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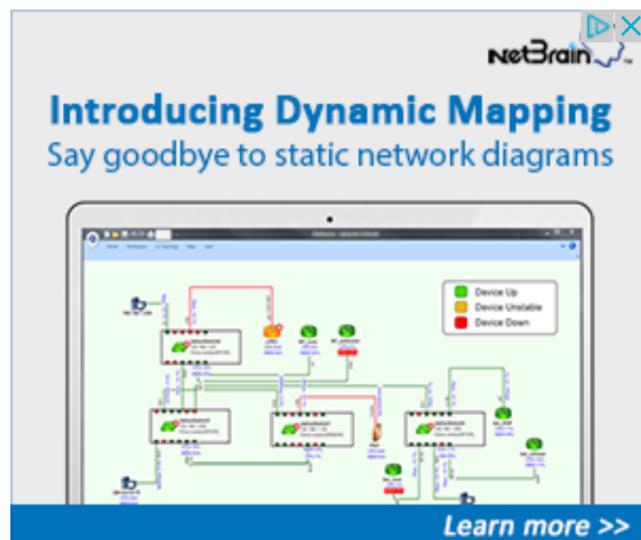
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Anzeige

Data storage using individual molecules

17.12.2018

Researchers from the University of Basel have reported a new method that allows the physical state of just a few atoms or molecules within a network to be controlled. It is based on the spontaneous self-organization of molecules into extensive networks with pores about one nanometer in size. In the journal 'small', the physicists reported on their investigations, which could be of particular importance for the development of new storage devices.

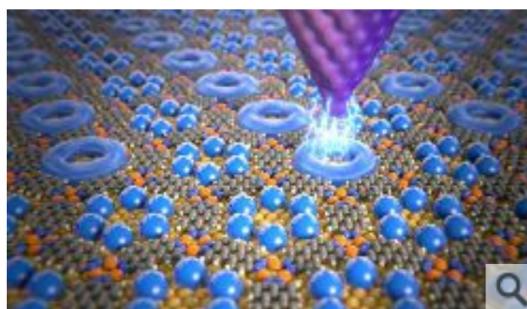


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Around the world, researchers are attempting to shrink data storage devices to achieve as large a storage capacity in as small a space as possible. In almost all forms of media, phase transition is used for storage.

For the creation of CD, for example, a very thin sheet of metal within the plastic is used that melts within microseconds and then solidifies again. Enabling this on the level of atoms or molecules is the subject of a research project led by researchers at the University of Basel.



Graphic animation of a possible data memory on the atomic scale: A data storage element - consisting of only 6 xenon atoms - is liquefied by a voltage pulse.

Universität Basel, Departement of Physics

Changing the phase of individual atoms for data storage

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In

principle, a phase change on the level of individual atoms or molecules can be used to store data; storage devices of this kind already exist in research. However, they are very labor-intensive and expensive to manufacture.

The group led by Professor Thomas Jung at the University of Basel is working to produce such tiny storage units consisting of only a few atoms using the process of self-organization, thereby enormously simplifying the production process.

To this end, the group first produced an organometallic network that looks like a sieve with precisely defined holes. When the right connections and conditions are chosen, the molecules



arrange themselves independently into a regular supramolecular structure.

Xenon atoms: sometimes solid, sometimes liquid

The physicist Aisha Ahsan, lead author of the current study, has now added individual Xenon gas atoms to the holes, which are only a bit more than one nanometer in size. By using temperature changes and locally applied electrical pulses, she succeeded in purposefully switching the physical state of the Xenon atoms between solid and liquid.

She was able to cause this phase change in all holes at the same time by temperature. The temperatures for the phase transition depend on the stability of the Xenon clusters, which varies based on the number of Xenon atoms. With the microscope sensor she has induced the phase change also locally, for an individual Xenon containing pore.

As these experiments have to be conducted at extremely low temperatures of just a few Kelvin (below -260°C), Xenon atoms themselves cannot be used to create new data storage devices. The experiments have proven, however, that supramolecular networks are suited in principle for the production of tiny structures, in which phase changes can be induced with just a few atoms or molecules.

“We will now test larger molecules as well as short-chain alcohols. These change state at higher temperatures, which means that it may be possible to make use of them,” said Professor Thomas Jung, who supervised the work.

Graphic animation of a potential data storage device on the atomic scale: a data storage element – made of only six Xenon atoms – is liquefied using a voltage pulse.

Wissenschaftliche Ansprechpartner:

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Originalpublikation:

Phase transitions in confinements: Controlling solid to Fluid transitions of xenon atoms in an on-surface network

Aisha Ahsan, S. Fatemeh Mousavi, Thomas Nijs, Sylwia Nowakowska, Olha Popova, Aneliia Wäckerlin, Jonas Björk, Lutz H. Gade, Thomas A. Jung small (2018), doi: doi.wiley.com/10.1002/sml.201803169

Iris Mücke | Universität Basel

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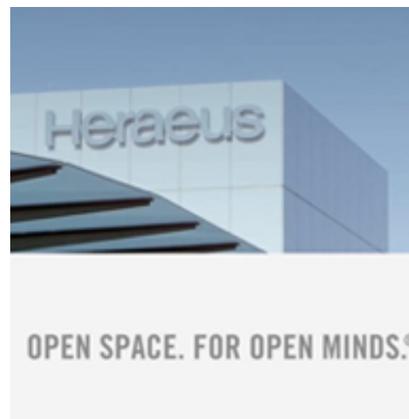
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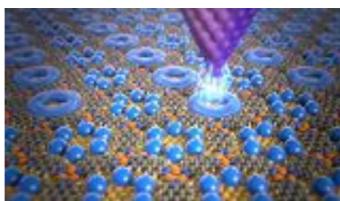
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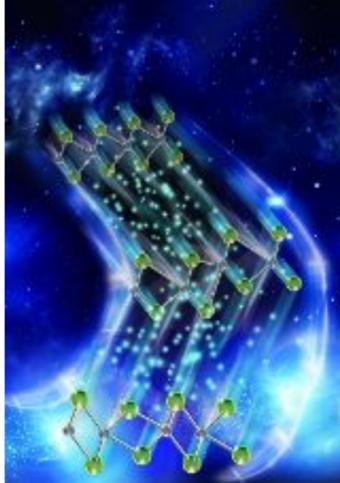




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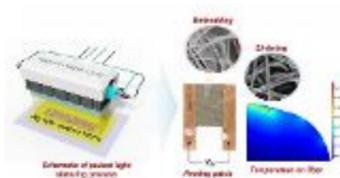
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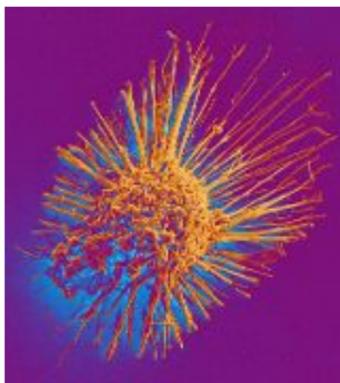
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What if, instead of turning up the thermostat, you could warm up with high-tech, flexible patches sewn into your clothes - while significantly reducing your...

Im Focus: Lethal combination: Drug cocktail turns off the juice to cancer cells



A widely used diabetes medication combined with an antihypertensive drug specifically inhibits tumor growth – this was discovered by researchers from the University of Basel's Biozentrum two years ago. In a follow-up study, recently published in "Cell Reports", the scientists report that this drug cocktail induces cancer cell death by switching off their energy supply.

The widely used anti-diabetes drug metformin not only reduces blood sugar but also has an anti-cancer effect. However, the metformin dose commonly used in the...

Im Focus: New Foldable Drone Flies through Narrow Holes in Rescue Missions



A research team from the University of Zurich has developed a new drone that can retract its propeller arms in flight and make itself small to fit through narrow gaps and holes. This is particularly useful when searching for victims of natural disasters.

Inspecting a damaged building after an earthquake or during a fire is exactly the kind of job that human rescuers would like drones to do for them. A flying...

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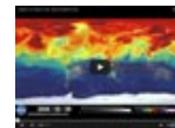
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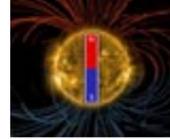
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