EUV Reticle Handling Implementation
— Discussion Topics

@ IEUVI TWG, 02.27.11
Simplified Mask Flow

Blank shop

Blank making → Shuffler / The last tool → Shipping

Masks hop

Mask making → Shuffler / The last tool → Shipping

Wafer Fab

Acceptance inspection

Clean / recover

Reticle re-qual

Atmospheric stocker

Reticle storage

Exposure, vac. storage

To Clean if failed

: EUV carrier

: non-EUV carrier
Handling Caused ML Defects

Can we absorb the level of handling caused ML defects?

ML defects caused by handling particles

(Courtesy of Frank Goodwill/SEMATECH)
Ballpark of Optical Mask Shipping

Conclusion:
• Particle ballpark is in single digits.
• No significant dependence found on different box cleans

Test definition:
• 8 Pozzetta compacts, 4 clean suppliers, 2 identical boxes, 4 slot per box, 8 Qz plates
• Completely mixed for comparison

Baseline performance of EUV blank shipping with supplier-specific boxes?

<table>
<thead>
<tr>
<th></th>
<th>Overall</th>
<th>Shipping</th>
<th>Box</th>
<th>Slot</th>
<th>Clean Supp.</th>
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<td>1</td>
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<td>2.8</td>
<td>3.5</td>
<td>3.7</td>
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<td></td>
<td>4.3</td>
<td>3.8</td>
<td>3.5</td>
</tr>
</tbody>
</table>

Particle adders averaged for overall, per shipping, per shipping box, per carrier slot positions inside the box, and per box clean supplier (@53nm sensitivity)
If EUV-pod Needed in Blank Shops?

1. Blank defects caused by handling particles:
   - ML defects; Absorber defects

2. What are the expectations when blanks arrive at mask shops?
   - Capped ML stack; Absorber; Resist coated

3. If EU-pod needed? Inside blank shops and/or blank shipping?

Blank Making Flow:

- Substrate Prep: Polish, Clean, Inspect, Flatness
- Blank Making: Backside Dep., Clean, Inspect, ML Dep., Clean, Inspect, Absorb. Dep., Shipping
- Reflectivity, AIMS disp., Inspection, Reflectivity, Flatness
Surface Contamination After Final Clean

- Mask stays “clean” for ~60 min.
- Should “the last tool” in mask shop be final clean, when needed to minimize surface contamination?

EUV blank contact angle increases vs. time after final clean.
Which is “The Last Tool” in Maskshops

- Final inspection or Final clean?
- Which needs EUV-pod capability or both?

Mask Shop – Flow A

<table>
<thead>
<tr>
<th>Clean</th>
<th>Resist</th>
<th>Write</th>
<th>Develop</th>
<th>Etch</th>
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<tr>
<td>Inspect</td>
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<td>Inspect</td>
<td>Measure</td>
<td>Measure</td>
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<tr>
<td>Defects</td>
<td>Defects</td>
<td>Defects</td>
<td>CD &amp; IP</td>
<td>Reflectivity</td>
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</table>

Fab

<table>
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<tr>
<th>Clean</th>
<th>Inspect</th>
<th>Ship</th>
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<tbody>
<tr>
<td>Pattern Defects</td>
<td>Repair</td>
<td>AIMS</td>
</tr>
<tr>
<td>Particles</td>
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</tr>
</tbody>
</table>

The last-tool

Print

Inspect

Pattern Defects On Wafer
Wafer Fab

1. Will the incoming inspection be necessary?
2. What are likely tool options for wafer fab inspection and clean?
3. How to manage backside particles?
4. What should be the right capacity for in tool storage?
5. Need in-tool mask inspection, front, back?
6. Atmospheric storage:
   - Gas options?
   - Number of purging ports?
   - Does purging make any significant difference, in term of wafer yield?