nGauge AFM

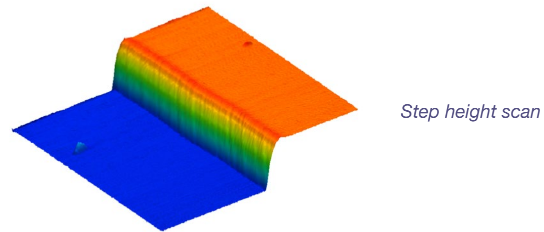
Thin-film Thickness Measurement

The nGauge Atomic Force Microscope (AFM) can be used to characterize film thicknesses from about 1 nm up to 10 um. Similar to a profilometer, the nGauge moves a sharp tip over the sample to collect topographical information —but unlike a profilometer, the nGauge collects three-dimensional data over an area, which allows users to easily identify any defects which may interfere with measurements.

Here, the nGauge is used to look at an etched silicon device where the expected thickness of the top layer is 520 nm. Although the lateral range of a profilometer is typically much larger than that of an AFM (millimeters compared to microns), sample alignment under the nGauge is very straightforward. It is easy to take advantage of the optical microscope available with the nGauge as well as the integrated XY stage to quickly position the tip of the nGauge AFM over the region of interest.

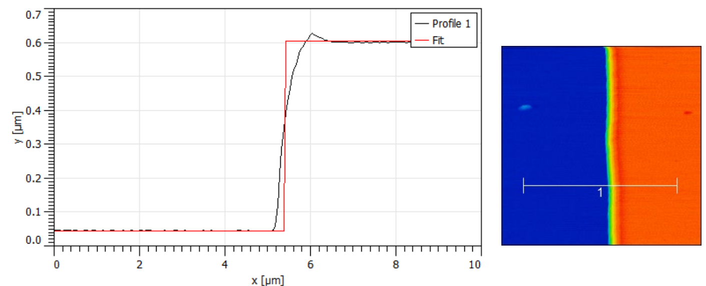
AFM tip alignment

Once aligned (in this case, with the left edge of the "P"), the user can proceed with a scan of the sample, then perform basic post-processing by lining up the terraces.



Step height scan

The data from the nGauge shows a well-defined step height, as well as several small debris particles on the sample. For this film thickness measurement, these particles can be ignored by simply drawing a line profile over a clean section of the sample, resulting in an accurate measurement. With a profilometer however, only one line profile would be collected - which means that if the profilometer collects a line profile over a contaminated section of the sample, there is no reliable way to tell if the measured step height is correct other than taking several measurements at different locations, lowering productivity. With the nGauge, the slope, texture, and profile of the sidewall can also be easily observed to optimize the etch parameters—which is otherwise infeasible with a profilometer.



Line profile over AFM data

The nGauge enables easy investigation of the thickness of thin films, coatings, and effectiveness of etch procedures, providing the user a significantly richer set of data than profilometry while maintaining the capability to obtain highly precise step height measurements.