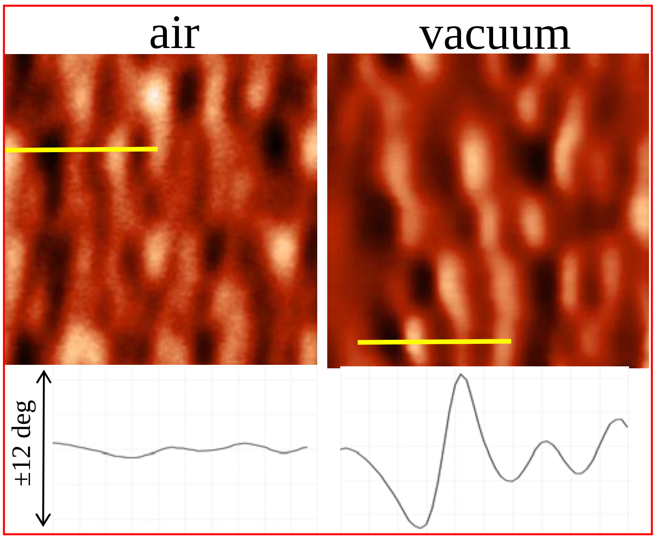
High-quality MFM

Six essentials of high-quality MFM

1. increased sensitivity due to vacuum environment
2. increased sensitivity due to electronics design
3. accurate external field application
4. scanner with no magnetic parts (external field does not obstruct the imaging)
5. many-pass compensation of electrostatic and other influences
6. precise temperature changing during MFM measurements

1



Even low vacuum substantially increases signal-to-noise ratio

MFM images of hard disk surface obtained in ambient air and in vacuum. Signal-to-noise ratio of phase imaging is more than ten times better even at 10^{-2} torr as shown on line profiles. Both images are 1x1 µm.

2

Very weak signal can be detected …

Phase detector sensitivity is as high as 0.04° thus very low phase shift can be detected. In addition there are two way the signal can be further amplified by electronics.

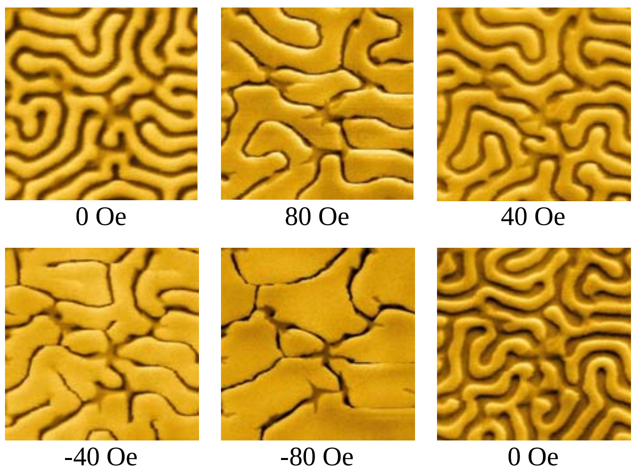
…moreover it can be electronically amplified

First the amplification can be set to occur in the phase detector itself. Second the mag*sin(t) signal (depending on both oscillation amplitude and phase) can be amplified by the synchronous detector. This channel is often much more sensitive than the phase itself and this way even very weak magnetization can be imaged and measured.

3

External field can be applied in vertical direction as well

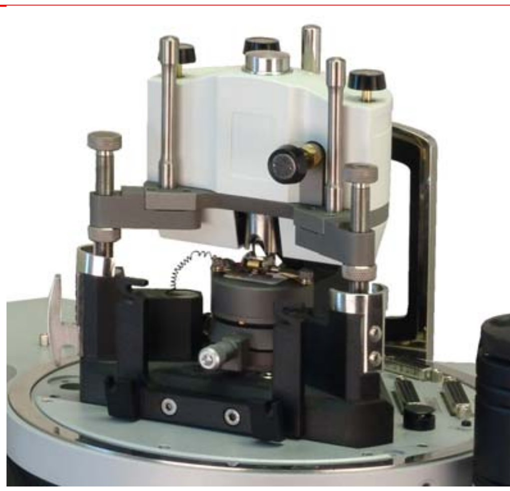
Sequential images of ferrite garnet film in the presence of vertical external field. Images are from the same area, 90x90 µm. Sample courtesy of Prof. F.V. Lisovskiy, Institute of Radioengineering & Electronics RAS, Fryazino, Russia.



4

Scanner is free of magnetic parts

External field do not obstruct the imaging process (even at the moments the field is turned on and off) because there are no magnetic parts within the scanner that could interact with the field. Now the scanning head is equipped with the CL sensors, thus even more precise and accurate imaging can be performed.



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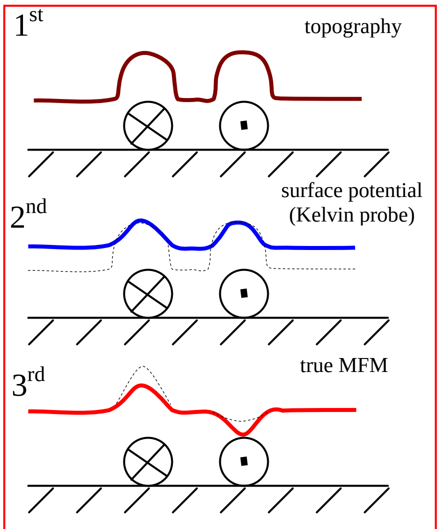


Coming soon

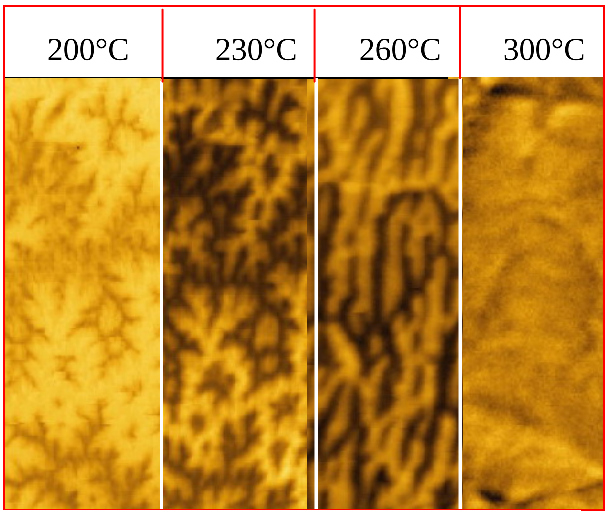
Compensation of electrostatic and topography influence

For samples possessing any electrostatic potential several passes should be performed in one session. On the scheme is an experiment with magnetization of nanoelectronic element:
1st pass shows topography;
2nd pass shows surface potential with topography influence compensated;
3rd pass shows magnetization with both electrostatic potential and topography compensated.

6

Sample temperature can be changed during the MFM

MFM images of the cobalt monocrystal with uniaxial anisotropy. Phase transition occurs when temperature increases. Images obtained from the same area, 14x40 µm. Sample courtesy of Prof. A.G. Pastushenkov, Tver University, Russia.



MFM on the NTEGRA platform

Vacuum		10^{-2} torr
Temperature		RT to +300°C
External field	in-plane vertical	+/- 0.2 T +/- 0.05 T

MFM in high vacuum

Vacuum		10^{-7} torr
Temperature		50K to 420K
External field	in-plane	+/- 0.08 T

Enjoy the highest quality of MFM!

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