Tracking Semiconductor Wafers

A typical semiconductor head wafer manufacturing facility produces 500,000 units per day. With fabrication yields of $\eta = 50\%$, and 20,000 heads per wafer on a 150 mm wafer, this drives the need to start approximately 50 wafers per day. A typical processing boat will contain anywhere from 1 to 15 lots requiring separate processing recipes by lot.

To estimate the value of such a project, below is a simplified list of necessary costs related to manufacturing:

- Average wafer cost: $600
- Manual process: 35 reads per wafer
- Scrap per quarter: $1 million or 20% of η

The facility attributes approximately $4 million scrapped wafer costs annually to the process of manually reading wafer IDs and entering the data into the system to pull the correct process recipe for the given lot. Since a single processing boat can hold multiple lots, the operator must read multiple codes and set up multiple recipes to run.

Since only complex wafer handling solutions were explored, and investment in high end capital equipment is cost prohibitive, the process remained manual. With the development of low cost 2D imagers, such as Microscan's Quadrus® MINI, with the ability to easily read ID characters (OCR, or Optical Character Recognition), a simple, fully integrated solution became possible.

THE BOTTOM LINE

Successful installation of Quadrus® MINI imagers within the wafer turntables allowed automatic data entry of the wafer ID into their systems, and recovery of 15% of the yield lost to mis-processing. The HD head fabricator has estimated that if they maintain their output and simply reduce the WSPD as a result of the improved yield, a 4-year ROI of $8 million (10% IRR) and a breakeven point of 3 quarters will result. If they can sell the incremental units produced at a fixed WSPD, their ROI becomes greater than $20 million.

- **Problem:**
  Manual reading of OCR leads to mis-processed 150 mm wafers
- **Project:**
  Identify a simple low cost OCR solution to integrate into current database / recipe management systems
- **Solution:**
  Microscan Quadrus® MINI imager with OCR reading capability embedded in wafer turntable
- **Result:**
  Eliminate mis-processed wafers and potential ROI of $20 million

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