Spin-Crossover in plasmonic-magnetic nanoparticle patterns studied by means of micro-Raman spectroscopy

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During the last decades, Spin-Crossover (SCO) complexes have attracted much interest due to their promising applications in the development of new information storage devices and other magnetic applications.[1] The interest on these materials lies in their magnetic bi-stability which can be driven by means of external stimuli: thermally, optically and even mechanically. Among these materials, the polymeric iron(II) complex $[Fe(Htrz)_2(trz)(BF_4)\cdot H_2O]$, where Htrz = *4H*-1,2,4-triazole, is one of the most intensely studied, since the can be designed to present abrupt transitions with large hysteresis loops above room temperature.

The introduction of these complexes into realistic devices has been attained by their recent miniaturization as SCO nanoparticles (NP)[2]. In particular, our work on single NP devices showed for the first time electrical switching and memory effects near room temperature.[3] Recently, the memory effect of assemblies of NPs of the same system has electrically been demonstrated,[4,5] showing their potential as switching elements of nanoscale devices. However, new challenges arise from these new technological platforms since as the size of the system is reduced the observation of the spin transition demands more sensitive characterization techniques.

In this work we present the preparation and optical characterization of ordered SCO NPs onto surfaces by means of Stamp Lithography. Our technique allows the ordering of both, gold NPs and the SCO NPs in close contact. Under this situation, Surface Enhanced Raman spectroscopy (SERS) can be exploited to determine the magnetic state of the NPs, since the spin transition is closely related with the strength of the chemical bounds between the iron(II) and the surrounding atoms. As a result, a sensitivity increase of several orders of magnitude with respect to general magnetic characterization techniques is observed.

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