Advanced Inorganic Synthesis Seminar 2024

Assessing the spin-state of metal-organic complexes by STM manipulation

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Venue : **N-531C (Uji Main Building)**

Abstract: Manipulating the spin state of individual atoms in a molecular environment opens-up fascinating prospect in spintronics and quantum-technology. However, for many technological applications, it is necessary to connect these molecules to metallic or possibly magnetic contacts. The interaction with their environment, such as substrate, other molecules, and dopants, can alter their properties [1-6]. Here we will show how the use of atomic-scale probes such as scanning tunneling microscopy/spectroscopy (STM/STS) can further our understanding of the spin properties of organometallic complexes on surfaces. As an example, we show how dimers of such molecules at the metal-organic interface, exhibit new properties, not anticipated from the monomeric counterparts, such as magnetic bi-stability leading to magnetic switches [1]. On the other hand, we show that a large domain of self-organized MnPc molecules on a Ag(111) surface forms a Kondo lattice which reveals a long-range antiferromagnetic order that can lead to 2D quantum criticality [2]. The lanthanide double-decker case is particularly relevant since it has raised a great deal of interest over the last two decades, due to their exceptional magnetic properties that makes them ideal systems for data encoding [3]. In the case of $TbPc_2$ molecules, the π-radicals of the Pc ligand constitutes the read-out quantum dot of the molecular qubits and can be identified STS. Controlled STM-manipulation of the molecules allows a simultaneous follow-up of the entanglement process by means of the space-resolved detection of the Kondo resonance [4]. Finally, an original approach is presented where the valence state of a cerium atom is tuned by its controlled insertion into an appropriate molecular network leading to intermediate valence complexes.

References

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