Implementation of AOI in a High-Volume Manufacturing Environment

Presented By
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June 11, 2000
Overview

- Previous process at this Fab
- What was implemented
- Improvements in process resulting from NSX implementation
- Tremendous benefits resulting from NSX implementation
- Payback $$$
- The improvements possible in your Fab
Customer Fab

• 100mm Fab shipping sawn wafers offshore for assembly
• Utilized manual inspection with paper trails for T&A inspection and tracking of defects
• Wafer maps were not used in the process – prober map did not go to assembly, etc…
• Defect categories, location and die count data recorded on paper by operator
• Inking wafers for pick and place
What was wrong?

- Defects not being found during inspection
- Die count variances between customer and foundry assembly site
- Inaccurate recording of defect location and type
  – only as accurate as the operator made it
- No quick feedback to engineering
- Inking
- Major production ramp
  – could not train or hire enough operators to meet ramp
Customer’s Previous Process

- Incoming Wafer
- Probing
- Manually Inspecting
- Sawing
- Manually Inspecting
- Inking

Customer’s Assembly House

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Solving the problems

- NSX-90 automatic visual inspection
- Electronic wafer maps
- Wafer map server (*provided by customer*)
- Offline review
- Automatic defect classification
NSX-90 Capabilities Implemented

- Automated Optical Inspection
- Wafer Map Import/Update and Export
- Auto Retrain- *automatically modifies inspection recipe as your process changes*
- Defect Classification Coding (*currently manual*)
- Film Frame Handling
- Automated Defect Classification
  - *Currently being phased in over next quarter*
NSX-90 Specifications

- Defect Sensitivity down to 0.5 microns
  - Typically 10 micron in this application
- Repeatability greater than 95%
- Uptime greater than 97%
Enhanced Process

Server

Incoming Wafer -> AOI -> Probe -> AOI -> Saw -> AOI

Wafer Maps

Customer’s Assembly House

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Results

- Elimination of inking
  - Wafers sent to offshore assembly house with electronic wafer maps
- Accurate recording of defects
  - Location
  - Classification
- Wafer maps implemented
- Elimination of manual inspection
- “Real time” review of defects
“Tangible” Benefits

• Inking process step removed
  – Saved time, resources and floor space
  – Eliminated chance of inking wrong die

• Pick and place defects eliminated
  – Locating ink dots not required
  – Wafer maps sent to “end customer”

• Count variance issues eliminated
  – Customer count discrepancies due to operator miscount
    “We shipped 10k and they received 9.5k?”
"The NSX-90 alone cut inspection cycle time by a factor of 4 when compared to manual inspection"
Yield Improvement

Added 1.5% to yield numbers

= 60,000 additional good die per week

= Payback in 8 weeks
Intangible Benefits

- Higher end-customer satisfaction due to higher quality of incoming products - *making their job easier!*
- Reduced human fatigue as operators are not looking through microscopes 8 hours a day
- Ergonomic improvements
- Operators utilized for other tasks - speeds ramp up
- Confidence in inspection –
  “*The NSX does not miss defects - operators do*”

Quote from manager at customer site
Ultimate Data Distribution – Where

Factory Yield Management

Front End Engineer

Server

Your Desk

YieldPilot
Excel
Custom Queries
SPC

Assembly

Probers

Wafer Maps

AOI

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What Data Can We Provide?

- **Bump inspection**
  - Diameter, height, area, presence, shape, coplanarity,…

- **Probe mark**
  - Presence, area, boundary intrusion
  - Location on pad (4 dims), area, number of marks

- **Active Area**
  - Chips, cracks, particles, FM, …
  - Saw damage
How Much Data Can You Get?

Tons of Data from Probe or Bump Metrology
2400 die, 8 pads, 100% Inspection, 1000 wafer/day

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Thinking 300mm?
Count on approximately 41 Mb of data per wafer for full metrology!!!
Implementation of the NSX

- Increased Fab productivity and profits
  - Improvements in your process through use of accurate and complete data
  - Elimination of process steps that are dirty or prone to create defects - i.e.- *Inking*
  - Yield improvements- *quality of work as well as process improvements*
  - Throughput, throughput, throughput

- Quality of work improvements
  - Higher quality inspection and accurate data
  - Improved job satisfaction - *Operators do not sit in front of a microscope for 8 hours = less turnover*
August Technology

- Founded 1993
- Bloomington, MN
- Cassette and FOUP inspection
- Automated visual inspection
- Bump, probe and sawn wafer inspection
- Over 85 NSX systems installed worldwide
- Wafer, film frame & Auer boat handling
August Technology’s Post-Fab

- Whole wafers
  - Active die area, bond pads, bump
- Sawn wafers
  - Chips, FM, cracks, scratches…
- Die in waffle pack or Gel-pak
- YieldPilot™ – defect data and process analysis
  - Data server
  - Browser integration
- 300mm inspection ready today!
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