Enviromental Surface and Interface Science at GSECARS

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Surface and interface phenomena play a profound role in low-temperature geochemistry and environmental chemistry. Mineral weathering and growth, sorption reactions, and surface-mediated (or catalyzed) transformations have a major impact on the composition and speciation of aquatic and atmospheric systems. A broad array of competing reactions influence such processes, and the reaction prevalence is often a sensitive function of the physicochemical and biological variables within the system [1, 2].

The GSECARS surface and interface program provides unique facilities and expertise to support the study of environmental surface and interface phenomena. Established techniques include: crystal truncation rod (CTR) diffraction and grazing angle reflectivity; grazing-incidence x-ray absorption spectroscopy (GI-XAS); long-period x-ray standing wave (XSW) fluorescence-yield measurements; grazing-angle x-ray powder diffraction (GI-XPD); and total reflection x-ray fluorescence (TXRF). In order to fully characterize complex environmental interfaces, detailed analyses from complementary probes within a controlled sample environment are required. Using the general purpose diffractometer (GPD) at the GSECARS undulator Beamline 13-IDC the above mentioned techniques can be utilized in a single experimental run, without the need for system reconfiguration.

Results from experiments focusing on the fundamental aspects of interface structure and structure-reactivity relationships will be presented, followed by studies of more complex phenomena such as mineral dissolution and growth. Finally future technical developments to enhance the array of surface and interface tools available to the user community are discussed.

References

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