3D AFM tomography.

Dr. Sergey Lemeshko NT-MDT Co.

Atomic force microscopy (AFM) is well known for its ability to image and measure surface properties from micro to nanoscale . Whether these properties are electrical, magnetic, physical, or chemical characterization, the images of these properties are typically represented as 2D images with Z color scale. A device called the Ntegra NanoTome™ from NT-MDT Co. integrates an AFM into an ultramicrotome form Leica to extend these surface investigations into the real world of 3-D, opening new possibilities for imaging biological ultrastructure as well as nanostructures and polymer domains, inclusions, and voids.

The basic approach underlying the new technology is conventional: The microtome then slices the AFM images. As with any tomographic approach, the process is repeated until the necessary number of individual images is collected to adequately represent the 3-D structures of interest. Because the diamond knife leaves an ultrasmooth surface, the commonly used AFM topography mode reveals little information. However, the use of advanced techniques that elicit other physical responses, such as local differences in conductivity, elasticity, modulus, uncovers hidden details. Especially now with well-developed nanomechanical properties mapping beyond 10nm spatial resolution the integrated instrument brings a lot of capabilities in quantitative mapping also in 3D. What makes the NanoTome distinctive is its integration, its collect the AFM images directly from the block face after each slice, eliminating typical artifacts such as stretching, tearing, and wrinkling inherent in imaging individual slices. Additionally, imaging from the block face ensures accurate slice-to-slice alignment in the 3-D reconstruction, minimizing the tedious and complex alignment processing involved when working from individual slices instead of the block face.