Chemical Imaging and Interaction Quantification Using High-Resolution Atomic Force Microscopy

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Chemistry is governed by the interactions between atoms and molecules. On surfaces, these chemical forces direct the behavior of many scientifically and technically important phenomena including surface catalysis. Therefore, it would be useful to map and quantify the interactions between a catalytically active surface and a probe with atomic resolution to study the role and effectiveness of surface defects such as vacancies, steps, and impurities as active sites. An ability to discriminate between different chemical species would offer further insight. In this talk, we will show with the example of an oxygen-terminated copper (001) surface that much of this information can be derived from combining the new method of three-dimensional atomic force microscopy, a variant of noncontact atomic force microscopy, with scanning tunneling microscopy. The surface oxide phase features domain boundaries and a chemically distinct structure of the Cu and O sublattices that is ideally suited for such model investigations.