

## Single Molecule Magnets on metallic and magnetic surfaces

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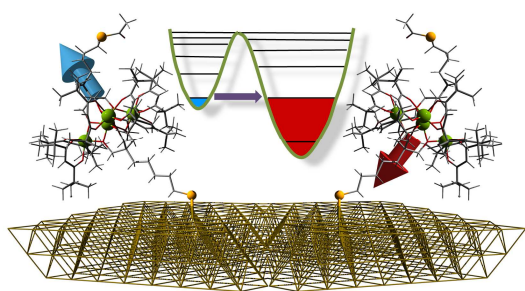
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Molecular nanomagnets, also known as Single Molecule Magnets (SMMs),<sup>1</sup> are a class of molecules that at low temperature exhibit magnetic hysteresis of pure molecular origin and not related to a cooperative effect. In the past fifteen years they have attracted great interest for their potentiality to act as magnetic memory units and for the many quantum effects in the dynamics of their magnetization. Organization of SMM on surfaces is the first step in order to address the magnetic state of a single molecule or to connect the molecule to a conducting substrate. The complex nature of SMMs and the peculiar origin of their magnetic bistability have been representing for half a decade an obstacle to the development of this research field. In our research activity we have successfully employed the self-assembly of functionalized molecules to prepare from solution sub-monolayer of SMMs. Synchrotron based techniques, in particular X-ray absorption as well as linear and circular dichroism, have revealed unique tools to investigate complex molecular systems on surfaces. The spin structure of polynuclear SMMs on surface has been determined thanks to the element selectivity of the technique. Sub-kelvin temperatures experiments have shown that a polynuclear SMM clusters, based on a propeller-like tetranuclear iron(III) core, Fe<sub>4</sub>, showed a “robust” SMM behaviour, with the typical hysteresis persisting also when the molecules are chemically grafted to a gold surface.<sup>2</sup> The tailoring of the anchoring ligand has allowed to control of the orientation of the molecules on the substrate. and has given the possibility to observe, the resonant quantum tunneling of the magnetization.<sup>3</sup>



Another significant advance in the organization of SMMs on surface is the recent successful thermal deposition of Fe<sub>4</sub> molecules in ultra-high vacuum (UHV) conditions.<sup>4</sup> While mononuclear complexes with phthalocyanine and porphyrine ligands are often thermally evaporable, their interaction with the substrate is in general very strong and modifies significantly the magnetic properties of the molecule.<sup>5</sup> On the contrary Fe<sub>4</sub> clusters can be thermally evaporated on surface without losing their SMMs properties, although the use of magnetic substrates modifies significantly their dynamic properties.

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