

Understanding the accuracy, resolution and stability of results requires specific and exacting nanoscale standards.

Nano Surface Standards Gain Traction

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Micro- and nano-scale components, found in everything from phones to automobiles, and even new medical devices, present unique manufacturing challenges. These issues include surface roughness, dimensions, and shape that must be controlled to the nanometer level, as friction, surface tension, electrical and biological properties can be significantly affected by minor differences in surface morphology.

Stringent nanoscale specifications can be verified by instruments such as interferometric microscopes, atomic force microscopes, stylus profilometers and scanning electron microscopes. However, understanding the accuracy, resolution and stability of results requires specific and exacting nanoscale standards as well as accepted measurement methodologies.

A significant, coordinated effort is underway to address these needs, involving various companies, research groups, and standards organizations. The ISO 25178 standard, parts of which are published while others are still undergoing final revision, describes calculations, instrumentation, and verification methods relating to precision 3D metrology.

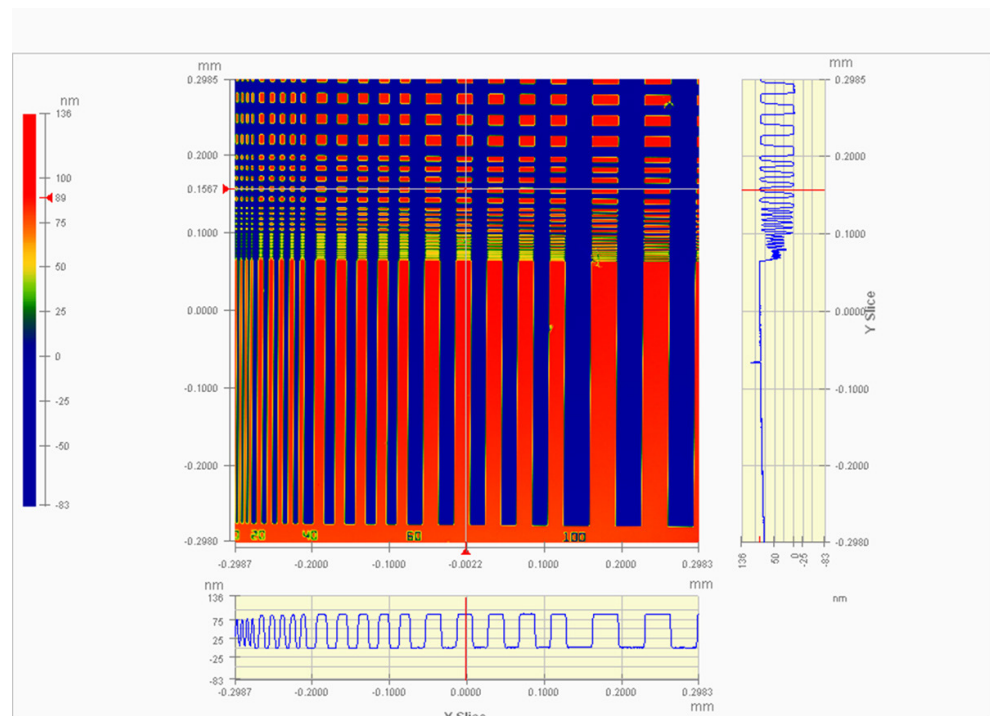


Figure 1. VLSI variable pitch standard as measured on a NanoCam interference microscope.

The NanoScale 2013 seminar in Paris, France, was devoted solely to nanoscale quantification, calibration and methods. Many other conferences and trade shows relating to precision manufacturing and other high-tech industries offer short courses and sessions on nanoscale metrology.

Additionally, companies and organizations including Physikalisch-Technische Bundesanstalt (PTB), National Physical Laboratory (NPL), VLSI, MoxTek, Supracon, Simetrics, and others have developed precision standards to calibrate metrology instrumentation for vertical uncertainty and resolution, horizontal uncertainty and lateral resolution, system frequency response, and more.

Figure 1 shows a measurement of a VLSI standard usable for calibrating height, pitch and frequency response as measured on a NanoCam interference microscope from 4D Technology. Figure 2 shows a Simetrics areal roughness standard measured on an atomic force microscope.

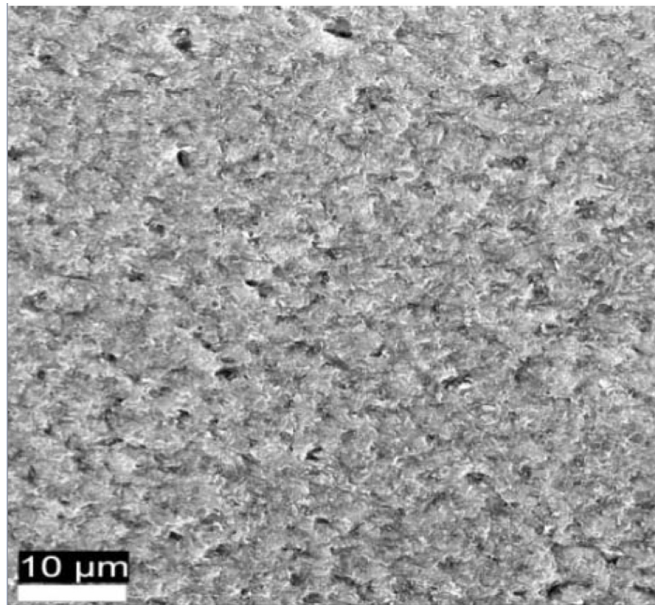


Figure 2. Simetrics areal roughness standard measured on an atomic force microscope.

Standards such as these can cost from a few hundred to a few thousand dollars depending on the number and dimensions of metrology artifacts incorporated into the standard. Common calibration artifacts include square and sinusoidal gratings, steps, line pairs, and regions of random roughness, and ramps of known angle. Thus, while nanoscale metrology remains challenging, tools, methods and standards are increasingly available to lead to accurate and relevant surface quantification.