

## ADDITIONAL SPM Methods

### MAGNETIC FORCE MICROSCOPY

Magnetic force microscopy (MFM) is a mode that maps the spatial distribution of magnetic materials on a surface, by measuring the magnetic interaction between a sample and a tip. MFM is conducted using a cantilever that is equipped with a tip that has a magnetic coating such as (Co-Cr). The interactions between the probe and surface can be detected via the deflection of the cantilever (contact mode). More commonly the magnetic interaction can be monitored through monitoring the oscillation of the probe (tapping mode). The changes in magnetic field shift the resonant frequency of the cantilever. This shift can be monitored as shown in Figure 1. A more detailed description of the various ways the actual shift frequency can be monitored can be found.<sup>1-3</sup>

A key aspect of this measurement is that a “background is taken” prior to the MFM measurement to ensure the MFM measurement is due to magnetic domains and not topography. First the topography of the sample is measured, then the probe is “lifted” a distance from the sample and the response of the tip to magnetic domain is measured (taking into account cantilever associated with topography).

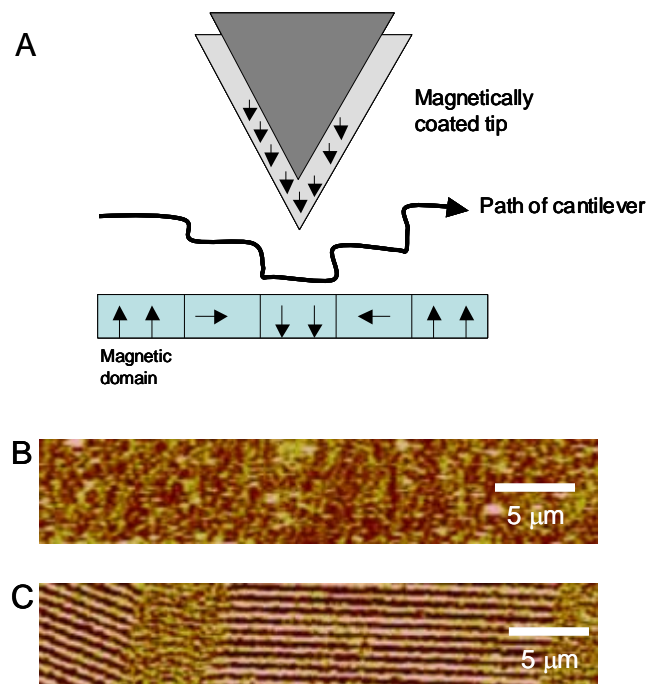


Figure 1. Example of MFM imaging. A) Diagram depicting movement of magnetically coated probe (tip) in response to magnetic domains on a surface B) Height profile C) magnetic profile of magnetic recording media showing bits of a hard disk.

**References:**

1. Bonnell, D. A., Ed. *Scanning Probe Microscopy and Spectroscopy: Theory, Techniques, and Applications*; Wiley-VCH: New York, 2001.
2. NTMD Homepage [http://www.ntmdt.ru/SPM-Techniques/SPM-Methodology/Magnetic\\_Force\\_Microscopy\\_MFM/text45.html](http://www.ntmdt.ru/SPM-Techniques/SPM-Methodology/Magnetic_Force_Microscopy_MFM/text45.html) (Accessed 1/26/07).
3. Excellent examples of MFM. [http://www.nanoscience.de/group\\_r/afm/](http://www.nanoscience.de/group_r/afm/) (Accessed 11/06/06).

**Acknowledgements:**

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