Science

Identifying Single Nucleotides by Tunneling Current
It has been proposed theoretically that reading the transverse tunneling current through a DNA molecule with the embedded electrodes enables sequencing of DNA translocating the nanopore. This new detection paradigm will revolutionize the present DNA sequencing capability. However, it still lacks experimental verifications. Here, we report direct current measurements through single nucleotide molecules residing in a pair of nanoelectrodes. We find linear current-voltage characteristics suggestive of electron tunneling transport in electrode-single nucleotide-electrode systems. We also demonstrate clear statistical discrimination of single nucleotides via the energy gap-tuned tunneling currents, thereby providing essential scientific basis for the emerging DNA sequencing technology.


Three-Dimensional Intramolecular Exchange Interaction in a Curved and Nonalternant π-Conjugated System: Corannulene with Two Phenoxyl Radicals
Three-Dimensional Intramolecular Exchange Interaction


Sub-Å Resolution Electron Density Analysis of the Surface of the Organic Rubrene Crystals
Wakabayashi, Y.1, Takeya, J.2, Kimura, T.1
1Graduate School of Engineering Science
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Near surface electron density distribution of an organic semiconductor is firstly observed by a combination of a synchrotron x-ray diffraction experiment and a new holographic method of analysis. The observed electron density profile of a rubrene single crystal, which is known as a high-mobility organic transistor material, shows a large positional distribution of the molecules at the first layer. Since the conduction path of the electric current in a transistor is confined to the vicinity of the surface of the crystal, the surface structure is highly important to elucidate the physical properties of the organic transistor microscopically.


Conformational Change of Flagellin for Polymorphic Superciling of the Flagellar Filament
Maki-Yonekura, S.; Yonekura, K.; Nambe, K. (Graduate School of Frontier Biosciences)
The bacterial flagellar filament is a helical propeller rotated by the flagellar motor for bacterial locomotion. The filament is a supercoiled assembly of a protein, flagellin. The reversal of motor rotation switches the supercoil between left- and right-handed by changing the ratio of two distinct protofilament conformations called L-type and R-type. We analyzed the structure of the L-type straight filament by electron cryo-electron microscopy and compared with the R-type and found that the orientation and packing of the outer core domains (D1) against the inner ones (D0) are invariant and that a conformational switching of D1 with flexibility of D0 and D1 play important roles.

Nature Structural & Molecular Biology, 17, 417-422 (2010)

Engineering

A four-component 2D crystal has been formed at a liquid-solid interface and successfully visualized by scanning tunneling microscopy. Simply premixing the four components and applying the solution onto the graphite surface leads to the spontaneous self-assembly of the 2D crystal. Selected guest molecules induce a structural transformation of the host network from nonporous to porous by coadsorption inside the formed pores.


Two-Dimensional Crystal Engineering: A Four Component Architecture at a Liquid-Solid Interface
Adusoejojo, J.; Tahara, K.; Okuhata, S.; Lei, S.; Tobe, Y.; De Feyter, S. (Graduate School of Engineering Science)


Unusually Large Tunneling Effect on Highly Efficient Generation of Hydrogen and Hydrogen Isotopes in p-Selective Decomposition of Formic Acid Catalyzed by a Heterodinuclear Iridium-Ruthenium Complex in Water
Fukuzumi, S.; Kobayashi, T.; Suenobu, T. (Graduate School of Engineering Science)


Controlled Fabrication of Epitaxial (Fe,Mn)Ox Artificial Nanowire Structures and their Electric and Magnetic Properties
Goto, K.; Tanaka, H.; Kawai, T. (The Institute of Scientific and Industrial Research)