ERC Roundtable Telecon

CMP Water Use Optimization: International SEMATECH Project Perspective

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Main source of DI water use in Member Company fabs: Wet cleans and CMP

Increased use by CMP in manufacturing:
FEOL: Oxide (STI, PMD), poly (DRAM),
BEOL: Oxide, W, Cu

Drivers for optimized water use:

• Water availability
• Cost of city water and discharge
• Expansion vs. DI plant capacity
• Need to treat CMP effluent before discharge
Water Use Optimization: Project Strategies

Tool / Process Focus
- Optimized rinses
- CMP water reduction/optimization

DI Water Recycle Focus
- Enabling technologies
- Integrated POU & site strategies

Process / equipment improvement / optimization

DI Feed (idle flow) → FAB Tool

Waste stream (tool level segregation) → Treatment options;
Reclaim;
Recycle;
CMP Water Use Optimization: 2000

Project Objectives

• Reduce/optimize water use in CMP/post CMP cleans
  – reduce NET water use in CMP operation
  – match quality of water with operation
  – no negative impact in CMP process performance

• Ensure continuity in technology transfer from 200mm to 300mm wet tools

• Promote the enabling technologies for risk free rinse/CMP water recycle & reuse
CMP Water Use Optimization: Tool Level Focus

• Benchmarking: CMP tool water usage
  – Member Company/Supplier participation
  – data from manufacturing fabs
  – individual tool characteristics

• Programmed flow rates:
  – no-process (“idle”)
  – pad conditioning (“buffing”)
  – polish
  – standardized/recommended flow rates

• Optimized hydrodynamic design in hardware
CMP Water Use Optimization: 2000

CMP Water Quality Requirements

• Tool Supplier specs/data: 18 ohm (?)

• Member Company experience:
  – CMP performance vs DI water quality
  – conductivity measurement at the tool/POU
  – dedicated CMP DI water supply loop
  – practice of local reuse/reclaim

• Collaboration with SRC/NSF ERC:
**Supplier Concept of an Integrated CMP Water Use Reduction Strategy**

**CMP Operation**
- Main CMP DI feed
- Alt DI feed
- "Waste stream"
- "Reclaim stream"
- Waste from Polish Steps
- Drain to Slurry Treatment

**Optional Polish/Recycle**
- Polish treatment
- CMP DI Supply Tank

**Removal/Reclaim**
- TSS < 1 ppm
- TOC < 1 ppm
- Cu < 0.1 ppm
- Solids Removal
- TOC Removal
- Cu Removal

**Recycle Collection Tank & Pump**
### 1999 ITRS: Water Use

**ESH Table 72a Resource Conservation Technology Requirements - Near Term**

<table>
<thead>
<tr>
<th>FACTORY INTEGRATION</th>
<th>YEAR TECHNOLOGY NODE</th>
<th>1999 180 nm</th>
<th>2000 130 nm</th>
<th>2001 130 nm</th>
<th>2002 100 nm</th>
<th>2003 100 nm</th>
<th>2004 100 nm</th>
<th>2005 100 nm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Decrease net feed water use</td>
<td>7.6 (13)</td>
<td>7.6 (13)</td>
<td>5.9 (10)</td>
<td>5.9 (10)</td>
<td>3.5 (6)</td>
<td>3.5 (6)</td>
<td>2.9 (5)</td>
<td></td>
</tr>
<tr>
<td>Decrease UPW use</td>
<td>6.0 – 8.0 (10.2 – 13.6)</td>
<td>5.0 – 7.0 (8.5 - 11.9)</td>
<td>4.0 – 6.0 (6.8 – 10.2)</td>
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</tbody>
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**ESH Table 72b Resource Conservation Technology Requirements - Long Term**

<table>
<thead>
<tr>
<th>YEAR TECHNOLOGY NODE</th>
<th>2008 70 nm</th>
<th>2011 50 nm</th>
<th>2014 35 nm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Decrease net feed water use</td>
<td>1.2 (2)</td>
<td>1.2 (2)</td>
<td>1.2 (2)</td>
</tr>
<tr>
<td>Decrease UPW use</td>
<td>3.0 – 5.0 (5.1 – 8.5)</td>
<td>3.0 – 5.0 (5.1 – 8.5)</td>
<td>3.0 – 5.0 (5.1 – 8.5)</td>
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