

Optical Measurement of Indexable Inserts

The quality of indexable inserts is highly dependent on their geometry and surface properties. Durability, feed rates and overall machining properties are influenced by the cutting geometry such as cutting angle and radius. Traditionally, quality assurance methods for geometry accuracy have been restricted to tactile methods. However, tactile measurement devices do not allow the measurement of specific radii or angles due to the mechanical contact of the stylus to the surface. The optical 3D measurement device InfiniteFocus removes inaccuracies caused by tactile inspection methods. It provides highly accurate measurement of angle and profile plus the additional functionality of roughness, waviness. Also, the analysis of faults such as pits, scratches and contamination is possible. Due to the optical inspection quality, output and tool durability become approved.

Quality Assurance of Indexable Inserts Through Surface Inspection

The use of premium indexable inserts is of major importance for all manufacturing companies that require high metal removal rates and high quality finishes. Therefore, as it is important that these manufacturing companies use inserts of high quality with accurate geometry, the methods used to provide quality assurance is of prime importance.

Optical Measurement of Angles and Radii in Contrast to Tactile Techniques

The improvements in inspection results performed by optical inspection are derived from the processes used in tactile measurements. Tactile measurement devices do not allow measurement of specific radii or angles due to the mechanical contact of the stylus to the surface to be analysed. Typically cutting edge radii vary between 10 μm and 100 μm . The smaller radii present difficulty for tactile systems as the stylus has the tendency to slip from the curve leading to inaccurate results. Also, errors can occur in angular measurement due to the influence of stylus radius friction between insert and stylus. Usually, angles and radii of the cutting edge are exactly defined before the insert is manufactured. Optical measurement allows accurate comparisons between the specified dimensions and the realities. One defines angles and radii directly on the optical colour image and results are yielded readily at hand. As the user is able to carry out 3D measurements directly on the viewable optical image, it is possible to improve the quality as well as measurement capabilities not normally associated with tactile measurement techniques.

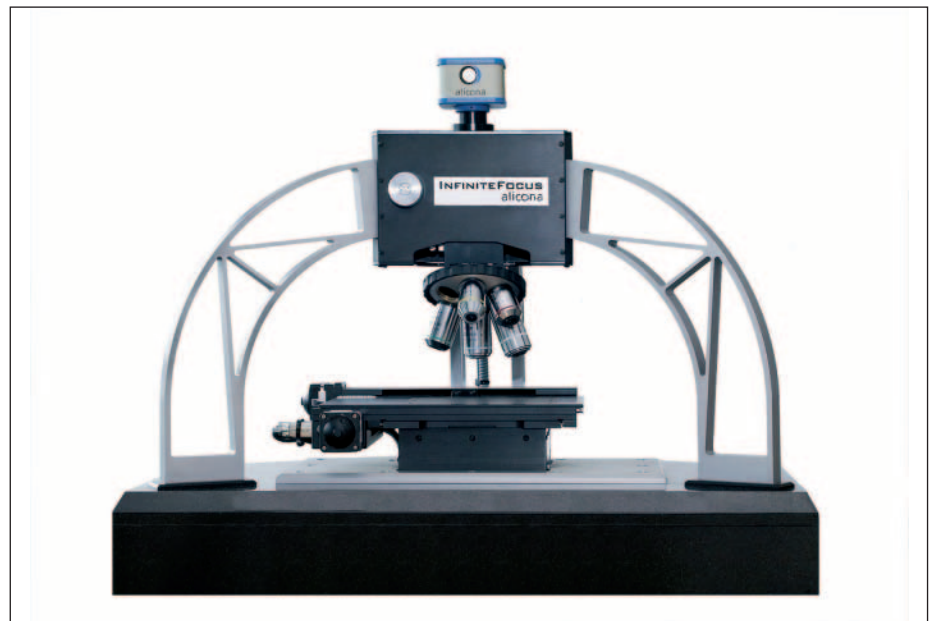


Fig.1: The 3D measurement device InfiniteFocus for optical measurement and inspection opens new capabilities for quality assurance. It allows 3D measurement directly on the optical colour image. The substitution of non contact optical inspection technology will remove the inaccuracies caused by tactile inspection methods improving quality, output and tool durability.

In addition, 3D visualisation of surfaces is provided. The 3D visualisation allows the characterisation of even large areas. This enables a surface to be imaged, and using the built in tools for differential height imaging, a user is able to observe roughness, height differences, scratches and surface contaminates. That provides an overview of the surface to establish if there are any defects that require further examination.

The viewing and measurement capabilities are also used in R&D, design and re-engineering. This provides benefits in ensuring that the accuracy required from the cutting tools is designed into the product development stage and carried

through to be identified in the finished product.

Optical Measurement and Inspection

Optical 3D measurement enables a user to perform highly accurate surface measurements. In addition to the depth information, a dense and robust 3D surface reconstruction is feasible. Unlike tactile measurement tools, the optical measurement technique provides meaningful, robust and highly accurate data from all surfaces whether they are flat, curved or angled. Varying sizes of objects can be viewed due to variable magnification. The X,Y,Z stage provides a movement

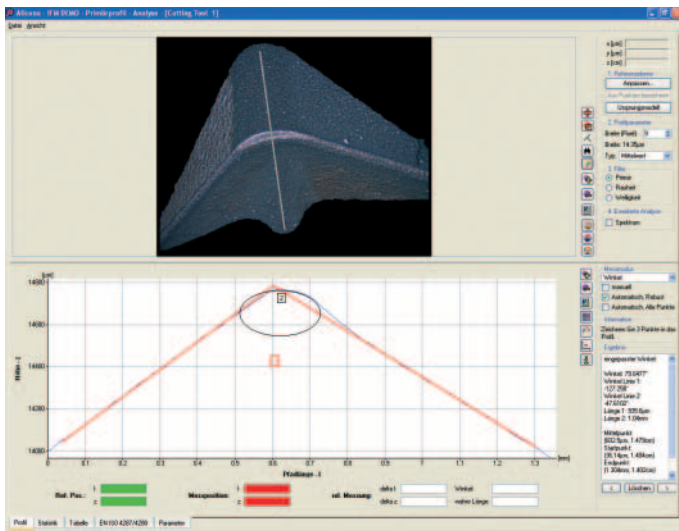


Fig.2: The 3D measurement device allows the optical measurement of angles and radii of cutting edges directly on the optical colour image. Additionally, it provides analysis capabilities such as profile, area, volumetric and roughness measurements. In contrast to tactile measurement techniques, results yield by optical inspection are highly accurate and reliable.

range of 120 mm x 53 mm at a maximum scan height of 70 mm. Results up to 20 nm in z are feasible. The colour focus sensor technology achieves 3D analysis measuring routines to be performed directly on the optical image allowing colour verification of height. The optical inspection technique offers comprehensive measurement capabilities such as profile, area and volumetric analysis. Roughness measurement can also be obtained according to EN ISO 4287/4288.

As far as its handling is concerned, InfiniteFocus is very user friendly. The user is able to extract, a profile on the optical 2D image and determine angles, radii and other values, e.g. lines, circles or polygons via a mouse click.

Traceability is provided with a PTB approved calibration tool, making it suitable for applications where such traceability is essential.

Summary

Cutting inserts for metal cutting made of tungsten carbide allow high-performance cutting. The outstanding hardness and wear resistance of the material assures high cutting speed, extended tool-life, and short machining time. As far as quality assurance of high-performance cutting inserts is concerned, optical measurement of surfaces can provide meaningful surface analysis since it removes inaccuracies caused by tactile inspection methods. With its optical measurement device, Alicona Imaging enables the highly accurate measure-

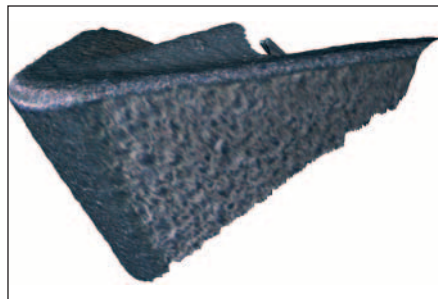


Fig.3: The 3D measurement device also provides robust and dense 3D visualisation capabilities of any solid and reflective surface. Examining the surface of a cutting edge in 3D makes it very easy to spot surface properties such as roughness, height steps, scratches or other contaminations.

ment of cutting edges' angles and radii. The user carries out 3D measurement directly on the optical colour image which significantly improves measurement results in contrast to tactile techniques. Measurements up to 20 nm z-resolution are achievable despite steep flanks and greatly varying surface reflection properties. Indexable inserts that are quality assured with optical inspection can be used with confidence in turning, milling and drilling operations, ensuring high quality and reproducible machining results.

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