

'Scanning Probe Microscopy of Single Molecule Switches on Insulating Films: From Orbital Imaging to Molecular Structure Determination'

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Ultrathin insulating films on metal substrates are unique systems to use the scanning tunneling / atomic force microscope to study the electronic and structural properties of single atoms and molecules, which are electronically decoupled from the metallic substrate. In the case of STM of molecules the electronic decoupling allows the direct imaging of the molecular frontier orbitals [Repp et al, Science 312, 1196 (2006)]. In combination with atomic/molecular manipulation this opens up the possibility to study elementary processes related to charge state control, molecular switching and electrical contact formation. Detailed structural and charge state information can be attained by Atomic Force Microscopy which leads to the direct imaging of the molecular geometry [L. Gross et al, Science 325, 1110(2009)]. The required high lateral resolution is achieved by specific AFM tip terminations (for example CO transferred to the tip by atomic manipulation) to tune the interaction of the tip with the adsorbed molecule. It will be shown that this technique has the prospect to determine the molecular structure of an unknown molecule [L. Gross, Nature Chemistry 2, 821 (2010)] and to understand switching processes in metal molecule complexes in detail.