DOUBLE DECKER

Single Molecule Magnets (SMMs) are among the most promising molecular systems for the development of novel molecular electronics based on the spin transport. However, the development of a SMM-based technology is hampered by the intrinsic chemical fragility of most polynuclear SMMs and the evanescence of the SMM behaviour, which make the retention of the molecular magnetic bistability at the nanoscale far from trivial. Another issue related to the technological fruition of SMMs is the development of suitable methods for their stable and robust integration into technologically relevant substrates like silicon.

This research activity addresses these issues by designing, synthetizing and grafting chemically engineered Tb^{III}-bisphtalocyaninato SMM on silicon wafers, covering also the structural and magnetic characterization of the resulting material. So far the research activity has led to:

- A new, versatile multiple peripheral functionalization of Terbium double decker phthalocyanines $TbPc_2$. The introduction of iodine substituents on the Pc ligands does not alter the magnetic properties of the corresponding Tb complexes. These iodinated $TbPc_2$ undergo multiple Sonogashira coupling reactions in high yield in a simple, effective way. This mild and versatile procedure paves the way for the highly sought $TbPc_2$ post-functionalization. The application of this new synthetic protocol for $TbPc_2$ functionalization allows to introduce a wide range of functionalities on $LnPc_2$, necessary prerequisites for the development of SMM-based technologies.
- A reliable methodology for the grafting on silicon of a functionalized Tb^{III}-bisphtalocyaninato SMM. The thermal hydrosilylation procedure employed leads to the formation of thermally and a hydrolytically stable SMM monolayer on silicon, making it solvent and sonication-resistant. The resulting Si-integrated SMM monolayer shows for the first time a surface enhancement of the magnetic bistability, rather than the commonly observed suppression of it. The unprecedented use of chemical design to realize a covalent grafting on silicon has at the same time maximized the robustness of the grafted monolayer as well as enhanced the magnetic memory effect as a result of the electronic effect induced by the grafting on silicon.