11-Surfaces, Interfaces and Thin Films

PS-11.01.35 THE APPLICATION OF STM AND AFM IN MINERALOGICAL STUDIES IN CHINA By Libing Liao*, Zhesheng Ma and Nicheng Shi, X-Ray Lab., China University of geosciences, Beijing 100083, China.

STM and AFM have rapidly and widely been used in various study fields since they were invented by Binnig et al. in 1982 and 1985. Up to now, all the study results by STM and AFM have proved that they are really powerful devices for material surface structure studies. Their applications in mineralogical studies were started by Zheng et al. in 1988. In china, as far as we know, our Lab. is the first group and also the only group that studied mineral surfaces with STM and AFM. We began to put STM and AFM in mineralogical studies in 1988 and 1991 respectively. Till now, seven minerals in all have been studied (five for STM and two for AFM). They are galena, molybdenite, hematite, stannite, pyrite, calcite and coal. For galena, both S and Pb atoms of its {100} surface were observed in air under positive Vbias. For stannite, we are the first to image its surface by STM and atomic resolution images of its surface were obtained. For pyrite, some new phenomena were observed which can not be explained satisfactorily by pyrite known band data. Therefore, it wait for further studies. Calcite and coal surfaces were studied by AFM. Some interesting results have already been obtained.

11.02 – Thin Film Structures

MS-11.02.01 THE STUDY OF CHEMICAL INTERFACES AND SURFACES USING NEUTRON REFLECTIVITY. By J.Penfold, Isis Science Division, Rutherford Appleton Laboratory, U.K.

The specular reflection of neutrons is now well established as a technique for the study of surfaces and interfaces. In combination with isotopic labelling it has been shown to be a powerful technique for the study of problems in Surface Chemistry. Examples of its application to the determination of adsorbed ammounts and structure of surfactants, polymers, proteins and their mixtures at the air-liquid and liquid-solid interfaces will be described. Particular emphasis will be placed on the study of surfactants and mixed surfactants adsorbed at the air-liquid interface.

MS-11.02.02 SPECULAR AND DIFFUSE SCATTERING STUDIES OF INTERFACES By M.K.Sanyal, Solid State Physics Division, Bhabha Atomic Research Centre, Bombay 400 085, India.

The availability of intense synchrotron X-ray sources has resulted in a rapid growth of new techniques to investigate interfacial structures of thin films. In this talk we shall discuss the use of specular and diffuse scattering studies to understand the interfacial structures in single layer and multilayer thin films. It has been shown (Sanyal et al., Phys. Rev. Lett., 1991, 66, 628) that capillary wave fluctuations lead to remarkable long-range algebraic decay of the density correlations at liquid-vapour interfaces as a consequence of dimensionality; this in turn produces power law tails in the diffuse scattering. We shall discuss our results of the analysis of polymer surfaces done using similar approach.
We present a new method (Sanyal et al., Euro-Phys. Lett., In Press) of obtaining a model independent electron density profile for a thin film using X-ray reflectivity measurements carried out at energies close to, and away from a X-ray absorption edge of the substrate. We shall illustrate this method using both simulated data and data obtained from a synchrotron experiment carried out on Langmuir Blodgett films. We shall also show that the analysis of small angle specular reflectivity and diffuse scattering data for multilayer films (Sanyal et al. Mat. Res. Soc. Symp., 1992, 237, 393) can provide us information regarding the interfacial roughness and its conformality.

MS-11.02.03
SELF-ASSEMBLED MONOLAYERS ON CRYSTAL SURFACES STUDIED BY SURFACE X-RAY SCATTERING.* By Keng S. Liang, Exxon Corporate Research, Annandale, New Jersey 08801, USA.

Self-assembled monolayers (SAM's) formed on solid surfaces by the spontaneous chemisorption of long chain functionalized hydrocarbons have attracted much interest recently. We report our studies of the structures and phases of n-alkyl thiols SAM's on crystal surfaces of Au(111), Au(100), and Ag(111) using surface X-ray scattering techniques with synchrotron radiation. The samples were investigated both under UHV conditions on pre-deposited films and in-situ in an electrochemical cell. In this talk, we will discuss: (1) the reconstruction of the metal surface as the result of thiol adsorption, and the consequent effects of the reconstruction, (2) the global (n,T) phase diagram of $CH_3(CH_2)_{n-1}SH$ on a Au(111) surface[1] which reflects the relative importance of hydrocarbon and interface interactions in these system, and (3) the modification of the electrolyte/SAM interfaces using different head groups and counter ions in solution[2]. The implications of our results for future molecular design of SAM's will be discussed.

* The work is performed in collaboration with P. Fenter, J. LI, P. Eisenberger, and G. Scoles.
[1] P. Fenter, P. Eisenberger, and K. S. Liang, to appear in Phys. Rev. Lett..
[2] J. Li, K. S. Liang, and G. Scoles, to be published.

MS-11.02.04 MICROROUGHNESS OF POLISHED SILICON SURFACES AND MAGNETIC MULTILAYER INTERFACES EVALUATED FROM X-RAY GLANCING-ANGLE REFLECTIVITY DATA, By M. Nakanishi*, A. Yu. Nikulin, O. Sakata and H. Hashizume, Res. Lab. of Engineering Materials, Tokyo Inst. of Technology, Nagatsuta, Yokohama 227, Japan.

