

Reversible photomechanical switching of molecules at a surface

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Resumen

The miniaturization of electronic devices has revolutionized the technology of today, but miniaturization to the nanometer size-scale of individual *mechanical* devices promises to revolutionize the technology of the future. Such molecular-scale nanomachine devices would provide completely new methods for manipulating matter, for converting energy into different forms, and for detection applications. In order to achieve such a fine level of mechanical control, however, characterization at the single molecule level of mechanically active molecules is needed.

We have used scanning tunneling microscopy (STM) to study the photomechanical behavior of molecular switches made from azobenzene at a surface. Azobenzene and its derivatives are known to reversibly photoisomerize between two stable conformations in a wavelength selective process that is usually measured in solution. Recently we achieved the reversible photomechanical switching of individual azobenzene molecules functionalized with four tert-butyl groups (tetra-tert-butyl-azobenzene) on a Au(111) surface [1]. I will discuss our progress toward understanding the dynamical processes by which this molecule reversibly photoisomerizes at a surface. We have additionally investigated the wavelength dependent photomechanical switching rates of tetra-tert-butyl-azobenzene molecules at a surface by exposing them to UV and visible light. We are able to determine both the forward and reverse surface photomechanical switching cross-sections for this azobenzene derivative. In a departure from behavior observed in solution-based environments, visible light does not efficiently reverse the photoreaction [2]. We also find that the photoswitching process for azobenzene molecules at a surface is dependent on the chirality of the adsorbed molecules. By measuring chirality-dependent photoswitching selection rules of adsorbed azobenzene, we are able to rule out a common dynamical pathway for azobenzene photoisomerization. Our symmetry-dependent molecular switching data leads us to propose a new dynamical pathway for azobenzene photoisomerization on gold.

Referencias:

[1] Matthew J. Comstock, Niv Levy, Armen Kirakosian, Jongweon Cho, Frank Lauterwasser, Jessica H. Harvey, David A. Strubbe, Jean M. J. Fréchet, Dirk Trauner, Steven G. Louie, and Michael F. Crommie *Phys. Rev. Lett.* **99** (2007) , 038301

[2] Matthew J. Comstock, Niv Levy, Jongweon Cho, Luis Berbil-Bautista, Michael F. Crommie, Daniel A. Poulsen, and Jean M. J. Fréchet. *Appl. Phys. Lett.* **92** (2008)., 123107

