

RIKEN SEMINAR

16:00 – 17:00, Nov. 12, 2013 (Tuesday)

2F Seminar room, Nanoscience Building

Speaker : Dr. Thomas A. Jung

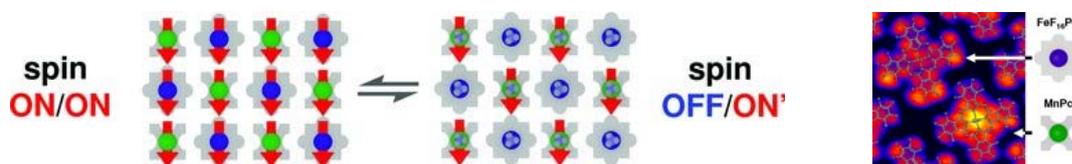
(Paul Scherrer Institute, Switzerland)

Electronic and Spin States in Metal--Organic Supramolecular Materials at Surfaces probed by X-ray Spectroscopy and Scanning Probe Microscopy

Well defined electronic and spintronic interfaces can be architected by combining self-assembly and surface science. The atomically clean metal surface in the ultra-high vacuum provides a very specific environment affecting the behaviour of the ad-molecules as well as the adsorbent-adsorbate interaction. Depending on the bonding at the interface, complex electronic and magnetic interaction can occur which can be explored using spectro-microscopy correlation, in this case photoemission and photoabsorption spectroscopy (PES, PAS) and Scanning Tunnelling Microscopy (STM).

One example is provided by the emergence of quantum dot states from the interaction of a porous network with the 2D (Shockley) surface state of Cu(111) which exhibit sufficient residual coupling to show the emergence of a band-like structure in angle resolved photoemission experiments [1]. In another example, specifically chosen surface supported molecules have been shown to exhibit ferromagnetic [2] or anti-ferromagnetic [3] exchange interaction and their spin system has been shown to change induced by physical parameters and / or chemical stimuli [4]. By combining supra-molecular chemistry with on-surface coordination chemistry, the reversible spin switching of self-assembled bi-molecular arrays has recently been demonstrated. [5]

All these examples have in common that the molecular interfaces are well defined by their production from atomically clean substrates and molecular building blocks. The physics and chemistry of these unprecedented systems, which are addressable by scanning probes, provide insight into novel materials in their assembly, their electronic and spintronic properties which emerge from the interaction of their components down to the scale of single atoms, molecules and bonds.



Scheme. 1. Controlling the spin state of a supra-molecular array of Fe-Phthalocyanines and Mn-Phthalocyanines by NH₃ as a stimulus. The NH₃ binding can be reversed by thermal desorption which brings the system back to its original state.

- [1] J. Lobo-Checa et al. *Science* **325**, 300 (2009)
- [2] A. Scheybal et al. *Chem. Phys. Lett.* **411**, 214 (2005)
- [3] D. Chylarecka et al. *J. Phys. Chem. Lett.* **1**, 1408–1413 (2010)
- [4] C. Waeckerlin et al. *Nature Communications* **2010**, 1:61 DOI: 10.1038/ncomms1057
- [5] C. Waeckerlin et al. *Advanced Materials* 2013, DOI: 10.1002/adma.201204274