

OC4-STATION AND VEECO EnviroScope – ADVANCED VACUUM MEASUREMENTS

Veeco EnviroScope combines a hermetically sealed sample chamber with scanning microscopy. Due to the relative high Q factor of the cantilevers in vacuum this instrument can be operated with an external PLL for advanced combined measurements, i.e. nc-AFM, MFM, EFM...

We used the fully digital OC4-Station that can be easily integrated in the EnviroScope equipped with Signal Access Module (SAM). Nanonis can provide the right solution for performing, for instance, measurements where the tip-sample distance is controlled by keeping the frequency shift (Δf) of the cantilever constant (nc-AFM). Even more, we combined this technique with Magnetic Force Microscopy (MFM) and investigated a magnetic tape sample. The EnviroScope has been operated in LiftMode allowing the imaging of relatively weak and long-range magnetic interactions while trying to minimizing the influence of topography. Measurements are done in two passes across each line. First, topographical data is taken in non-contact mode, then the tip gets lifted to a certain height and the second pass is performed while maintaining a constant separation tip-surface. Magnetic interactions are detected during this second pass, so the topographical features are removed from the MFM image. As it can be seen in Fig. 1, there is no correlation between topography and Δf signals. In fact, Δf signal is caused by the magnetic forces acting on the tip, thus Fig. 1b represents the magnetic force image.

Frequency modulation detection is superior method for magnetic force imaging in vacuum, offering greater ease of use, better signal-to-noise ratios, and reduced artifacts as compared to amplitude detection.

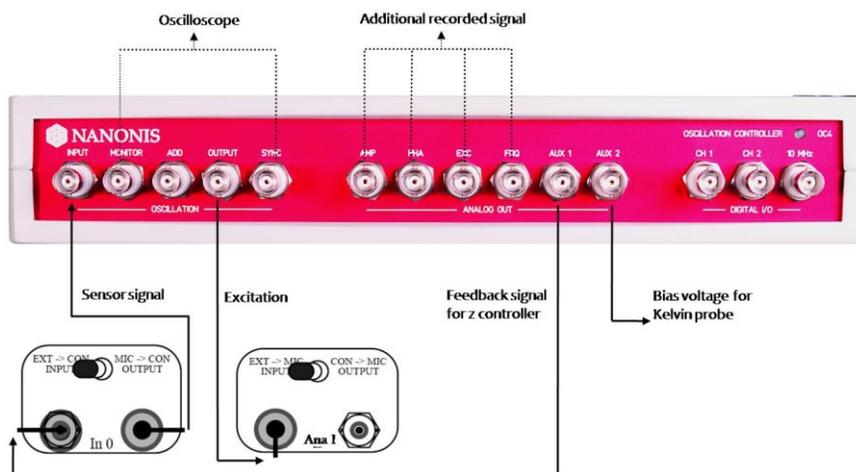


Fig. 2. Schematic of the connection of the Nanonis OC4-Station to EnviroScope via the SAM box.

Reference:

<http://www.trt.thalesgroup.com/ump-cnrs-thales>

Author:

K. Bouzehouane, S. Fusil,
CNRS/Thales, France
A. Socoliuc, Nanonis GmbH

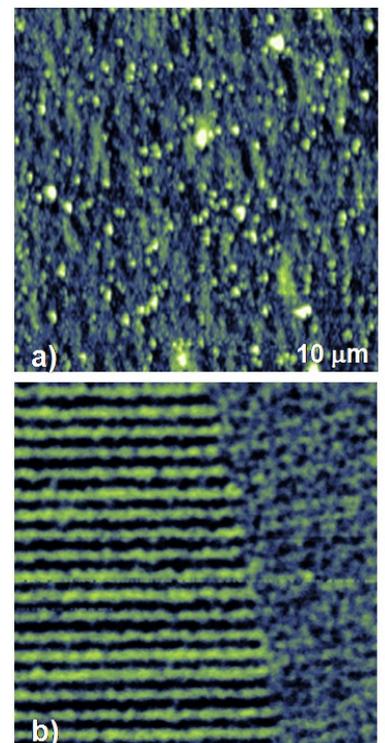


Fig. 1. MFM measurements on standard magnetic tape sample in high vacuum 1E - 6 mbar. a) topography, b) Δf signal on the second pass at 100nm above the surface.

Nanonis Modules in Use:

- Oscillation Controller OC4
- perfectPLL™

System:

- Veeco EnviroScope equipped with SAM
- LiftMode

