ABC Semiconductor Case Study:
Improving CMP Yield
October 2008

The Challenge:

ABC Semiconductor operates an 8-inch fab in Texas with an average of 20,000 wafer starts per month. As part of the production process, it uses twenty seven Chemical Mechanical Planarization (CMP) tools manufactured by Westech, model 472 (circa 1995 vintage).

The CMP tools are used at various stages of the fabrication process, and their yield has been averaging well under 90%. At a cost of approximately $1,250 per scrapped wafer, the impact to profitability is huge.

ABC Semiconductor convened a Kaizan team to examine the CMP process to try to reduce the scrap rate. The team identified five key unmonitored variables which they believe may be affecting the yield rate.

- Polishing head downward pressure
- Platten up pressure
- Platten rotation torque
- Slurry flow rate

As a company which takes prides in its Six-Sigma culture, ABC Semiconductor wanted to measure and capture these process variables on their Fabguard fault detection system so they may analyze it using statistical process control tools and establish control limits. They believe that once they identify the variations which occur, they can take proactive steps to address the root causes and improve consistency.

Unfortunately, unlike modern day tools, the Westech units do not provide the proper data outputs to send to the Fabguard system (the SECS/GEM interface is very limited, typical of machines of that vintage). The tools do have gauges and transducers installed, but they can only be manually read by operators. There appeared to be no easy way for ABC Semiconductor to capture the process data they need short of buying new tools.

Cypress Envirosystems's Solution:

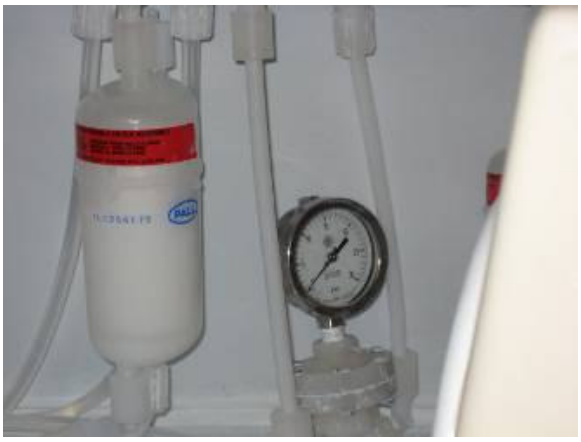
Cypress Envirosystems proposed using its Wireless Gauge Readers to read existing pressure gauges for downward head pressure and platten upward pressure. Cypress also proposed using its Wireless Transducer Readers to capture the current draw of the motor to infer the platten rotation torque. Finally, Cypress proposed using a clamp-on ultrasonic flow meter together with a Wireless Transducer Reader to measure the slurry flow rate.

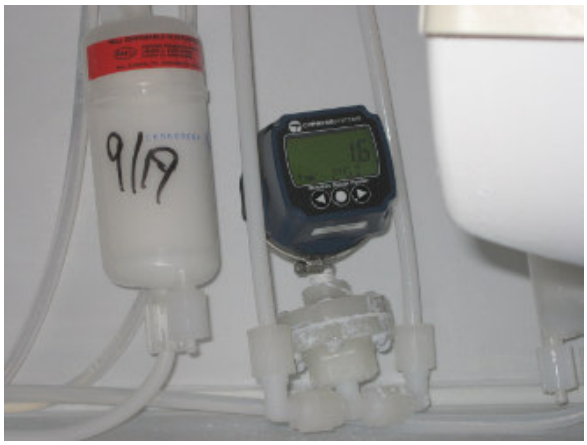
ABC Semiconductor decided to install the Cypress solution on two of its CMP tools as a trial. The installation was completely non-invasive (i.e. did not involve disrupting or modifying any flow lines or electronic element of the tool). The non invasive nature avoided any need to requalify the tool, and the installation took less than three hours.

Two identical CMP tools were selected for the initial trial so that both the variability within a single tool, and variability between different tools, can be determined. Data was collected at a sampling interval of 20 seconds and fed to the Fabguard system using a standard OPC communications protocol over their factory LAN.

Figure 1 – Circa 1995 Westech 472 CMP Tool

Figure 2 – Non-Invasive Mounting for Wireless Gauge Reader





The Results

Within less than two weeks, the Fabguard system was able to collect sufficient data to determine that variability in the polishing head downward pressure and the slurry flow rate were the main contributors to process variation and ultimately lower yield.

ABC Semiconductor developed a corrective action plan which involved procedural changes including monitoring slurry filter change-outs and better regulation of the compressed air sub-system. The yield rate improvement was conservatively estimated to be about 1%. Further improvements are anticipated as more data is gathered and analyzed.

As a result of the trial, ABC Semiconductor plans to deploy the Cypress monitoring system to all twenty seven CMP tools at a cost of approximately $235,000. Related corrective action measures would require an additional $250,000, for a project total cost of $485,000.

The project would achieve a yield improvement of 1%, which translates into annual savings of $3,000,000. The project payback period is less than two months.

Figure 3 – Savings from Wireless Gauge Reader

Average Cost per Wafer	$1,250
Wafer Starts per Month	20,000
Yield Improvement	1.0%
Total Savings per Year	**$3,000,000**

Figure 4 – Payback Analysis for Wireless Gauge Reader and Wireless Transducer Reader

Cost per point for Wireless Gauge Readers/Wireless Transducer Readers	$1,250
Number of Points per CMP tool	5
Additional ultrasonic flow sensor per tool	$2,000
Number of tools	27
One-time Fabguard connectivity interface	$10,000
Sub-total Cost of Cypress Envirosystems instrumentation	***$232,750***
Sub-total Additional cost of corrective measures actions	***$250,000***
Total project cost	***$482,750***
Payback period (based on annual savings of $3,000,000)	***1.93 Months***

About Cypress Envirosystems:

Cypress Envirosystems is a subsidiary of Cypress Semiconductor (NYSE: CY). Its mission is to save energy and improve productivity in older plants and buildings, using state-of-the-art non-invasive and wireless technologies to minimize disruption and cost, delivering payback of 12 months or less. For more information, please visit: http://www.CypressEnvirosystems.com or call (408) 943-2800.