

9th European Advanced Equipment Control/Advanced Process Control (AEC/APC) Conference

Title:	Smart Test Wafer for troubleshooting monitoring and predicting Wafer Handling Problems
Author(s):	Yigal Tomer
Affiliation:	InnerSense LTD
Presenter:	Yigal Tomer
E-mail:	Yigal @Innersense-semi.com
Fits to topic(s):	1.Equipment and Process Fault Detection, Classification and Prediction

Preferred presentation: oral

1. Motivation

One of the leading factors to scrapped wafers and excursions, both seen and unseen, done to wafers, is the robotic wafer handling. The occasionally broken, chipped or scratched wafers, as well as the mechanically generated particles, are sometimes harbingers of even more serious tool problems that may not get adequately addressed in typical PM protocols or check lists. The more dramatic occurrences are where undetected or under evaluated tool problems lead to major excursions covering a thousand lots or more, that result in half of the wafers in those lots to be scrapped. The true gap in this scenario is that there was no good way to get an unbiased and accurate data based monitoring of wafer handling tools behavior. The criteria for the health of the wafer handling system is usually based on the subjective evaluation of the technician.

2. Description of the approach

The *InnerSense Smart Wafer* is a highly sensitive vibration recording device glued on a virgin silicon wafer, which addresses the problems covered above. It collects and stores vibration signals experienced by production wafers. By running it through the tool with standardized recipes, characteristic vibration patterns are collected. The heart of the monitoring work is the analysis, interpretation, and corrective actions associated with these waveforms. Those waveforms can be broken down per individual mechanical activities and be measured (amplitude and # of peaks) and monitored by the fab SPC system.

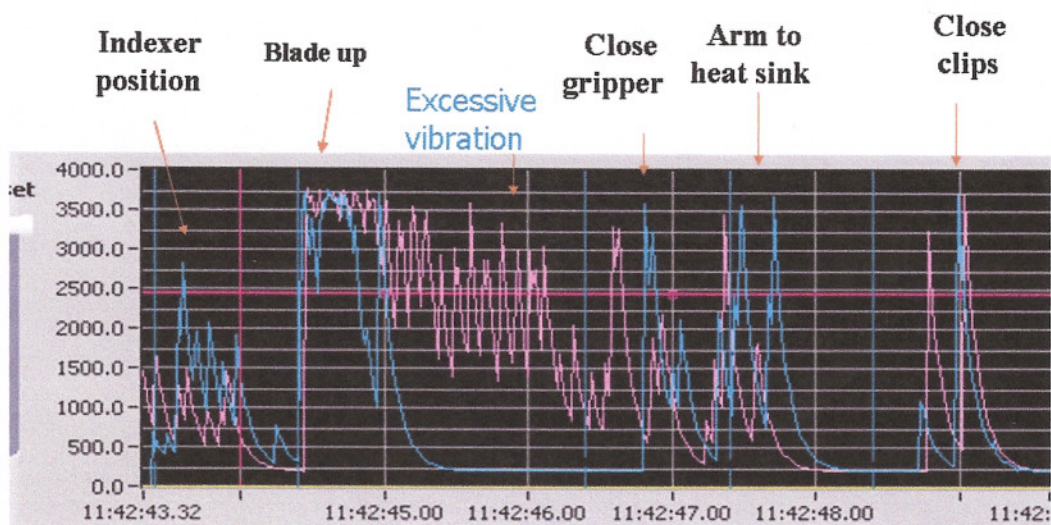
This approach provides significant benefits in maintenance as it permits the implementation of a methodology for Predictive maintenance and augments HPM efforts. By developing baseline waveforms, deterioration in tool performance can be identified, monitored, tracked and addressed. The waveforms can also be used for e-diagnostics at a data-base expert center.

3. Evaluation of benefits

The Smart Wafer system is already used in about 35 fabs worldwide, Some already reported a 50% wafer breakage reduction due to mechanical problems since the implementation of the Smart Wafer system.

Examples

XR80 implanter wafer breakage incident



Blue : good signal

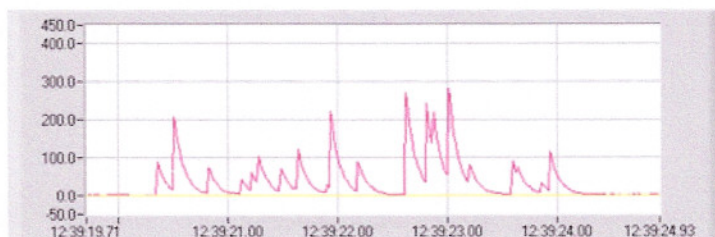
Pink : bad signal- Bad blade bearing caused vibration during blade up and eventually a wafer drop

INNERsense Diagnostic Systems

Indexer bad vs. good bearing experiment (lab test)

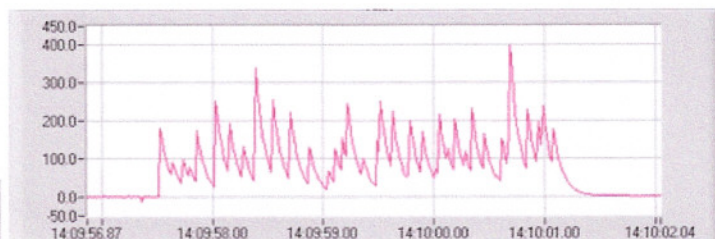
Good bearing

Test Mean
40.50



Bad bearing

Test Mean
93.49



Note: small amount of sand was applied on the lead screw upper bearing to simulate bearing degradation. Signal was very clear (~2x) although eye sight could not detect the difference