RCMS ·IGER Seminar

"A spin crossover-based multifunctional molecular memory"

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Place : Chemistry Gallery

A nano-scale molecular switch is conventionally based on a conductancechange by external stimuli such as temperature, light, pressure, magnetic or electric fields or charge flow. A spin-crossover (SCO) molecule is a promising candidate to additionally attach the spin switching functionality to the molecular switch due to its switchable nature between a high-spin (HS) state and a low-spin (LS) state. Controlling conductance and spin of a single molecule is the key concept to realize molecular spintronics devices. Here we show scanning tunneling microscopy (STM) study of individual SCO molecules,Fe(phen)2(NCS)2 (phen = 1,10-phenanthroline) directly anchored on surfaces [1]. When the molecules are adsorbed on a metallic Cu(100) surface, two different molecular configurations were found. Spectroscopic measurements revealed that one of the configurations shows a Kondo resonance but the other the absence, indicating the coexistence of HS and LS states. However, a strong coupling of the NCS-groups to the surface prohibits the molecule to switch its spin states. The spin state switching of the molecule has been achieved by introducing a thin insulating CuN layer, which considerably reduces the interaction with the surface. Injecting tunneling electrons with a tip of STM changes the configuration of the molecules between two states, resulting in on (HS-state) and off (LS-state) of a Kondo resonance accompanied with high and low conductance states. Real time traces of the tunneling current demonstrate reversible and deterministic switching behaviours of the molecules. The observed robust memory effect gives a perspective to future molecular spintronics devices with the smallest unit.

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