Wednesday Morning Poster Sessions, October 4, 2000

Surface Science
Room Exhibit Hall C & D - Session SS-WeP
Poster Session

SS-WeP2 Substrate-Dependent Interaction of Carbon Monoxide and Ammonia on Metal Carbide Surfaces*, S.S. Perry,* ***L.C. Fernández-Torres****, R.L. Guenard, O. El-bjeirami,* University of Houston*; S.V. Didziulis, P.P. Frantz,* The Aerospace Corporation

A study of the interaction of carbon monoxide (CO) and ammonia (NH@sub 3@) with titanium carbide (TiC) and vanadium carbide (VC) is presented. The interaction of CO and NH@sub 3@ with the (100) face of the single crystal carbides was studied over the temperature range of 100-400 K. The adsorption states of CO and NH@sub 3@ were probed with high resolution electron energy loss spectroscopy (HREELS) and photoelectron spectroscopy. The desorption of CO and NH@sub 3@ was followed with temperature programmed desorption (TPD). Together, these measurements indicate that both CO and NH@sub 3@ adsorb molecularly on TiC and VC. However, HREELS measurements show CO adsorbs more strongly on VC than on TiC, and NH@sub 3@ adsorbs similarly on TiC and VC. TPD supports these observations; CO has a higher desorption temperature on VC than on TiC while NH@sub 3@ has a similar desorption temperature from the two surfaces. Strong evidence of @pi@-backbonding for CO on VC is seen in the vibrational data, as well as in the core and valence level photoelectron spectra. This mechanism, which is not active on TiC, differentiates the interaction of CO with these two substrates. Similar interaction mechanisms and adsorption energies are observed for NH@sub 3@ on TiC and VC, where @pi@-backbonding would not be expected to play a role. These results are discussed in terms of the difference in electronic structure between the two metal carbides.

SS-WeP3 Effects of Film Morphology on the Electron Stimulated Desorption of O@super -@ from O@sub 2@ Deposited on Benzene*, A.D. Bass,* ***L. Parenteau****, L. Sanche,* University of Sherbrooke, Canada

Low energy electron impact techniques can be used to study thin molecular solids under ultra high vacuum (UHV) and have already provided valuable information on the electronic interactions underlying phenomena such as radiation damage to biological materials, dielectric aging and surface mediated photo-chemistry.@footnote 1@ Experiments measuring the electron stimulated desorption (ESD) of ionic and neutral fragments have been of considerable value, yet only recently have researchers considered how factors such as film porosity or morphology affect ESD measurements.@footnote 2,3@ In this article we investigate the effects of film phase and porosity on the ESD of O@super -@ from O@sub 2@ molecules deposited onto the surface of multilayer benzene. Benzene films deposited at temperatures below 30 K are amorphous@footnote 4@ and appear porous so that O@sub 2@ molecules diffuse into their surface. When benzene is deposited at temperatures near 100 K, a non-porous film is formed which severely limits the penetration of O@sub 2@ into the benzene layer. The results are compared with measurements of O@super -@ production from O@sub 2@ covered water ices.@footnote 5@ @FootnoteText@ @footnote 1@See for example L. Sanche, IEEE Trans. Dielec. Elec. Insulat. 4, 507 (1997) @footnote 2@ W.C. Simpson M.T. Sieger T.M. Orlando L. Parenteau K. Nagesha L. Sanche J. Chem. Phys., @footnote 3@ E. Vichnevetski, P. Cloutier, and L. Sanche, J. Chem. Phys. 110, 8112 (1999) @footnote 4@ P.Swiderek and H. Winterling Chem. Phys. 229, 295 (1998) @footnote 5@ R. Azria, Y. Le Coat, M. Lachgar, M. Tronc, L. Parenteau, L. Sanche, Surf. Sci. 436, L671 (1999).

SS-WeP4 Electron Transfer Reactions on Layered Transition Metal Sulfide Surfaces+*,* ***K. Park****,* Baylor University

Recent advances in high resolution X-ray photoemission spectroscopy (HRXPS) have enabled one to directly probe an electron transfer reaction between adsorbates and model catalyst surfaces. For example, on cesium adsorbed molybdenum disulfide surface it has been observed that deposition of submonolayer cesium onto the basal plane of clean MoS2 introduces a new electron density of states at 1.25 eV above the MoS2 valence band maximum (VBM). Combined density functional theory and angle-resolved HRXPS indicate that the new VB state originates mainly from the bottom of the MoS2 conduction band, mixed to a small extent with the Cs 6s orbital. It has been further demonstrated that the supra-valence electrons in MoS2 can be captured and reacted with electron acceptor molecules forming surface ionic species. On the other hand, the interface between Li and MoS2 exhibits a quite different behavior - a reductive reconstruction. In this talk, I will review recent findings from alkali metal adsorbed, layered transition metal sulfide surfaces and discuss the on-going effort to understand the underlying principle for the adsorbate-substrate interaction.

SS-WeP5 Alloy Formation at the Co-Al Interface for Thin Co Films Deposited on Al(100) and Al(110) at Room Temperature*,* ***R.J. Smith****, N.R. Shivaparan, M.A. Teter,* Montana State University

High-energy ion backscattering spectroscopy and channeling (HEIS), combined with x-ray photoelectron spectroscopy (XPS) and low energy electron diffraction (LEED) were used to characterize the evolution of the Co-Al interface for thin Co films deposited on Al(001) and Al(110) surfaces at room temperature. This interface is of particular interest because of the possible applications for tunneling magnetoresistive junctions and the associated fabrication processes such as oxidation of Al films deposited on magnetic thin films. For the Al(001) surface, measurements of the backscattered ion yields from Al and Co show that substrate Al atoms are continuously displaced for Co coverages up to about 3 ML as the interface alloy forms. Cobalt metal eventually covers the mixed interface. Based on XPS intensity analysis, we conclude that a CoAl-like phase forms at the interface. A very diffuse LEED pattern with large spots and high background was observed after a deposition of 7.6 ML of Co coverage. For the Al(110) surface, intermixing of Co and Al atoms was observed up to 5 ML of Co deposition, where Co metal begins to cover the surface. No LEED spots were observed for any Co coverage exceeding 0.2 ML on the Al(110) surface. A Volmer-Weber type growth model for these interfaces was used with the XPS intensity data to characterize the morphology of the interfaces in both cases. In neither case was Co diffusion into the bulk Al substrate observed at room temperature. These results are briefly compared with similar measurements for Ni and Fe films on Al surfaces. Work supported by NSF Grants DMR9409025 and DMR9710092.

SS-WeP6 Defect Structures on the Si(5 5 12)-2x1 Surface*,* ***A.S. Sun****, K.M. Jones, E.S. Bowman, A.A. Baski,* Virginia Commonwealth University

Scanning tunneling microscopy (STM) studies of the high-index Si(5 5 12)-2x1 reconstructed surface show that it forms a single domain of row-like structures. It has therefore been proposed as a viable template for metallic nanowire growth. In this work, we use STM to characterize two common surface defects that may influence its application as such a template. The most commonly observed surface defects are disruptions in the periodicity of the Si(5 5 12) unit cell. The Si(5 5 12) unit cell can be considered as a combination of one (7 7 17) and one (337) unit cell. In up to 20 percent of the (5 5 12) units, an extra or missing (337) subunit appears, resulting in a non-uniform surface periodicity. Because there is a dominance of either extra or missing (337) units on a given sample, sample preparation conditions appear to play an important role. Another type of defect observed on the Si(5 5 12) surface is the presence of adsorbed dimers. These dimers have a typical coverage of 10-15 percent, and exist as single dimers or in clusters up to ~10 dimers long. Statistics taken from STM data indicate that as the dimer cluster size increases, the number of clusters decreases exponentially. A Monte Carlo model of 1D clusters has been used to correlate the distribution of these dimer defects with their relative "hopping" probabilities on different surface sites.@footnote 1@ We find that single dimers have a strong preference to remain attached to the ends of existing clusters. A better understanding of both the adsorbed dimer and (337) unit cell defects should lead to a more controlled preparation of Si(5 5 12) as a growth template. @FootnoteText@ @footnote 1@ E. S. Bowman, M. F. Bishop, T. McMullen, and A. A. Baski, Cluster and Nanostructure Interfaces, edited by P. Jena (World Scientific, New York, 2000), p. 569-574, in press.

SS-WeP7 Growth of a Group-IV Metal on Si(5 5 12)*,* ***I. Samanta****, A.A. Baski,* Virginia Commonwealth University

Recently, we have used scanning tunneling microscopy (STM) to study the growth behavior of noble metals (Ag, Au) on the row-like Si(5 5 12) surface.@footnote 1@ In this study, we explore the different growth modes for a Group IV metal such as Sn, where we expect more intermixing of the tetravalent Sn and Si atoms. Our STM studies show that, unlike for the noble metals, Sn forms adsorbed dimers on the Si(5 5 12) surface at low coverage (< 0.5 ML) and moderate annealing temperatures (~450C). These dimers appear as bright protrusions in the trenches between Si rows, and in fact intermix with existing Si dimers on the surface. At higher coverages, Sn forms relatively large protrusions with a 4x periodicity along the underlying Si tetramer rows. Such strongly corrugated features have never been observed for the deposition of noble metals, indicating a significantly different growth behavior for this group-IV metal. As the coverage is increased (>1 ML), Sn creates a disordered surface with only remnants of the row-like surface morphology remaining. At higher annealing temperatures (700C+), however, the surface undergoes a large-scale rearrangement with sawtooth facets being formed. We are presently exploring the optimal conditions to produce such sawtooths, because such a corrugated surface provides yet another interesting template for growth. @FootnoteText@ @footnote 1@ K. M. Jones, K. M. Saoud, and A. A. Baski, Cluster and Nanostructure Interfaces, edited by P. Jena (World Scientific, New York, 2000), p. 49-54, in press.

SS-WeP8 Cyanogen Iodide Adsorption on Si(100)*, **N.F. Materer**, T. Watt,* Oklahoma State University

The adsorption of cyanogen iodide (ICN) on a silicon (100) surface is studied by X-ray photoelectron spectroscopy (XPS). At room temperature, ICN chemically adsorbs on the surface. The C 1s photoelectron peak indicates that the carbon nitrogen triple bond is intact. The triple bond remains until approximately 400C. Initial experiments suggest a sticking coefficient at room temperature of 0.1 for ICN. Experiments are in progress to quantitatively determine this number. In addition, thermal desorption measurements are proceeding to further complementing the XPS studies.

SS-WeP9 Effects of Al/Si(111) Surface Phases on the Wandering of the Single-Height Steps@footnote 1@*, **I. Lyubinetsky**, D.B. Dougherty, H.L. Richards, T.L. Einstein, E.D. Williams,* University of Maryland, College Park

The thermally-induced wandrering of single-height steps have been studied by STM on a vicinal Si(111) surface, miscut by 0.5° in the [2,-1,-1] direction, after aluminum deposition at elevated temperatures (500-700°C). From direct measurement of the step-correlation function, the step diffusivity, b@super2@/a, is shown to increase strongly as Al coverage @Theta@ in the surface phases increases: b@super2@/a ~ 0.4 Å for the a(7x7) phase (@Theta@ = 0.12 ML), ~ 1.5 Å for the (@sr@3x@sr@3) phase (@Theta@ = 0.3 ML), and ~ 4.6 Å for the @gamma@ phase, also referred to as the (9.4x9.4) phase, (@Theta@ = 0.68 ML), implying corresponding systematic decrease in the kink energy. An increase of the step diffusivity compared to a clean Si(111)-(7x7) surface has been observed even at the very initial stages of the a(7x7) reconstruction formation, at @Theta@ as low as 0.02 ML. For the least stable phase of (@sr@7x@sr@7) (@Theta@ = 0.43 ML), which coexists with the @gamma@ phase on the same terrace, the wandering of the phase boundaries between (@sr@7x@sr@7) and @gamma@ phases will also been discussed. @FootnoteText@ @footnote 1@Work supported by the UMD-NSF-MRSEC.

SS-WeP10 Oxide and Nitride Film Growth on Microfabricated Cantilevers by Pulsed Mode DC Magnetron Sputtering*, P. Cao, M.-S. Lim, S.S. Perry,* University of Houston*; **K.P. Wiederhold**, Y. Yamaguchi, E.J. Mitchell, D.C. Koeck, H.C. Galloway,* Southwest Texas State University

We have investigated the growth of TiN and Al@sub 2@O@sub 3@ films on microfabricated atomic force microscopy (AFM) probes. These films are grown using a pulsed mode DC Magnetron sputtering technique. This method allows us to extend the range of traditional DC magnetron sputtering to a wider range of conductivities for oxide and nitride film growth. The TiN thin films tend to grow in a highly stressed manner which can cause severe deformations of the microfabricated cantilevers. The deposition of a thick interfacial Ti layer, increased growth temperature, and the use of pulsed mode deposition are effective in producing usable cantilevers. The Al@sub 2@O@sub 3@ films have been produced with both Ti and Al interfacial layers with less cantilever deformation than the TiN coating, indicating only moderate stress of the Al@sub 2@O@sub 3@ films. These studies indicate that an interfacial layer is essential for adhesion and that Al layers result in lower interfacial stress as compared to Ti layers. Resistivity, XPS and AFM measurements have been used to characterize blanket films grown by the same methods. Specialized samples are used to measure the tip shape and the conductive tips are used as point contacts to characterize the electrical properties.

SS-WeP11 Vibrationally Activated Dissociative Adsorption of CO@sub2@ on Ni(100)*, **C.L. DiCologero**, A.L. Utz,* Tufts University

We will present recent results from our study of the dissociation of vibrational-state-selected CO@sub2@ on Ni(100). Previous studies@footnote 1@ have shown that the reaction is enhanced by increasing the average thermal vibrational population of the CO@sub 2@ molecules. In our study, infrared laser excitation of CO@sub 2@ in a supersonic molecular beam produces molecules with a well-defined translational energy in a particular vibrational and rotational state. Quantifying the efficacy of energy in a specific rovibrational coordinate reveals key aspects of the potential energy surface governing the interaction. @FootnoteText@ @footnote 1@ M.P. d'Evelyn, A.V. Hamza, G.E. Gdowski, R.J. Madix, Surface Science, 167,451,(1986).

SS-WeP12 W-Si(111) Force Interaction Measurements with Force-feedback Force Sensor*, R. Erlandsson,* Linkoping University, Sweden*; **V. Yakimov**,* McGill University, Canada

We have investigated the tungsten-silicon contact in ultrahigh vacuum using an atomic force microscope equipped with a force-feedback force sensor. The operation of the sensor is based on balancing the tip-sample interfacial force by an electrostatic actuator. The measurements show that the force changes in discrete steps both upon approach and retraction, and the magnitude of the steps indicate that these events can be attributed to neck formation and relaxation phenomena involving only a few atoms. The data is in good agreement with previously published molecular dynamic simulations of the behaviour of sharp tips interacting with surfaces. It is shown that the commonly used calculation of the long-range van der Waals force using a spherical tip approximation is inadequate for measurements on this scale. Curves obtained using force-feedback method are compared with conventional force curves, and the role of the dynamic behaviour of the force-feedback sensor in the interpretation of force spectroscopy data will be discussed.

SS-WeP13 CC Bond Breaking Before CH Bond Breaking on a Metal Surface*, **S. Lavoie**, A. Adnot, P.H. McBreen, M. Castonguay,* Université Laval, Canada

CC bonds are very rarely broken before CH bonds in the same molecule, despite the fact that they are weaker. Intense research in organometallic chemistry is aimed at the selective activation of CC bonds, however examples of selective CC bond scission are usually restricted to strained ring molecules. In contrast, this RAIRS and SSIMS study shows the selective CC bond scission of methyl pyruvate on Ni(111) leading to the formation of adsorbed methoxycarbonyl and acetyl groups. The novel surface chemistry revealed in this study is also of interest due to the fact that the hydrogenation of methyl pyruvate is a test case reaction in heterogeneous chiral catalysis.

SS-WeP14 Rovibrational State-Selected Studies of CD@sub 3@H on Ni(100)*, **R.R. Smith**, A.L. Utz,* Tufts University

Previous results in our laboratory have demonstrated the effects of rovibrational excitation in the dissociative chemisorption of methane on Ni(100). In an effort to further probe the dynamics of this system, we have recently begun state-selected experiments of the molecule CD@sub 3@H on this surface. Replacing three hydrogen atoms with deuterium removes the spherical top symmetry and changes the nuclear motions of the normal modes. This gives us access to a nearly pure C-H stretching vibration (@nu@@sub 1@) and, by using polarized laser light, allows us to investigate the effects of the incident molecular orientation. This provides us with a method to more accurately probe the transition-state and may shed light on the role that dynamical steering plays in this reaction. In a related study, we have also been investigating the collision-induced absorption and collision-induced recombinative desorption of hydrogen on this surface. Our most recent results of these topics will be presented.

SS-WeP15 Conformation of Model Self-assembled Monolayers Studied by Sum-frequency Generation Spectroscopy*, **M.B. Raschke**, P.B. Miranda, X. Wei, Y.R. Shen,* University of California, Berkeley

Potential technological applications of self-assembled monolayers (SAM) as lithography resists, lubricants or biosensors make detailed surface strucural analysis of these materials highly desirable. In this respect chemisorbed films of model self-assembling n-alkyl monolayers have been investigated by means of infrared-visible sum-frequency generation spectroscopy providing information about chain orientation and internal molecular conformation. The trans-gauche transformation behavior of n-Octadecyltrichlorosilane (OTS) and Octadecyldimethyl(3-trimethoxysilyl-propyl)ammonium chloide (DMOAP) adsorbed on quartz with different surface molecular densities has been studied in vacuum for temperatures between 100 and 450 K. Whereas tight packing sterically prevents low energy excitations (e.g. molecular tilt, gauche defects), for low chain-densities large number of gauge conformations are found even at low temperatures. This corresponds to an observed increase in the onset temperature for chain melting with increasing surface density. For high chain densities metastable conformations (e.g. entanglement with neighboring molecules) can persist even at T=300 K and may be annealed at elevated temperatures. The observed behavior will be discussed in terms of the thermodynamics describing linear chain molecules.@FootnoteText@ Work supported by DOE.

SS-WeP16 X-ray Photoelectron Spectroscopy Measurements of Mid-gap Density of States in Amorphous Hydrogenated SiC Thin Films*, **F.S. Ohuchi**, M.-H. Lee, D.A. KuKuruznyak,* University of Washington

Optical properties of amorphous Si-C thin films are directly related to electronic structure. The most significant optical parameters in amorphous systems are the optical band gap, E@sub g@, and the steepness parameter of the exponential absorption edge called Urbach energy, E@sub u@. In amorphous materials such as amorphous hydrogenated SiC (a-Si@sub 1-x@C@sub x@:H) thin films, the absorption edge is not clearly defined, and the Urbach tails further complicate the electronic band structure due to the mid-gap energy states. By fabricating metal-semiconductor junctions, electrons can be externally supplied to the mid-gap states. When an insulating layer further exists between the metal and a-Si@sub 1-x@C@sub x@:H thin film, occupied electrons in the mid-gap states will induce charges in the insulator, resulting in a shift in the electron binding energy at the interface, thus the density of mid-gap states can be measured by X-ray photoelectron spectroscopy (XPS). In this talk, a new method to evaluate the mid-gap density of states is proposed and applied to a-Si@sub 1-x@C@sub x@:H thin films. Experimentally, a-Si@sub 1-x@C@sub x@:H was deposited on the top of Au surface on Si by DC plasma enhanced chemical vapor deposition. Very thin oxide (SiO@sub 2@) and Au layers with the thickness of below electron penetration depth were grown subsequently. The shift in difference between Au 4f and Si 2p core-level binding energies was measured by XPS as a function of the bias voltage. The energy distribution of mid-gap DOS was obtained from analyzing the amount of the bias-induced binding-energy shift, and the measured mid-gap DOS was further compared to optical absorption measurements in an attempt to elucidate the relationship between the optical property and electronic structure in a-Si@sub 1-x@C@sub x@:H thin films.

SS-WeP17 CO Adsorption on Au{110} and Au/TiO@sub 2@*, **D.C. Meier**, V. Bukhtiyarov, D.W. Goodman,* Texas A&M University

A great deal of interest has been generated by the catalytic properties of gold nanoclusters on metal oxide supports. These complex systems will be better understood if they are first dissected into their simplest components and studied separately. After comparing and contrasting the behavior of the components to the behavior of the system of interest, conclusions can be drawn as to the function of the catalytic system. With this information, steps can be taken to optimize those properties with the most desirable catalytic effects. IRAS studies of the dynamics of CO adsorption on the Au{110}(1x2) and Au{110} unreconstructed surface were performed as a function of CO pressure and sample temperature. The CO IRAS absorption shifted from 2118 cm@super -1@ to 2108 cm@super -1@ with increasing coverage on the reconstructed surface while the unreconstructed sample exhibited no shift, remaining at 2108 cm@super -1@. Clausius-Clapeyron data analysis yielded a E@sub a@ for CO adsorption of 12 kcal/mole at low coverages and 9 kcal/mole at elevated coverages, where the phase change appears at approximately 0.17 monolayers. These results are compared and contrasted to CO adsorption on Au/TiO@sub 2@ systems, which exhibit similar wavenumber shifts, but at higher adsorption energies.

SS-WeP18 Adsorption, Decomposition and Stabilisation of 1,2-dibromoethane on Cu(111)*, **A.S.Y. Chan**,* University of Nottingham, UK*; R.G. Jones,* University of Nottingham, UK, U.K.

The molecular adsorption and thermal reaction of 1,2-dibromoethane (DBE) on Cu(111) has been studied using Ultraviolet Photoelectron Spectroscopy (UPS), work function change (@Delta@@Phi@) measurements, Low Energy Electron Diffraction (LEED) and Line-of-sight Temperature Programmed Desorption (LOSTPD). At 100 K, DBE adsorbs molecularly, exhibiting a decrease in work function of 0.86 eV at the completion of the monolayer. Layer-by-layer growth is observed up to two molecular layers, with further adsorption leading to the growth of tower crystallites. The first layer of DBE undergoes thermal decomposition at 120 K to give gaseous ethene and chemisorbed bromine in a (@sr@3x@sr@3)R30° structure, which increases the work function of the surface by 0.58 eV. Chemisorbed bromine from partial decomposition of the first layer is found to stabilise the remaining DBE molecules in the decomposing layer, thereby arresting complete decomposition until a higher temperature, leading to the emission of ethene at 140 K and 160 K for decomposition of the surface DBE layer in the submonolayer and multilayer regime respectively. The possibility of the ethene product being stabilised by co-adsorption adjacent to the chemisorbed bromine is discussed.

SS-WeP19 Methyl Nitrite: Potential Intermediate in Methane-assisted Reduction of Nitric Oxide*, **L.J. Deiner**,* Harvard University*; S.W. Wilke,* California Institute of Technology*; C.M. Friend,* Harvard University

Reactions of methyl nitrite (CH@sub 3@ONO) on O-covered Mo(110) were studied in order to determine if methyl nitrite is a possible intermediate in the methane-assisted reduction of NO. The product distribution in temperature programmed reaction studies depends on the coverage of CH@sub 3@ONO. At saturation coverage, there is low temperature desorption of CH@sub 3@ONOand NO (160 K)and high temperature desorption of methyl (CH@sub 3@) radicals (650 K). At low coverage, the only products detected in temperature programmed reaction are CH@sub 3@ radicals at 650 K. Isothermal reaction experiments performed at 100 K and 300 K indicate that N@sub 2@O and NO are evolved directly into the gas phase. At both temperatures, N@sub 2@O evolution occurs first and then decreases rapidly as NO production rises. NO continues to desorb until saturation coverage of CH@sub 3@ONO. Fourier transform infrared spectroscopy confirms the results of the temperature programmed reaction and isothermal experiments. The infrared spectrum of the low coverage surface displays only one band corresponding to the C-O stretch of methoxy. The infrared spectrum of the saturation coverage surface possesses bands corresponding to intact CH@sub 3@ONO, NO, and methoxy. Upon heating the surface to 450 K, only the methoxy bands remain.

SS-WeP20 Technique for Optical Lever Calibration for Surface Stress Measurements*, **P.J. Williams**, M. Godin, V. Tabard-Cossa, P. Grutter,* McGill University, Canada

The atomic force microscope (AFM) is increasingly being used not just to image surfaces of interest but also to probe the mechanical properties of the surface, using force spectroscopy for example. In addition, AFM cantilevers are being used as the basis of nanosensors to measure a variety of signals, including surface stress, temperature etc. In all of these applications, it is important that the relationship between the output of the position sensing detector (PSD) and the deflection of the cantilever be well known. In this poster we present a new technique for determining this relation. We attach a small resistive heater to the cantilever chip to induce a bending through the bimetallic effect. We simultaneously monitor the deflection of the beam with a fibre optic interferometer that is brought up to the backside of the cantilever and with a PSD. The interferometer fibre is positioned to be at the focus of the laser beam and hence we are measuring the deflection of the cantilever at the same position that the laser spot is focused. By computing the power spectrum of the interferometer output versus the PSD output, the PSD can be accurately calibrated. We have employed this calibration technique in a measurement of the surface stress associated with the formation of a self assembled monolayer of alkanethiol on gold.

SS-WeP21 The AFM Study of the Growth Process of a-Si:H Films Deposited by Low Frequency PECVD*, B.G. Budaguan, **M.N. Meytin**,* Moscow Institute of Electronic Technology, Russia*; A.A. Aivazov,* UniSil Corp.

In this work the growth process and surface morphology of a-Si:H films fabricated by the low frequency (55 kHz) PECVD at substrate temperatures from 40°C to 325°C was investigated.The results of the mass-spectra measurements of LF plasma have shown the presence of SiH3 and Si2Hx radicals.We detected large powder particles in plasma by laser beam scattering.The intensity of Si2Hx mass spectra peaks as well as the intensity of laser beam scattering decrease with the Ts increase, indicating on the decreasing of the probability of polymerization processes. The AFM analysis of a-Si:H surface reveals the island type morphology. The average diameter of islands increases with Ts, while the concentration of islands decreases. The dependence of the RMS roughness,w, on the thickness of the films,d, is w~d^b,where b~6. The high value of b (b>0.5 for a conventional 13.56MHz PECVD) and the dependence of islands diameter on Ts are proposed to be due to the participation of powder particles in the film growth. In that case the formation of a-Si:H surface morphology is controlled by two types of precursors-SiH3 radicals and powder particles. We performed computer modeling of the growth process. The initial diameter of islands formed from the powder particles and the rate of islands formation,Ci, were determined by the fitting of simulated RMS and islands diameter distribution to the experimental data. It was found that Ci decreases with increase of Ts,which correlates with the experimental data. The dependence of the island diameter on Ts is explained by the participation of SiH3 radicals in the growth process. The sticking of the SiH3 radicals to the film surface leads to the growth of island diameter, which is restricted by the boundaries of the neighbor islands. So,the higher the number of islands the lower their diameters and vice verse. This mechanism of island growth allows to explain the increase of the island diameter with the substrate temperature.

SS-WeP22 Effects of Low Dose Ion Bombardment Upon the Hg-distribution in a CeO2-layer in a TL-lamp*, C. Van der Marel,* Philips Electronics, The Netherlands*; V.H. Hildenbrand,* Philips Research, The Netherlands

Experiments have been done with a TL-lamp of which the inside was coated with CeO2. After a long time of operation the Hg vapor pressure in the lamp was too low to sustain the plasma. ARXPS was applied to determine the chemical state of the Hg and to obtain information about the depth-distribution of the Hg in the upper few nm of the CeO2-layer. Additionally experiments were done with a low flux, low energy ion beam (0.5 kV). The dose was chosen such that, even when a sputter yield of 1 is assumed, much less then 1 ML might be removed. The influence of successive ion bombardments upon the Hg-distribution was investigated. It is found that even low dose ion bombardment, in which only a small fraction of the surface is directly hit by the ions, has an important influence upon the depth distribution of the Hg within the layer.

SS-WeP23 Electron-Stimulated Desorption of Europium Atoms from Oxidized Tungsten Surfaces*, V.N. Ageev, Yu.A. Kuznetsov,* A. F. Ioffe Physico-Technical Institute, Russia*; T.E. Madey,* Rutgers, The State University of New Jersey

We have measured the electron-stimulated desorption (ESD) yield for neutral europium (Eu) atoms from Eu layers adsorbed on oxidized tungsten surfaces, as a function of electron energy, europium coverage, degree of oxidation of tungsten and surface temperature. The objective is to compare ESD of multivalent Eu with ESD of monovalent alkali atoms, studied previously. The measurements have been carried out using a time-of-flight method and surface ionization detector. The Eu ESD desorption yield is a complicated function of Eu coverage, electron energy E@sub e@ and substrate temperature. In the coverage range 0.05 to 0.35 monolayers (ML), thresholds for Eu desorption are observed at electron energies E@sub e@ of 25 and 37 eV, and are associated with Eu 5p and 5s excitations. Additional features (resonant-like peaks) are seen at E@sub e@ = 50 eV and 80 eV; these are associated with W 5p and 5s, respectively, and are observed even for Eu coverages > 1 ML. The Eu yields at 25 and 37 eV vanish above 330K, whereas the yields at 50 and 80 eV persist above 500K. This is the first report of ESD of metal atoms in which threshold features correlate both with adsorbate excitation energies and substrate excitation energies.

SS-WeP24 Optical and STM-based Excitation of Adsorbed Molecules: Elucidating their Elementary Mechanisms and Novel Experiments*, L. Bartels,* University of California, Riverside*; E. Knoesel, D. Moeller, T.F. Heinz,* Columbia University*; S.W. Hla, G. Meyer, K.H. Rieder,* Free University Berlin, Germany*; D. Velic, A. Hotzel, M. Wolf,* Fritz-Haber-Institute, Germany*; P. Saalfrank,* University College, England

Photodesorption and other photochemical reactions have been studied for a long time and lately using femtosecond laser pulses extremely detailed measurements could reveal an astonishing amount of their underlying elementary steps in the time domain. The scanning tunneling microscope, initially invented as a tool to image surfaces at atomic resolution, has in the meantime developed into a highly precise and powerful means to manipulate them. It could be shown that some of the excitation mechanisms relied elementarily on electron attachment to a molecular resonance. This is very similar to photoelectron attachment, but while STM has poor inherent temporal resolution, its superior spatial resolution can trace down reactions to specific adsorption sites and molecular arrangements. In this contribution a comparison of both excitation methods is given and for the induced lateral movement of CO on copper the results are compared. Further results from STM induced measurements are shown.

SS-WeP25 Atomic Resolution Imaging of Si(100)2x1-H Surface with Non-contact AFM*, A. Yoshimoto, Y. Sugawara, S. Morita,* Osaka University, Japan

Noncontact Atomic Force Microscopy (NC-AFM) have achieved true atomic resolution in 1995. NC-AFM is one of the most promising tools for surface analysis of materials including insulators on an atomic scale. In fact, many experimental groups reported atomically resolved images on various surfaces. NC-AFM imaging mechanism which contributes to the image contrast is still in progress. Although NC-AFM imaging mechanism has been investigated mainly on a chemically reactive surfaces such as semiconductor surface (Si(111)-7x7, Si(111) r3xr3-Ag etc.), there is no report on a comparative study between a reactive surface and an inactive surface using the same tip. In the present experiments, we performed the NC-AFM imaging on reactive Si(100)-2x1 reconstructed surface with dangling bond and inactive hydrogen- terminated Si(100)-2x1-H surface without the dangling bond. As a force sensor, we used a silicon tip with dangling bond, which was cleaned by Ar ion sputtering. As a result, by using the same tip, we succeeded in obtaining atomic resolution images on Si(100)-2x1 reconstructed surface and Si(100)-2x1-H monohydride surface. We found that the distance between bright spots of AFM images increased by the hydrogen termination. This suggests NC-AFM has capability for hydrogen atom imaging of Si (100) 2x1-H on an atomic scale.

SS-WeP26 Desorption Induced Change in Surface Stress of Self-assembly Alkanethiol Monolayer on Gold*, A.N. Itakura,* National Research Institute for Metals, Japan*; T. Narushima,* University of Tsukuba, Japan*; M. Kitajima,* National Research Institute for Metals, Japan*; R. Berger,* IBM SSD GmbH, Germany

Self-assembled monolayers such as alkanethiol, -HS-(CH@sub 2@)@sub n-1@-CH@sub 3@ for n=4,6,8,12, on metal surface have been well studied because they have potential use in the wide range of technological applications such as molecular recognition and nanofabrication. The alkanethiol monolayer on gold induces a compressive surface stress during the self-assembly and the saturation value of the compressive stress is directly proportional to the alkyl chain length. There are few papers on the stress induced by the desorption. Here we present the evolution of surface stress during adsorption and desorption of self-assembly alkanethiol monolayers (SAM). The adsorption of SAM (n=12) produces a compressive stress of 0.18 N/m in air. An exposure to an argon plasma, in a UHV system, induces a rapid decrease of the compressive stress. This is because of the desorption of SAM, and if the adsorption and desorption are a reversible reaction then the final stress should be zero. But actually, the final value of the stress is tensile : -0.12 N/m. After the stress experiment we examined the surface with Auger electron microscope and detected S remaining on the surface. It suggests that the removing of dodecanethiol is not as a molecule but a part of alkyl chain which is cut from adsorbed molecule. The tensile stress should be due to the remaining part.

SS-WeP27 HREELS on CO/Rh(111): Lateral Interactions in Adsorbate Layers and Vibrational Frequency Shifts*, R. Linke,* Eindhoven University of Technology, The Netherlands*; J.W. Niemantsverdriet,* Eindhoven University of Technology, The Netherlands, Netherlands

Lateral interactions in CO adlayers on Rh(111) were studied by HREELS and TDS. At low coverage CO adsorbs only on-top. From about 0.5 ML also the 3-fold hollow site becomes populated. The occupation of the second adsorption site is accompanied by the development of a low temperature shoulder in the TDS peaks indicating increasingly repulsive interactions in the adsorbate layer. A continuous shift to higher frequencies of the internal C-O vibration is observed over the whole coverage range. At low coverage the on-top Rh-CO frequency hardly shifts but undergoes a shift to lower frequencies upon the emergence of the 3-fold hollow. To assess the origin of the frequency shifts we measured isotopic CO mixtures. HREEL spectra of 12CO and 13CO mixtures at total CO coverage of 0.33 ML proof that the frequency shifts arise purely from dipole-dipole coupling. We also used a fixed low 13CO coverage to monitor the frequency shifts in a changing 12CO matrix. The internal 13C-O frequency remains at its singleton frequency until 0.5 ML total CO coverage, then a pronounced shift to higher frequencies begins. This testifies that at low coverage (<0.5 ML) frequency shifts arise from dipole-dipole coupling while at high coverage (0.5 - 0.75 ML) also chemical effects contribute to a large extent.

SS-WeP28 Evidence for Two Chain Length Distributions in the Polymerization of Formaldehyde on Cu(100)*, T.R. Bryden, S. Garrett,* Michigan State University

The adsorption of formaldehyde on Cu(100) has been studied using electron energy loss spectroscopy (EELS) and temperature programmed desorption (TPD). At 85 K, formaldehyde (H@sub 2@CO) spontaneously polymerized to form a monolayer of poly(oxymethylene) (POM). Thermal decomposition/desorption of the polymer monolayer occurred via two kinetically different routes, producing two peaks in TPD that can be attributed to molecular H@sub 2@CO generated via depolymerization of the polymer. The presence of two polymer desorption peaks has not been previously observed in studies of formaldehyde adsorption on metal surfaces. The zero and first order features observed are attributed to chain length differences present between the species and can be explained using rate equations describing the production of monomer. Our data seems to indicate the number of chains, for the zero order species, is fixed while the degree of polymerization is changing as the amount of POM formed increases. EELS spectra, taken as a function of anneal temperature, indicate the two species are similar and show losses due to POM. However, the losses due to POM for the second species are lower in intensity and new modes are identified that are attributed to the end groups of the polymer, which is consistent with shorter chains. Additionally, the second species is more ordered relative to the mixture, which could account for the enhanced production of the first species during dosing experiments where the surface is covered with the second species during exposure to H@sub 2@CO.

SS-WeP29 Photon-stimulated Ion Desorption from Mono- and Multi-layered Silicon Alkoxide on Silicon by Core-level Excitation*, Y. Baba,* Japan Atomic Energy Research Institute, Japan*;* ***G. Wu****, T. Sekiguchi, I. Shimoyama,* Japan Atomic Energy Research Institute

Photo-induced processes at semiconductor surface are of great importance for the fabrication of semiconductor devices, because surface modification at low-temperature is possible using photons as a driving force of the reaction. For the deposition of silicon dioxide on silicon, silicon alkoxide is widely used for the source material. Synchrotron radiation (SR) has advantages as light source of photo-induced deposition, because of the potentiality of the element-selective and site-selective reactions due to the localized nature of inner-shell electrons. Here we present the results for the fragment-ion desorption from tetramethoxylsilane (TMS) on silicon using monochromatized SR beam around the Si K-edge. In order to separate the photochemical processes induced by substrate excitation and adsorbate excitation, we have prepared well-defined monolayer, bilayer and multilayer of TMS on Si (100). In the X-ray absorption near-edge structure (XANES) spectrum taken by total electron yield, the peak energy of the resonant excitation from Si 1s to unoccupied @sigma@* orbits for TMS was shifted to higher energy by 6 eV than that for silicon substrate. For monolayer, the desorbed fragment was only CH@sub 3@@super +@ ions. Although the XANES spectrum of monolayer was almost the same as that for silicon substrate, the photon-energy dependences of the CH@sub 3@@super +@ yield followed the XANES spectrum for TMS. The results show that the secondary electrons produced by Auger decay in silicon substrate scarcely contribute to the CH@sub 3@@super +@ desorption. And it was elucidated that the core-to-valence resonant excitation in adsorbed molecule is the main cause of the molecular-ion desorption.

SS-WeP30 Formate Synthesis on Cu(111) by an Eley-Rideal Mechanism*,* ***M. Sano****,* University of Tsukuba, Japan*; T. Fujitani,* National Institute for Resources and Environment, Japan*; J. Nakamura,* University of Tsukuba, Japan

We have studied the kinetics and the mechanism of the formate synthesis by the hydrogenation of CO@sub 2@ over a Cu(111) model catalyst. The pressure dependence of H@sub 2@ and CO@sub 2@ upon the formation rate of the formate suggested that this reaction proceeds by an Eley-Rideal (E-R) mechanism. We thus examined the formate synthesis by the reaction of gaseous CO@sub 2@ and adsorbed hydrogen on Cu(111), where the experiments were carried out by an in-situ IRAS apparatus with a closed high pressure (1 atm) reactor. The Cu(111) sample was first exposed to 380 Torr H@sub 2@ to prepare a H/Cu(111) surface. Then, the formate synthesis was performed by exposing H/Cu(111) to CO@sub 2@ (380 Torr), where the sample temperature was constant at 308 K while the gas temperature was varied from 310 to 328 K. It was clearly shown that the bidentate formate species was formed on Cu(111) from the reaction of gaseous CO@sub 2@ and adsorbed hydrogen by IRA spectra. Moreover, the initial formation rate of the formate species increased with the heating temperature of gaseous CO@sub 2@ , indicating that the gaseous CO@sub 2@ temperature affects the formation rate of the formate synthesis. The activation energy and the pre-exponential factor of the rate constant were in good agreement with those of formate synthesis from CO@sub 2@ and H@sub 2@ at 760 Torr (P@sub CO2@ /P@sub H2@ = 1). The results mean that the formation rate of the formate synthesis only depends on CO@sub 2@ temperature, further indicating that the formate synthesis proceeds by the direct reaction between gaseous CO@sub 2@ and adsorbed hydrogen. We thus concluded that formate synthesis proceeds by an E-R mechanism.

SS-WeP31 Surface Treatment and Characterization of PMMA, PHEMA, and PHPMA*,* ***H. Lim****,* Korea University*; Y. Lee,* Korea Institute of Science and Technology*; J. Cho,* Hanyang University, Korea*; S. Han,* Korea Institute of Science and Technology*; K.-J. Kim,* Korea University

Poly(methyl methacrylate)(PMMA), poly(2-hydroxyethyl methacrylate)(PHEMA), and poly(2-hydroxypropyl methacylate)(PHPMA) were modified to improve the wettability using two methods: plasma treatment and Plasma Source Ion Implantation(PSII) treatment. The modified surfaces were characterized to investigate the dependence of polymer structure on the treatment conditions and hydrophobic recovery behaviors. The contact angle measurement was used to calculate the surface free energy. The polar component of surface energy is a dominant factor to improve the wettability. The changes of surface functionality were observed with XPS and ATR-IR. PSII treatment has provided much more various functional groups on the surface and deeper modified layer than plasma treatment during the same treatment time. The surface morphology was investigated by SEM and AFM after treatment. However, the severe surface alteration was not observed. The difference of experimental conditions among the polymers was interpreted by the glass transition temperature which is related to the structure of each polymer.

SS-WeP32 Coadsorption of CO and O@sub 2@ on W(110) Surface*, K.-H. Lee, H.-S. Han, H.-G. Yun,* ***T.S. Yang****, J.-H. Boo, S.-B. Lee,* Sungkyunkwan University, Korea*; H.T. Kwak,* Kookmin University, Korea

The coadsorption of CO and O@sub 2@ on W(110) surface was studied by LEED, TDS, and photoelectron spectroscopy. In the TDS for the coadsorption of CO at RT on O@sub 2@ precovered W(110) surface, two CO desorption states were observed at about 400 and 1150 K, called @alpha@ and @beta@, respectively. The @beta@-CO spectra with second order desorption kinetics were shifted to lower desorption temperature as increasing the amount of preadsorbed atomic oxygen on the W(110). Moreover, the @beta@-CO spectra were gradually increased with increasing the amount of preadsorbed oxygen to 0.5 ML. Even though a (2x1) LEED pattern appeared during oxygen adsorption at RT and 1-3 L oxygen exposures, we didn't observe any new pattern induced by CO in this study. Only the structure of c(11x5) was obtained at temperature in their range of 800-1100 K. These results indicated that there were interaction between CO and O and thereby the @beta@-CO might not be dissociated even at the higher temperature than 800 K. By using the XPS and UPS, it was also confirmed that the coadsorbed @beta@-CO at 950 K doesn't dissociate as the experimental results of the adsorption of pure CO on W(110) surface at the same temperature. According to the valence band spectra, two CO peaks at near 10.7 eV(4@sigma@) and 7.0 eV(5@sigma@+1@pi@) were observed, indicating molecular CO adsorption on the oxygen preadsorbed surface at RT. Even heating the coadsorbed surface to 950 K, we could also detect the CO 4@sigma@ peak that can be an important factor for identifying a contribution of the CO 4@sigma@ molecular orbital to the CO-metal bond. To our best knowledge, this is the first report and quite contradictory result to that reported previously.

SS-WeP33 Effect of the Sample Topography on the Adhesive Force in Atomic Force Spectroscopy Measurements in Air*,* ***N. Nakagiri****,* Nikon Corporation, Japan*; L. Sirghi,* Nagoya University, Japan*; K. Sugisaki,* Nikon Corporation, Japan*; H. Sugimura, O. Takai,* Nagoya University, Japan

It is widely recognized that water thin films formed on probe and sample surfaces greatly affect the atomic force microscopy (AFM) measurements in air. Generally, the interaction between the probe tip and sample surface is a result of superposition of van der Waals, electrostatic, capillary and interfacial tension forces. The latter two forces arise due to water thread usually formed at tip-sample contact region in air and their contribution to the tip-to-sample adhesive force is dominant The effect of local curvature of sample surface on the capillary and interface tension adhesion force of water meniscus formed between AFM tip and sample in air is demonstrated both, theoretically and experimentally. An analytic solution for capillary and tension adhesive force is founded under approximation of thermodynamic equilibrium of a symmetric water meniscus formed at the tip-sample contact region. It is shown that the sample local curvature strongly affects the water meniscus geometry and the adhesion force. Compared to the force computed for a null local curvature of the sample surface, the theoretical model predicts larger/smaller adhesive force for concave/convex local curvature. The theoretical predictions were confirmed by experiment. Atomic force spectroscopy measurements were performed for a silicon nitride cantilever and a standard sample of quartz patterned with 3x3 mm2 in area and 20 nm in depth grooves and platinum covered. Maps of sample surface topography and adhesive force have shown a much small/large force on the high/low part of groove edges, where the sample local curvature is convex/concave.

SS-WeP34 Surface Electronic Structure of Rare Gas Xe on Cu(111): A Scanning Tunneling Microscope Study*, **J.-Y. Park**, U.D. Ham,* Seoul National University, Korea*; S.-J. Kahng,* University of Illinois at Urbana-Champaign*; Y. Kuk,* Seoul National University, Korea

A newly built ultrahigh vacuum cryogenic scanning tunneling microscope (STM) was used to study the modified surface state and image state on an adsorbate-covered surface, one monolayer (ML) Xe on Cu(111). Electron standing waves were observed on 1 ML Xe-covered Cu(111) as well as on bare Cu surface. By carefully controlling the Xe coverage, standing waves on both bare Cu surface and 1 ML Xe-covered Cu surface could be observed simultaneously in one STM image. Therefore, any possibility of artifact due to different conditions of the tunneling tip can be ruled out. The wavelength of standing waves on Xe layer is ~15% longer (~17Å) than that on Cu surface at sample bias as low as 10meV. By performing scanning tunneling spectroscopy on this surface, dispersions of the surface state both on Xe layer and bare Cu surface are determined. It was found that the onset of the surface state is shifted towards Fermi level by (130±20) meV and the effective electron mass is slightly larger on Xe layer than on bare Cu surface. The electronic lifetime, the multilayer effect, and the effect of image states will also be discussed.

SS-WeP35 STM Barrier-Height Imaging of Alkali Adsorbed Si(111)7x7*, **S. Kurokawa**, A. Sakai,* Kyoto University, Japan

The chemisorption of alkali metals on silicon is one of the most studied adsorption systems, and a large number of theoretical and experimental investigations have been carried out to understand its atomic and electronic structures. However, little has been known on atomic-scale properties of the K adsorption on Si(111)7x7. Hashizume and his coworkers have investigated the initial stage of K adsorption on Si(111)7x7 by STM, and identified some adsorption geometries of K. They also concluded that the bonding between K atoms and Si(111)7x7 surface atoms changes from ionic when K atoms adsorb individually to weakly covalent when they form clusters. We have performed STM imaging and local barrier-height (BH) measurements upon adsorbed K atoms and clusters. The K coverage is about 0.01ML, which corresponds to a very initial stage of adsorption. We found that the local BH decreases at K cluster and each single K atom. The average BH reduction at the K adsorbed site is -1.9 eV under positive sample bias where the electronic structure of tip has little influence on the BH. According to recent photoemission experiments, the reduction of the work function at the saturation coverage of K is -2.9 eV. The measured BH reduction at K sites is smaller than this value but can be a plausible value since the K-Si bonding at the initial stage of adsorption may be different from that in a K overlayer at the saturation coverage. @FootnoteText@ @footnote 1@ T. Hashizume, K. Motai, Y. Hasegawa, I. Sumita, H. Tanaka, S. Amano, S. Hyodo and T. Sakurai, J. Vac. Sci. Technol. B9, 745 (1991).

SS-WeP36 Laser Etching of Si with NF3 using CuBr Laser*, **B. Ivanov**, K. Woynov,* University of Chemical Technology & Metallurgy, Bulgaria*; M.P. Tarassov,* Central Laboratory of Mineralogy and Crystallography, Bulgaria*; L. Zambov, V. Shanov,* University of Chemical Technology & Metallurgy, Bulgaria

Laser induced thermal etching of Si using focused copper bromide vapor laser beam with wavelengths of 510 and 578 nm on monocrystalline Si (100) with NF3 gaseous phase was presented. The laser average power was in the range 4-10 W with repetition rate - 20 kHz and pulse duration - 60 ns. The process parameters were varied in the ranges: scanning speed from 10 to 1000 microns/s, substrate temperature from 100 to 400 C and partial pressure in the range of 100 - 1000 mbar. The etching products were estimated on the base of thermodinamcal calculation. The width, depth and cross section of the etched channels were investigated by Scanning Electron Microscopy (SEM). Some residues on the side wall are removed by subsequent thermal wet etching in KOH solution. In some cases we find evidence for waveguiding effect of laser radiation during the laser etching. The etching rate increases with the scanning speed and is in the range of 2.10^5 - 5.10^6 micron^3/s for the scanning speed of 10 micron/s to 1 mm/s. The aspect ratio of laser etched groves are in the range of 5 - 40 for all structures and reaches 100 for waveguiding part of the trench. This very high etching rate allows using of such process for micromachining of Si. Application of this approach for production of square rods array and field emission like tips was presented.

SS-WeP37 Reactivity of CO over Au Surfaces at Elevated Pressure*, **K.F. Peters**, P. Steadman, O. Robach, J. Alvarez, S. Ferrer,* European Synchrotron Radiation Facility, France

The "Pressure Gap" in surface science separates the well-studied UHV regime from the near-atmospheric pressure regime, where gas-phase catalysis is typically employed. We present first results from a new UHV/HiP surface x-ray diffraction chamber that is capable of spanning the pressure gap over 13 orders of magnitude up to 5 bars or higher.@footnote 1@ The UHV/HiP chamber is employed here to study gas-surface reactivity of carbon monoxide over metals. The Au(111) and Pt(111) surfaces are investigated because of their known inertness to carbon monoxide in vacuum studies. Moreover, CO/Pt(111) is an archetypal model of catalysis, whereas gold is among the most inert metals and is only known to adsorb CO at cryogenic temperatures. The observed gas-surface reactions are unexpectedly strong, owing to the elevated pressures. Both CO/Au(111) and CO/Pt(111) become reactive at near-atmospheric pressures and elevated temperatures. On Au(111), the Herringbone reconstruction can be lifted under certain conditions.@footnote 2,3@ The Pt(111) surface reacts with CO to form a new structure that has never previously been observed in vacuum studies. An important feature of these two examples is that the metal atoms are displaced significantly from their natural positions, which is uncommon in traditional examples of gas adsorption. @FootnoteText@ @footnote 1@P.Bernard, K.F.Peters, J.Alvarez, S.Ferrer, Rev.Sci.Instr., 70, 2, 1999, 1478-1480. @footnote 2@Steadman et al, accepted to Phys.Rev.B @Footnote 3@Peters et al, submitted.

Author Index

Bold page numbers indicate presenter