Surface Science Division
Room 613/614 - Session SS3+BI-ThA

Biological Surface Science

Moderator: B. Kasemo, Chalmers Univ. of Tech. and Göteborg Univ.

2:40pm **SS3+BI-ThA3 Thia(Ethylene Oxide) Alkanes: Tuning the Structure of a Supported Biomimetic Membrane via Spacer Length and Packing Density**, *D.J. Vanderah, C.W. Meuse, T. Petralli-Mallow,* ***A.L. Plant,*** National Institute of Standards and Technology **INVITED**

Interest in reconstituting transmembrane proteins in supported cell membrane mimics of phospholipid/alkanethiol hybrid bilayers has led to development of novel tethering molecules. In an attempt to introduce a disordered, hydrophilic region at the proximal side of the supported lipid bilayer, ethylene oxide moieties have been used as spacers between the sulfur and the alkane chain of alkanethiols. We have observed by infrared spectroscopy, neutron reflectivity, and electrochemistry that such ethyleneoxide moieties are not necessarily hydrated or disordered. The ethylene oxide of thiahexa(ethylene oxide) alkanes (HS(EO)@sub 6@-alkanes) form a highly ordered arrangement of 7/2 helices when allowed to self-assemble at gold from an ethanolic solution. This highly ordered conformation is apparently not driven by order in the alkane chains, since the helical structure occurs in both HS(EO)@sub 6@-decane and HS(EO)6-octadecane. The conformation is, however, determined in part by molecular density. Infrared analysis of mixed monolayers of HS(EO)@sub 6@-alkanes and phospholipids transferred from the air-water interface indicates that at low packing densities the EO region is disordered, but it assumes the helical structure at higher packing densities. Infrared spectroscopy and sum frequency generation suggest that the conformation of the EO region may be controlled by its length. For a series of self-assembled monolayers of HS(EO)@sub n@-decanes, the EO segment is an extended all-trains chain when n=4, a 7/2 helix when n=5-7, and a less ordered conformer when n=8. This effect of spacer length and packing may provide a means of tuning the molecular order of biomimetic matrices.

3:20pm **SS3+BI-ThA5 Quantitative Analyses of Biological Interactions using Surface-Biofunctionalized Surface Plasmon Resonance Devices**, ***C.T. Campbell,*** *L.S. Jung, J. Shumaker-Parry, K.E. Nelson, P.S. Stayton, M.S. Boeckl, M.H. Gelb, S.S. Yee, T. Sasaki, R. Aebersold,* University of Washington **INVITED**

The adsorption of molecules from liquid solutions onto solid surfaces can be monitored with high sensitivity and fast time response by following changes in the angle or wavelength at which the surface plasmon resonance (SPR) of a thin metal film is optically excited. Simple methods convert these measured changes into adsorbate concentrations. We report here the adsorption and desorption kinetics and equilibrium coverages of a variety of species on well-characterized surfaces as determined by SPR techniques. When the diffusion constant of the adsorbing species is known in the liquid phase, the intrinsic rate constants can be determined from the kinetic results. A new method will be described for converting intrinsic adsorption rate constants into sticking probabilities (i.e., the probability that adsorption occurs, given a collision of the molecule with the surface). Several applications of gold-thin-film SPR sensors in quantifying biological interactions will be described. A gold surface containing a few biotin headgroups in a self assembled alkylthiol monolayer of mainly oligo(ethylene glycol) headgroups has been used to assess the effects of protein mutations on the strength of biotin-streptavidin binding. With wild-type streptavidin, the free biotin sites in the resulting streptavidin monolayer have been used as strong linker sites for further attachment of intact, biotinylated lipid vesicles and biotinylated, double-stranded oligonucleotides to the surface. These complex biological films then provide a surface template that can be used to probe the kinetics and equilibrium binding constants for: (1) peripheral membrane proteins binding to vesicle walls, and (2) the binding of DNA-binding proteins to select oligonucleotide sequences.

4:00pm **SS3+BI-ThA7 Adsorption and Reactions in Enzymes and on Surfaces: Similarities And Differences**, *A. Logadottir, T.H. Rod,* Technical University of Denmark*;* ***J.K. Nørskov,*** Technical University of Denmark, Denmark **INVITED**

There are a number of cases where surfaces and biomolecules adsorb the same molecules and catalyze the same reactions. This makes it possible to make comparisons and to see if the concepts of surface science can be transferred to biomolecules. As a specific example, the adsorption of N@sub 2@ and the ammonia synthesis reaction on metal surfaces and in the enzyme nitrogenase will be compared in detail. The comparisons are largely based on density functional calculations which provide a detailed description of the extensive database of experiments for the nitrogen activation process on Fe and Ru surfaces, and which can be used to give the first hint of a mechanism in the enzyme process.

4:40pm **SS3+BI-ThA9 The Role of Hydrogen Bonding in Chemisorbed Aminoacids**, ***N.V. Richardson,*** University of St Andrews, UK **INVITED**

Glycine and its derivatives such as phenyl glycine and alanine form well-ordered monolayers of the corresponding anion on Cu(110). The unit cells reflect both the strong adsorbate-substrate interaction and the hydrogen bonding interactions between adsorbed species. In the case of the chiral amino acids studied, this leads to ordered domains of the two isomers which are distinguishable. Glycine undergoes several orientational changes during the build up of the ordered monolayer and is then able to form a stable bilayer. Such a bilayer is not formed in the case of phenyl glycine or alanine demonstrating the importance of optimal hydrogen bonding in stabilising the bilayer. Adsorption of water on the glycine covered copper surface drives a re-orientation of the molecule which we also relate to the importance of hydrogen bonding between the co-adsorbed species.

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