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Turning a Single Molecule into an Electric Motor

In stark contrast to nature, current manmade devices, with the exception of liquid crystals, make no use of nanoscale molecular motion. Studying the rotation of molecules bound to surfaces offers the advantage that a single layer can be assembled, monitored and manipulated using the tools of surface science. Thioether molecules constitute a simple, robust system with which to study molecular rotation as a function of temperature, electron energy, applied fields, and proximity of neighboring molecules. We demonstrate the effect of molecular architecture on their rotational barrier and report a method whereby rotation can be induced electrically. On the path towards constructing a single-molecule electric motor we have investigated chiral molecular rotors. These systems offer a unique opportunity to study both symmetry breaking and 1:1 chiral interactions in a well defined environment at the single molecule level.

Low-temperature Scanning Tunneling Microscope image of two butyl methyl sulfide molecular rotors on Cu(111). Surface coordination via one of the two S atom lone pairs leads to chirality of the adsorbed complex. Image size: 8nm x 4nm.



Charles Sykes is an Associate Professor in the Department of Chemistry at Tufts University. Charles got his B.S. and M.S. from Oxford University before moving to Cambridge University for a Ph.D. under the supervision of Professor Richard Lambert. He then relocated to the U.S. to start postdoctoral fellowships with Professor Paul Weiss at Penn State and Professor Mike Fiddy at the University of North Carolina at Charlotte. Research in the Sykes Group at Tufts University is aimed at understanding a range of technologically important systems from molecular rotors to chiral surfaces. Sykes was named a 2008 Beckman Young Investigator, a Cottrell Scholar of Research Corporation, an IUPAC Young Observer and is the recipient of a 2009 NSF CAREER Award.

Website: <http://ase.tufts.edu/chemistry/sykes/index.html>

Friday, April 29, 2011
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1:30-2:30 pm
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Host:
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