



Weekly Seminar

Single-molecule surface chemistry with STM

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Time: 4:00pm, Nov. 25, 2015 (Wednesday)

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4:00

Venue: Room w563, Physics building, Peking University

563

Abstract

Dynamics of H-bonds plays a central role in determining physical and chemical properties of diverse systems from isolated molecules in gas phase to condensed matters and biological systems. At solid surfaces exposed to vacuum, we can directly “see” the on-going H-bond reactions and dynamics by using a microscope, which is of great interest owing to the fundamental importance of H-bond chemistry in a broad range of scientific disciplines. Here we conduct the visualization of hydrogen-bond dynamics, namely, formation/breaking of individual H-bonds, H-bond interchange within a water dimer, H-atom transfer along engineered H-bond chains, on a Cu(110) surface by using a STM.

Molecular interaction on metal surfaces is one of the central issues of surface science for the microscopic understanding of heterogeneous catalysis. I present the studies on NO on copper surfaces, employing a STM to probe and control the molecule-molecule interaction on the surface. The STM visualizes the $2p^*$ orbital of individual NO molecules and controls the overlap of the $2p^*$ orbital between the molecules. It is found that the covalent interaction works at the intermolecular distance as large as 5 Å, which provides insight into the role of the surface in the catalytic reduction. I also show that the interaction of NO with water molecules causes facile dissociation of the N-O bond on the surface.

References: Phys. Rev. Lett. 100, 166101 (2008); Nature Mater. 11, 167 (2012); Phys. Rev. Lett. 106, 156104 (2011); Chem. Sci., 5, 922 (2014).

About the speaker

Hiroshi Okuyama has been an associate professor in the Department of Chemistry, Graduate School of Science, Kyoto University since 2005. From 1999 to 2005, he was a research associate with Prof. Emeritus M. Nishijima in the Department of Chemistry, Kyoto University. In 1998 and 1999, he was a postdoc in the Institute of Physical and Chemical Research, Surface Chemistry Laboratory with Prof. M. Kawai. He obtained his PhD degree from the Kyoto University in 1999. In 1993 and 1995, he received his BS and MS degrees from the Department of Chemistry, Kyoto University, respectively.