are typically lower than for gridded ion sources. The trends toward higher production volumes and reduced cost of ownership in the optical coatings industry require ion sources with higher output, modular integration, and more effective maintenance features. This paper presents a new end-Hall ion source that has improvements in performance, form factor, and required maintenance over the current industry-leading end-Hall ion source. Ion production rates, beam uniformity, and thermal characteristics are presented at discharge powers up to 3 kW.

1:20pm **EW-TuL4 Next Generation Commercial LEEM FE-LEEM P90**, *B. Achilles,* ***A. Berghaus,*** SPECS GmbH, Germany

A next generation Low Energy Electron Microscope (FE-LEEM P90) with unsurpassed 5 nm resolution for dynamic LEEM experiments is available from SPECS GmbH, Berlin. With this instrument, based on the design of Dr. Rudolf Tromp, nanometer scale processes on surfaces can be made visible in real-time. At this year's AVS Fall Meeting an innovative energy filter for PEEM imaging will be presented, which enables imaging with an energy resolution down to 250meV with a minimal impact on the high spatial resolution of the instrument. Low Energy Electron Microscopy, invented by E. Bauer, is a key technique for research in the field of surface dynamical processes, growth and structure. In a LEEM electrons are slowed down to energies of not more than several ten eV before they interact with the sample. Therefore the information only comes from the very surface of the sample. This allows in situ observation and analysis of surface processes. Guiding the design of the SPECS FE-LEEM P90 was the goal to achieve the highest resolution with a minimum number of electron-optical elements. Incoming and outgoing electrons are separated by a 90° magnetic prism array. This geometry allows a simple, intuitive step by step adjustment of all lens parameters. The magnetic prism transfers both the LEEM image and the LEED pattern astigmatically, allowing routine switching between real image and diffraction pattern. Both image and LEED pattern are transferred without the negative effects of chromatic dispersion, offering superior image and diffraction capabilities. The SPECS FE-LEEM P90 is integrated into a UHV LEEM sample analysis chamber with facilities for sample preparation and in-situ high temperature sample processing.

1:40pm **EW-TuL5 BOCCT Magnet Retrofit Assemblies**, *M. Bernick,* ***J. Hrebik,*** Angstrom Sciences, Inc.

Angstrom Sciences, Inc. has optimized a high-performance magnet retrofit assembly for BOCCT-HRC magnetron assemblies to improve target utilization over existing designs. As a magnetron sputtering cathode ages and the machine's efficiency declines, a decision to either replace or repair the equipment becomes necessary. However, cost effectiveness in production is vital to maintaining a competitive edge in the marketplace. Angstrom Sciences' BOCCT-HRC retrofit offers a solution, dramatically improving target utilization over the existing design without changing process parameters and ultimately maximizing ROI.

2:00pm **EW-TuL6 K-Alpha, A New Approach to X-ray Photoelectron Spectroscopy (XPS)**, ***R.G. White,*** Thermo Electron Corporation, UK

X-ray Photoelectron Spectroscopy (XPS) is a powerful surface analysis technique. It provides quantitative information about the elemental and chemical state composition of the first few monolayers of a material. When combined with ion beam sputtering, compositional depth profiles can be obtained from a few micrometers. The method has applications in many fields, including polymers, biomaterials, glasses, metals catalysts, and semiconductors. Until now, the instrumentation has been expensive to acquire and has needed an expert to determine the most appropriate analytical conditions. These two factors make the cost of ownership very high. Many scientists, who would benefit from this type of analysis, are deterred from using the technique. In this symposium, it will be shown that, by the use of modern manufacturing techniques, novel technology and advanced software design, XPS has become available to all analysts. High sensitivity combined with extensive automation maximises throughput. Automation in data processing and reporting allows the analyst to obtain maximum use of the instrument, avoiding the need for repetitive and time-consuming activities. XPS has become be a multi-user analytical method.

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10:00am **EW-WeB1 Capacitance Diaphragm Vacuum Gauge with ASIC Electronics**, *H. Hanselmann,* INFICON Ltd, Balzers, Liechtenstein*; R. Steiner, W. Hinn,* Hochschule für Technik Rapperswil, Switzerland*; M. Wüest,* ***C. Berg,*** INFICON Ltd, Balzers, Liechtenstein

We have developed a capacitance diaphragm vacuum gauge with digital electronics using an application specific integrated circuit (ASIC). The ASIC incorporates a charge balance amplifier and a matching network of capacitances which allows tuning the compensation capacitance between 0 and 1023 fF by software command. The use of digital electronics including an ASIC has many advantages such as improved accuracy since temperature drift and nonlinearity are better compensated. Further, owing to the highly integrated design stray capacitances have been reduced and immunity to electromagnetic interference has been improved.

10:20am **EW-WeB2 Properties of Today's Vacuum Components**, ***D. Koster,*** Danfoss, Germany

Vacuum processing today demands shorter process times and higher through-put at lower power consumption. There will be a continually increasing demand for vacuum equipment that secures these competitive benefits. At the same time, end products must meet consistently high quality standards. Choosing an appropriate vacuum valve technology has become markedly more important in meeting the requirements of the end user's application. This presentation focuses on the development of today's most commonly used vacuum valves and provides background on the benefits to be sought from those valves in today's vacuum processing.

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12:00pm **EW-WeL1 DIGITEL Ion Pump Controller user interface enhancements*, T. Wynohrad**, D. Wetterlin,* Gamma Vacuum

Gamma Vacuum has changed to an ion pump controller that uses a ¼ VGA flat panel LCD touch screen. Functionality of DIGITEL lines remains similar with user requested enhancements. The new display allows for simplistic operation and programming of advanced ion pump and TSP controller features. Differences in operational and programming methods between the previous LED and LCD DIGITEL models will be discussed in detail for training purposes.

12:20pm **EW-WeL2 Renaissance of the PHI 5000 ESCA and PHI TOF-SIMS Systems*, J. Hammond**, H. Iwai, S.R. Bryan, D. Watson, D. Doescher, J. Luedtke, N. Sekiya, M. Miller, R. Oiwa,* Physical Electronics

This presentation will describe the latest product developments at PHI for XPS and TOF-SIMS. New developments will be introduced which will expand the applications of both techniques to a wider range of scientific studies.

12:40pm **EW-WeL3 Nano, Micro and Macro Indentation of Coatings on the Same Tester*, N.V. Gitis**,* CETR

A unique tester mod. UMT has been developed to allow for measurements of ALL COMMON hardness scales: instrumented indentation with continuous force-displacement monitoring and automatic Oliver-Pharr calculations of stiffness, hardness and Young modulus within an unmatched wide range from 100 nN to 1 kN, with Berkovich, conical and cube-corner indenters, Rockwell with both Brale and ball indenters, Knoop, Vickers, Brinell, sclerometry (both micro-scratching with lengths from microns to centimeters and nano-scratching with reproducible depths from 1 nm to 100 nm). Comparison of results per any hardness scales on the same specimens without their removal allows for in-depth investigations of surface properties. Multi-sub-loading-unloading cycles during instrumented indentation allow for studies of hardness versus depth of penetration.

1:00pm **EW-WeL4 Manufacturing and Imaging of Magnetic Nanostructures: FIB and SEMPA Combined with UHV SEM*, J. Westermann**, M. Oertel, T. Berghaus, M. Maier, G. Schaefer,* Omicron NanoTechnology, Germany

The capabilities of Omicrons NanoSAM, Multiscan and Nanoprobe systems have recently been extended by two new techniques. On the one hand, the UHV Gemini SEM column has been combined with a Focussed Ion Beam source (FIB) for surface structuring. On the other hand, magnetic domains can be imaged with the SEMPA technique (SEM with Polarisation Analysis). The FIB is a fully UHV compatible version of the Orsay Canion 31+, with a spot diameter down to 5 nm. Together with the UHV Gemini column, this unique combination allows "Cross beam"TM applications under true UHV conditions in the 10-8 Pa regime. A newly developed SEMPA detector based on the SPLEED principle@footnote 1@ allows the imaging of magnetic domains with resolution in the 10 nm regime. The SEMPA detetctor has been developed in collaboration with the University of Hamburg. Compared to other polarisation detectors, for example such as Mott detectors, it offers a superior spin asymetry (A > 0.25) and overall detetcion efficency (figure of merrit: A2I/I0 > 6*10-5). Two systems with sligthly different instrumental combinations are currently under construction. These instruments will enable their operators to create "arbitrarily" shaped nanoscale structures and optimise their properties. Goals are for example related to the understanding of exchange coupling between layers in dependence of the pattern shape, or understanding the electronic transport in dependence of the domain structures on the nanoscale, both topics closely related to the fields of magnetic data storage and spintronics. The techniques SEM, FIB, SEMPA may also be extended with dedicated Low Temperature STM for Tunneling Spectroscopy or Spin Tunneling, as well as with a four probe for conductivity measurements of the magnetic structures, for example in dependence of the domain structure or applied magnetic fields. @FootnoteText@ @footnote 1@R. Frömter, H.P. Oepen, J. Kirschner Appl. Phys. A 76, 869-871 (2003).

1:20pm **EW-WeL5 The New NanoIndenter (tm) for Quantitative Surface Characterization with AFM*, A. Bonilla**,* Asylum Research

Nanoindentation applications in AFM have been a popular technique for characterizing a wide range of materials. This workshop will discuss the new Asylum Research NanoIndenter for true quantitative measurements. Unlike other commercially-available cantilever-based (AFM), the NanoIndenter drives the indenting tip perpendicular to the sample. Displacement and force are measured with optimized AFM sensors that eliminate inaccuracies present in other systems. This allows for increased sensitivity and resolution and extremely accurate tip characterization. The technology and operation will be discussed and current examples of nanoindenting applications will be presented

1:40pm **EW-WeL6 Nanopositioning and Scanning Probe Microscopy for Extreme Environments*, A. Kueng**, D. Haft,* attocube systems AG, Germany

attocube systems AG manufactures and distributes a complete line of easy-to-use probing stations, scanning probe microscopes and nanopositioning systems for temperatures in the range from 300 K down to 10 mK! The innovative instruments are also compatible with high vacuum and UHV environments as well as with high magnetic fields up to 15 T. Central to our proven suite of cryogenic probe stations and microscopes is our powerful combination of fully automated low temperature positioning devices with modular and flexible scanning probe sensors, designed specifically to meet the needs of today's low temperature and high vacuum research. Our instruments give users the ability to analyze samples down to the atomic level, even at Milli-Kelvin temperatures.

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11:00am **EW-ThL1 MM-16: New Spectroscopic Ellipsometer for Fast and Simple Advanced Materials Characterization***, P. Tivin, E. Teboul, Y. Ji,* HORIBA Jobin Yvon Inc

HORIBA Jobin Yvon now introduces the MM-16, a new, low-cost spectroscopic ellipsometer dedicated to advanced characterization of a broad range of materials. In addition to the standard measurements of film thickness and optical constants, the MM-16 provides the full polarization states matrix (Mueller matrix) of a sample in less than 2 seconds. This additional capability allows accurate, simple and easy characterisation of anisotropy, retardance and degree of depolarization. With options such as automatic variable angle of incidence (VASE), motorized mapping stage and micro spot, the MM-16 is a powerful and cost effective tool for fast, comprehensive, and simplified materials characterization. Results obtained with the MM-16 for a wide range of applications such as: Displays with Liquid Crystals, ITO, polymers; Coatings with TiO@sub 2@, ZnO, Al@sub 2@O@sub 3@, Y@sub 2@O@sub 3@, ZrO@sub 2@; Semiconductor with AlGaN, AlN, TiN are presented.

11:20am **EW-ThL2 Flexible 200 mm ALD Oxide, Nitride and Metal Processes***, N. Singh,* Oxford Instruments Plasma Technology, UK, United Kingdom*; C. Hodson,* Oxford Instruments Plasma Technology, UK

Al@sub 2@O@sub 3@, HfO@sub 2@, TiN and Ru films have been deposited in the Oxford Instruments flexible 200 mm ALD reactor. The effects of process parameters such as process temperature, precursor dosage and plasma power on film quality were investigated. Film thickness was obtained from nanospec measurements. XRD, AES, RBS techniques were used to characterize the stoichiometry, film structure and contamination levels. Four point probe was used to measure the resistivity of metallic films. TiN films deposited from TiCl@sub 4@ and N@sub 2@ / H@sub 2@ plasma showed self limiting behaviour at a deposition rate of 0.33Å/cycle. The resistivity at 350°C deposition temperature was < 170μ@ohm@cm. The chlorine impurity in TiN varied from 2.6% to 1.2% for plasma exposures of 3 sec and 5 sec respectively. Longer plasma exposures also lowered the resistivity values from 170 to 140μ@ohm@cm at 350°C deposition temperature. Hafnium Oxide films deposited from TEMAH and O@sub 2@ plasma showed saturation at a deposition rate of 1.1Å /cycle. The dielectric constant of the film was found to be ~20. The same film deposited thermally using H@sub 2@O as the oxidant saturated at 0.8Å/cycle and had a lower dielectric constant ~18. A compositional ratio of [O]/[Hf] 2.0 to 2.13 was obtained from RBS. The C content in plasma HfO@sub 2@ films was < 2%. Aluminum oxide films deposited from TMA and O@sub 2@ plasma showed self limiting behaviour at 1.2Å/cycle at 200°C. The total cycle time was < 5 sec with a 20 msec TMA pulse suffcient to provide self limiting ALD growth. Ruthenium (Ru) films deposited from Ru(EtCp)@sub 2@ and oxygen plasma showed self limiting behaviour at a deposition rate of 0.37Å/cycle on 100Å thick TiN layers. The film resistivity was < 20μ@ohm@cm at 350°C. The impurities (C, H, O) in the deposited films are < 2%. By varying the plasma conditions and oxygen composition, ruthenium oxide films can be deposited.

11:40am **EW-ThL3 Introducing the Dektak D150 Stylus Profiler: Performance, Stability and Value***, T. Ballinger, G. Anderson, J. Horwitz,* Veeco Instruments Inc.

Introducing the Dektak D150 Stylus profiler. Veeco's 7th generation stylus profiler expands the capabilities of stylus profiling. A quantum advance over the industry standard, the Dektak 6M profiler, the D150 adds 3D mapping and 6" programmability to the manual capability of the former Dektak 6M, yet maintains an affordable price point for value conscious consumers. Low force scanning, high accuracy stress measurements, accurate angle determination for advanced applications are but a few of the enhancements. Add in a complete rewrite of the basic Dektak software architecture to create an intuitive user interface with unparalleled analytical capabilities.

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