

Tuesday Evening Poster Sessions, November 4, 2003

Organic Films and Devices Room Hall A-C - Session OF-TuP

Poster Session

OF-TuP3 Real Time Observation of Surface Stress during Dithiol Adsorption in Gas Phase, A.N. Itakura, National Institute for Materials Science, Japan; *R. Berger*, Max Planck Institute for Polymer Research, Germany; *S. Igarashi*, Japan Science and Technology Corporation, Japan; *M. Kitajima*, National Institute for Materials Science, Japan
Self-assembled monolayers (SAM) such as alkanethiol, HS-(CH₂)_n-SH for n=4,6,8,12, on Au induce compressive surface stresses during the self-assembly, and the saturation value of the stress is proportional to the length of alkyl chain. We observed the compressive stress for dithiol HS-(CH₂)_n-SH for n=6,8,10, adsorption on Au in gas phase. Contrary to the alkanethiol adsorption, the saturation value of the compressive stress showed smaller value for longer alkyl chain. The compressive stress for dithiol adsorption may be induced by the bonding between S and Au substrate. Dithiol adsorbs on Au surface as a lie-down phase, while alkanethiol as a standing phase. Density of the S-Au bonds should be lower for longer chain of dithiol, resulting in the reduction of the stress. @FootnoteText@ @footnote 1@ A.N.Itakura, R.Berger, T.Narushima and M.Kitajima, Appl.Phys.Lett.80, 3712 (2002)

OF-TuP4 XPS Studies of Charge Transfer between Dye Molecules and Polymer Chains in Dye Molecule Doped Conducting Polymer Films, H. Kato, S. Takemura, Kanto Gakuin University, Japan

Conducting polymer polythiophene (PT) films incorporated with dye molecules such as methylene blue (MB), safranin T (ST) and brilliant green (BG) were prepared by electrochemical doping and diffuse injection methods. Polymeric structure, charge transfer and interaction between the dye molecule and PT polymer chain in the hybrid films were closely investigated by analyzing the core-level energies and spectral profiles of the atomic components. Vibrational states of the doped dye molecule and polymer backbone were also investigated by FTIR RAS and ATR in order to examine the dopant configuration into polymer chains. XPS measurements clarified the identification of doping species into the polymer chains varied with synthetic methods and conditions. Dye molecules such as MB, ST and BG were doped in polymer films as two types of states such as cation-like and salt-like. In the case of BG, XPS core-level analysis of S 2p split indicates simultaneous doping of BG cation and HSO₄⁻ in the hybrid films prepared by electrochemically reduced and dye diffused injection methods. The higher binding energy peak corresponds to HSO₄⁻ while lower binding energy peak can be assigned to the S sites of polymer backbone. Synthesized film samples were categorized into two types by the difference of S 2p core-level energy shift. In the cation-like doped sample, the energy shift of the lower peak of S 2p suggests the charge transfer between BG molecules and polymer chains creating a n-type conducting polymer state. The relation between dopant species with different configuration and dopant-chain charge transfer will be also discussed.

OF-TuP5 XPS Studies of Organic-Inorganic Interface Interaction between Conducting Polymer Chains and Si Sublayers, H. Kato, S. Takemura, Kanto Gakuin University, Japan

Conducting polymer polythiophene (PT) and polypyrrole (PP) films were grown on Si substrates. PT/Si and PP/Si interfaces were fabricated by electrochemical method. Thin polymer film growth was obtained by controlling the applied voltage to the anode Si wafer in an electrochemical cell. Obtained film thickness was thin enough to be penetrated by XPS measurement to detect the organic-inorganic interface. Polymer chain configuration was also investigated by FTIR. XPS measurements were conducted closely investigating the core-level energies and spectral profiles of the atomic components. An affinity between a deposited polymer film and a Si substrate was strong compared with the case of film growth on metal oxide substrates such as ITO and SnO₂. Si 2s and 2p core-level spectra which were basically composed of different Gaussian components reflect different valence states of Si interacting with upper polymer layers in comparison with the core-level spectra of non-deposited Si substrate expecting bonds between polymer chains and Si substrate layers. The lower binding energy peaks observed in Si 2p spectra of PT/Si correspond to the Si states with strong interaction between Si and PT suggesting Si-C and Si-F bonds created at the PT/Si interface. In addition to the organic-inorganic bonding, the polymer chain configuration was also investigated

by FTIR. The polymer chain orientation on a Si substrate will be discussed comparing with the data obtained by RAS and ATR techniques detecting ring stretching modes of the polymer chain. The polymer chain linkage which reflects symmetric and asymmetric vibration modes will be also discussed.

OF-TuP6 Vibrational Spectroscopy and Charge Transport Characteristics of Metal-Molecule-Metal Junctions, J.L. Lazorcik, J.G. Kushmerick, R. Shashidhar, Naval Research Laboratory

We report the current-voltage characteristics and inelastic electron tunneling spectra of self-assembled monolayers in a crossed-wire tunnel junction. Inelastic electron tunneling spectroscopy (IETS) enables in situ vibrational characterization of metal-molecule-metal junctions. The well defined spatial orientation of molecules in a self-assembled monolayer enables the selection rules for IETS to be explored. Results for an insulating alkane-thiol and two @pi@-conjugated molecular wires, oligo(phenylene ethynylene) and oligo(phenylene vinylene), will be presented.

OF-TuP7 Photolithographically Defined Micropatterned Organosilane Monolayer as a Template Surface for Guided Self-Assembly of Charged Microparticles, A. Takahara, T. Koga, M. Morita, H. Otsuka, Kyushu University, Japan

Two-dimensional arrangement of microparticles on the substrate surface might be a promising method to fabricate functional materials. In this study, micropatterned fluoroalkylsilane/aminosilane monolayer was prepared as a template surface for site-specific arrangement of sulfonated polystyrene (PS) microparticles. Micropatterning of organosilane monolayer was carried out by area-selective irradiation of vacuum ultraviolet-ray through the photomask. Si wafer substrates with micropatterned organosilane monolayer were then exposed to the dispersed aqueous solution of sulfonated PS microparticles. Atomic force microscopic (AFM) observations revealed that the PS microparticles were area-selectively adsorbed onto the aminosilane phase. The site-specific adsorption of PS microparticles onto the aminosilane phase was ascribed to the electrostatic interaction between sulfonic acid groups of PS microparticles and amino groups of aminosilane phase. The height of adsorbed PS microparticles is in good agreement with the diameter of PS microparticle. This result suggested that the sulfonated PS particles formed a monolayer on the substrate surface. This consideration was supported by the result of adhesion force measurements. Adhesion force measurements clearly showed the specific interaction between sulfonic acid group of cantilever tip and amino group of aminosilane patterned surface. Compared with fluoroalkylsilane phase, strong adhesion force was observed on the aminosilane phase. On the other hand, very weak adhesion force originated from repulsive interaction was observed between sulfonic acid group of cantilever surface and that of PS microparticles. It is considered that the micropatterned surface prepared by present method can be applied for area-selective arrangement of two kinds of microparticles onto the substrate surface.

OF-TuP8 Electrical and Optical Characteristics of Indium Tin Oxide Thin Films Deposited by an Oxygen Beam Assisted Deposition Technique on Organic Electroluminescent Device (OLED), N.G. Cho, Y.H. Lee, J.H. Lee, Sungkyunkwan University, South Korea; *Y.W. Ko, J.H. Lee*, Electronics and Telecommunications Research Institute (ETRI), Korea; *G.Y. Yeom*, Sungkyunkwan University, South Korea

To fabricate active matrix organic electroluminescent devices (OLED), a transparent conducting material such as indium tin oxide (ITO) has to be deposited on the organic material of the devices and the organic materials are easily damaged by the oxygen atom, ion bombardment, heating, etc. during the deposition processing of ITO. Therefore, it is very difficult to deposit ITO on the OLED to form a transparent electrode. Also, it is difficult to maintain both electrical conductivity and transparency of ITO without generating damages to OLED when a conventional ITO deposition technique such as sputter deposition is used. Therefore, in this study, a dual oxygen ion, neutral beam assisted evaporator system has been used to deposit ITO films on the OLED to investigate as a possible transparent and conductive ITO deposition technique without generating damage to OLED. The characteristics of the deposited ITO on OLED was investigated using a four-point probe and a UV-spectrometer to measure the resistivity and transmittance of ITO films, respectively. The change of surface roughness after ITO deposition was investigated using an atomic force microscopy. Also, current-voltage (I-V) characteristics of the fabricated OLED with the ITO electrode were measured by HP-4145A semiconductor parameter analyzer.

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OF-TuP9 Contour TPD of N,N'-disalicylidene-1,2-propanediamine Thin-films, C.C. Chusuei, University of Missouri-Rolla; *J.A. Schreifels*, George Mason University

A simple method for obtaining a comprehensive overview of large ($m/e > 200$) molecular weight compounds desorbing from the surface during temperature programmed desorption (TPD) experiments is presented. Standard 2D TPD methods require a priori knowledge of surface reactions and typically therefore is limited to a few pre-selected mass-to-charge ratios (< 10). Our method precludes this necessity since wide mass ranges ($m/e = 25$) can be monitored in a single experiment. Desorbing organic films can be represented in the form of contour TPD (CTPD) plots. In our example, the desorption of N, N'-disalicylidene-1,2-propane -diamine, an important jet fuel additive used in aircraft, is adsorbed onto oxidized and oxide-free 304 stainless steel surfaces. The utility of CTPD for providing mechanistic insight into thermal decomposition pathways is demonstrated. Four chemical species were observed at $m/e = 107, 133, 232$ and 290 respectively, and mechanistic pathways for their formation are presented. Conventional 2D TPD spectra can be extracted from the CTPD by taking vertical slices of the contours.

OF-TuP10 Organic Electroluminescent Devices Fabricated by Ink-jet Printing, S.J. Jo, S.M. Jeong, Yonsei University, Korea; *H.K. Baik*, Yonsei University, Korea, South Korea; *S.H. Choi, W.H. Koo*, Yonsei University, Korea; *K.M. Song*, Kon Kuk University, Korea; *S.J. Lee*, Kyungsoong University, Korea

Organic Electroluminescent Devices for full color were fabricated by ink-jet printing methods. ITO used as anode was treated by atmospheric plasma for hydrophilic surface. Also polyimide as a bank was treated by atmospheric plasma for hydrophobic surface. In this experiment, we investigate characters of OLED and the influence of atmospheric plasma treatment.

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