Seminar

9:45 a.m. Monday, January 23
402 Walter Library

Postdoctoral Associate

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A Versatile Toolbox for the Interrogation and Imaging of Electrodes

Abstract

Electrode processes, from energy conversion-oriented electrocatalysis to fundamental outer-sphere electron transfer, are often complex and rich in chemical effects. Traditional single electrode measurements often overlook the complications and opportunities that the electrochemical experiment presents, for instance, in the spatial heterogeneity or chemical composition of the electrode. The Scanning Electrochemical Microscope (SECM) offers a versatile set of tools to characterize and exploit these properties. In SECM, an ultra-micro electrode probe decouples the analytical measurement from the operation of the substrate electrode of interest. These measurements are performed with temporal and spatial resolution, e.g. imaging, and provide high-quality quantitative and kinetic information. In my talk, I will discuss how I have used SECM to develop analytical methods for quantifying adsorbed intermediates and measuring surface diffusion. During my graduate studies I developed the Surface Interrogation mode of SECM (SI-SECM) (Fig. 1 left), in which the amount and chemical reactivity of adsorbed intermediates of (electro)catalytic reactions (e.g. adsorbed H, O and CO) were probed using a "micro-titration" approach. SI-SECM is a powerful alternative to surface sensitive techniques that cannot be used in electrochemical media. My present post-doctoral work includes the electrochemical imaging of single layer graphene (SLG), an atom-thick electrode that allows an exciting control of its interfacial reactivity. For instance, pristine and defective SLG show very different electrochemical activities (Fig. 1 right). We can use this reactivity contrast to detect changes in the surface concentration of species at SLG, thus we have also used electrochemically active molecular binders adsorbed onto its surface and explored their surface diffusion.

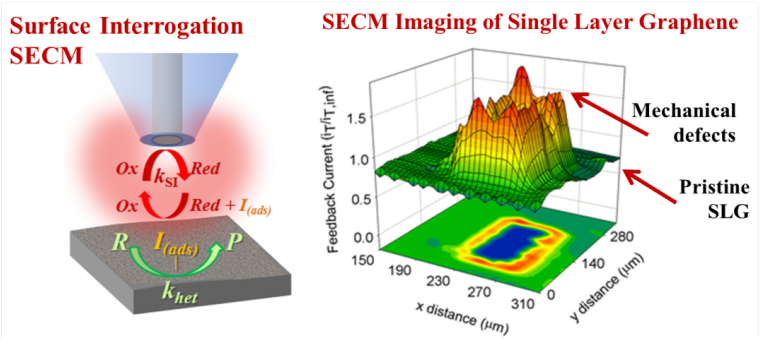

Figure 1. Left: Depiction of SI-SECM. Right: Imaging of active mechanical defects on SLG.

Hosts: Professors Christopher Cramer & Philippe Buhlmann
Refreshments will be served prior to the seminar.