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Tenkých vrstev a nanostruktur

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TÉMA

Magnetic properties of single molecules and metal-organic networks on surfaces

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(T4PT) on a Au(111) surface exhibit a sizable magnetic moment with an out of pThe magnetic properties of atoms and molecules on a surface are significantly affected by details in the atomic-scale surrounding. Manipulation of this surrounding provides the possibility to tune the electronic and magnetic functionality of surfaces on a nanometer scale.

Using scanning tunnelling spectroscopy (STS), we show that the lifetime of excited spin states in the paramagnetic Fe-Octaethylporphyrin-Chloride (FeOEP-Cl) is orders of magnitude longer when the molecule is adsorbed on a superconductor as compared to a normal metal substrate. We ascribe this increase in spin relaxation time to the superconducting energy gap at the Fermi level, which prohibits efficient pathways of energy quenching into the substrate [1]. The small spin relaxation rates allow for pumping into higher spin states by large current densities.

We further manipulate the magnetic properties of individual FeOEP molecules on a gold surface by an in-situ chemical reaction of the organic ligand. A temperature-induced step-wise electrocyclic ring closure of the ethyl groups results in the final product Fe-Tetrabenzoporphyrin (FeTBP). The chemical modification is accompanied by an increased magnetic interaction with the metallic substrate as resolved by changes in the shape and width of a Kondo resonance [2].

Employing a combination of STM and X-ray circular magnetic dichroism (XMCD), we show that Fe atoms embedded in a bilayer of 2,4,6-Tris(4-pyridyl)-1,3,5-triazine lane magnetic anisotropy. The field dependence of the XMCD signal reveals a ferromagnetic coupling of the Fe atoms within the highly ordered network [3].

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[2] B. W. Heinrich, G. Ahmadi, V. L. Müller, L. Braun, J. I. Pascual, K. J. Franke, NanoLetters 13, 4840 (2013)
[3] T. R. Umbach, M. Bernien, C. F. Hermanns, A. Krüger, V. Sessi, I. Fernández-Torrente, P. Stoll, J. I. Pascual, K. J. Franke, and W. Kuch, Phys. Rev. Lett. 109, 267207 (2011)

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