Cantilever based Low Temperature Scanning Near-Field Optical Microscope

Scanning near-field optical microscopes (SNOMs) are designed to measure the optical contrast of a sample with sub-wavelength resolution. The attoSNOM I works by scanning a cantilever in the optical near-field of a sample surface. This microfabricated SNOM sensor, distributed by WITec©, consists of a Silicon cantilever with a hollow Aluminum pyramid as tip. At its apex the pyramid has a small aperture of approx. 100 nm in diameter. The near-field probe in this configuration acts simultaneously as a topographic sensor in contact or modulation mode, hence enabling also force measurements, and as an optical aperture. One major advantage of these robust, mass-produced tips is the ease of probe handling unique in SNOM technology.

The well known tip-sample distance control using the interferometric detection scheme as also applied in attoAFMs is another key feature of this system. The schematic drawing in Figure 1 describes this setup. A laser beam coupled into a single mode fiber (port 1) is used to illuminate the SNOM cantilever via a fiber coupler. Hereby, the backside of the cantilver and the fiber end form a Fabry-Perot interferometer and monitoring the intensity of the interference fringes allows to measure the tip vibration amplitude. The non-reflected part of the light is guided through the hollow cantilever and illuminates the sample through the aperture. The cantilever is scanned across the sample in a proximity smaller than the wavelength and the scattered light can be detected in transmission or reflection.

Figure 2 shows the results of simultanously conducted measurements on a Vanadium rhomb-structure on glass substrate with the attoSNOM I. Whereas the left picture illustrates the topography of the sample, the right one depicts the results of a near-field measurement in transmission. The image shown in Figure 2 was acquired at room temperature and ambient conditions, but ongoing studies are currently establishing these measurements at cryogenic temperatures around 4 K.

The attoSNOM I is an easy-to-use system that combines the advantages of SNOM and Atomic Force Microscopy in a single instrument which is highly suitable for applications under extreme environments such as low temperature and high magnetic fields.

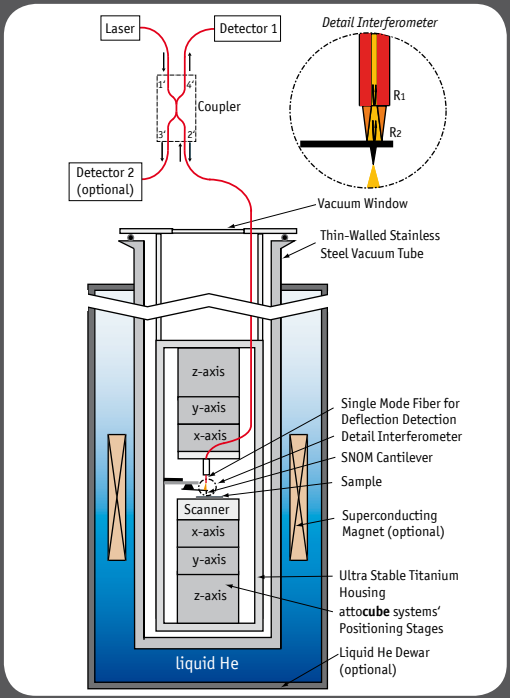

Figure 1: Schematic drawing of the low temperature attoSNOM I system.

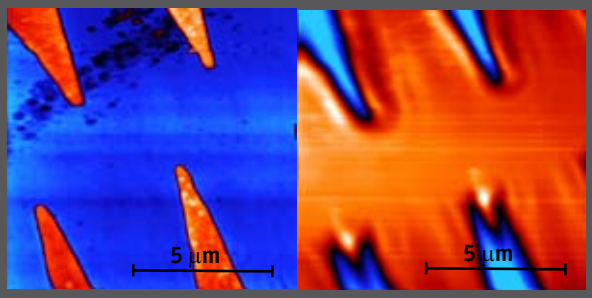

Figure 2: Topography measurement (left) and simultaneously obtained near-field measurement in transmission (right) using the attoSNOM I. Sample: Vanadium rhomb-structure on glass substrate with a layer thickness of 10 nm and a period of 5 µm. Distance control: interferometric sensor. (attocube application labs, 2007).

RELATED PRODUCTS

attoSNOM I	cantilever based scanning near-field optical microscope
ANPxyz101/LT	high precision, highly stable piezo electric, inertial positioner
ANSxy100/LT	high precision piezoelectric scanner
ANC150/3	electronic stepper controller
ANC200	electronic scan controller
ASC500	scanning probe microscopy controller

attocube systems
explore your nanoworld

attocube systems AG, Königinstrasse 11 A (Rgb), D-80539 München, Germany, www.attocube.com, Tel. +49 (0)89 2877 809-0, Fax. +49 (0)89 2877 809-19.

© attocube systems AG 2001-2007 All rights reserved.