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## Metal leads to the desired configuration

09.10.2018

*Scientists at the University of Basel have found a way to change the spatial arrangement of bipyridine molecules on a surface. These potential components of dye-sensitized solar cells form complexes with metals and thereby alter their chemical conformation. The results of this interdisciplinary collaboration between chemists and physicists from Basel were recently published in the scientific journal ACS Omega.*

Anzeige

Dye-sensitized solar cells have been considered a sustainable alternative to conventional solar cells for many years, even if their energy yield is not yet fully satisfactory. The efficiency can be increased with the use of tandem solar cells, where the dye-sensitized solar cells are stacked on top of each other.

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The way in which the dye, which absorbs sunlight, is anchored to the semiconductor plays a crucial role in the effectiveness of these solar cells. However, the anchoring of the dyes on nickel oxide surfaces – which are particularly suitable for tandem dye-sensitized cells – is not yet sufficiently understood.

Binding on surfaces

... more about:

- » conventional solar cells
- » dye-sensitized solar cells
- » gold surface
- » iron atoms
- » metal complexes
- » nickel oxide
- » semiconductor
- » solar cells
- » spatial arrangement

Over the

course of an interdisciplinary collaboration, scientists from the Swiss Nanoscience Institute and the Departments of Physics and Chemistry at the University of Basel investigated how single bipyridine molecules bind to nickel oxide and gold surfaces.

Bipyridine crystals served as an anchor molecule for dye-sensitized cells on a semiconductor surface. This anchor binds the metal complexes, which in turn can then be used to bind the various dyes.

With the aid of scanning probe microscopes, the investigation determined that initially the bipyridine molecules bind flat to the surface in their trans configuration. The addition of iron atoms and an increase in temperature cause a rotation around a carbon atom in the bipyridine molecule and thus leads to the formation of the cis configuration.

“The chemical composition of the cis and trans configuration is the same, but their spatial arrangement is very different. “The change in configuration can be clearly distinguished on the basis of scanning probe microscope measurements,” confirms experimental physicist Professor Ernst Meyer.

Metal complexes in a modified configuration

This change in spatial arrangement is the result of formation of a metal complex, as confirmed by the scientists through their examination of the bipyridine on a gold surface.

During the preparation of the dye-sensitized solar cells, these reactions take place in a solution. However, the examination of individual molecules and their behavior is only possible with the use of scanning probe microscopes in vacuum.

“This study allowed us to observe for the first time how molecules that are firmly bound to a surface change their configuration,” summarizes Meyer. “This enables us to better understand how anchor molecules behave on nickel oxide surfaces.”

Wissenschaftliche Ansprechpartner:

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Originalpublikation:

Sara Freund, Rémy Pawlak, Lucas Moser, Antoine Hinaut, Roland Steiner, Nathalie Marinakis, Edwin C. Constable, Ernst Meyer, Catherine E. Housecroft, and Thilo Glatzel  
Transoid-to-Cisoid Conformation Changes of Single Molecules on Surfaces Triggered by Metal Coordination  
ACS Omega (2018)

Weitere Informationen:

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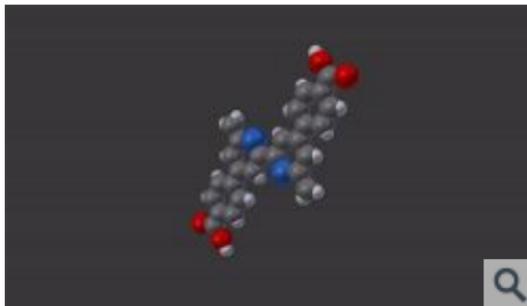
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Further information:

<http://www.unibas.ch>

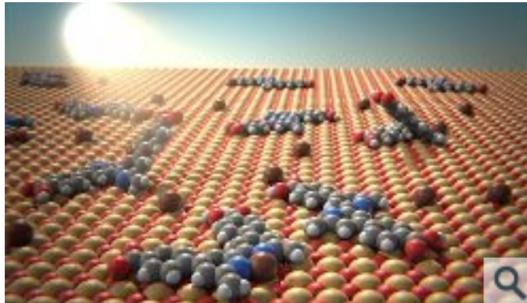
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The configuration of the bipyridine molecule is changed by binding an iron atom (brown).

Image: University of Basel, Department of Physics



Scientists were able to determine the spatial arrangement of bipyridine molecules (gray) on a surface of nickel and oxygen atoms (yellow/red).

Image: University of Basel, Department of Physics



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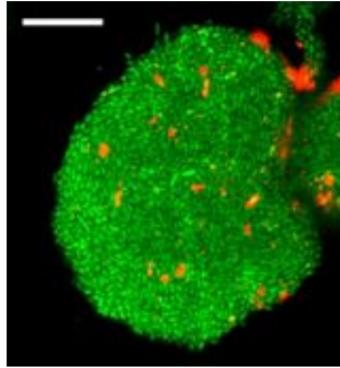


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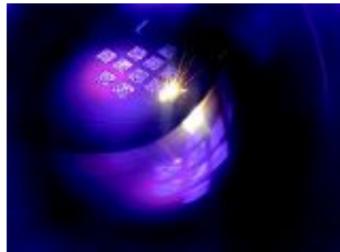
### Im Focus: Researchers discover how fatal biofilms form



*By severely curtailing the effects of antibiotics, the formation of organized communities of bacterial cells known as biofilms can be deadly during surgeries and in urinary tract infections. Yale researchers have just come a lot closer to understanding how these biofilms develop, and potentially how to stop them.*

Biofilms form when bacterial cells gather and develop structures that bond them in a gooey substance. This glue can protect the cells from the outside world...

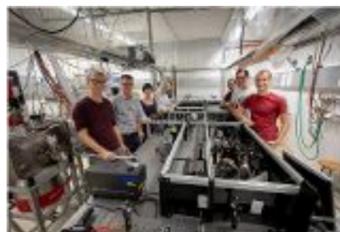
### Im Focus: Flying High with VCSEL Heating



*Additive manufacturing processes are booming, with the rapid growth of the formnext trade fair a clear indication of this. At formnext 2018, the Fraunhofer Institute for Laser Technology ILT will be showing a new process in which the component in the powder bed is heated with laser diodes. As a result, distortion can be reduced, taller parts generated and new materials used.*

In just three years, formnext has established itself as the industry meeting place to get the latest on additive manufacturing (AM) processes. With 470...

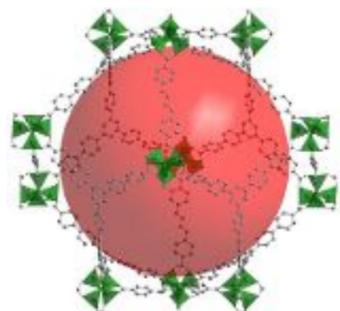
### Im Focus: Breakthrough in quantum physics: Reaction of quantum fluid to photoexcitation of dissolved particles



*Researchers from Graz University of Technology have described for the first time the dynamics which takes place within a trillionth of a second after photoexcitation of a single atom inside a superfluid helium nanodroplet.*

In his research, Markus Koch, Associate Professor at the Institute of Experimental Physics of Graz University of Technology (TU Graz), concentrates on...

### Im Focus: Chemists of TU Dresden develop highly porous material, more precious than diamonds



*World Record of Cavities*

Porosity is the key to high-performance materials for energy storage systems, environmental technologies or catalysts: The more porous a solid state material...

### Im Focus: New function of "kidney-gene": WT1 plays a role in the central nervous system and controls movement

*The WT1 gene fulfills a central role in the development of a healthy, proper functioning kidney. Mutations in WT1 lead to impairments in kidney development and cause Wilms tumors, a pediatric kidney cancer. Researchers of the Leibniz Institute on Aging – Fritz Lipmann Institute (FLI) in Jena have now discovered a further important function of WT1. It is also active outside the kidneys in the central nervous system and is involved in controlling movement. If the gene is missing in the spinal cord, locomotor aberrancies occur. The results have now been published in Life Science Alliance.*

Transcription factor WT1 (Wilms tumor 1) has been known for nearly 30 years and it is significantly involved in the development of a healthy and properly...

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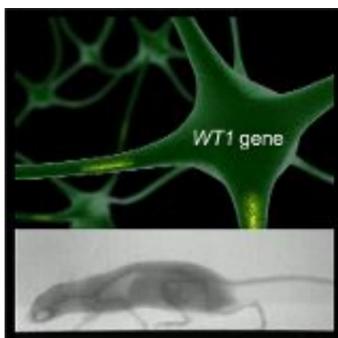
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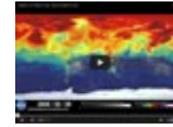
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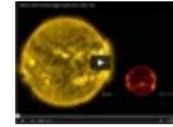
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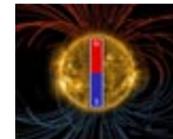
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NASA's Swift satellite detected the strongest, hottest, and longest-lasting sequence of stellar flares ever seen from a nearby red dwarf star.



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NASA's airborne Hurricane and Severe Storm Sentinel or HS3 mission, will revisit the Atlantic Ocean for the third year in a row.



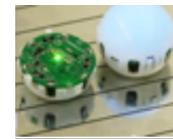
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Giff Miller, geologist and paleoclimatologist, is walking the margins of melting glaciers on Baffin Island, Nunavut, Canada.



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