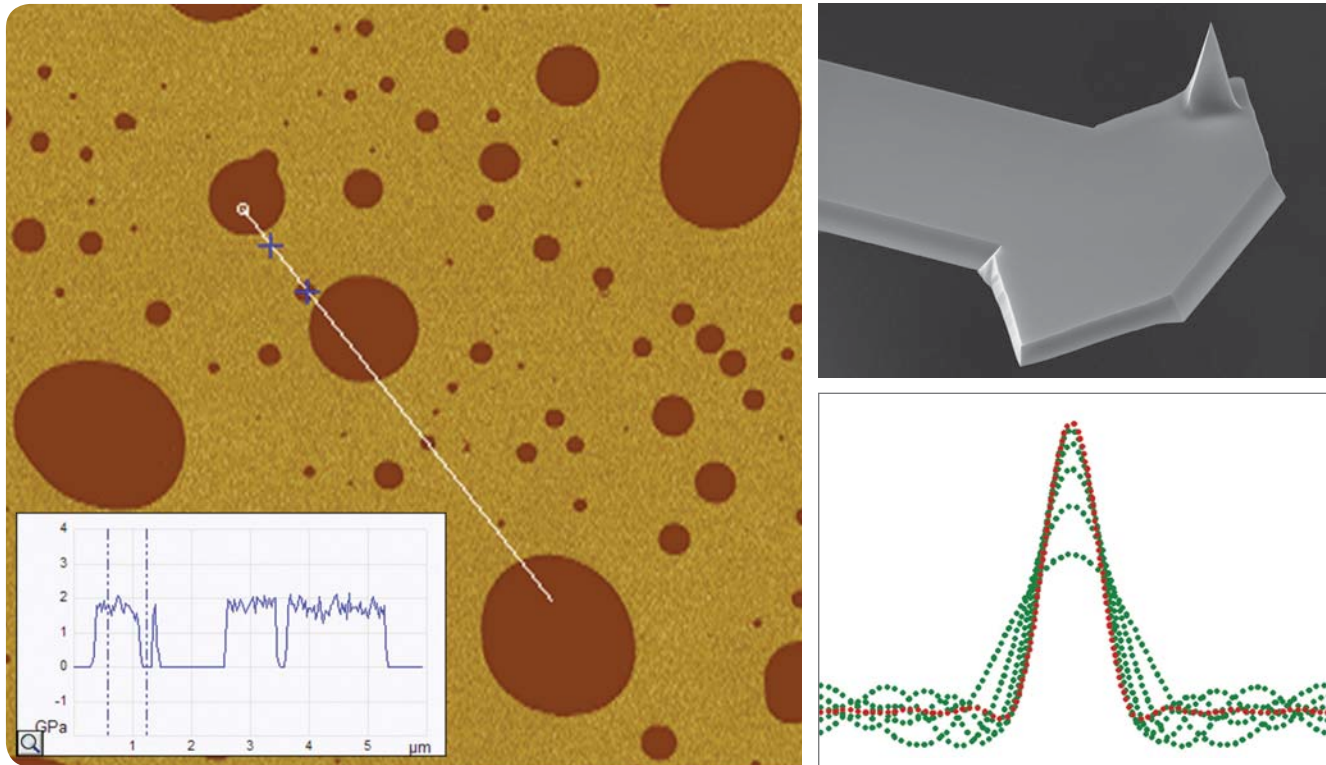


HarmoniX™ Nanoscale Material Property Mapping

The High-Resolution, Quantitative Revolution in Rapid AFM Material Characterization



HarmoniX Nanoscale Material Property Mapping is a powerful new AFM mode that revolutionizes material property mapping of adhesion, stiffness, dissipation and other properties. It offers:

- Small contact area, high-resolution nanoscale images
- Quantitative results from multiple harmonics to derive force-distance curves and enable precise material property mapping, directly traceable to Elastic Modulus
- Non-destructive measurement with very low force levels and no lateral force
- Real-time simultaneous capture of multiple independent material properties



Solutions for a nanoscale world.™

HarmoniX Nanoscale Material Property Mapping

HarmoniX Nanoscale Material Property Mapping fundamentally will revolutionize how atomic force microscopy (AFM) is used to research and develop material properties. HarmoniX material mapping provides, for the first time, true nanoscale quantitative material property mapping results, such as adhesion, stiffness, dissipation, peak force and average force, for a broad range of materials.

HarmoniX material mapping is able to deliver the full spectrum of quantitative results through the advanced design of Veeco HarmoniX probes. This unique design, which offsets the probe tip from the cantilever, enhances the signal-to-noise ratio of the cantilever harmonics in TappingMode™ by coupling the normal forces of the tip with the torsional, or “twisting” motion of the cantilever.

It is the combination of full-spectrum multiple harmonics from both the flexural and torsional motion of the cantilever that enables the revolutionary change to AFM material mapping, providing force distance curves — the basis for quantitative material property mapping.

High-resolution HarmoniX material mapping provides precise imaging of molecular-level details, with unprecedented clarity. Since HarmoniX is based on the TappingMode technique, it is able to limit deformation depths to as little as 1 nanometer while using extremely sharp SPM probes. Deformation depth is proportional to contact area, which in turn is proportional to lateral resolution, and this is how HarmoniX provides material mapping at SPM resolution.

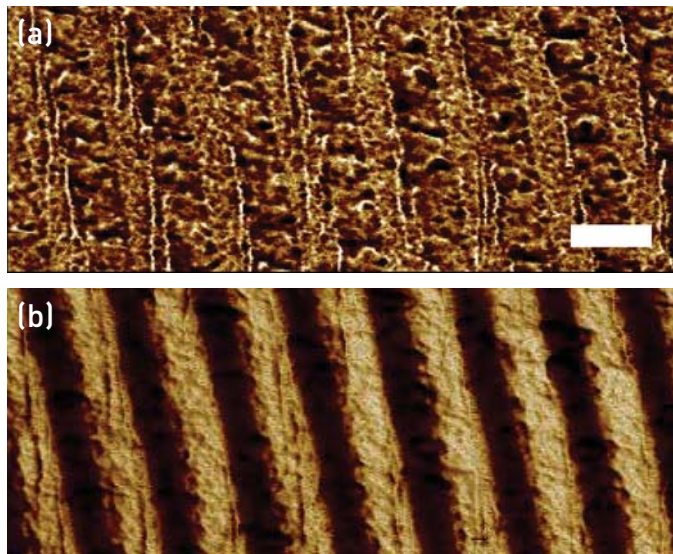
By leveraging the power of our industry-leading NanoScope® V Controller, HarmoniX enables high-pixel-density material property mapping at real-time, and at regular SPM imaging speeds. The alternative technique of force volume, which is typically operated at approximately 1 curve/second, would take several days to acquire a 512 x 512 pixel image. HarmoniX imaging can acquire a material map of this size in about 15 minutes, but unlike the force volume technique, HarmoniX delivers high-resolution images. An additional benefit of the HarmoniX technique is that the force curve data are automatically, and immediately, analyzed to provide real-time image data directly, and simultaneously provides maps of properties such as adhesion, stiffness and dissipation. No additional processing is required to extract these quantities and no rescanning of the same region is required to obtain different properties.

The most revolutionary advance HarmoniX material mapping brings to AFM is true quantitative results. Through the high-speed processing power of the NanoScope V and algorithms provided exclusively by Veeco, the multiple harmonics generated by the HarmoniX probe are converted in real time into force distance curves, allowing multiple material properties to be decoupled and measured independently.

For real-time, quantitative maps of soft materials, thin films, small particles, or domains within a bulk solid, only Veeco HarmoniX Nanoscale Material Property Mapping delivers the full spectrum of results you need.

HarmoniX Specifications

Minimum recommended sample modulus	10MPa
Maximum recommended sample modulus	10GPa
Typical force range	1-100 nN
Typical spatial resolution	10 nm
Mapping speed	Minutes
Veeco AFM	MultiMode® V, BioScope™ II, Dimension™ V, NanoMan™ VS
Controller	NanoScope V



Simultaneously collected Adhesion (a) and Stiffness (b) maps of PET multilayer. Length of scale bar is 200 nm.



Solutions for a nanoscale world.™

Veeco AFMs are covered under more than 100 patents. For a complete and updated list of patents, please visit www.veeco.com/patents

Find out more at www.veeco.com or call 1.800.873.9750