Fiducial mark development

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- EUV blank roadmap
- Fiducial mark process development
  - Introduction
  - Status and plan
### EUV blanks roadmap

<table>
<thead>
<tr>
<th>CY</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>DRAM hp</td>
<td>50 nm</td>
<td>45nm</td>
<td>40 nm</td>
<td>36nm</td>
<td>32nm</td>
<td>28nm</td>
</tr>
</tbody>
</table>

#### Alpha exposure (ADT, EUV1)

- **β blanks**
- **γ blanks**
- **★PPT/NXE3100 (ASML)**
- **★HVM/NXE3300**

#### Step 0 for development

- Blank quality improvement
  - Defects, Flatness
- Productivity improvement

#### Step 1 for 32-27nmhp

- **★HVM/NXE3300**

#### Step 2 for 22nmhp

- Production blanks

### EUV blanks for 22nmhp

- **CA resist**
- **TaBN absorber**
- **Ru_A cap**
- **Mo/Si multilayer (ML)**
- **LTE glass: ULE™**
- **Backside film: CrN**

- **Low defects:** Zero@70nm
- **Low defects:** <10def@22nmSEVD
- **High flatness:** <30nm

- **Bow:** <400nm*
- **CW:** ±0.014nm*
- **BS defects:** Zero@1μm*

* Requirement from ASML
Defect mitigation process w/ Fiducial mark

EUV blanks w/ FM + Device pattern → Overlap defect to pattern

Blank inspection → Position@IPRO → EB writing

Position accuracy required in defect mitigation

Acceptable max position shift to completely hide a defect

<table>
<thead>
<tr>
<th>hp</th>
<th>50nm defect</th>
<th>30nm defect</th>
</tr>
</thead>
<tbody>
<tr>
<td>32nm</td>
<td>78</td>
<td>98</td>
</tr>
<tr>
<td>22nm</td>
<td>38</td>
<td>58</td>
</tr>
<tr>
<td>16nm</td>
<td>14</td>
<td>34</td>
</tr>
</tbody>
</table>

Defect repair process

Needs high contrast on FM in repair tool and EUV-AIMS

➢ Needs high overlay accuracy of <38nm for 50nm defects at 22nm hp
Fiducial mark process development

EUV blank w/ FM

1) Sub-FM

2) ML-FM

✓ High mark contrast
✓ Nearly zero defects
✓ Process easiness (High productivity)

Blank inspection
[M1350, Teron610]

Position repeatability
to FM

Position accuracy
to IPRO

EB writer
[EBM, JBX]

Position repeatability
in EB scan

High position accuracy

High position accuracy

Optimize mark size (width and depth)

✓ Needs optimum FM process for future volume production
## Fiducial mark process status and plan

<table>
<thead>
<tr>
<th></th>
<th>Substrate-FM</th>
<th>ML-FM</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Process easiness</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Defect</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Mark contrast</strong></td>
<td></td>
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</tbody>
</table>

- HOYA has two kinds of FM processes
  - Will optimize FM process for volume production in 2012
  - Position repeatability in Teron is less than 100nm
  - Position accuracy in BI and in EB writer should be improved
  - Target would be overlap accuracy within 30nm
  - Collaboration work with tool suppliers is progressing

Details will be presented at poster session on Feb. 15th. Please visit poster presentation [8322-115]