New Experiments and Applications Made Possible by a Low Temperature 4-Tip STM with UHV-SEM Navigation

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A major challenge in the development of novel devices in nano- and molecular electronics is their interconnection with larger scale electrical circuits required to control and characterize their functional properties. Local electrical probing by multiple probes with STM precision can significantly improve efficiency in analyzing individual nano-electronic devices without the need of a full electrical integration. Recently we developed a new microscope stage that merges the requirements of a SEM navigated 4-probe STM and at the same time satisfy the needs for high performance SPM at low temperatures.

Besides SEM/STM probe fine navigation and NC-AFM (QPlus) imaging with atomic resolution at temperatures of T<5K, the excellent STM/AFM performance level of the LT NANOPROBE expands applications to tunneling spectroscopy and even the creation or modification of nano-structures or single atoms by a sharp and precise SPM probe. In this contribution we will focus on measurements that prove the performance level of the instrument as well as on tunneling spectroscopy and atom manipulation experiments on Ag(111) at temperatures of T < 5K.

Figures

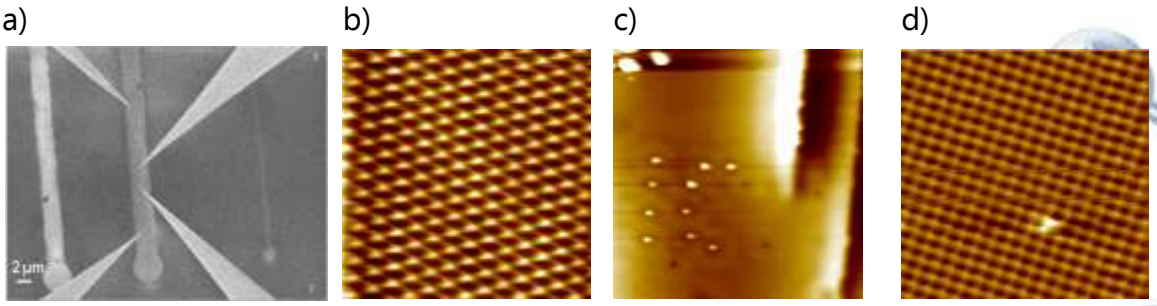

Figure 1: a) SEM image of 4 STM probes placed on a Fe-nanowire for 4-point conductance measurements at T < 5 K; b) High resolution STM image of a Ag(111) surface at T<5K. Imaging parameters: Scan area: 5.7nm x 5.7nm, U_{gap}= 25mV, $I_{setpoint}$=2nA; c) Atom manipulation of Ag-particles on a Ag(111) surface at 5K. Imaging parameters: Scan area: 48.3nm x 48.3nm, U_{gap}= 90mV, $I_{setpoint}$=5.4nA; d) High resolution NC-AFM image of a NaCl(001) surface at T=4.4K. Imaging parameters: Δf= - 1.3 Hz, f_{res}= 23.8 kHz, A≈ 0.5 nm, Q ≈ 20.000, U_{gap}= -200 mV