Japan update

ASET EUV Process Technology Laboratory
Iwao Nishiyama

This work was supported by NEDO
## EUVL R&D Projects in Japan

<table>
<thead>
<tr>
<th>Year</th>
<th>Light Source</th>
<th>Exposure Tool</th>
<th>Metrology</th>
<th>Mask/Resist</th>
<th>Evaluation Integration</th>
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<tbody>
<tr>
<td>1998</td>
<td>EUV</td>
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<td>1999</td>
<td>EUVA Source Pj</td>
<td>EUVA Tool Pj</td>
<td>Wavefront Measurement</td>
<td>Mask/Resist/Metrology</td>
<td>Mask Blank Inspection</td>
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<td>2000</td>
<td>Leading Project by MEXT (LPP light source)</td>
<td>Tool R&amp;D by Companies</td>
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</table>

- **Light Source**
  - EUV
  - Leading Project by MEXT (LPP light source)
- **Exposure Tool**
  - EUVA Source Pj
  - EUVA Tool Pj
- **Metrology**
  - Wavefront Measurement
  - ASET Mask/Resist/Metrology
  - Mask/Blank Inspection
- **Mask/Resist**
  - Mask/Resist Process
  - Resist Pj
  - Mask technologies
- **Evaluation Integration**
  - EUV Lithography program

- **Supported by**
  - NEDO
  - Companies Pj
  - Government Fund
ASET Exposure Tool

HiNA

Illumination Optics
Mask holder
Projection Optics
Wafer Stage

MET

Berkeley MET exposure tool

- Based on MET optic
- Magnification = 5x, NA = 0.3
- Rayleigh resolution = 27 nm
- Field size = 200x600 μm
- Programmable coherence illuminator for low k1
- Reticle and wafer load-lock and manual transfer systems
- Wafer-height sensor
- nm-resolution wafer-height sensor and focus actuation
- Pupil-fill monitor

From synchrotron
Scanner module

Reticule stage
MET
Wafer stage and height sensor
Pupil-fill monitor

ASET EUV Process Technology
SELETE Exposure Tool

SFET

EUV Emission Chamber

SFET Main Chamber

Exhaust Ventilation

Source Laser

Beam Delivery

Wafer Handling

HiNA

EUV Process Technology
Molecular resist evaluation in NEDO project

Pattern collapse improvement by molecular design

LER evaluation with 2 um measurement length

LER : 3.6nm (3σ)

Oizumi et al EUVL Symposium 2006
Screening of polymer resist

High resolution resist

35nm

32nm

30nm

28nm

Photo-speed improvement

40nm

35nm

Goo et al EUVL Symposium 2006
Calculated shapes of resist patterns also agreed well with the experimental results for pattern B.

Simulation conditions:
- Aberration: 0.7nm RMS
- Flare: 10%
- Diffusion length of acid: 20nm

Tanaka et al EUVL Symposium 2006