

O 50: Spins on Surfaces at the Atomic Scale IV

Time: Wednesday 10:30–11:30

Location: REC C 213

O 50.1 Wed 10:30 REC C 213

Growth and magnetism of ultrathin Fe films on Ta(110) — ●REINER BRÜNING, ROBERTO LO CONTE, KIRSTEN VON BERGMANN, and ROLAND WIESENDANGER — Institut für Nanostruktur- und Festkörperphysik, Universität Hamburg

The field of hybrid systems, where magnetism and superconductivity are interacting with each other, is a field which is attracting more and more attention in recent years. Spin-polarized scanning tunneling microscopy (SP-STM) is an ideal tool to study the magnetic as well as the superconducting properties and investigate the interplay between each other.

Here, we investigate ultrathin Fe films on the anisotropic (110) surface of the elemental superconductor Ta by SP-STM. For the pseudomorphic Fe monolayer, theory has predicted [1] interesting magnetic ground states depending on the interlayer distance [1], e. g. a magnetic spin spiral with a period of 6 nm.

We observe pseudomorphic growth for sub-monolayer coverage, however, for higher coverage we find several different structures. Two of these three different reconstructions have been observed previously also for Fe on Nb(110) [2]. For the pseudomorphic Fe monolayer on Ta(110), we indeed find a spin spiral with a period of roughly 6 nm as the magnetic ground state at zero field.

[1] L. Rózsa *et al.*, Phys. Rev. B, **91**, 144424 (2015) [2] J. Goedecke *et al.*, ACS Nano, **16**, 14066-14074 (2022)

O 50.2 Wed 10:45 REC C 213

Spin polarization in polyaniline molecules: the role of coupling, chirality and coordination — ●T. N. HA NGUYEN¹, L. L.T. BACZEWSKI², and C. TEGENKAMP¹ — ¹Solid Surface Analysis, Technische Universität Chemnitz, Germany — ²Institute of Physics, Polish Academy of Sciences, Al. Lotnikow, Warszawa, Poland

Propagation of electrons along helical polyaniline-based backbone structures comes along with a robust spin polarization effect. However, studies on a molecular scale are still rare, although this length scale provides direct insight into the role of molecular properties. The self-assembly process and electronic transmission properties of racemats of right and left handed α -helix polyaniline (DL-PA) molecules from solution on atomically smooth and magnetically switchable Al₂O₃/Pt/Au/Co/Au substrates was investigated by ambient scanning tunneling microscopy and spectroscopy. For various lengths of molecules with and without a cysteine termination, we studied the spin polarization in detail. The phase separation into well-ordered enantiopure hexagonal phases and hetero-dimer structures (DL-PA) allow for the analysis of the spin polarization of PA molecules in different environments. The spin polarization reaches up to 70% for chemisorbed molecules arranged in an hexagonal phase. Our results clearly demonstrate that both the coupling as well as the ordering and coordination are important in order to achieve a high spin-polarization in chiral systems.

O 50.3 Wed 11:00 REC C 213

Robust Monolayers of Endohedral Fullerenes: Towards Highly Ordered Arrays of Single Molecule Magnets and Spin Qubits — ●LUKAS SPREE¹, LUCIANO COLAZZO¹, CAROLINE HOMMEL¹, ANDREAS HEINRICH¹, and ALEXEY POPOV² — ¹IBS Center for Quantum Nanoscience, Seoul, South Korea — ²Leibnitz Institute for Solid State and Materials Research

In 2012 DySc₂N@C₈₀ was the first endohedral fullerene proven to be a single molecule magnet. Ten years and many fullerene based single molecule magnets later, lanthanide dimetal fullerenes show high blocking temperatures of magnetization approaching 30 K and suppression of quantum tunnelling of magnetization at zero magnetic field due to coupling of two magnetic moments via an electron in a singly occupied molecular orbital. The isostructural non-magnetic versions of these molecules with Y or Sc dimers show long T₂ times and might be promising candidates for spin qubits. A great advantage of fullerene based molecules is their exceptional chemical stability.

For future research the deposition of fullerene based single molecule magnets in ordered layers is desirable to control intermolecular interactions and ease measurements with scanning probe techniques. Several causes for disorder can be identified and one approach to counteract them is chemical functionalization of the fullerene cage to promote self-assembly of monolayers. A challenge with the direct deposition of functionalized fullerenes on a substrate is a mismatch of the distance between potential binding sites and the size of the fullerenes. Therefore, templating with tetrapyrrole complexes is investigated.

O 50.4 Wed 11:15 REC C 213

Tuning the magnetic properties of self-assembled molecular networks on Au(111) and graphene — ●ADAM J. WATSON, KOEN HOUTSMA, MIHAELA ENACHE, ANTONIJA GRUBIŠIĆ ČABO, and MEIKE STÖHR — Zernike Institute for Advanced Materials, University of Groningen, 9747 AG, Groningen, The Netherlands

The ability to manipulate the spin state of low dimensional magnetic networks is of emerging interest and forms the basis of prospective technologies in the atomic limit. These include molecule-based quantum computers and spintronic devices, which require addressable spin architectures. Recently, two-dimensional (2D) networks have been prepared using the methods of on-surface supramolecular self-assembly, exhibiting a variety of different magnetic exchange interactions which are experimentally accessible. [1]

In this work, we performed scanning tunnelling spectroscopy (STS) and x-ray magnetic circular dichroism (XMCD) measurements to characterize the magnetic properties of self-assembled networks of a cyano-functionalized cobalt-porphyrin derivative (CoTCPP) on Au(111) [2] and graphene. Kondo and XMCD measurements indicate a variation in spin-substrate coupling with bonding motif, and variations in magnetic moment and spin distribution. These results highlight the importance of the bonding motif within supramolecular architectures, and the role of the substrate, in tuning molecular magnetism.

[1] Girovsky, J. *et al.*, Nat. Comm. 8 (2017) 15388

[2] B. D. Baker Cortes *et al.*, J. Phys. Chem. C 123 (2019) 19681