NANOMEZ® RT-3500

Automatic Wafer Thickness & 3D Optical Profiler

WLI (Interferometer) and Non-contact Thickness Measurement

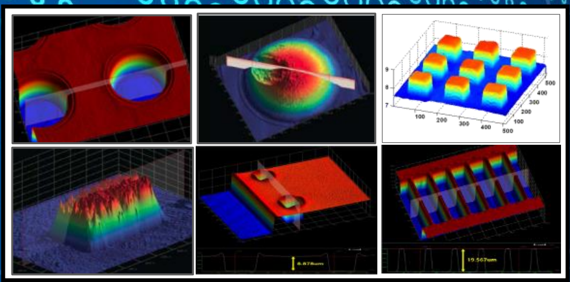
NANOMEZ® RT-3500 is a specially designed hybrid metrology system that can automatically measure wafer shape & sub-micro 3D structure and roughness in one measurement system. In particular, it uses multi-sensor technology of Confocal, Capacitance probes and IR transmission sensors to measure wafer thickness, warpage and bow as well as WLI (Interferometer) FOV sensor for nanoscale surface roughness measurement and 3D tomographic measurement. Its powerful combined multi-sensor technology allows users to proceed with one stop measurement for wafer in front-end of wafer packaging. Those combination with various contact and non-contact metrology tools make it easy for engineers to conduct micro or nano-level of surface analysis and measurement.

Thickness & Warpage

- Thickness, TTV
- Bow & Warpage
- Bare Si, Patterned, Framed and Bump wafers and Bump wafers on tapes
- Edge chip and edge crack (Optional)
- Si, Ge, GaAs, InP, Glass, Solar cell, FPD
- Capable to measure wafer thicknss with the tapes (clear, opaque, milky)
- Ultra Thin Wafer Measurement ability up to 20㎛ wafer or thicker
- Thin film thickness option

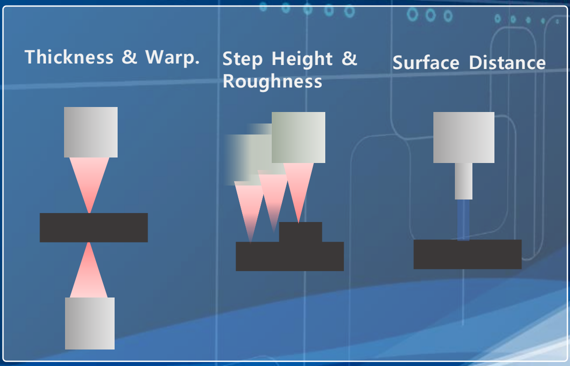
Roughness & 3D Topography

- Roughness Measurement by FOV Sensor
- Surface 3D profilometer
- Height Resolution, 0.1nm Max
- The same resolution for different object lenses
- High speed, High accuracy, High resolution surface 3D topography measurement
- Excellent measurement performance for the transparent/ semi-transparent/ milky colored samples
- High accuracy of repeatability, accuracy and reproductivity
- Height, Step height, Depth, Line, Circle, Round, Angle, Width, Distance Measurement
- Roughness of line, FOV, measurement of waveform
- Scratch, abrasion and defects analysis
- Area, volume measurement



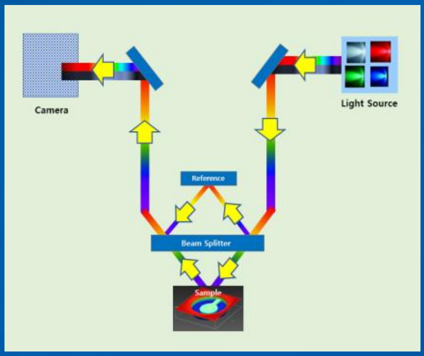
System Features

- Non-contact, High accuracy of measurement
- Automatic mapping measurement with pre-programmed recipes
- One metrology system of multi-purpose & multi-sensors
- Intuitive user interface of simple & easy, one click measurement program
- 2D, 3D display for measurement results
- Versatile measurement capability for difficult materials (Mirror, irregular reflection, rough surface)
- Sub-micron accuracy and repeatability (< ±1㎛)
- Higher UPH by magnet linear motor stages
- Ultra thin wafer measurement up to less 20㎛ thickness of wafer and thicker



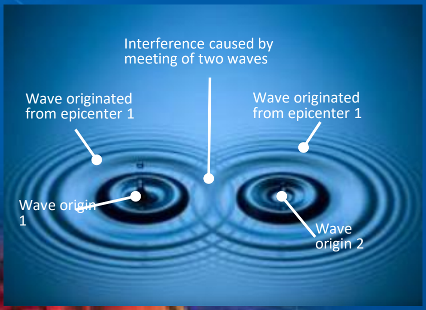
RT3500 System Specification		
1	Main Operation Program Function	Program one-click auto start / Button box (option)
		Recipe programming, infinite recipe creation
		Measuring points set-up on wafer Image
		Automatic measurement with pre-programmed recipe
		Wafer ID, Lot#, User name and other category DB
		Measured data Display, Saved & Export in CSV
		Capable to call saved data in specified folder (File name of LOT NO.)
2	Wafer Size	Small piece, 4", 6", 8", 12" wafer (custom design available)
3	Wafer Chuck	Steel Vacuum chuck with sensor holes & ESD coating
4	Wafer Handling	Manual loading on motorized XY stage
5	XYZ Stage & work table	350 x 350 mm Servo linear XY stage / 65mm Z-axis/ Multi-point sensor hole work table
6	Stage Accuracy	± 10㎛ / 5㎛ / 1㎛ / 0.1㎛
7	Anti Vibration Support	Passive anti-vibration table (Active option)
8	HW System Frame	Steel & Granite frame
9	Operation Program	Windows 7 based KOVIS metrology studio, Nanomez V.3.5
10	PC	Industrial PC, minimum 2.2GHh Intel i7, 32GB Memory, 256GSSD
11	Accessories	21" single monitor, keyboard, mouse and holder arm
12	System Size	860W x 1230D x 1350H mm (System size changeable)
13	Weight	350Kg or more
14	Electrical	220 volts single phase at 4.9 KVA (peak), 50/60 Hz
15	Vacuum	0.5Mpa
16	Exhaust	One 10.16cm (4 in.) diameter port on the floor adjacent to the instrument
17	Environmental	Operating Temp : +18 to +24°C
Metrology 1. Wafer Thickness & Warpage Measurement Module (WT3500)		
1	Capability of WT3500	Automatic Wafer Thickness (TTV) measurement
2	Optional Function	Warpage/ Bow measurement ☐
		Bump Height I Strip Thickness I Die Height (Manual ☐ Auto☐)
		Edge Chip and Crack ☐
3	Measurable Materials	• Bare wafer (Pattern, Si, Ge, GaAs, InP, Sapphire), Glass, Solar cell, FPD ☐
		• Wafer on tape(ring framed) ☐ Bump wafers ☐ Strip, PCB ☐
5	Metrology Sensors (option)	CCP Capacitance sensor
		CLS Confocal sensor
		Vision A/F height measurement
		CIR Transmittance sensor
		CAS High precision micro air touch sensor
7	Measuring Range	10㎛ ~ 790㎛ thickness (Max. 1,500㎛ including tape thickness)
8	Measurement Resolution	0.01㎛
9	Measurement Accuracy	± 0.5㎛
10	Repeatability	± 0.25㎛
11	TTV (Total Thickness Variation)	TTV (Total Thickness Variation)
12	Optional (Bump Height)	Bump sizes : 50~500㎛
		Measurement method : Manual by vision auto-focus
13	Calibration Method(Baseline)	Silicon master piece, Si Certification from authorities
14	Auto-map Point (Thickness)	89 points for 12” and 37 points for 8” wafers
15	Software	RT-3500 main program
Metrology 2. 3D Profilometry Module (WL3500)		
1	Capability of WL3500	Nano~Micro 3D profilometry
2	Vertical Resolution	VSI, VEI < 0.5nm, VPI < 0.1nm
3	Lateral Resolution	0.05~7.2µm (Depends on magnification)
4	Height Repeatability	≤0.1% @ 1σ (Standard Height)
5	Objective Lens	5 Seletable (Automatic)
6	Zoom Lens	2 Selectable (Automatic)
7	Camera Format	1/2" Mono CCD (option: 1/3" or 2/3")
8	Scan Method	Piezo @ Capacitive Sensor Closed loop (Linearity error ≤ 0.05%)
9	Scan Range	≤150µm (option≤300µm@Piezo or 10mm@Motor)
10	Scan Speed	7.5µm/sec(1x) / 22.5µm/sec(3x)
11	Illumination	White LED
12	Filter	2 or 3 Filter (Automatic)
13	Z Axis Stroke	50/ 100mm (Automatic)
14	Tilt Aixs Stroke	±2° / 3° / 6° (Manual)
15	Max Workpiece Load	≤ 10kg
16	Auto Focus	Optional
17	Stitching	Yes
18	Software	Surface View / Surface Map @ window 10 64bit

• WLI (White Light Interferometer)



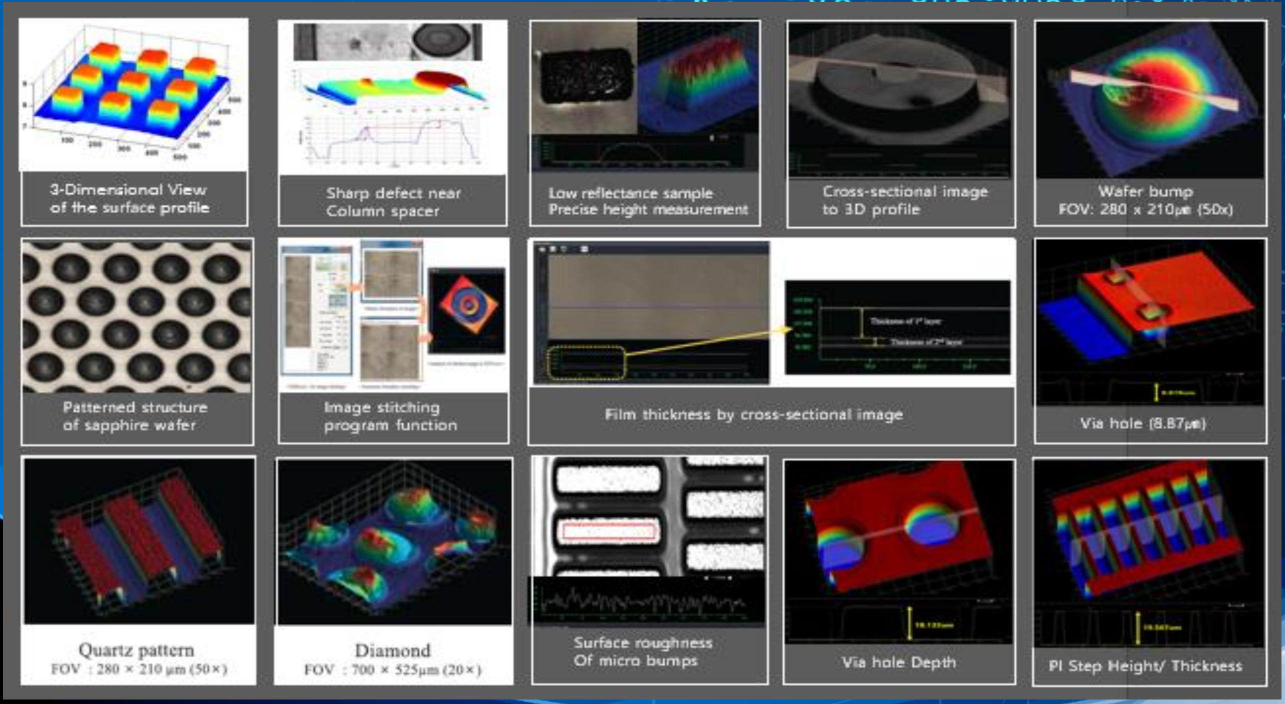
White Light Interferometry is a non-contact optical method for surface height measurement on 3-D structures with surface profiles varying between tens of nanometers and a few centimeters. It is often used as an alternative name for coherence scanning interferometry in the context of areal surface topography instrumentation that relies on spectrally-broadband, visible-wavelength light (white light).

WLI (WSI) measures the height within the scan range by continuously scanning the area using multiple interference signals. The interference signal means that the light originating from a certain reference point can be combined after moving different optical paths. When the physical phenomenon due to the optical path difference between two lights is expressed in the light and dark form of the light is called an interference signal. For example, suppose you threw two stones on a calm lake shore as shown in the figure on the right. Waves spread around the epicenter and become stronger or weaker as two waves overlap each other. (Pulse property of light) at this time, interference pattern occurs. Using the above principle, generate interference as shown in the figure below and use it as WSI measurement method.



NANOMEZ-3D Optical Profiler instruments enable precise, quantitative, ISO-compliant, non-contact surface measurement and characterization of micro- and nano-scale surface features, capturing up to two million data points in just seconds. Choosing the right optical profiler system depends on your application's requirements, including speed, precision, vertical range, automation, and flexibility.

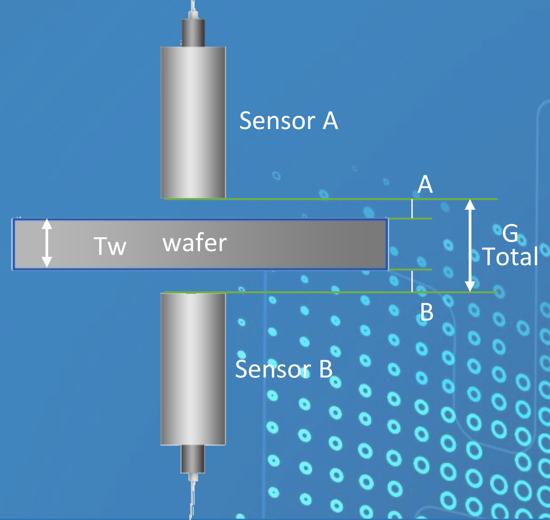
- 3D surface profiling
- Roughness
- Step heights
- Dimensional analysis
- Surface 3D texture
- Flatness or curvature measurement
- Stress measurement
- Particle measurement



• Total Thickness Variation (TTV)_ASTM F657

Among the methods of analyzing the shape of a semiconductor wafer, the easiest method for evaluating the overall thickness deviation of a wafer is to determine the difference between the maximum value (T.max) and the minimum value (T.min) among the measured thickness information of 9 points or more as TTV and the thickness deviation of the wafer It is. TTV is expressed in microns or millimeters (thousandths of an inch).

The following figure is a method of measuring the thickness of a wafer placed between two upper and lower non-contact displacement measurement sensors. First, the measuring equipment is calibrated with a wafer thickness jig (Tw) of which thickness value is known. And measurement instruments calculate the thickness of the wafer at that point by using read distance values of top and bottom sensors.
If the distance A from the upper sensor A to the wafer surface and the distance from the lower sensor B to the bottom of the wafer are B and the thickness jig is Tw,



In upper Sensor A, the total distance between lower Sensor B is calculated as:

$$G.Total = A + B + Tw$$

The thickness of the wafer to be measured by a simple equation calculation can be calculated as follows.

$$Tw = G.Total - (A + B)$$

Measure the wafer thickness in the same way as above, and when the measurement is completed, TTV calculates by subtracting the minimum thickness (T.min) from the maximum thickness (T.max) as follows.

$$TTV = T.max - T.min$$

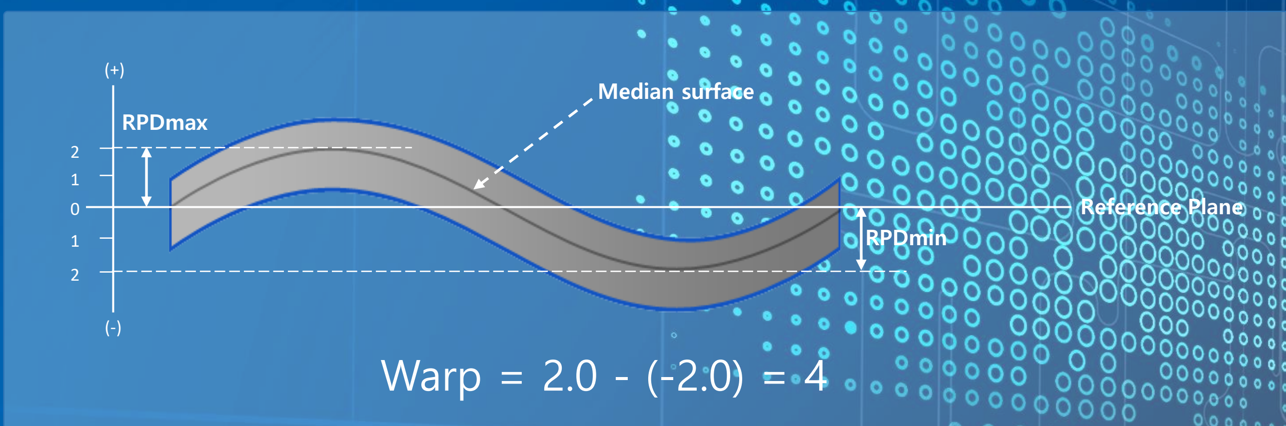
• Warpage _ ASTM F1390

Warpage (Warp) is an efficient measurement method to measure and express the external structure and shape of wafer such as twisting and warpage of semiconductor wafers.

Like the Bow value measurement, Warp is measured by summing the difference between the three-point virtual center reference plane of the wafer and the maximum and minimum height values of the measured wafer.
Warp uses the entire center plane of the wafer instead of the center point, and by observing the entire wafer, Warp can more effectively represent the actual wafer geometry.

Calculate the Warp value by finding the maximum deviation (RPDmax) in the plane and the minimum derivative (RPDmin) in the plane.
RPDmax is defined as the maximum distance above the plane and is positive, and RPDmin is the largest distance below the plane and negative.

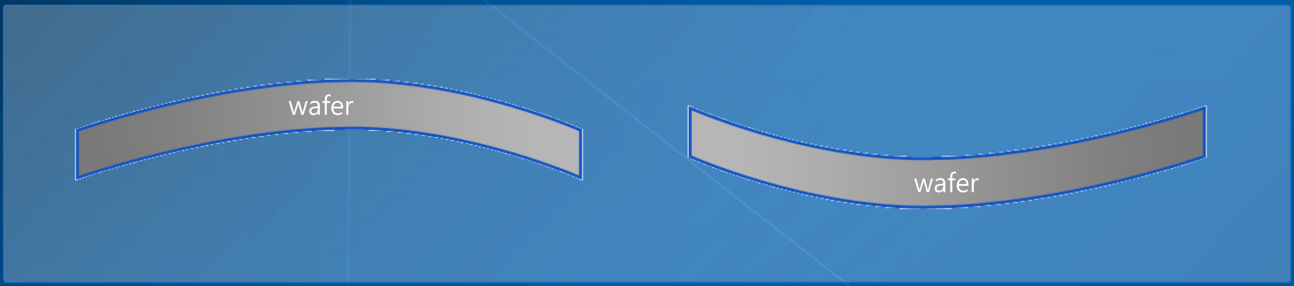
The figure below shows the Warp calculation. In this example, RPDmax is 2.0 and is represented by the maximum distance of the center surface above the reference plane, RPDmin is -2.0 and is represented by the maximum distance of the center surface below the reference plane. Warp is always a positive value.



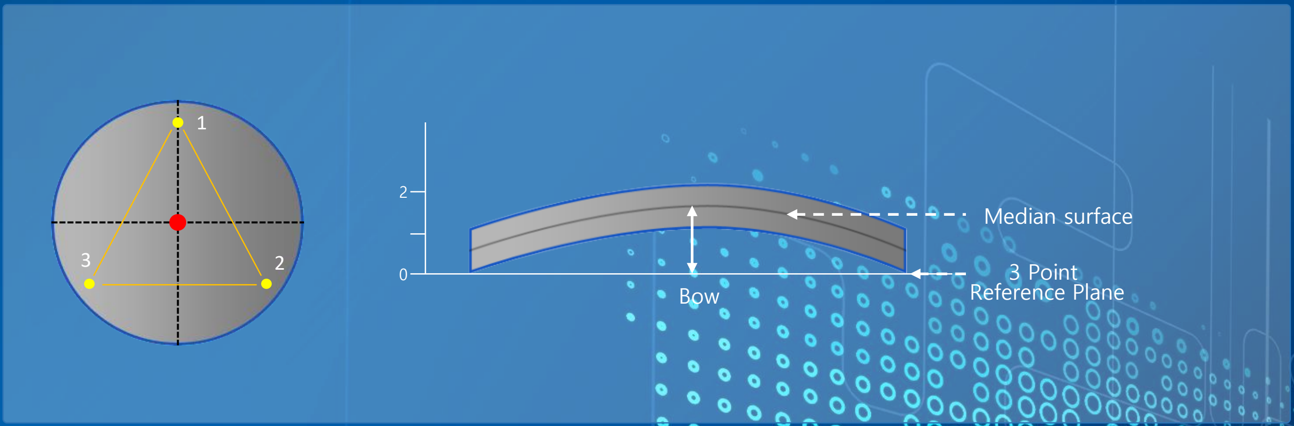
This calculation shows that it is useful to read both Bow and Warp.
Since the center surface of the wafer above intersects the reference plane at the wafer center, the Bow measurement is zero. In this case, the calculated warp value informs the user that there is a shape irregularity on the wafer, and therefore, it becomes more stereoscopic and useful wafer warpage expression information.

• Bow – ASTM F534

In order to analyze the shape of the semiconductor wafer, the bow value is displayed as a positive or negative value.



Bow is measured at the center point of the center surface of the wafer and the imaginary plane connecting the three points at the same distance around the edge of the wafer is extracted and the height from the virtual reference plane to the center of the median surface is measured Bow value.



Bow values can be positive or negative.
Positive numbers indicate that the center point of the wafer center surface is above the three-point virtual reference plane, Negative (-) indicates that the center point of the wafer center surface is below the three-point virtual reference plane.