IEUVI Resist TWG meeting

ASET update

ASET EUV Process Technology Laboratory
Iwao Nishiyama
High-NA Small-Field Exposure Tool
High-NA Small-Field Exposure Tool

- Illumination Optics
- Mask holder
- Projection Optics
- Wafer Stage
Development of HiNA Set-3 optics

- Final wavefront errors were 0.91 nm rms (raw) and 0.75 nm rms (z36).
- MSFR was refined to ½ of Set-2 Optics, 0.17 and 0.2 nm rms.
- Set-3 optics was installed to Atsugi lab at July, and exposure experiment has just been started at August, 2004.

<table>
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<th></th>
<th>LSFR</th>
<th></th>
<th>MSFR</th>
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<th>HSFR</th>
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<td></td>
<td>Raw</td>
<td>Z36</td>
<td>φ1mm</td>
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<td>Set-3</td>
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<tr>
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<td>M2</td>
<td>0.25</td>
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Two illumination systems of ASET HiNA exposure tool

1) Partial coherent illumination
   Advantage:
   - intensity and angle homogeneity
   - cover wide spatial frequency
   Disadvantage
   - sensitive to wavefront error
   Application
   - Mask Evaluation
     OPE/MEF, defect printability, off-axis incident effect…

2) Coherent illumination
   Advantage:
   - high contrast for L/S periodic pattern
   - insensitive to wavefront error
   Disadvantage
   - effective only for L/S pattern
   Application
   - Resist Evaluation
     Resolution, LER, Sensitivity, Collapse…
Dense 60-nm C/H patterns (σ ≈ 0.8)

(a) Mask image  (b) Wafer image

Dense 60-nm C/H patterns were successfully fabricated without OPC or PSM.

See 5751-85 by Y. Tanaka
Effect of defocus on pattern fidelity ($\sigma \approx 0.8$)

Since the corner rounding was not much affected by defocus, the resist process might be one of the cause of the rounding.

See 5751-85 by Y. Tanaka
HINA3: L/S Pattern delineation ($\sigma \approx 0.0$)

Non-chemically amplified resist: ZEP520A 90nm

See 5751-08 by H. Oizumi
HINA3: L/S Pattern delineation \((\sigma \approx 0.0)\)

Chemically amplified resist (CAR): 92 nm

45nm L/S  40nm L/S  35nm L/S  30nm L/S

50-nm half pitch  40-nm half pitch

See 5751-08 by Oizumi
Contamination/Optics lifetime testing facilities
Outgas Evaluation Apparatus at SBL-2 of Super ALIS
Summary

We have started resist evaluation in collaboration with resist suppliers. By using coherent illumination of HiNA Set-3, we can evaluate the resist performance up to 30 nm resolution.

Outgas evaluation apparatus has just been installed, and will be utilized for evaluation of outgassing rate and species.