

Status of the Micro Exposure Tool for EUV Microsteppers



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Outline

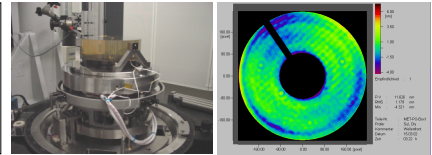
- The fabricated EUV MET illuminator from Carl Zeiss SMT AG is presented
- Results from resist printing with the MET projection optics are shown
- The system is used in the Exitech EUV microstepper MS-13 (see poster)

Illuminator Design

- Quasi-critical Design : Source is imaged into field plane with defocus
- Source defocus allows flexibility for different source sizes
- Simplicity : Collector + 2 spherical NI-Mirrors + 2 plane folding mirrors only
- Nested Wolter-Collector forms annular pupil; aperture is illuminated almost homogeneous
- Pupil and Field stop positions available

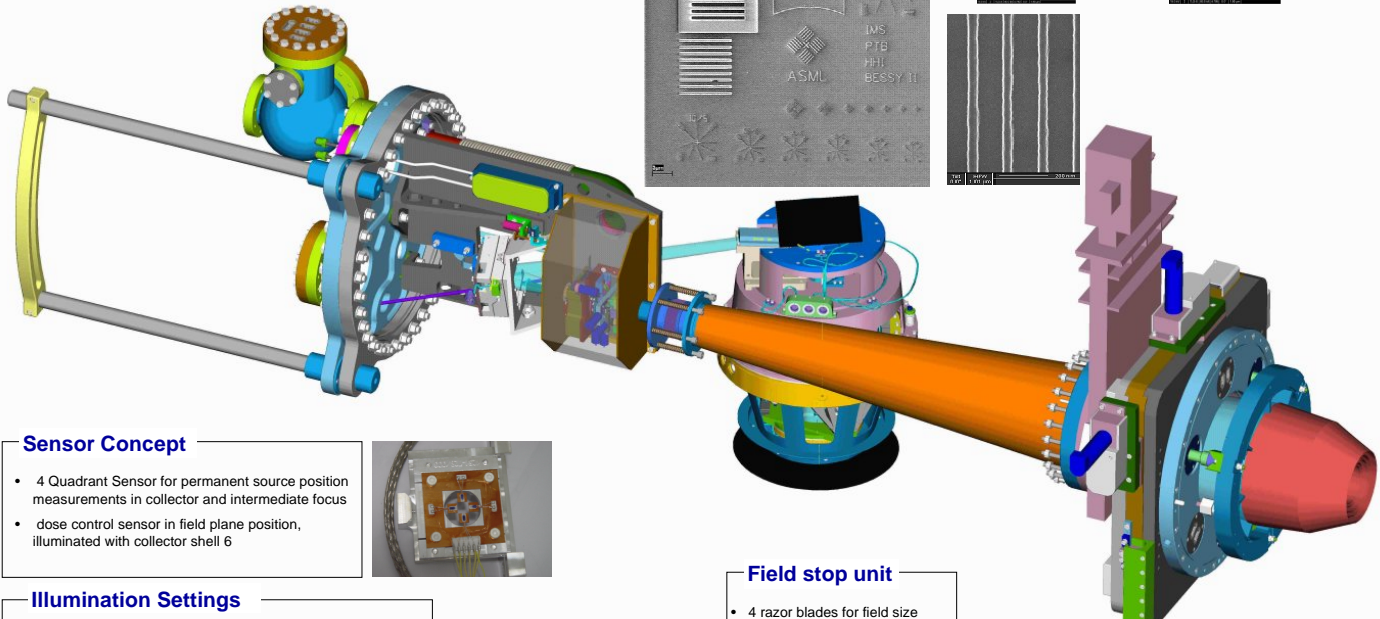
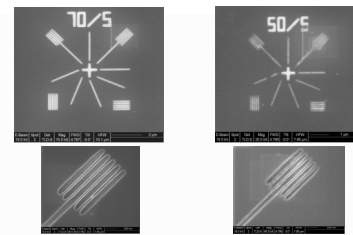
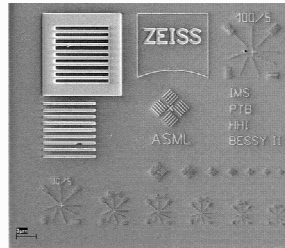
Projection Optics

- Two mirror system with 0.3NA
- Designed for 50nm node
- 600µm field size, full performance on 200*600µm
- Alignment with µm accuracy by the use of Carl Zeiss coordinate measurement tool
- Fine alignment with 633nm interferometer



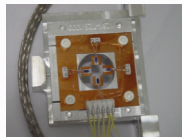
Resist printing

- A metrology tool at the BESSY Synchrotron bases on the MET Projection Optics was used for EUV resist printing experiments
- The PTB undulator U180 was used as source
- Shipley EUV14F resist FT=125nm
- 35nm 1:3 dense lines were successfully printed



Sensor Concept

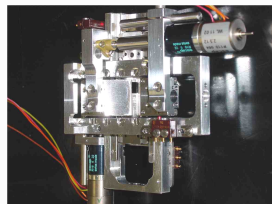
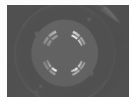
- 4 Quadrant Sensor for permanent source position measurements in collector and intermediate focus
- dose control sensor in field plane position, illuminated with collector shell 6



Illumination Settings

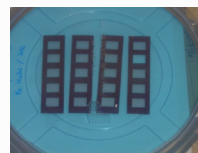
- annular illumination with 0.36 inner and 0.55 outer sigma defined by collector shells 3, 4 and 5
- pupil wheel with 6 positions
 - Scintillator screen for alignment and error control,
 - Viewport from air side
- 5 individual sigma settings
- possible outer sigma settings and power by shells:

(shell 2:	0.68	150%)
• shell 3,4,5:	0.56	100%
• shell 4,5:	0.47	60%
• shell 5:	0.40	25%
- quadrupole or dipole setting possible



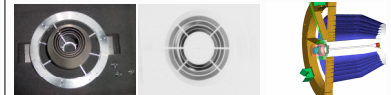
Field stop unit

- 4 razor blades for field size definition.
- 3*3mm used size at reticle.
- Spectral purity filter for Vis/UV absorption and vacuum sealing



Collector Unit Design

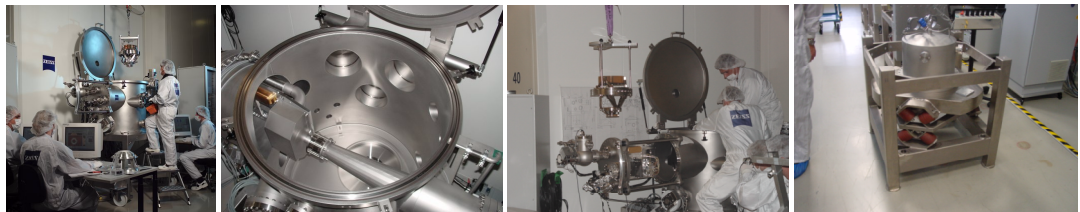
- A Wolter type collector with 4 (5) shells is used to collect 0.55 sterad of the source



- 5 DOF collector manipulator for alignment to source
- integrated foil trap from Xtreme for debris mitigation
- Debris tube for vacuum sealing to main chamber

Illuminator Qualification

- For integration and qualification of the illumination system a vacuum system was installed at Zeiss
- alignment was done with visible light



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