



Focus Variation – A New Technology for High Resolution Optical 3D Surface Metrology

S. Scherer

Dr. Stefan Scherer, CEO, Alicona, Grambach/Graz, Austria, info@alicona.com, fax +43 316 4000 711

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S. Scherer¹, E. Cristea¹, O. Huber¹, A. Krenn¹

¹ ALICONA GmbH Graz, Austria

The need for increasing accuracy is a characteristic of all geo-applications, and hence of the instruments contributing to obtaining relevant data. Small and fine sensors are being developed, measuring different parameters of our geosystem and requiring continuous validation and calibration. These sensors have often very small components (fine sensors able to sense dust, atmospheric water vapour characteristics, pressure change, gravimeters, satellite micro-components), showing complex topographies including steep flanks and having varying reflective properties.

In order to get valid and reliable results, quality assurance of these instruments and sensors is required. The optical technology Focus-Variation, developed by Alicona and added in the latest draft of the upcoming ISO standard 25178, provides high resolution 3D surface metrology even at those complex topographies.

The technique of Focus-Variation combines the small depth of focus of an optical system with vertical scanning to provide topographical and color information from the variation of focus. It is used for high-resolution optical 3D surface measurements. The traceable and repeatable measurement results are further being used for calibration and validation purposes.

Some of the characteristics of the technology are:

- Measurement of instruments / samples with steep flanks up to 80°
- Measurement of materials with strongly varying reflection properties
- Measurement of surfaces presenting fine (from 10nm) or strong roughness

Here, we present the operating principle and possible applications of the optical 3D measurement system "InfiniteFocus", which is based on the technology of Focus-Variation and used for quality assurance in the lab and in production.

With the vertical resolution of up to 10nm, InfiniteFocus yields meaningful form and roughness measurements. The 3D measurement device simultaneously captures the entire surface topographic information in combination with its true color information. Both the topographic and color information are registered to the 3D data file.

The system is capable to handle a large amount of data and can be used for industrial quality assurance as well as research and development activities.

The key applications of the system are:

- Surface analysis
- Characterization of tools (particularly crucial parameters such as radii and angles) and all kinds of scientific materials

- Failure analysis
- Investigation of corrosion and tribology (cause, influence, effects)
- Variance and wear analysis

Compared to tactile instruments, the technique of Focus-Variation offers several advantages from which the performance of the geo-instruments benefits. Since the optical technique is an area-based one, a much larger amount of data is obtained from a single measurement, leading to more accurate results. Also, measurements are non destructive and wearless.