

Glass Displacement Measurement

Executive Summary

Optimet's NanoConoProbe Mark 3.0 with a 100mm focal lens LS was used in the application of glass displacement measurement. The main industrial inspection application is related to the relative position of a glass plate with limited clearance at standoffs above 90mm from the sensor. The measurements were performed through a holed metal surface. Optimet's unique collinear / coaxial characteristic, in contrast to triangulation technologies, enables measurements via holes.

1. Optimet's Advantages Over Other Technologies:

1. Collinear and coaxial characteristics – permit measurement via holes.
2. Axis scans have similar performances due to circular sensor laser spot shape.
3. High sampling rate

2. Application Description

The test was performed using the NanoConoProbe at a standoff of 97mm from the glass sheet target. The NanoConoProbe measured the distance to the glass sheet front surface at 3000 Hz (fig. 1).

Glass height monitoring by the NanoConoprobe existing (top) and new (bottom) measurement system

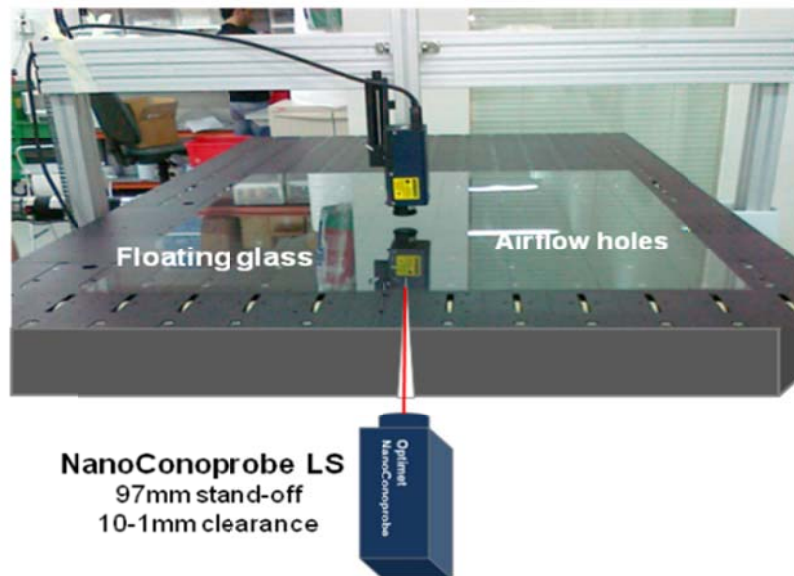


Figure 1-Application scheme

2.1 Method

The test performed (figs. 3-5) satisfies the requirements (see fig. 2):

1. The NanoConoProbe (Serial # 20125 SW ver.3.56 Mark3) is mounted on a PI stage.
2. A 60mm cone (composed of two parts representing 2 plates), which has a tapered hole with a changing diameter between 10mm to 1mm at its end, is placed between the sensor and the glass sheet.
3. The NanoConoProbe is moved (by the stage) in relation to the glass sheet along working range of 0.7mm and the distance measurements are compared with the nominal stage movement (high accuracy linear stage is used).

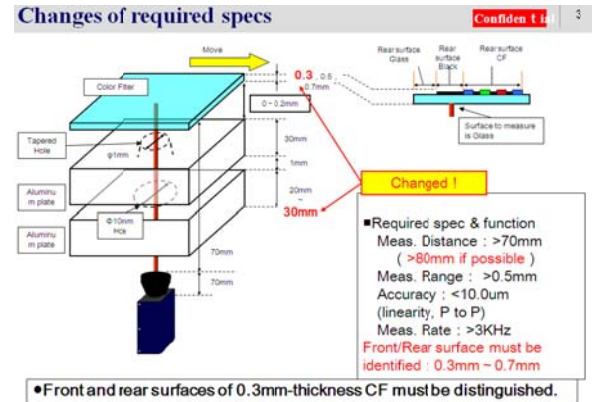


Figure 2 - Required specifications

Results show that the NanoConoProbe solution provides measurements within the requirements of <math><10\mu\text{m}</math> in the measurement environment and limitations defined.

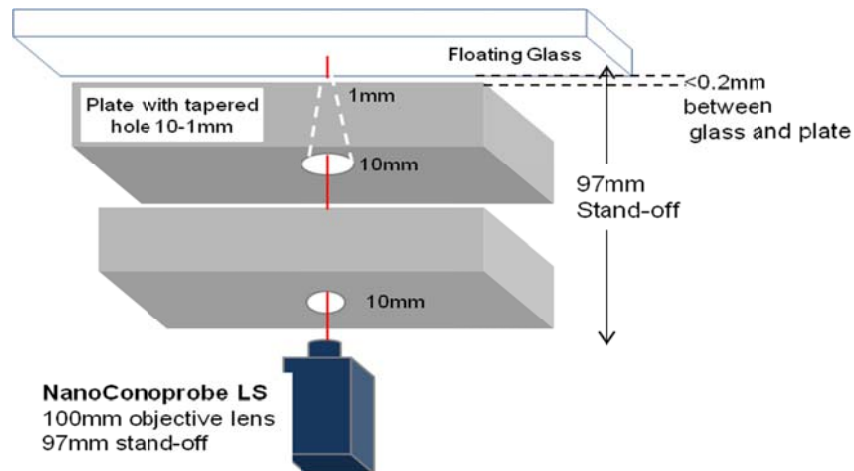


Figure 3 - Setup scheme

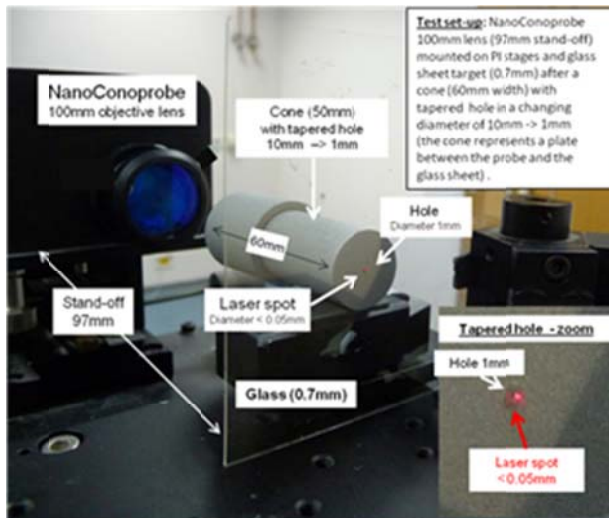


Figure 4 - Actual test setup – 0.7mm glass

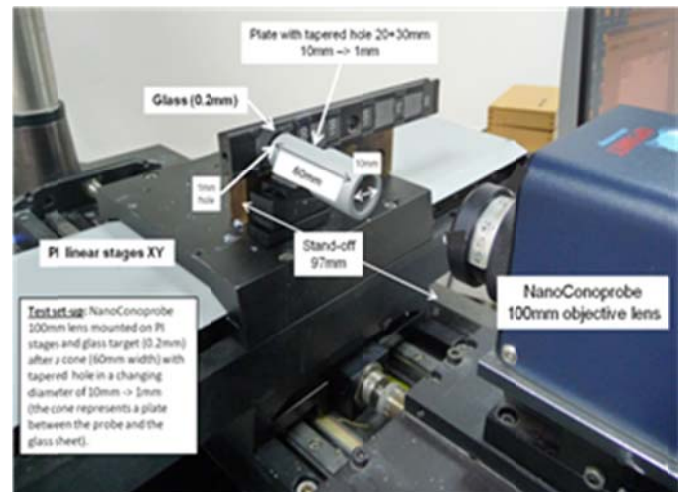


Figure 5 - Actual test setup – 0.2mm glass

3. Results and Observations

Test Results:

Working range (mm)	Glass thickness	Linearity 1 σ (μ m) Precision		Linearity (μ m) (peak to peak)		Requirements (μ m)
0.7mm	0.7mm	1.28	0.18%	6.40	0.92%	<10 μ m
	0.2mm	1.31	0.19%	6.55	0.93%	<10 μ m

Table 1-Test results

Notes (table 1):

- The results are based on three readings (average) in each position at a sample rate of 3000Hz.
- The accumulated distance deviation along the entire working range between the stage nominal motion and the sensor measurement is below 2.15 μ m.

Data analysis

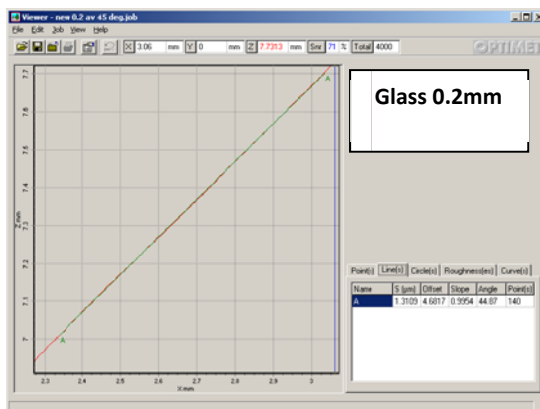


Figure 6-Linearity deviation along working range of 0.2 mm

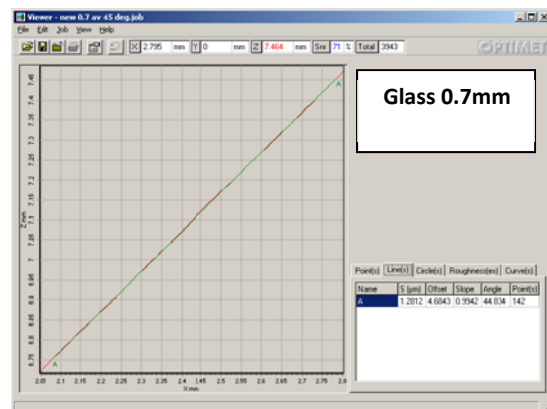


Figure 7- Linearity deviation along working range of 0.7 mm

GUI Sample

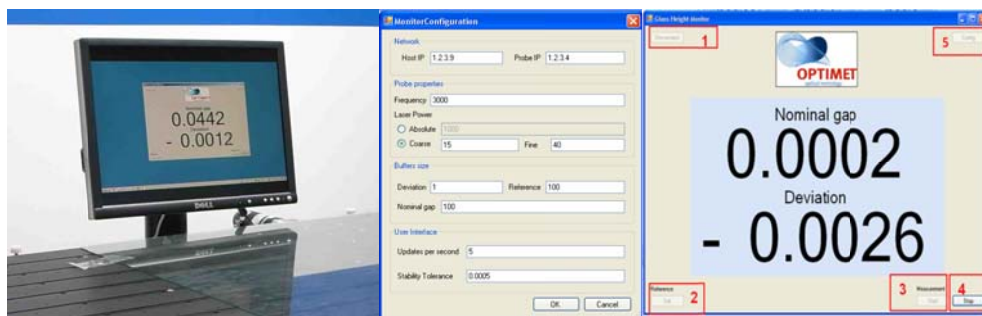


Figure 8- GUI software sample

Note (fig.8):

A GUI software sample for quick system set-up, display of displacement measurement and distance changes is available upon request.

4. Data:

Parameter	Value
Reflective/Diffusive/Transparent/Translucent	Transparent
Working Range (mm)	0.7
Precision (μm)	6.5
Stand Off (mm)	97
Max. Data Rate (KHz)	9
Lateral Resolution	-
Z Resolution	-
Application Category	-