4.8 Build-up of an Ultra High Vacuum Scanning Force Microscope

(A. Kündig, L. Eng and Z. Sitar)

An ultra high vacuum (UHV) chamber for scanning force microscopy (SFM) bas been designed, built, and commissioned to complement an existing UHV system for molecular beam epitaxy (MBE). It has been successfully leak-tested down to a base pressure of $5*10^{-10}$ mbar. The whole vacuum system consists now of four different chambers that are connected with a transfer system allowing the manipulation and transport of samples under UHV conditions. Two of the four chambers are for the epitaxial growth of inorganic and organic thin films, while the other two serve for surface analysis (LEED, XPS, AES, and SFM).

The SFM UHV chamber has been specially designed to allow in-situ tip and sample exchange within the SFM. The SFM-head itself has been designed and is now under construction. It will enable measurements in both the contact and the non-contact mode. In the latter mode, it will be possible to detect the amplitude modulation, the phase shift, or the frequency modulation of the vibrating cantilever. Force detection will be performed with so-called integrated cantilevers of the piezoresistive type. They consist of a single crystal silicon structure with a diffused conductive channel and an integrated ultra sharp silicon tip. Deflection of the cantilever alters the resistance of the conductive channel (the piezoresistive effect) which can be measured.

In addition, the electronics for our SFM (from Topometrix™) has been tested with an existing SFM-head (type EXPLORER) in air.