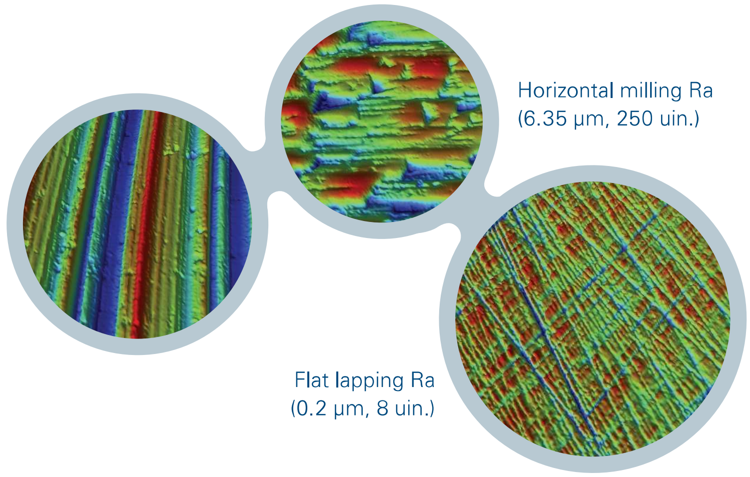

Application Note #558

Correlating Advanced 3D Optical Profiling Surface Measurements to Traceable Standards

This application note describes the advantages of the non-contact inspection method employed by 3D optical profilers, and discusses the best practices and measurement results for some specialized PTB (Physikalish-Technische Bundesanstalt) traceable roughness standards and other low-cost fingernail roughness gages. The correlation results are based on measurement factors that should be understood and considered when imaging and analyzing surface textures that range in roughness from a few nanometers to micrometers in scale. 3D optical profilers that utilize coherence scanning interferometry, also known as white light interferometry (WLI), provide fast, accurate surface measurements over large areas to quantify a variety of properties about surfaces under inspection. These profilers are being increasingly used in engineering, research, and production process control for an extremely wide range of markets, including precision machining, medical, microelectronics, MEMS, semiconductor, solar, data-storage, automotive, aerospace, and material science. Understanding how this technology correlates to traditional 2D techniques and standards, and how the increase of measurement data can be quantified and utilized are crucial to taking full advantage of the capabilities of today's top-performing 3D optical profilers.

Advantages of 3D Optical Profiling Over Other Measurement Technologies

Surface roughness characterization started in the early 1930s with 2D stylus profilers, which were adopted as the industry standard until the development of 3D metrology instruments decades later. The many advantages of 3D optical profiler measurement systems have led the international metrology community to develop new measurement standards to take full advantage of this superior technology. Today's most advanced surface profilers provide industry-leading speed and accuracy while maintaining the same "nanometer" Z accuracy at all magnifications. Such systems can measure a very wide range of surface parameters, including surface roughness, step heights, pitch, curvature, lateral displacement and waviness; all in a single measurement and on nearly any surface. Based on white light interferometry as seen in Figure 1, this measurement technique can quickly determine 3D surface shape over large lateral areas, up to 8 millimeters, in a single measurement. To measure even larger lateral surface areas, stitching algorithms can be applied to allow multiple lateral images to be taken and merged into one image for analysis.