Title: Improving Tool Repeatability, Process Control and Predictive Maintenance Using Precision Wireless Sensing Technology

Author(s): Dennis Bonciolini

Affiliation: CyberOptics Semiconductor, Inc. Beaverton, OR, USA

Presenter: Dennis Bonciolini

E-mail: dbonciolni@cyberoptics.com

Fits to topic(s):
1. Equipment and Process Fault Detection, Classification and Prediction
3. Metrology and Analytics

Preferred presentation: oral

1. Motivation

As the semiconductor industry moves to processing at lower nanometer ranges, the margin for error gets smaller even as the opportunity for significant error grows. Clearly, changes in semiconductor manufacturing to smaller nano-scale dimensions needs to be accompanied by more stringent calibration and monitoring of the manufacturing process. Innovative new tools, such as those which make it possible to control equipment inclinations and measure processes to tighter parameters, can help fabs achieve greater manufacturing consistency, reduce bottlenecks, improve productivity, reduce wafer scrap and ultimately maximize the return on investment.

Until now, calibration routines to ensure precise equipment leveling, transfer alignment, or gapping distances have been accomplished by bubble levels or wired methods at best, and by estimation and eyeballing at worst. Verification of alignment often requires the technician to install various jigs, read dial indicators or meters, and directly view the interactions among various parts of the automation system as it moves through its sequence. Fixture installation and removal, coupled with technician intrusions into the ultra-clean tool environment, create contamination that compounds downtime and jeopardizes yields. In addition, because most current alignment methods do not allow for the collection of data that can be trended and used to control the automation process, this manual calibration never gets easier: it must be repeated periodically during the manufacturing process.

2. Description of the approach

Recognizing a number of the inefficiencies inherent in traditional bubble levels and wired leveling devices, CyberOptics Semiconductor (CSI) has developed wireless technologies that are helping keep process equipment aligned to tighter specifications, teach robot handoff positions, measure gaps between pedestals and shower heads in the deposition process and monitor vibration characteristic of tools and robots. Because these new tools also make system data available in real time, fab personnel can take immediate corrective action to significantly reduce wafer damage. In addition, the tools shorten the time it takes for fab engineers to set up equipment while significantly reducing the need for human interference and the opportunity for contamination. Their ability to quickly teach

robots precisely correct wafer handoff techniques ensure the greater manufacturing consistency that today's processes require.

3. Evaluation of results

The results are astounding to many already, improved teaching times to upwards of 400-600% in photo tracks and cluster tools, improved thin film uniformities of 30-40% and ability to monitor the health and consistency of tools wirelessly and at will. Specific results to be presented.