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Press Release

How Organic Magnets Grow in a Thin Film

Tübingen scientists investigate a first step towards future technological applications

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Development of organic single molecule magnets opens a great many of applications for magnetic materials and new memory technologies. Organic magnets are lighter, more flexible and less energy intensive in production than conventional magnets. Scientists from the laboratory of Dr. Benedetta Casu and Professor Thomas Chassé at the Institute of Physical and Theoretical Chemistry of the University of Tübingen have established together with colleagues of the University of Florence a first step on the road to new applications for organic magnets: Their controlled deposition in a thin film.

Purely organic magnets are chemical compounds based on carbon, they are not comprised of classic magnetic elements like iron. To be precise, these organic compounds are paramagnetic, exhibiting their magnetic character only as long as they are near a magnetic field. The investigated organic magnets contain an unpaired electron enabling the magnetic character of the molecule. In chemistry, these compounds are called free radicals. In previous studies, the investigation of the chemistry of organic magnets has been the main object. However, in their new study the scientists concentrated on the production of a very thin film of molecular magnets in the dimension of nanometers – only millionths of millimeters. The scientists let grow the molecule NitPyn, a derivative of the nitronyl-nitroxide radical that had already proved to be a stable organic magnet, in an ordered structure on a single gold crystal.

For the first time the scientists used an established production process of thin layers of organic compounds for the deposition of a thin film of organic magnets. The paramagnetic character of NitPyn proved to be stable even during evaporation and deposition processes. The scientists investigated also the interface between the gold crystals and the layer of NitPyn. It is foreseen that the thickness of the NitPyn layer and structural order of the molecules can be varied with temperature or structure of the substrate.

In producing these thin films of purely organic magnets, the scientists have provided a substantial progress for the development of component parts for new memory technologies. In future, a single molecule could transport one bit of information, storing a great many data in a very small space. This project at the interface of physics, chemistry, material science and technology pushes the potential of these substances towards organic electronics.

Original Publication:

Sabine-Antonia Savu, Indro Biswas, Lorenzo Sorace, Matteo Mannini, Donella Rovai, Andrea Caneschi, Thomas Chassé, Maria Benedetta Casu: Nanoscale Assembly of Paramagnetic Organic Radicals on Au(111) Single Crystals. Chemistry. A *European Journal*, Vol. 19, Issue 10, pp. 3445-3450, 4th March 2013.

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