Wednesday Morning Poster Sessions, November 5, 2003

Applied Surface Science
Room Hall A-C - Session AS-WeP

Poster Session

AS-WeP1 A Simple Method Identifying the Influence of Photoperturbation Effect on Ultrashallow Junction Images Observed by Scanning Capacitance Microscope, *M.-N. Chang,* National Nano Device Laboratories, Taiwan, R.O.C.*; W.-W. Wan, J.-H. Lai,* National Tsing Hua University, Taiwan, R.O.C.*; C.-Y. Chen, F.-M. Pan,* National Nano Device Laboratories, Taiwan, R.O.C.*; J.-H. Liang,* National Tsing Hua University, Taiwan, R.O.C.

Scanning capacitance microscopy (SCM) with high sensitivity and high spatial resolution has attracted much interest in profiling two-dimensional carrier distribution and investigating ultrashallow junctions. Atomic force microscope (AFM), equipped with a SCM system, is a typical setup that synchronously provides SCM images and the corresponding topographic images for cross-sectional characterization. In this work, we have provided a simple method to investigate the influence of photoperturbation effect induced by AFM laser beam on ultrashallow junction images observed by SCM. The samples were ultrashallow p$^+$ junctions formed by BF_2^+ implantation at low energies. RTA processes were performed at 1050 °C for different anneal times from 5 to 30 seconds in N_2 ambient. The width and pitch of the designed grating pattern are 0.8 and 2 μm, respectively. It is revealed that the photoperturbation effect induced by AFM laser beam leads to SCM image broadening and junction region narrowing. In other words, the photoperturbation effect not only significantly affects the dC/dV signals but also deteriorates the accuracy of junction characterization, in particular for ultrashallow junctions. The experimental results will be shown and discussed. The section analysis also reveals that there are distorted differential capacitance (dC/dV) profiles in the photoperturbed SCM images. Comparing dC/dV profiles of various photoperturbed SCM images, one can identify the area not affected by AFM laser beam. This simple method allows us to identify the influence of the photoperturbation effect on the pattern region. According to this study, the pattern edge region is more sensitive to the photoperturbation effect than the pattern central region.

AS-WeP2 Wettability Control of Polymer Surface through 126 nm Vacuum Ultraviolet Light Irradiation, *Y. Nakanishi,* Waseda University, Japan*; A. Hozumi, N. Shirahata,* National Institute of Advanced Industrial Science and Technology, Japan*; S. Asakura, A. Fuwa,* Waseda University, Japan

The surface modification of polymeric materials through vacuum ultraviolet (VUV) light irradiation has attracted much attention due to its wide variety of applications, including improvement of the wettability, biocompatibility and coating adhesion of such surfaces. In this study, we report on the surface modification of poly (methyl methacrylate) (PMMA) using VUV light of 126 nm radiated from an Ar_2^* excimer lamp. We have particularly focused on the effects of atmospheric pressure during VUV-irradiation on the surface wettability, chemical structure and morphology of the PMMA surfaces, since atmospheric oxygen plays a crucial role in the photocleavage of polymeric chains and subsequent photooxidation. Each of the samples was exposed to VUV light for 1~50 min under various pressures of 3×10^{-4}, 10, 10^3 or 10^5 Pa. Hydrophobic PMMA surface became hydrophilic during VUV irradiation conducted over the pressure range of 10~10^5 Pa. However, the degree of hydrophilicity of the modified surface was primarily determined by the atmospheric pressure. The minimum water-contact angles of the samples treated at 10, 10^3 and 10^5 Pa were about 49, 31 and 64$Â$°, respectively. On the contrary, in the case of 3×10^{-4} Pa, PMMA surface became highly hydrophobic with its contact angle changing from 80 to about 100$Â$°. As confirmed by X-ray photoelectron spectroscopy, at 3×10^{-4} Pa the C concentration and the intensity of the C-C groups in the C1s spectra increased. This was probably due to crosslinking reactions including the formation of new C-C bonds. Since the oxidation reactions did not proceed efficiently under such high vacuum condition, the free radicals may have recombined and crosslinked with each other, resulting in the increase of C-C groups. These results indicate that surface wettability of the PMMA substrates might be controllable by selecting the atmospheric pressure during 126 nm VUV irradiation.

AS-WeP3 An XPS Comparison of ALD and PLD Grown Thin Al$_2$O$_3$ Layers, *A.I. Zinine, J.M. Sturm, R.G. Bankras, H. Wormeester, B. Poelsema,* University of Twente, The Netherlands

Atomic Layer Deposition (ALD) is regarded as a suitable deposition technique for high-K metal oxides. Pulsed Laser Deposition (PLD) is an attractive alternative for a fast identification of new materials. A comparative XPS study of thin Al$_2$O$_3$ films grown by ALD (5, 10 and 20 nm) and PLD (15 and 30 nm) was made. This analysis is possible without a sputterprofile and is thus not compromised by co-sputtering. Water and trimethylaluminum were used as precursors in the ALD process. Fully oxidized alumina films with good stoichiometry and a band gap of 6.8±0.1 eV were obtained in all cases. The Si 2p XPS peak of the ALD films grown on hydrogen terminated Si with 50 ALCVD cycles did not show the formation of SiO$_2$. Angle resolved measurements gave a thickness of 4.2 nm, while a film grown on silicon oxide was 5.0 nm thick as expected for 50 cycles for the recipe used. This indicates growth inhibition in the first case. We note that both films showed a negligible carbon contamination. Freshly prepared ALD samples showed an O 1s XPS peak, composed of oxygen bonded to aluminium and a 1.6 eV energy shifted feature. Angle dependent measurements showed that this shifted feature is limited to the two topmost layers and can be identified as an OH species. Prolonged air exposure introduced a third component, which is attributed to oxygen bonded with carbon. The PLD samples grown in oxygen or argon ambient pressures of 0.1 mbar showed both a significant carbon content. However, only samples prepared in oxygen ambient exhibited carbide contamination and oxidized interfacial silicon.

AS-WeP4 Plasma Etching of (Ba,Sr)TiO$_3$ Thin Films for DRAM Applications, *G.H. Kim, C.I. Kim, D.P. Kim, K.T. Kim,* Chung-Ang University, Korea

(Ba,Sr)TiO$_3$ (BST) thin film attracts a great interest as a new dielectric material in capacitors for the next generation ultralarge scale integrated dynamic random access memories, such as giga bit DRAM in the wide range of research institutes to semiconductor industries because of its large dielectric constant, low leakage current, low dielectric loss, lack of fatigue, and low Curie temperature. A lot of papers have been presented on BST film characteristics using growth methods, however, its patterning have been studied less. In order to realize the higher integration, it is important to minimize the dimension of storage capacitors, simplify the memory cell structure and maintain sufficient accumulated electric charge within a smaller capacitor. Although BST thin films are excellent capacitor dielectric materials for DRAMs, several problems such as fine pattern transfer and no plasma induced-damage etc. In order to solve these problems, the etch behavior of BST with Ar/Cl$_2$/CF$_4$ gas mixtures is investigated with inductively coupled plasma (ICP). In this study, ICP etching system was used for BST etching. The etching characteristics of BST thin films were investigated in terms of etch rates and selectivity as a function of Cl$_2$/Ar and additive CF$_4$ into Cl$_2$/Ar, rf power, dc bias voltage and chamber pressure. The Cl$_2$/Ar and additive CF$_4$ into Cl$_2$/Ar plasmas were characterized by optical emission spectroscopy and Langmuir probe analysis. The chemical states on the etched surface were investigated with x-ray photoelectron spectroscopy. Scanning electron microscopy was used to investigate the etching profile.

AS-WeP5 Dielectric Properties of Epitaxial Growth (Pb, Sr)TiO$_3$ Thin Films on Al$_2$ O$_3$ (100) Substrate, *K.T. Kim, C.I. Kim,* Chung-Ang University, Korea

Electrical tunable dielectric devices rely on the variation of a ferroelectric materials dielectric constant with application of an electric field. The requirements of Ferroelectric materials are low dielectric constant, high tunability, low losses and low leakage current. The structure and morphology of the films were characterized using X-ray diffraction and scanning electron microscopy. We investigated on the structural, electrical properties of (Pb$_{0.5}$,Sr$_{0.5}$)TiO$_3$ thin films on the Al$_2$ O$_3$ (100) substrate prepared using MOD method. From the XRD analysis, the peak in the XRD pattern of PST thin films on the Al$_2$ O$_3$ substrate was shown epitaxial growth. The low loss (~0.001) and high tunability (~60%) were obtained for (Pb,Sr)TiO$_3$ thin films on the LaNiO$_3$ substrate measured at 1 GHz. @FootnoteText@ This work was supported by Korea Research Foundation Grant (KRF-2001-042-E00042).

AS-WeP6 Ferroelectric Properties of Bi $_{3.25}$La $_{0.75}$Ti$_3$O$_{12}$ Thin Films on (117)-oriented LaNiO$_3$ Electrodes, C.I. Kim, *K.T. Kim*, Chung-Ang University, Korea

The BLT thin films were prepared by using metal organic decomposition method. The structure and morphology of the films were analyzed by x-ray diffraction (XRD), atomic force microscope (AFM), and Scanning electron micrograph (SEM). SEM and AFM showed uniform surface of the films. The LNO thin films annealed at temperature as high as 600°C exhibit the (100)-oriented structure. The BLT thin films were found to crystallize preferably with (117)-oriented grains on LNO bottom electrode annealed at 600°C for 1h. However, the BLT thin films were grown using a Pt bottom electrode showed a polycrystalline phase. The BLT thin films grown on LNO thin films showed excellent ferroelectricity and higher remanent polarization than BLT thin film using a Pt electrode. The remanent polarization Pr and coercive field is 22.5 mC/cm^2 and 120 kV/cm. The BLT thin films on LNO bottom electrode exhibited no significant degradation of switching charge at least up to 5x10^9 switching cycles at a frequency of 50 kHz below cycling fields of 5 V. It was shown experimentally that there was no data loss after 3x10^4 s of memory retention at room temperature.

AS-WeP7 Distinguishing the Dependence of the Apparent Local Barrier Height on Measurement Conditions, *S. Yagyu*, M. Yoshitake, National Institute for Materials Science, Japan; Y. Mizuno, R.E. Kirby, Stanford Linear Accelerator Center

Work function is an important and fundamental property of materials related to the electron emission and reaction of molecules on the surface. As functional materials of reduced dimension become increase, the measurement of the local work function becomes important. The apparent local barrier height (LBH) related to the local work function has been measured by STM. The LBH is not the local work function of a sample material but multi-parameters value correctly, because the LBH based on the STM technique depends on the tip parameters (material, shape), the measurement parameters (tunnel current (I), bias voltage (V) and tip-sample separation (s)) and certainly the local work function of the sample material. Since each LBH obtained on same material surface with various measurement parameters is extremely different, we should know relation between the measurement parameters and the LBH. In STM/LBH measurement a I is proportional to a V and a s. For example, if we fix a I and change a V, a s is changed automatically. We measured dependence of the LBH on the I, V, and s precisely on the reconstructed Au (111) surface with an Au tip. The results under three different conditions, a constant s, I, and V were compared in the low bias voltage range (-50mV to -5mV) where I-V curve shows linear (ohmic). Under a constant s, the LBH does not change with the V, indicating that the LBH is independent of the V. Under a constant I, the LBH increases with the increased V. Under a constant V, the LBH increases with the increased s. The three results indicate that LBH depends exclusively on the s in our experimental conditions.

AS-WeP8 The Systematic Study of Ga TOF SIMS High Mass Molecular Ion Registration, Composition and Fragmentation of Selected Peptide Hormones on Silver Substrate, H Chen, College of William and Mary and Incogen, Inc.; *A. Wilkerson*, College of William and Mary; D. Malyarenko, College of William and Mary and Incogen, Inc.; E. Tracy, Applied Research Center and College of William and Mary; D. Manos, Applied Research Center and College of William and Mary.

This paper reports the use of Ga+ SIMS to provide imaging simultaneously with high sensitivity and specificity for peptide hormone registration. Although this technique is developed for high molecular weight organic polymers on silver and gold, no similar systematic quantitative studies are reported for biopolymers. We report high resolution spectra obtained by ToF-SIMS for molecular ions of Vasopressin II, Human Angiotensin and Somatostatin adsorbed on silver substrate. Characteristic positive high-mass parent peaks and adducts have been identified. The mass resolution exceeds 2000 for all three peptides. The dependence of the yield for the parent peak on solution concentration has been studied for Angiotensin. Parent peak intensities comprise from 1 to 15 % of the intensity for identifiable fragments. Images confirm that the fragmentation is associated with multi-layer formation. Parent peak adducts reproducibly display the anticipated quantitative isotope ratios and are skewed toward high masses. Sodium contamination adducts are registered as well. The images of surface coverage are reported at the parent masses. Unlike MALDI, no multiply charged species, ladder fragmentation or dimers are observed in the intermediate mass range. The low molecular weight peaks (below 200 Da) have characteristic signatures of the amino acid content for the peptides.

AS-WeP9 Analysis of Silane Coupling Compound Monomolecular layer on Sapphire Glass used by TRXPS, *T. Tazawa*, JEOL Ltd., Japan; C. Mochizuki, M. Shibata, University of Yamanashi, Japan; Y. Iijima, JEOL Ltd., Japan

Recently, the material which spreads silane coupling compound is actively researched. This material is usually applied to the fabrication of chip level interconnects, ohmic contacts, and printed circuit boards, and plating. Moreover, the application to life sciences is expected as for this compound However, the thickness of silane coupling compound is very thin. In general, silane coupling compound is used by one or two molecular layers.Therefore, the analysis of interface between silane coupling compound and the base material surface becomes important. The interface and surface for this material is useful analyzed with XPS, because silane coupling compounds are organic compounds. It is difficult to measure interface information accurately in a normal XPS analysis, because the thickness of silane coupling compound is thin. There is total x-ray reflection photoelectron spectroscopy (TRXPS) as a method of solving this problem. The use of x-ray total reflection has become noteworthly in photoelectron spectroscopy. The angular dependence of photoelectron peak intensities corresponds to the position change in the standing wave was caused by change in the x-ray glancing angle. Especially, at the measurement of multi-layer film and/or monomolecular layer formed on glass or Si wafer, because the belly and the paragraph position of standing wave of x-ray can be adjusted in such a way that they coincide with the respective layer position by changing the glancing angle. In this work, we examined silane coupling compounds monomolecular formed on sapphire glass measured by TRXPS. The profile of photoelectron intensity was observed to grazing incidence x-ray with C and Si. As the result, it is observed that the island structure of silane coupling compounds formed on the glass surface.

AS-WeP10 Electronic Structure of Carbon Nanotube Filled with Cs, Y.J. Song, *H. Kim*, Seoul National University, Korea; G.-H Jeong, R. Hatakeyama, Tohoku University, Japan; Y. Kuk, Seoul National University, Korea

As one of the most promising candidate materials for nanoelectronic devices,a carbon nanotube (CNT) has attracted much interest for its ideal electrical properties. The properties of a pristine CNTs are now well understood after studies with scanning probe microscope, transmission electron microscope, raman spectroscopy and transport measurements. CNTs can be semiconducting or metallic, but their electronic properties cannot be controlled since they are determined by uncontrollable chirality. Recently it has been suggested that the local modification of their electronic properties can be done by inserting or adsorbing various molecules into or on the side wall of CNTs. The modification of the local density of states can be utilized to produce nanometer-scale electronic devices. Filling metals into CNTs produce local metallic nanotubes. We have chosen to fill CNTs with Cs. We studied the geometric and electronic structures of these CNTs. The local change in the geometric structure implies the modification of CNT with Cs metal filling. That was confirmed by measuring the shift of the van Hove Singularities in scanning tunelling spectroscopy. Partially filled Cs metal chains in CNT seems to work as carrier dopants.

AS-WeP11 Investigation of Secondary Cluster Ion Emission from Self-Assembled Monolayers of Alkanethiols on Gold with TOF-SIMS, S. Sohn, M. Schröder, *H.F. Arlinghaus*, Westfälische Wilhelms-Universität, Germany

Self-assembled monolayers (SAMs) of alkanethiols on gold are ideal model systems for studying the emission processes of secondary ions from thin organic layers on metal substrates under keV ion bombardment. In this experimental study, we focus on the emission processes of gold-alkanethiolate cluster ions, which are not well understood yet. For this purpose we carried out time-of-flight secondary ion mass spectrometry (TOF-SIMS) measurements on SAMs of different alkanethiols CH$_3$(CH$_2$)$_n$SH with various alkyl chain lengths (1 $\leq$ n $\leq$ 17) on gold substrates. The gold-alkanethiolate cluster ions Au$_x$M$_y^-$ with M = CH$_3$(CH$_2$)$_n$S, 1 $\leq$ x $\leq$ 7 and x-3 $\leq$ y $\leq$ x+1 show intense peaks in negative mass spectra of all investigated alkanethiol SAMs under 10 keV Ar$^+$ bombardment. Around the corresponding peaks, a characteristic peak pattern of additional ions is observed. We analysed the contribution of different cluster ions formed by an attachment or a loss of up to five hydrogen atoms and their isotopy to the individual peaks of the peak pattern. We found two different types of gold-alkanethiolate cluster ions. The first type has only one parent ion, which has no hydrogen atom attached. The second type has two parent ions, one with no attachment of additional hydrogen atoms and another with one additional hydrogen atom. Moreover, we found a universally valid sum formula, which predicts

the most intense peak in the peak pattern of gold-alkanethiolate cluster ions of all investigated alkanethiol SAMs.

AS-WeP12 Multivariate Statistical Analysis of Time of Flight Secondary Ion Mass Spectrometry Images, Looking beyond the Obvious, *V.S. Smentkowski,* General Electric Global Research Center; *J.A. Ohlhausen, M.R. Keenan, P.G. Kotula,* Sandia National Laboratories

Analytical instrumentation such as Time of Flight Secondary Ion Mass Spectrometry (ToF-SIMS) provides a tremendous quantity of data since an entire mass spectrum is saved at each pixel in an ion image. The analyst often selects only a few species for detailed analysis; the majority of the data are not utilized. Researchers at Sandia National Laboratory (SNL) have developed a powerful Multivariate Statistical Analysis (MVSA) tool kit named AXSIA (Automated eXpert Spectrum Image Analysis) that looks for trends in complete data sets (eg. analyzes the entire mass spectrum at each pixel). A unique feature of the AXSIA tool kit is the generation of intuitive results (eg. negative peaks are not allowed in the spectral response). The robust statistical process is able to unambiguously identify all of the spectral features uniquely associated with each distinct component throughout the data set. GE and Sandia used AXSIA to analyze raw data files generated on an Ion Tof IV ToF-SIMS instrument. Select examples will be shown. The MVSA toolkit positively identified metallic contaminants within a defect in a polymer sample. These metallic contaminants were not identifiable using standard data analysis protocol. We will also demonstrate that the MVSA toolkit is able to analyze images collected using the burst pulsing mode. This work was funded in part under CRADA SC00/01609 PTS 1609.02 Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company, for the United States Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.

AS-WeP13 Surface Composition of Polyurethane Foams with Accelerated Aging, *J. Manzerova,* D. Parsons, University of Nevada, Las Vegas; S.W. Yu, Lawrence Berkeley National Laboratory; *D.W. Lindle, A.L. Johnson,* University of Nevada, Las Vegas

Polyurethane foams find broad application as structural and insulating (shock, electrical, etc.) materials. The long term stability of these materials are of particular interest. We have studied ReCrete and TDI types of polyurethane foams by means of the near edge x-ray absorption fine structure (NEXAFS) spectroscopy and the x-ray photoelectron spectroscopy (XPS). The foams were subjected to accelerated aging studies (60C and 80C under atmospheric conditions) for times up to 2 years. Systematic shifts in composition of the surface of the samples were found. Spectral assignments will be given and issues having to do with the variability of the surface of the polyurethane with temparature and environmental exposure will be addressed.

AS-WeP14 Field Emission Electron Spectroscopy of Clean and Oxidized Mo Single Tips, *X. Zhao,* R.A. Outlaw, R.L. Champion, D. Manos, B.C. Holloway, The College of William and Mary

We have constructed a multi-functional apparatus to characterize surfaces by ARAES, ARXPS, EELS and TDS both prior to and after, measurement of field emission spectra. The fine structure of field emission energy distributions, in concert with these adjunct surface analyses, provides information of both bulk band structure and localized electronic structure as a function of adsorbate uptake. This paper reports measurements of field emission spectra taken on a 10 nm radius Mo tip under UHV ($\sim 10^{-10}$ torr), and as a function of exposure to controlled doses of CO and O^2 . Effective work functions are extracted from Fowler-Nordheim plots and show variation over the range of gas dosage. Field emission theory with total energy representation (TED) is used to further interpret the spectra and to elucidate the effects of oxygen bearing adsorbates.

AS-WeP15 Optical, Structural and Electrical Characteristics of High Dielectric Constant Zirconium Oxide Thin Films Deposited by Spray Pyrolysis, *M.A. Aguilar,* CICATA-IPN, Mexico, Spain; *G. Reyna,* UAM-I, Mexico; *M. Garcia, J. Guzman,* IIM-UNAM, Mexico; *C. Falcony,* CINVESTAV-IPN, Mexico

High dielectric constant zirconium oxide thin films have been deposited on silicon substrates at temperatures from 400 to 600°C, using the spray pyrolysis technique. The films were deposited from two spraying solutions (0.033 and 0.066M) of zirconium acetylacetonate dissolved in N,N-Dimethylformamide. The as deposited films were stoichiometric, transparent and with a very low surface roughness (5-40Å). The films present a dielectric constant in the range from 12.5 to 17.5, depending on the experimental conditions. The films deposited at 500°C and with the 0.066M spraying solution can stand electric fields up to 3 MV/cm, without observing destructive dielectric breakdown. X ray diffraction as well as transmission electron microscopy measurements indicate that the films are polycrystalline. Infrared spectroscopy show the existence of silicon dioxide (SiO_2) in the films. Spectroscopic ellipsometry indicates that SiO_2 as well as ZrO_2 and c-Si comform a roughness layer located at the ZrO_2/Si interface. The presence of this interface layer, as well as the overall optical and structural characteristics of the films prepared, are probably responsible for the good dielectric characteristics observed on them.

AS-WeP16 Using MEMS Microarrays and Neural Networks to Identify Preferred Surface Chemistry in Application-Specific Gas Sensing, *Z. Boger,* R.E. Cavicchi, D.C. Meier, C.B. Montgomery, S. Semancik, National Institute of Standards and Technology

Surface chemical interactions between target analytes and sensing films are of primary importance in determining gas sensor performance. However, selecting the most appropriate sensing materials and conditions to detect certain analytes in different gas monitoring applications is very difficult. We present a novel approach for identifying well-suited thin film and surface compositions, preferred microstructures, and operating temperatures for conductometric gas sensing. It employs response databases measured from multi-element MEMS microarrays as well as artificial neural networks (ANN) signal processing. The array elements are microsensor platforms that contain varied sensing film types (TiO_2 and pure and surface-modified SnO_2), and can be programmed to operate individually at a variety of temperatures (20 °C to 500 °C), while the composition of test gases is changed. Recursive ANN pruning and re-training techniques are used to identify the more relevant inputs (materials, temperatures) for recognizing and quantifying a specific analyte in a given background. We describe several example cases involving pure and metal-dosed oxide films for: 1) recognition of 6 gases (H_2, ethanol and varied VOCs); 2) estimation of concentrations for binary mixtures of H_2, methanol and acetone in the 5-200 ppm (micromole/mole) range; 3) concentration estimation of chemical warfare agents (sarin, tabun, sulfur mustard) and simulants in the range of several ppb (nanomole/mole) to several ppm. Greatly reduced subsets of materials and temperatures, in the range of 3-15 out of a possible 80-1260 combinations, have been shown to carry the most effective analytical information. These selected interfaces and operating conditions provide a basis from which to understand, and then predict, the adsorption, desorption and reaction behavior that are critical to solid state transduction processes for varied classes of gaseous compounds.

AS-WeP17 Nitrogen Doped Carbon Nanoflake Field Emitter Synthesized by RFI PECVD on Patterned Nickel Catalyst Layer, *M. Zhu,* J. Wang, R.A. Outlaw, X. Zhao, N.D. Theodore, College of William and Mary; *V.P. Mammana,* International Technology Center; *B.C. Holloway, D. Manos,* College of William and Mary

This paper reports the synthesis of a novel morphological form of carbon, which we call carbon nanoflake (CNF), using high-density RF inductively coupled plasma enhanced chemical vapor deposition. We observe that CNF grows rapidly in contact with a Ni catalyst which has been created using a self-assembling nano-sphere lithographic method. Experiments were performed using mixtures of hydrocarbon feedstock (methane or acetylene) diluted in hydrogen to deposit CNF onto the Ni catalyst pattern lying either on a doped-Si wafer, or lying on 300 nm of SiO_2. The gas composition was varied systematically from 10% to 100 % hydrocarbon. Pressure and temperature were varied over a small range in the vicinity of p = 10^{-1} Torr and T = 680°C. We have also performed CNF deposition under conditions to produce nitrogen-doped CNF. SEM images show that the carbon nanoflake has edges less than 10nm wide and that the surface morphology changes with gas composition. CNF structures appear to be robust and well-suited for potential applications in field-emission devices. Kelvin Probe measurements show that the contact potential (work function) of CNF is close to that of graphite. Raman spectra show that the ratio of D to G peaks is a function of the gas composition. The paper also reports field emission tunneling parameters extracted from Fowler-Nordheim I-V curves and field emission spectra (FES).

Wednesday Morning Poster Sessions, November 5, 2003

AS-WeP18 Microsensor Technique for Analyte Surface Coverage vs. Sensor Response Correlation, *A.G. Shirke, R.H. Jackson, B.G. Frederick,* The University of Maine*; R.E. Cavicchi, S. Semancik,* National Institute of Standards and Technology*; M.C. Wheeler,* The University of Maine

This paper presents results based on the combined use of a single microsensor platform (as a Temperature Programmed Desorption [TPD] device) with a sensitive, calibrated mass spectrometer that has a minimum detection limit of 10@super 10@ molecules/s. Desorption kinetics of model systems have been investigated as part of an effort to develop a technique for correlating the relative surface coverages of gas analytes to the electrical responses of chemical sensors. The pulsed-TPD technique takes advantage of the rapid heating characteristics of micromachined sensor platforms (called microhotplates) which are layered structures developed at NIST. Microhotplate sensors include a sensing film, electrodes, and a polysilicon heater all separated by insulator layers. Previous microheater desorption experiments utilized arrays with large numbers of devices to provide enough desorption flux for detection while maintaining the rapid heating rate (over 10@super 6@ K/sec) of the individual devices. Unlike the current experiments that use single microsensors, the large array studies did not explore conductance changes of sensing films. The model system described in this work, condensed benzoic acid on the microsensor surface, is used to evaluate the challenges involved in extension of the technique to actual sensor systems. The experiments were conducted at a base pressure of 5x10@super -10@ Torr, using a constant, directed-dosing arrangement for benzoic acid (vapor pressure: 7x10@super -3@ Torr at 300 K). A voltage pulse of 500 ms duration was used to heat the polysilicon heater to temperatures up to 700 K within approximately 3 ms while the isothermal desorption flux was monitored by the differentially-pumped mass spectrometer. Limitations and modifications in the data acquisition, sample mounting, and minimum detectable desorption flux are discussed along with the presentation of the desorption isotherms.

AS-WeP19 High Spatial Resolution XPS Analysis of Si Samples Prepared using the FIB Lift-out Technique, *J. Fenton, J.E. Fulghum,* University of New Mexico*; L.A. Giannuzzi,* FEI Company*; F.A. Stevie,* North Carolina State University

The FIB lift-out technique is increasingly utilized to prepare a wide variety of samples for SEM and TEM analysis, although there have been few studies of sample preparation-related changes in surface chemistry. The goal of this project is to assess the impact of Ga@super +@ contamination resulting from FIB lift-out preparation of Si. X-ray photoelectron spectroscopy (XPS) has become an increasingly useful characterization technique for such samples due to recent advances in imaging and small area analysis. The Ga distribution on the Si surface, and the impact of sample preparation on surface oxidation, were evaluated using high spatial resolution XPS. The SiO@sub 2@ thickness and uniformity were compared with Si from a control sample, which was not exposed to the FIB Ga@super +@ source. Both quantitative, high spatial resolution imaging and spectra-from-images methods were used to characterize Ga and SiO@sub 2@ distributions. These methods are required for accurate characterization of the FIB samples, as the samples are generally smaller than the areas analyzed using small area spectroscopy methods.

AS-WeP20 Ion Beam Alignment of Liquid Crystals on Polymer Substrates, *S. Pylypenko, K. Artyushkova, J.E. Fulghum,* University of New Mexico*; L. Su, L. West,* Kent State University*; Y. Reznikov,* Ukraine Academy of Science

Liquid crystal alignment is generally obtained through rubbing methods that require direct contact with the alignment surface. Non-contact methods could solve many of the problems that result from rubbing. One of the latest non-contact techniques for alignment of liquid crystals, ion beam alignment, has become a promising substitute for the conventional method based on mechanical rubbing. Although LCD prototypes have been fabricated using the ion beam alignment technique, there is incomplete understanding of both the macroscopic and microscopic alignment mechanisms. Organic and inorganic alignment layers were studied using X-ray Photoelectron Spectroscopy (XPS) and Polarized Attenuated Total Reflection Infrared Spectroscopy (ATR-IR) to characterize chemical changes and surface anisotropy to the alignment substrate. The surface analytical characterization results have been correlated with measurements of liquid crystal alignment and pre-tilt angle measurement to enhance our understanding of non-contact alignment.

AS-WeP21 Relation between RF Breakdown and Particles Contamination on RF-Processed X-band Structures, *F. Le Pimpec,* **S. Harvey**, *R.E. Kirby, F. Marcelja,* SLAC

X-band accelerator structures meeting the Next Linear Collider(NLC) design requirements have been found to suffer damage due to Radio Frequency (RF) breakdown when processed to high gradients. Improved understanding of these breakdown events is desirable for the development of structure designs, fabrication procedures, and processing techniques that minimize structure damage. RF reflected wave analysis and acoustic sensor pickup have provided breakdowns localization in RF structures. Particles contaminant, after the clean autopsy of 3 RF-processed travelling wave structures, have been catalogued and analyzed. Their influence on RF breakdown will be discussed.

Author Index

Bold page numbers indicate presenter

— A —
Aguilar, M.A.: AS-WeP15, **3**
Arlinghaus, H.F.: AS-WeP11, **2**
Artyushkova, K.: AS-WeP20, 4
Asakura, S.: AS-WeP2, 1
— B —
Bankras, R.G.: AS-WeP3, 1
Boger, Z.: AS-WeP16, **3**
— C —
Cavicchi, R.E.: AS-WeP16, 3; AS-WeP18, 4
Champion, R.L.: AS-WeP14, 3
Chang, M.-N.: AS-WeP1, **1**
Chen, C.-Y.: AS-WeP1, 1
Chen, H: AS-WeP8, 2
— F —
Falcony, C.: AS-WeP15, 3
Fenton, J.: AS-WeP19, **4**
Frederick, B.G.: AS-WeP18, 4
Fulghum, J.E.: AS-WeP19, 4; AS-WeP20, 4
Fuwa, A.: AS-WeP2, 1
— G —
Garcia, M.: AS-WeP15, 3
Giannuzzi, L.A.: AS-WeP19, 4
Guzman, J.: AS-WeP15, 3
— H —
Harvey, S.: AS-WeP21, **4**
Hatakeyama, R.: AS-WeP10, 2
Holloway, B.C.: AS-WeP14, 3; AS-WeP17, 3
Hozumi, A.: AS-WeP2, 1
— I —
Iijima, Y.: AS-WeP9, **2**
— J —
Jackson, R.H.: AS-WeP18, 4
Jeong, G.-H: AS-WeP10, 2
Johnson, A.L.: AS-WeP13, 3

— K —
Keenan, M.R.: AS-WeP12, 3
Kim, C.I.: AS-WeP4, 1; AS-WeP5, 1; AS-WeP6, 2
Kim, D.P.: AS-WeP4, 1
Kim, G.H.: AS-WeP4, **1**
Kim, H.: AS-WeP10, **2**
Kim, K.T.: AS-WeP4, 1; AS-WeP5, **1**; AS-WeP6, **2**
Kirby, R.E.: AS-WeP21, 4; AS-WeP7, 2
Kotula, P.G.: AS-WeP12, 3
Kuk, Y.: AS-WeP10, 2
— L —
Lai, J.-H.: AS-WeP1, 1
Le Pimpec, F.: AS-WeP21, 4
Liang, J.-H.: AS-WeP1, 1
Lindle, D.W.: AS-WeP13, 3
— M —
Malyarenko, D.: AS-WeP8, 2
Mammana, V.P.: AS-WeP17, 3
Manos, D.: AS-WeP14, 3; AS-WeP17, 3; AS-WeP8, 2
Manzerova, J.: AS-WeP13, **3**
Marcelja, F.: AS-WeP21, 4
Meier, D.C.: AS-WeP16, 3
Mizuno, Y.: AS-WeP7, 2
Mochizuki, C.: AS-WeP9, 2
Montgomery, C.B.: AS-WeP16, 3
— N —
Nakanishi, Y.: AS-WeP2, **1**
— O —
Ohlhausen, J.A.: AS-WeP12, 3
Outlaw, R.A.: AS-WeP14, 3; AS-WeP17, 3
— P —
Pan, F.-M.: AS-WeP1, 1
Parsons, D.: AS-WeP13, 3

Poelsema, B.: AS-WeP3, 1
Pylypenko, S.: AS-WeP20, **4**
— R —
Reyna, G.: AS-WeP15, 3
Reznikov, Y.: AS-WeP20, 4
— S —
Schröder, M.: AS-WeP11, 2
Semancik, S.: AS-WeP16, 3; AS-WeP18, 4
Shibata, M.: AS-WeP9, 2
Shirahata, N.: AS-WeP2, 1
Shirke, A.G.: AS-WeP18, **4**
Smentkowski, V.S.: AS-WeP12, **3**
Sohn, S.: AS-WeP11, 2
Song, Y.J.: AS-WeP10, 2
Stevie, F.A.: AS-WeP19, 4
Sturm, J.M.: AS-WeP3, **1**
Su, L.: AS-WeP20, 4
— T —
Tazawa, T.: AS-WeP9, 2
Theodore, N.D.: AS-WeP17, 3
Tracy, E.: AS-WeP8, 2
— W —
Wan, W.-W.: AS-WeP1, 1
Wang, J.: AS-WeP17, 3
West, L.: AS-WeP20, 4
Wheeler, M.C.: AS-WeP18, 4
Wilkerson, A.: AS-WeP8, **2**
Wormeester, H.: AS-WeP3, 1
— Y —
Yagyu, S.: AS-WeP7, **2**
Yoshitake, M.: AS-WeP7, 2
Yu, S.W.: AS-WeP13, 3
— Z —
Zhao, X.: AS-WeP14, **3**; AS-WeP17, 3
Zhu, M.: AS-WeP17, **3**
Zinine, A.I.: AS-WeP3, 1