

# Introduction to Scanning Probe Microscopy (SPM)

## ADDITIONAL SPM Methods

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### PHASE IMAGING

Phase Imaging is a powerful extension of tapping mode AFM that provides nanometer-scale information about surface structure.<sup>1</sup> Phase imaging detects variations in composition, adhesion, friction, viscoelasticity and other properties by mapping the phase of the cantilever oscillation during tapping mode, Figure 1. Some applications include:

- identification of contaminants
- mapping of different components in composite materials
- differentiating regions of high and low surface adhesion or hardness

An excellent interactive demonstration of phase imaging can be found [here](#).

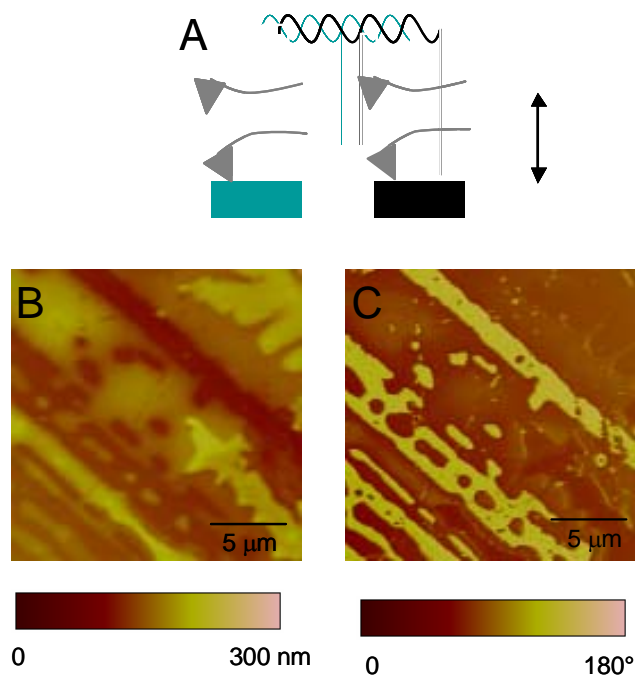


Figure 1. Example of Phase imaging. A) Diagram depicting phase shift of oscillating cantilever frequency in response to variations on a surface. B) Height profile of copolymer C) Phase contrast. The phase image provides additional contrast mapping of the surface.

**Online Images:**

Excellent source for images using phase, CFM and friction contrast.  
NIST Building and Fire Research Laboratory Image Gallery

[http://www.bfrl.nist.gov/nanoscience/BFRL\\_AFM.html](http://www.bfrl.nist.gov/nanoscience/BFRL_AFM.html)

**References:**

1. Bonnell, D. A., Ed. *Scanning Probe Microscopy and Spectroscopy: Theory, Techniques, and Applications*; Wiley-VCH: New York, 2001.

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