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Single-molecule chemistry and spectroscopy on insulating films with STM

Ultrathin insulating films grown on metal substrate has been a subject of great interest for investigation of individual adsorbate atoms and molecules using a scanning tunneling microscope (STM), because of electronic decoupling between the adsorbate and supporting metal surface under an STM junction. Here, I will talk about two representative works that we have done about energetics at the single-molecule interfaces on the ultrathin insulating films. The chemical reactivity of a water molecule on an ultrathin MgO film supported by the Ag(100) substrate depends greatly on film thickness and be enhanced compared to that achieved with their bulk counterpart. The change of chemical reactivity of ultrathin MgO film depending on the film thickness can be explained by the strengthening of the interaction between the oxide and metal interface layers. Our results clearly show that such structural imperfections at the interface can improve the chemical reactivity of the MgO film supported by an Ag substrate. Optical properties of a single metal-free phthalocyanine (H2Pc) molecule on the 2-ML thick NaCl film supported by Ag(111) have been also studied by scanning tunneling luminescence spectroscopy. I will discuss about the single molecule reaction of an H2Pc molecule with tunneling electrons and accompanied optical property changes in single molecule luminescence spectra.

Biography

Yousoo Kim has completed his graduation from the Department of Chemistry, Seoul National University, where he has also obtained his Master's degree in 1993. In 1999, he has earned PhD in Applied Chemistry from The University of Tokyo. In the same year, he has joined RIKEN as a Postdoctoral Researcher. Since 2010, he has been the Director of the Surface and Interface Science Laboratory at the RIKEN. He has published more than 120 papers in reputed journals. His research focuses on describing the details of energy transport and conversion on solid surfaces and interfaces in the nanoscale regime by combined study of scanning probe microscopy/spectroscopy.

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