Single-electron tunneling at room temperature in cobalt nanoparticles

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We report on the observation of the Coulomb blockade with Coulomb staircases at room temperature in cobalt nanoparticles, with sizes ranging between 2 and 4 nm. A monolayer of these particles is supported by a thin 1 – 2 nm thick Al_2O_3 film, deposited on a smooth Au(111) surface. The local electrical-transport on isolated Co clusters was investigated with a scanning tunneling microscope. The tunnel contact of the STM-tip allowed us to observe single-electron tunneling in the double barrier system STM-tip/Co/Al_2O_3/Au. Very high values for the Coulomb blockade of up to 1.0 V were reproducibly measured at room temperature on different particles with this setup. The current-voltage characteristics are well fitted by simulations based on the orthodox theory of single-electron tunneling. In a second step we measured the I-V characteristics of Co particle-arrays, contacted via in-plane point contacts.

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