

Manufacturing microchips is a complicated process demanding precision and accuracy. Applied Materials sought to improve their yields, save fab time and expense.

With wafer production being prone to all kinds of errors in the manufacturing process itself, they needed to find a solution to help with misalignment, cross contamination, and particle generation.

Achieving better uniformity is their goal. And solving for the hidden defect status' is critical to improving rate and yields.

## Challenges

Applied Materials experienced several challenges in their journey.

- The need to reduce misalignment, cross contamination, and particle generation.
- To achieve better uniformity.
- Reduce high cost and time in the venting of the chamber lid.
- Prevent poor leveling causing a wafer to be hooked on the edge with ceramic parts, or vibrate during lifter pins movement causing position shift inside the chamber.
- Reduce step up issues causing non-uniformity of temperature.
- Better assessments of robot qualification.

## The Solution

After thorough research and competitive analysis, Applied Materials discovered CyberOptics' WaferSense™ Auto Multi-Sensor AMS and Auto Vibration System AVS, as well as the RecticleSense™ Auto Leveling Systems, would solve their production problems.



### WaferSense® Auto Multi-Sensor™ AMS

Speeds setting the right inclination by measuring pitch, roll, rise overrun and vertical inclinations.

Quickly and accurately enables setting the same level across the tools for better process uniformity.



### WaferSense™ Auto Vibration System AVS

Monitors 3-axis accelerations and vibration to enable yield improvements by maximizing acceleration and minimizing vibration.

Records vibration data for easy comparison between past and present, as well as one tool to another, to reduce particles, maintenance time and cycle time.



## **ReticleSense™ Auto Leveling System (ALSR)**

Speeds setting the right inclination by measuring pitch, roll, and rise overrun.

### The Results

Applied Material was able to improve wafer shift and heat uniformity. They experienced less misalignment, less cross contamination, and fewer particle generation. They also found they needed to perform fewer vibration adjustments.

Time and money were saved using the AMS as it produced repeatable data to differentiate the Good and Bad status of a given chamber. They found the shareable numerical data was consistent to keep the equipment status healthier for longer periods of time.

Using this objective data, their FAB engineers were able to find the hidden cause of an issue when present, which leads to increased yields and shorter down times for shorter periods.

The data comparison of Before/After was easily evaluated and objective/reproducible measurement help optimize the equipment performances.

They even found it provided FAB engineers with confidence and the ability to optimize preventative maintenance plans.

Applied Materials found reduced “shock” to wafer during a smoother transportation. The vibration and hooking at the edge were significantly reduced when parallelism of the heater stage and pedestal was improved through the use of AVS.

And AMS was also used to evaluate whether robot needs to be overhauled or not.

One time optimum leveling by using AMS for 30 minutes can help achieve savings of 12kUSD per year by solving hidden defective status’, and the FAB will get the returns by improved up rate and yield.

Overall, they reduced the machine downtime and improved performance of the processing equipment.

### About the Customer

Applied Materials is the leader in materials engineering solutions used to produce virtually every new chip and advanced display in the world. Their expertise in modifying materials at atomic levels and on an industrial scale enables customers to transform possibilities into reality. At Applied Materials, their innovations make possible the technology shaping the future.

Applied Materials has \$10.8 billion in revenue with \$1.5 billion spent on R&D investment. They hold over 10,200 patents and have over 15,600 employees in 82 locations in 17 countries around the world.

They are on Fortune World’s Most Admired Companies 2017, Global 100 Most Sustainable Corporations in the World, and 2017 World’s Most Ethical Companies lists.

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## Customer

Applied Materials

<http://www.appliedmaterials.com>

## Industry

microchip manufacturing

## Challenge

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- To achieve better uniformity.
- Reduce high cost and time in venting the chamber lid.
- Prevent poor leveling causing a wafer to be hooked on the edge with ceramic parts, or vibrate during lifter pins movement causing position shift inside the chamber.
- Reduce step up issues causing non-uniformity of temperature.
- Better assessment of robot qualification.

## Solution

**WaferSense® Auto Multi-Sensor™**

**WaferSense™ Auto Vibration System (AVS)**

**ReticleSense™ Auto Leveling System (ALSR)**

## Results

- Less misalignment, less cross contamination, and less particle generation achieved.
- Better uniformity achieved.
- It saves cost and time to produce repeatable data to differentiate the Good and Bad status of the chamber.

- The adjustment of handoff leveling achieves better uptime of a machine for production.
- When parallelism of the Heater Stage and Pedestal is improved, vibration is reduced, and hooking at the edge is significantly reduced.
- During the adjustment, the ease-of-use from the AMS leveling function can reduce machine downtime and improve the overall performance of the processing equipment.
- AMS can be used to identify robot qualification.
- The shareable numerical data keeps the equipment status healthier for longer periods of time.
- With this objective data, the FAB engineers are able to find the hidden cause if an issue is present, which can lead to increased yields or have shorter downtimes for shorter periods.
- One time optimum leveling by using AMS for 30 minutes can help achieve savings of 12kUSD per year by solving hidden defective status', and the FAB will get the returns by improved up rate and yield.
- AMS may improve user activities in the FAB. AMS data can easily separate Good/Bad statuses of each chamber.
- The data comparison of Before/After can be easily evaluated and objective/reproducible measurement can optimize the equipment performances.
- Provides FAB engineers with confidence and the ability to optimize preventative maintenance plans.