

Materials Science Colloquium of the SFB 986

Public Talk – All students, staff and interested people are warmly invited!

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Probing reactive processes and molecular adsorption at solid/liquid interfaces

Abstract: Function and properties at biologic as well as technological interfaces are controlled by a complex and concerted competition of specific and unspecific interaction of reactive surfaces with ions, molecules and water in the electrolyte. Atomic force microscopy techniques provide an unprecedented resolution of surface structures, in both gaseous and aqueous environments. Here, I will discuss our understanding of ion exchange processes, and competitive molecular interaction at the interface of Muscovite mica.

Muscovite mica, $\text{KAl}_2(\text{Si}_3\text{Al})\text{O}_{10}(\text{OH})_2$, a layered phyllosilicate with perfect cleavage planes, has been one of the prime model-surfaces for probing molecular resolution imaging at the solid/liquid interface in 3D. Starting from highly resolved data of freshly cleaved mica surface, all the way to competitive adsorption at this well-defined solid/liquid interface, quantitative and even thermodynamic information can be derived from experiments based on SPM techniques. In particular, to date it is not possible to directly estimate by experiment the interfacial binding energies of surface-active species at the solid/liquid boundary in a consistent approach, thus limiting our understanding of how surface interactions in complex media are moderated. I will show how force probe experiments can be utilised to derive a quantitative and visual model for describing surface/ion interactions, using a competing Langmuir isotherm model, which can describe concentration-dependent competitions of ions and functional molecules at a solid/liquid interface. In essence, this enables extraction of thermodynamic interaction energies and kinetic parameters of ionic species during monolayer level interactions at a solid|liquid interface. I will then further discuss how complementary surface analysis methods may be utilised to complement our data.

