

attoAFM I: Contact - Non-Contact Mode

The attoAFM is an atomic force microscope for low temperature applications. The instrument works by scanning a cantilever over a sample surface and by measuring the tip-sample interactions. The attoAFM uses an optical fiber based interferometer to measure the deflection or the oscillations of the cantilever. The sensor is compatible with any commercial cantilever and measures the vertical deflection of the cantilever with picometer resolution. The microscope is designed to work in contact and also in non-contact mode.

The two measurements shown above result from the investigation of a gold on glass grating with 10nm of height. The contrast is due to the topography (contact mode) but also due to the local differences of the material elasticity (non-contact mode). The comparison of both pictures makes it possible to distinguish the two different effects.

Contact mode: In the contact mode, no feedback is necessary. The tip is in contact with the sample. A very sharp tip is dragged across a sample surface and the measured vertical deflection of the cantilever reflects the topography of the surface.

Non-contact mode: The cantilever is excited by a dither piezo at its resonance frequency. As the cantilever approaches the sample, the vibration amplitude drops sharply. A feedback loop (PI or PLL) attempts to keep the cantilever deflection or the tip-sample force constant by adjusting the voltage applied to the scanner and the dither frequency.



Fig. 3: The attoAFM I microscope sensor head.

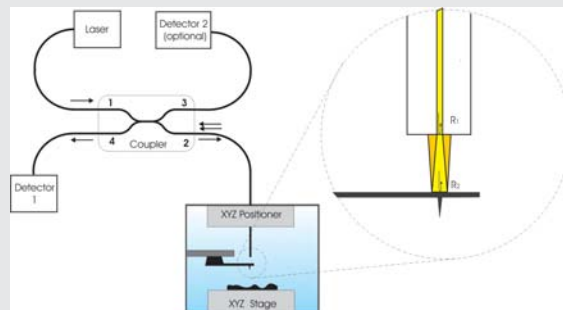


Fig. 1: Schematic drawing of the AFM setup. Insert: The small interferometer between the cantilever and the fiber end is used for the feedback control. The cantilever interface and the fiber end face form a Fabry-Perot interferometer. The precision of the cantilever deflection measurement is better than $160 \text{ fm/Hz}^{1/2}$.

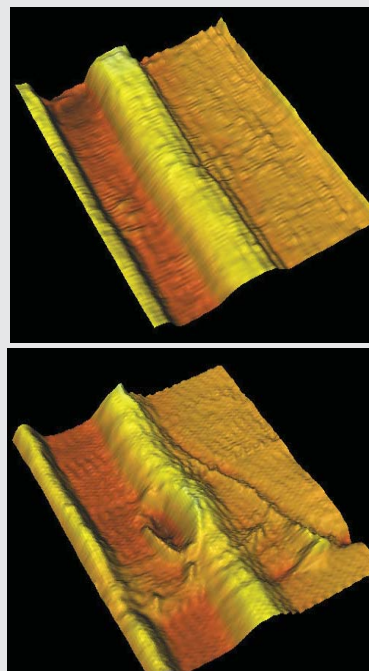


Fig. 2: Contact and non-contact mode images of a chromium-on-glass grating with one micron of period. Top: contact mode; bottom: non-contact mode.

RELATED PRODUCTS

attoAFM I	highly stable and compact atomic force microscope
ANPxyz100/LT	high precision, piezo electric, inertial positioner for big loads
ANSxy100	high precision piezoelectric scanner
ANC150/3	electronic controller
ANC200	electronic scan controller
attoSCAN	data acquisition software
attoVIEW	data viewing software