Outline

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itez Flipper
itez The New, In With
irez The End
The Window

Annual Wafer Starts (200mm equivalent)

Source: Techcet Group, April 2011

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The Window

* Fabs in a Downturn
  - Clean, train, maintain
  - Develop new ways to reduce cost
  - Evaluate new products & methods

* Cost reduction impacts incumbents

* Evaluation time benefits insurgents

* Bonus motivation: customer dissatisfaction with current supplier
Magic Triangles

Slurry

Unexpected Exceptional Performance

Pad

Conditioner
Magic Triangles

Why now?
- Years of talk about synergy between pad and slurry development produced nothing
- Crazy tight specs made us look more closely

Systematic engineering work
- Designed experiments
- New products available for evaluation
- Fab tool time available
- Fab engineer work product, no R&D transfer
Magic Triangles

🌟 Process characteristics
- Less aggressive pad conditioning
- Highly reproducible pad roughness
- Tight slurry PSD

🌟 Resulting observations
- Sharp reduction in surface scratches
- Dishing meets aggressive specs
- Exceptional removal rate stability
- Lower CoO (pad life, conditioner life)
Specific examples: CONFIDENTIAL

- Patriot Act does not apply
- Enhanced interrogation techniques off limits
  - Slurry-boarding on hold

Magic triangle citations
- Cabot (pads)
- Fujimi
- Hitachi
- innoPad
- Intel
- Morgan
**Scratch That Itch**

<table>
<thead>
<tr>
<th>Table FEP14</th>
<th>Shallow Trench Isolation CMP Process Technology Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year of Production</td>
<td>2009</td>
</tr>
<tr>
<td>DRAM $\frac{1}{2}$ Pitch (nm) (contacted)</td>
<td>52</td>
</tr>
<tr>
<td>MPU/ASIC Metal 1 (M1) $\frac{1}{2}$ Pitch (nm) (contacted)</td>
<td>54</td>
</tr>
<tr>
<td>MPU Physical Gate Length (nm)</td>
<td>29</td>
</tr>
<tr>
<td>Wafer diameter (mm)</td>
<td>300</td>
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<tr>
<td>Wafer edge exclusion (mm)</td>
<td>2</td>
</tr>
<tr>
<td>Critical scratch length, $s_c$ (nm) [Å]</td>
<td>25.8</td>
</tr>
<tr>
<td>Critical scratch count, $S_{pc}$ (#/wafer) [Å]</td>
<td>40.1</td>
</tr>
<tr>
<td>Uniformity</td>
<td></td>
</tr>
<tr>
<td>CMP total uniformity (3σ) for removal (%) [Å]</td>
<td>8</td>
</tr>
<tr>
<td>CMP uniformity (3σ) within wafer (%) [Å]</td>
<td>6</td>
</tr>
</tbody>
</table>

*Manufacturable solutions exist, and are being optimized*

*Manufacturable solutions are known*

*Interim solutions are known*

*Manufacturable solutions are NOT known*

**Magic triangles will contribute to success**

- Critical scratch length $<20$nm, $<40$/wafer

Source: 2010 Interconnect ITRS

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Flipper

- Old way
  - Conditioner wears out, throw it away

- New way
  - Conditioner wears out, turn it over

- Saint-Gobain introduces Flipper
  - Abrasive on both sides
  - Reported CoO benefits 2.0x–2.5x
In With the New

Source: P. Feeney, Solid State Technology, November 2010
In With the New

* Number of unique new CMP processes today is equivalent to total of all CMP steps at 0.25µm node
  - Single step R&D cost same as multi-step interconnect process
  - Unique by device type; few common to all

* Recession rewards
  - New collaborations, new personal relationships
  - Startups gain traction and momentum
The End

* Both CMP users and suppliers will benefit from work completed during the recession.

*Market Update at Semicon West 2011*

**Outlook from Semicon West 2010:**

* CMP recovery is ahead of expectations
  - CMP consumables revenue will surpass 2007 peak levels in 2010
  - No residual impact beyond 2010
The Techcet Group, LLC

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