Precision Wireless Metrology Applications for Improved Productivity and Process Control

CyberOptics Semiconductor, Inc.
“innovating measurement technology”
WaferSense™ Product Overview

- Wireless, Waferlike, battery powered form-factor with bluetooth communication
- Real-Time data reporting
- Real-Time Adjustments with Direct Feedback
- Ability to Record, Store and Trend Data over Time
  - Compare Tools, Chambers and Technicians
  - Correlate Process Results Tool to Tool
- Vacuum Compatible
- Inclination measurement, robot alignment, chamber gap measurement and vibration measurement systems
WaferSense™ ALS2- Inclination Measurement System

- Horizontal capability ±7.0° (±0.03° accuracy)
- Vertical capability ±50° (±0.05° accuracy)
- Wafer-like form factor and wireless communication ensure access to all stations
- Measurement data is logged for reference to CSV file
- Absolute and relative plane measurement
ALS2 Value Propositions - Foup and Cassette Validation

- X axis is shown as BLUE line and Y axis is shown as PINK line. Y axis is inclined 0.5 degrees to rear at 18th slot.

18th Slot is inclined for 0.5 degrees from 3rd slot.
In Tool Inclination Checks

Detects the slightest excursion in pitch and roll

- **Accurate to ±0.03°**

Easily levels end effectors, lift pins and hot plates to assure smooth wafer transfers and consistent process results.
End Effector and Lift Pin Leveling

- ALS was transferred from End Effector Retracted, Stretched, Xfr to Lift Pins and Cool Plate
- Arm/end effector was pitched and rolled 0.1 and 0.2 degrees. Lift pin set is 0.1 degree pitched. Cool Plate is level
Vertical Furnace Leveling

Too High and Critical

Quartz Boat

Parallel?

5 Wafer End Effector

Parallel?
**WaferSense™ ATS - Robot Teaching/Alignment/Positioning System**

- Vision based target acquisition system
- On Board Camera w/Illumination & DSP
- Align automation handoffs
- Data can be logged to CSV file

- Center wafer placement - spin cups, hot/chill plates, diffusion boats, Deposition and Etch Chambers
Automatic Teaching System (ATS)

Wafer-like, wireless hardware

Intuitive software

Image of Target Feature acquired by ATS camera
ATS Innovative Principle of Operation

- Real-Time Video
ATS Theory of Operation

Measured Offset

Camera Axis

Pedestal Center Line

Target Acquisition Volume

Target Feature

Transfer Pins

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ATS Value Propositions

• **ATS does not require equipment dismantling or chamber breaking.**

• **ATS can access stations through automation and can be used by one technician.**

• **ATS collects/records objective data for consistent process setup and makes it available for statistical analysis and recording.**
WaferSense™ AVS: Wireless Vibration Measurements

- Wireless, non-contact, wafer-like device for measuring vibrations of wafer transfers in x, y and z axis
- Troubleshoot tool and robot issues
- Repeatable and Objective vibration and acceleration data can be Compared tool to tool
- Automatic handling, speeds setups & troubleshooting
WaferSense™ AVS- Overview

• Baseline performance can be recorded and periodically monitored for changes.

• Engineers can see the effect of adjustments in real time, speeding equipment alignment and setup, and motion parameters can be optimized.

• Vibration data can be compared not only to past readings but from one tool to another to reduce maintenance and cycle time.
AVS: Wireless Vibration System - Specs

- 3 axis measurement
- Dual SW applications for real time recording of events and replay/comparison of events
- Standard wafer sizes of 200 and 300 mm
- Freq Response: up to 200 Hz
- 1kHz Sample Rate
- Range ±2 G
- Amplitude Resolution: ±0.01 G
- Height 6.3 mm
- Weight: 300mm <200g, 200mm <150g, 450mm ~450g
- Operational use of more than 4 hours on a single charge
- Temperature spec: 20 - 70°C continuous; Able to withstand temperatures of 120°C for up to 5 minutes in air, not in contact with heat source
**VibeView™ Event recording SW**

- Real time display of time domain and frequency domain (FFT) data and recording capable software with selectable scale factor, Go/No Go, event marking, recording length.
VibeReview™ Event replay and comparison SW

- VibeReview™ allows you to display recorded event data and can compare multiple files.
AVS Value Propositions

- Troubleshoot and predict robot and transfer equipment failures before they happen
- Identify Wafer Scraping or Dragging that Impact Yields due to Particle Generation
- Verify acceptable conditions that exist on tools
WaferSense™ AGS - Precision Wireless Gap Measurement

- Wireless, non-contact, wafer-like device for measuring critical gaps in Deposition & Etch tools
- Reduce tool calibration time with live feedback
- Objective & reproducible adjustments for better process uniformity
- Automatic handling, speeds setups, maintenance & troubleshooting
AGS Operation- Three capacitance sensors for measurement and parallelism
How Does AGS Work?

• Three points define a plane
• Three equal gaps means surfaces are parallel
GapView™ SW Features

Current gap measurements

Your gap tolerance

Offset display
AGS Value Propositions

- Reliable and accurate
- Recordable
- Non-contact, hands free capability
- Time savings
- Potential for better process uniformity