Glass Grinding Tool - The ConoProbe Mark 10 Auto-Exposure

Executive Summary

Optimet's Mark 10 Sensor with auto-exposure was used in glass grinding tools measurement. The object inspected was a glass grinding wheel with small grooves. The main industrial inspection application is related to these grooves. Optimet's Mark 10 Sensor with auto-exposure enables surface measurements of surfaces with highly absorbent (dim black) parts as well as highly reflective (bright white) parts in one set-up. Measurements are performed at a high data rate of up to 9000 Hz and eye safe laser intensity (Class II). The sensor measures and characterizes in detail the grinding wheel grooves and it can be used for CAD comparison and measures both dry and wet surfaces with the same output results. The sensor measures various dimensions of the grooves: aperture (opening), depth, angle from both side-walls, side-walls radii, internal scratches in the groove and wall and surface roughness.

The groove features analyzed in the 4 grooves were:

- Groove center-to-center distance
- Angles between the grooves
- Radii for both walls of the groove
- Groove depth

1. Optimet's Advantages over Other Technologies:

1. **Collinearity –** laser output and measurement are performed on the same axis, enabling measurement inside holes, between bumps and inside small tunnels.
2. **Profile and 3D measurements** of complex geometrical objects.
3. **Auto-Exposure** functionality allowing measurements at high data rate of variable surface reflective properties such as white paint on a black surface in one set-up.
4. **High accuracy and repeatability** down to the micron level.
5. **True measurements rate** up to 9000 Hz with no averaging.
6. **Interchangeable lenses** from 25 mm to 150 mm focal length.
7. **OPS – Synchronize with 3 motion Axes –** the sensor's output measurements can be synchronized with 3 motion axes encoders.
8. **Multiple sensors -** capability to manage in parallel multiple sensors from one single host PC. This feature includes automatic IP recognition, allocation and multiple data stream management software.

2. Application Description

Grooves of a glass grinding wheel both in dry and wet conditions were measured.

2.1 Measurement Setup

The ConoProbe Mark 10 Auto-exposure is a non-contact point sensor with micron accuracy for 3D measurements and inspection of complex geometrical objects. The measurement set up is shown in fig.1.

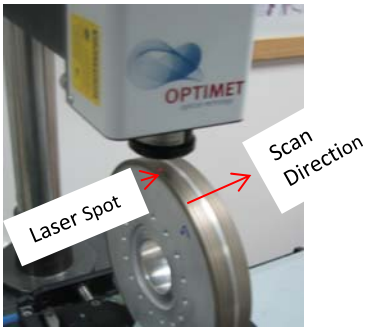


Figure 1-Measurement set up

2.2 Glass Grinding Wheel Measurements Characteristics/ Features

The sensor analyzed a group of 4 grooves out of 8 of the glass grinding wheel. The grooves K1-K4 as indicated in the drawing received (fig.2).

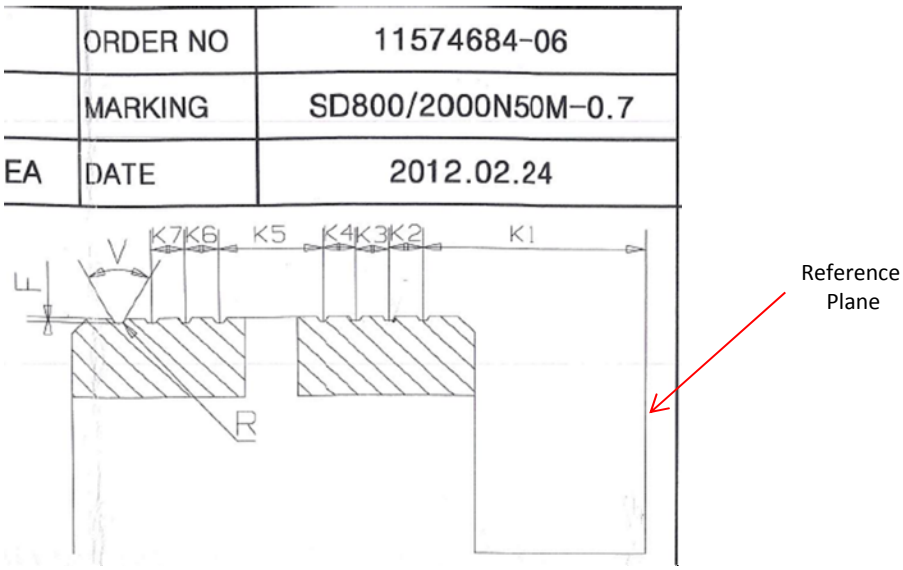


Figure 2-Drawing received from customer

3. Results and Observations

Grooves Angles and Distances

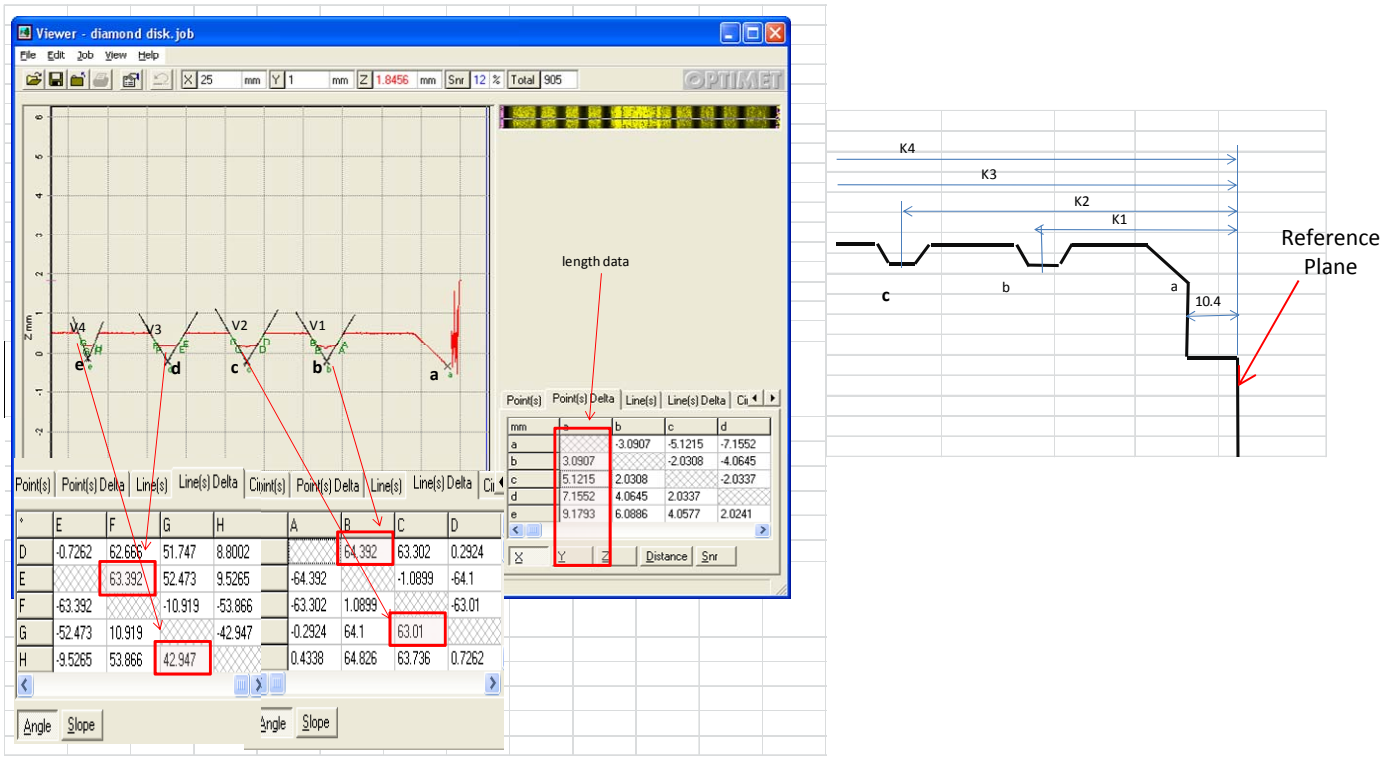


Figure 3- Distance between grooves and grooves' angles

Length (mm)		Drawing indicator	Measured from reference	Drawing Value	length difference
Ref	10.4				
ab	3.0907	k1	13.4907	13.5	-0.0093
ac	5.1215	k2	15.5215	15.5	0.0215
ad	7.155	k3	17.555	17.5	0.055
ae	9.1793	k4	19.5793	19.5	0.0793

Table 1- Distance between grooves' centers

Drawing indicators	Angle	Measured	Drawing value	Angle Difference
V1	AA-BB	64.392	65	-0.608
V2	CC-DD	63.01	65	-1.99
V3	EE-FF	63.392	65	-1.608
V4	GG-HH	42.947	40	2.947

Table 2- Total grooves' angles

The grooves' center to center distances (fig. 3 and table 1) have a deviation of up to 80 µm from the nominal one. In all groove angles measured (fig.3 and table 2), the total angles received are smaller by 1.6° than the nominal 65° and larger by 2.94° than the nominal 45° given in the drawing (fig.2).

Grooves Depths

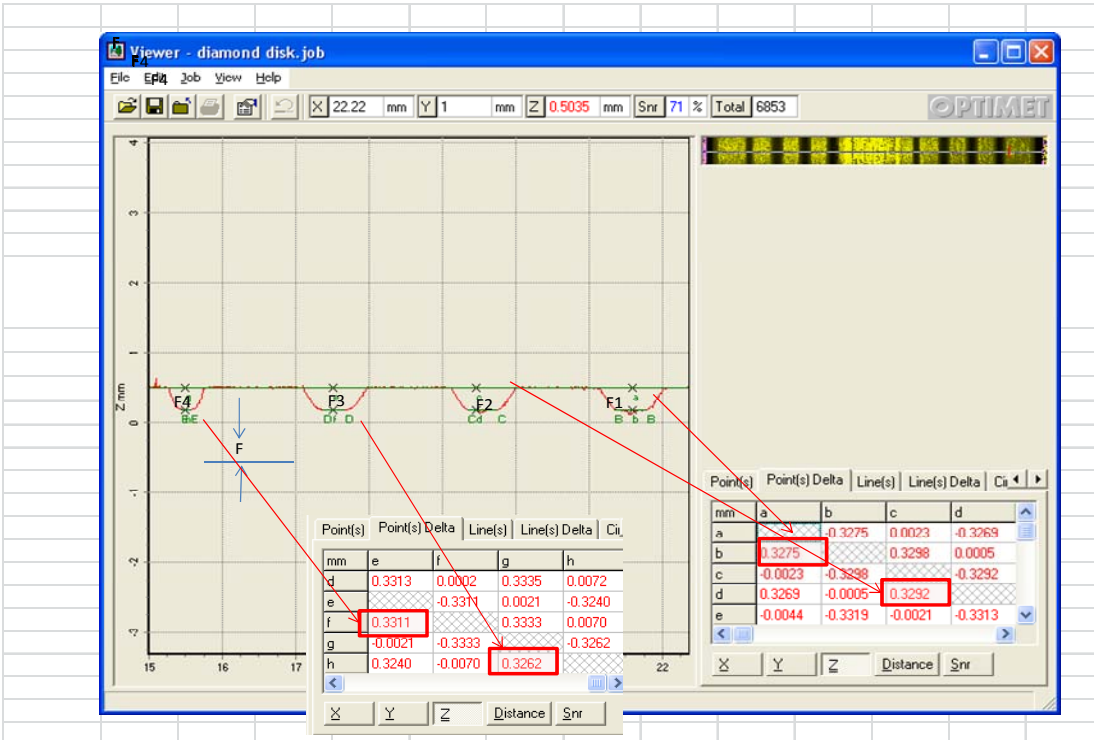


Figure 4- Groove depth measurements

Depth measurements (mm)	Groove Indicator	Depth measured	drawing nominal	Measurement Difference
	F1	0.3275	0.3	0.0275
	F2	0.3292	0.3	0.0292
	F3	0.3262	0.3	0.0262
	F4	0.3311	0.3	0.0311

Table 3- Groove depth measurements

The groove depths (fig.4 and table 3) measured are higher by up to 31 µm from the nominal values.

Groove Radii

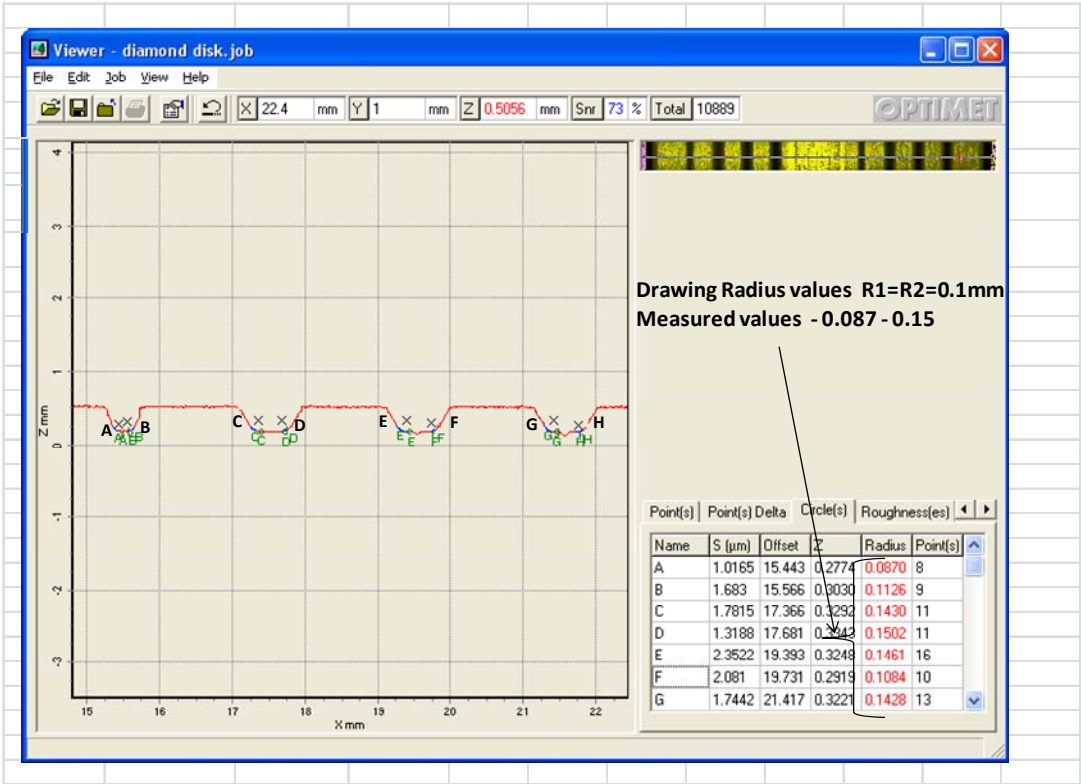
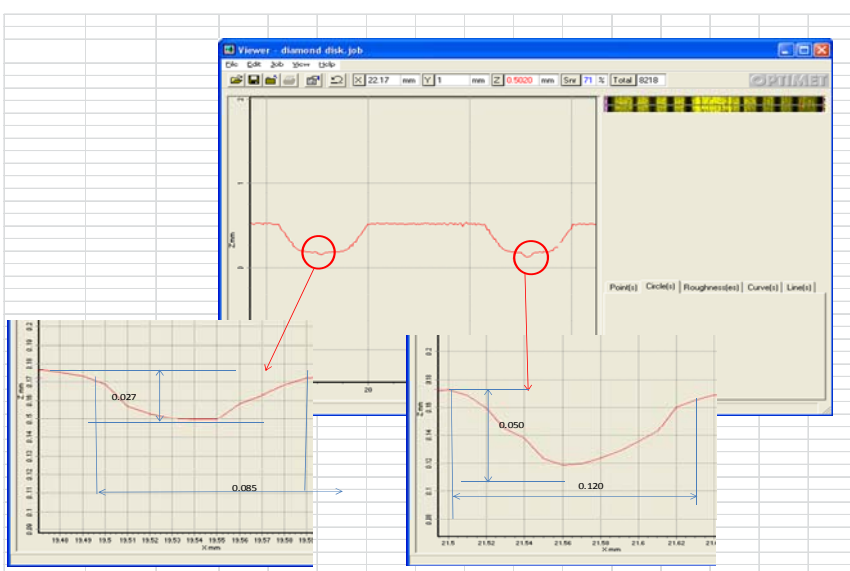


Figure 5- Radii measurements on both corners of the Grooves

The nominal radii for both walls of the grooves are given in the drawing (fig.2) as 0.1mm. The actual range (fig.5) is between 0.087 – 0.15mm.



The sensor is capable of measuring small grooves at the center of the grinding grooves; the scratches inside the groove can be noticed (fig.6).

Some of the grooves have an additional internal groove (fig.6) usually at its center with depth up to 50µm.

Figure 6- Grooves radii measurements-internal grooves

4. Data

Parameter	Value
Reflective/Diffusive/Transparent/Translucent	Reflective/Diffusive
Working Range (mm)	1.8-70
Precision (µm)	3-35
Stand Off (mm)	15-140
Max. Data Rate (KHz)	9
Lateral Resolution	10(µm)
Z Resolution	-
Application Category	-