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Real Space Observation of Inelastic Kondo Effect and Interorbital Spin-Coupling in Molecule-Metal Contacts AITOR MUGARZA, CORNELIUS KRULL, Catalan Institute of Nanotecnology, ROBERTO ROBLES, NICOLAS LORENTE, RICHARD KORYTAR, Centre d'Investigacions en Nanociència i Nanotecnologia, CIN2 (ICN-CSIC), SEBASTIAN STEPANOW, GUSTAVO CEBALLOS, PIETRO GAMBARDELLA, Catalan Institute of Nanotecnology — We present a comparative scanning tunneling spectroscopy study of four different types of MPc complexes (M = Fe, Co, Ni, Cu) adsorbed on the Ag(100) surface. Their magnetic properties are studied via the Kondo interaction with the substrate. Whereas the spectra of FePc and CoPc near the Fermi level is featureless, CuPc and NiPc show a Kondo resonance arising from the interaction of a ligand spin with conduction electrons. The spin at the organic macrocycle is induced by charge transfer from the Ag substrate. In CuPc, the coexistence of ion and ligand spin gives rise to interorbital coupling and spin excitations. The latter are observed via inelastic tunneling, where the Kondo interaction appears coupled to spin and vibrational excitations. By using the tip as a mobile electron we find that each type of excitation occupy mutually exclusive regions within the molecule, and result in different spin relaxation dynamics, reflecting the need of an atomic control of the molecule-metal interface to obtain reproducible transport properties. Finally, we study the influence of intermolecular interactions on the electronic and magnetic properties by creating artificial clusters in a controlled manner by manipulation of individual molecules.

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