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Evidence of Kondo effect in organic radical nanoassemblies MOHAMMAD RASHIDI, STEFAN MULLEGGER, MICHAEL FATTINGER, REINHOLD KOCH, Solid state physics division, Johannes Kepler University, Linz, Austia — The outstanding spatial resolution of low temperature (LT) scanning tunneling microscopy (STM) and spectroscopy (STS) enables to probe the frontier orbital electronic structure of single magnetic molecules and clusters adsorbed on substrates. Here, we study self-aligned nanostructures of (spin-1/2) hydrocarbon radicals on a metal surface by means of LT-STM and STS. Pronounced involvement of surface state electrons is observed in the frontier molecular orbital (MO) resonances. An empty hybrid state closely above the substrate Fermi level exhibits the characteristic properties of surface Kondo effect reported for similar systems in the literature. By identifying three electronic states as hybrids of molecular orbitals and surface state electrons (two of them directly related to the Kondo effect), we are able to present a modified picture of the surface Kondo effect. It is based on a valence-bond model, where the bonding state represents Kondo's virtual bound state and the antibonding state is the so called 'Kondo resonance' reported in STM studies of the surface Kondo effect. Furthermore, double occupation of the originally singly unoccupied MO by tunneling electrons leads to the third state well above the Fermi level due to Coulomb repulsion as described by the Anderson model.

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