Wafer Geometry Topography Measurement System

WT Series

High-precision measurement?

Made easy with Raphael.

Raphael Optech specializes in the R&D and production of optical 3D measurement and imaging systems.

National high-tech enterprise, Jiangsu Province Innovative Talent Enterprise, with over forty invention patents and software copyrights.

Dedicated to providing precision "eyes" for advanced manufacturing, offering comprehensive 3D measurement solutions from R&D to production and quality control.

Wafer Geometry Topography Measurement System

Equipped with measurement functions for wafer bow, thickness, micro-topography, film thickness, and other geometric parameters, it is widely used in semiconductor substrate manufacturing, wafer production, chip packaging process control, wafer thickness sorting, glass substrates, display panels, MEMS devices, and other manufacturing processes. Modularly integrated functions for wafer bow, thickness, layer thickness, roughness, film thickness, etc., allow a single measurement system to complete measurements of THK, TTV, LTV, BOW, WARP, roughness Sa/Ra, layer thickness, and film thickness.

Measurement Advantages

- Multiple configurable measurement modes: 5-point, 49-point, star line, pulse line
- Strong measurement adaptability: rough surfaces, polished surfaces, patterned surfaces
- Comprehensive measurement functions meet wafer geometry measurement needs at various semiconductor manufacturing stages
- Single probe and dual probe thickness measurement
- Full-aperture bow measurement and film stress measurement
- Surface roughness / micro-topography
- Nanoscale film thickness measurement
- 2D/3D Mapping of measurement results
- Detailed data export and record management functions

Applicable Objects

4" - 12" silicon, SiC, glass, GaAs, sapphire and other wafer substrates; bonded wafers; wafers with film layers

Application Fields

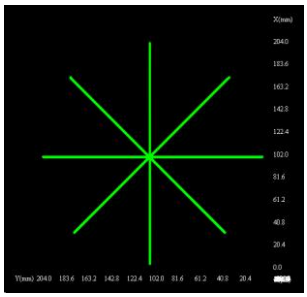
- Production and quality inspection of semiconductor and glass wafers
- Process control and failure analysis of semiconductor manufacturing and packaging thinning processes

Measurement Principles

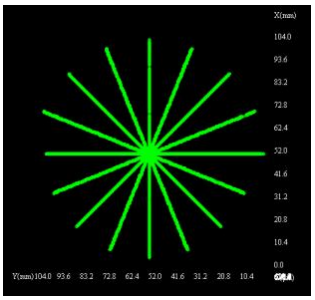
- High-precision spectral confocal displacement sensor combined with compensation algorithm for high-precision wafer thickness and profile measurement.
- Multiple pre-set scanning paths and interpolation fitting algorithms for fast thickness difference and bow distribution measurement and parameter calculation.
- Thickness and film thickness measurement based on spectral interference principle: Broadband light reflects from both surfaces of the wafer and film layers, causing interference. FFT and fitting of the spectral interference signal calculate the thickness between the two surfaces.
- White light interferometry 3D microscopy principle: Uses a white light source, combining incoherent light interference and high-resolution microscopy to reconstruct micro-3D profiles with vertical measurement resolution down to sub-nanometer.

Measurement Examples

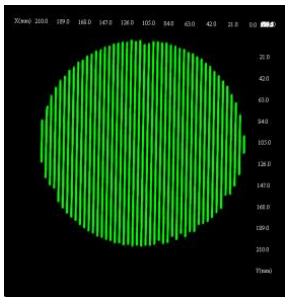
Mode–Line scan



Star line scan(4lines)

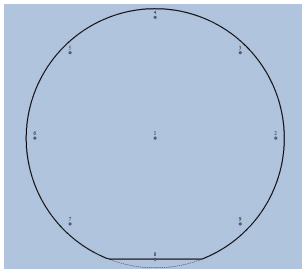


star line scan（ 8lines ）

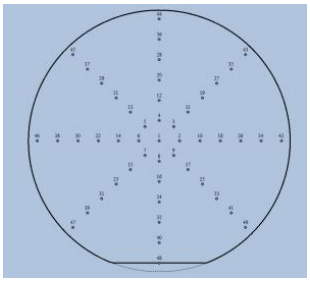


Pulse line scan（ 47lines ）

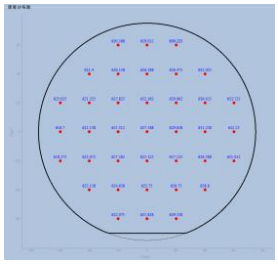
Mode–Custom point scan



8–point distributed

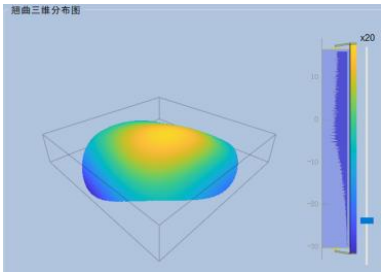


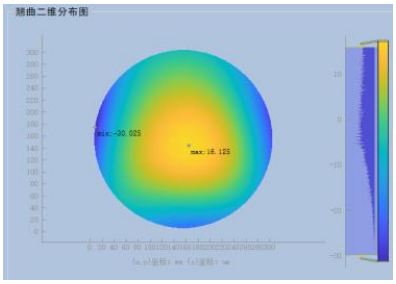
49–point distributed

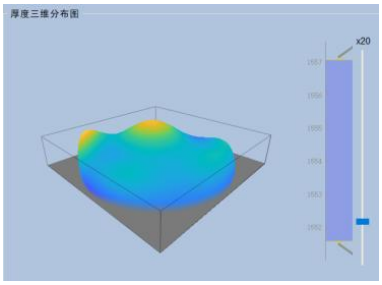


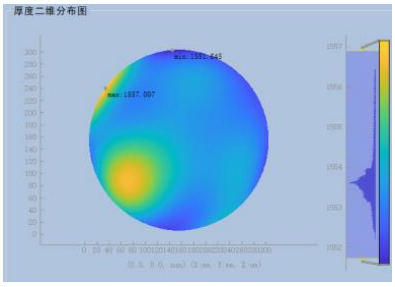
37–point grid

12–inch bonded silicon wafer geometry parameter measurement



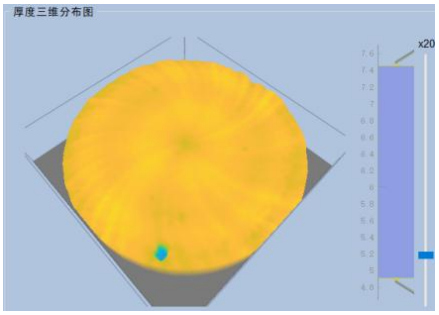


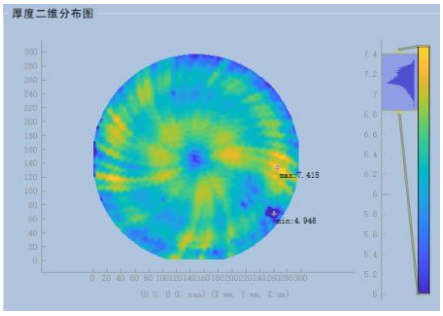




Parameter	Value	Unit
3pt Bow	25.104	μm
Warp	48.223	μm
bf Bow	15.805	μm
Sori	46.813	μm
THK	1553.826	μm
TTV	5.361	μm
LTV	1.818	μm
LTIR	0.132	μm

Bonded wafer thinning thickness measurement





Parameter	Value	Unit
THK	7.148	μm
TTV	2.473	μm
LTV	2.082	μm

WT Series Technical Specifications

Parameter		WT Standard	WT Pro	WT Ultra
Applicable Process Stages		Wire Cutting, Rough Grinding, Fine Grinding, Polishing, Epitaxy, Photolithography, Packaging	Double-Sided Polishing, Bonding, Packaging	Wire Cutting, Rough Grinding, Fine Grinding, Double-Sided Polishing, Epitaxy, Photolithography, Bonding, Packaging, Wafer Sorting
Sensor Type & Quantity		Sensor Type & Quantity	High-Precision Infrared Interferometry (1)	High-Precision Spectral Confocal (2)High-Precision Infrared Interferometry (1)
Output Parameters		TTV、LTV、Bow、Warp、Thickness	TTV、LTV、Bow、Warp、Thickness	TTV、LTV、Bow、Warp、Thickness
Wafer Chuck		Anti-Static Flat Support, Anti-Static 3-Point Support (Optional)	Anti-Static Flat Support (Optional)	Anti-Static Flat Support, Anti-Static 3-Point Support (Optional)
Scanning Mode		Pulsed Line & Area Scan, Star Pattern Scan, Programmable Multi-Point Scan	Pulsed Line & Area Scan, Programmable Multi-Point Scan	Pulsed Line & Area Scan, Star Pattern Scan, Programmable Multi-Point Scan
Thickness	Range	5-2500 μm	8-1500 μm	5 μm-2500 μm
	TTV Accuracy	0.5 μm 或 1.5%	0.1 μm 或 1%	0.1 μm 或 1%
	TTVRepeatability	0.2 μm 或 1%	0.05 μm 或 0.5%	0.05 μm 或 0.5%
	Time	Typical Time 90s（@12inch）		
Warpage	Range	1-2000 μm		
	Accuracy	1 μm 或 1.5%		
	Repeatability	0.5 μm 或 1%		
	Time	Typical Time:90s（@12inch）		
Measurable Wafer Sizes		4"、6"、8"、12"		
XYZ Stage Travel		350mm/350mm/50mm	350mm/350mm/50mm	550mm/350mm/50mm
Motion Stage Accuracy		0.1 μm/0.1 μm/0.1 μm		
Dimensions (L × W × H)		1370x1370x1835mm	1370x1370x1835mm	1520x1370x1835mm
Total Weight		800kg	800kg	1500kg
Vibration Isolation Base		High-Stability Vibration Isolation Base		
Optional Modules				
White Light Interferometry 3D Microscopy Module				
Measurement Functions & Output Parameters		Surface Roughness (Sa / Ra), 3D Micro-Morphology (Step Height, Groove Depth, Coplanarity), 2D Dimensions		
Measurement Modes		PSI / VSI / Brightfield Imaging Mode		
Image Sensor		1600(H) × 1100(V)	Measurable Sample Reflectivity	0.1%-100%
Brightfield Objectives		5×，10×，50×，100×	Interferometric Objective	20×（Magnification Optional）
Single Measurement Field of View (20× Objective)		500*350 μm（Auto-Stitching Supported）	Roughness Vertical Repeatability	0.01nm（PSI mode）
Step Height Indication Error		≤0.75%	Lateral Resolution @550 nm	0.69 μm (20× Interferometric Objective)
Nanoscale Film Thickness Measurement Module				
Measurable Films		Dielectric Films such as SiO_2 , Al_2O_3 , Si_3N_4		
Spectral Wavelength Range		200-1700nm	Light Source	Halogen Lamp
Measurement Range		4nm-120 μm	Accuracy& Repeatability	1nm

Raphael Optech's Wafer Geometry Topography Measurement System integrates wafer THK, TTV, LTV, BOW, WARP, roughness Sa/Ra, dielectric film thickness and other analyses into every measurement, ensuring our customers can quickly confirm wafer geometric status.