

A variable-temperature ultrahigh vacuum scanning tunneling microscope

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A variable-temperature ultrahigh vacuum (UHV) scanning tunneling microscope (STM) was designed and tested. Design details and initial results are presented. The STM is directly attached to the cold face of a continuous flow cryostat which is mounted into a two-chamber UHV system. A significant advantage of this system in comparison to many others is, that samples can be cooled down to base temperature of 6.5 K within very short times of below 2 h. This feature not only increases the potential sample throughput, it also allows to cycle the sample temperature within the regime below 20 K without losing track of given sample locations. The instrument was tested by imaging Au layers on graphite. The vertical stability at low temperature was found to be below 3 pm. Images recorded at 6.5 K show crystalline Au islands and the Au(111) 22×3 reconstruction with atomic resolution. Using a resistive heater, the sample temperature was adjusted between 6.5 and 20 K. After an equilibration time of 15 min, the displacement due to the temperature change remained below 150 nm. Scanning tunneling spectroscopy on Au(111) grains resolves the Au(111) surface state.