CR-288
Concentration Monitor
Implementations

The CR-288 concentration sensor features materials and design compatible for use in CMP slurry applications.

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Hydrogen Peroxide in CMP Slurries

Summary: CR-288 enables real-time, in-line, and highly precise monitoring of hydrogen peroxide levels in slurries used in chemical-mechanical planarization (CMP).

Business Need: Hydrogen peroxide concentration impacts removal rate, consumables life time, and product yield. Hydrogen peroxide concentrations must be monitored in CMP slurries, especially for metal CMP, tungsten, and copper.

Maintaining the proper hydrogen peroxide concentration:

- Increases product yield
- Increases wafer throughput
- Reduces particle contamination from CMP tool polishing pads, gaskets, O-rings, and other consumables, further increasing yield

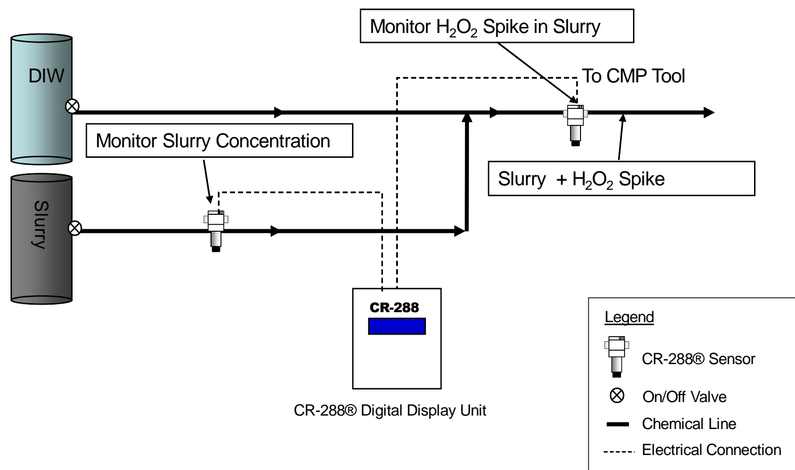
CR-288 Benefits

Because it is an in-line automated test, CR-288 offers multiple benefits over other test methods, including auto-titration and laboratory analysis. Specifically:

- Implementing CR-288 eliminates the need to grab samples for laboratory analysis, thus saving slurry, labor, and the opportunity cost associated with time spent waiting for results.
- Data is available continuously, at sampling rates of 1.2 seconds.
- The high degree of accuracy, simplified calibration, and temperature corrections, enables greater process control with a “set it and forget it” track record. The device itself has no impact on the solution being monitored.
- The flowcell footprint is only 3" x 2" x 4"(l x w x h) and is available in a variety of end connections, providing flexible installation options.
- CR-288 has no moving parts. Maintenance is minimal.

Implementation Diagram

This figure shows a typical configuration of two sensors and one DDU in a CMP slurry blending tool. Some implementations use only one sensor after the peroxide is added to the slurry.



CR-288 eliminates the need to grab samples for laboratory analysis.

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Realized Performance Data:

H_2O_2 resolution:

± 0.005% by weight

Cost compared with auto-titration

Using CR-288 for in-line monitoring provides significant cost savings in materials, labor, and maintenance compared with auto-titration.

Auto-Titration/Typical 200MM Wafer Fab	**Data**	**Cost Per Month**	**Cost Per Year**	**CR-288® Comparison**
Frequency of titrations	Every 8 hours			Real time monitoring
Time for complete titration	~45 minutes			Real time Data point every 1.2 seconds
Frequency per day	3 times			Real time monitoring
Number of values per each titration	2			Real time monitoring
Amount of slurry used for each titration	1kg per titration value For each titration cycle, 2 values are taken. The result will be the average of these 2 values and each value will require 1kg of slurry at a cost of ~$13 per kg.			0
Cost of slurry used per value	Cost $13 per titration value (2 samples = $26) x 3 per day = $78 per day. Average 30 days.	~$2,340	~$28,080	0
Re-agent used for each titration	Re-agent is needed for chemical reaction to get titration. Re-agent is needed for each titration.	~$4,300	~$51,600	0
O-ring replacement	Change every 3 months @ $10.00 per month	~$10	~$120	0
Probe	Change probe average of once every 6 mos.	~$105.00	~$1,260	0
Maintenance	Time to replace O-rings, probes, and other misc. items @ ½ day @ $150 per hour (estimate)	~$600	~$7,200	Re-zero 1 per month 1 hour @ $150
TOTAL		**~$7,355**	**~$88,260**	**$150**

Results Published by Chartered Semiconductor: "*CMP Slurry Blending Process Optimization and Cost Improvements using Real-time Concentration Monitoring,"* Aparece, C.D.; Wacinski, C.; Rajan, S. Advanced Semiconductor Manufacturing Conference, 2007. ASMC 2007. IEEE/SEMI Volume , Issue , 11-12 June 2007 pp.320 – 325.