

Dose Calibrations for EUV Exposure Tools

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Calibration Chain

EUV 10X1 → NA = 0.088
Copper Plasma Source

EUV-2D Resist
XP98248B

6.8 mJ/cm²
100nm Dense Lines
125 nm Thick(?) SB:130/60
PEB: 130/90

EUV 10X2 →
NA = 0.088

Engineering Test Stand
→ NA = 0.1

Berkeley MET
→ NA = 0.3

MET-1K*
(XP4502D) →
19 mJ/cm²
100 nm Dense
21 mJ/cm²
50 nm Dense
125 nm Thick

MET-2D
XP5271F 18.3 mJ/cm²
50 nm Dense

* Tool test resist for
Berkeley and Albany
METs

ASML EUV Alpha
→ NA = 0.25

PSI IFL Tool

Present dose calibration method

- Current EUV exposure tools are calibrated against “known” resists
- Initial calibration of the Berkeley MET (Feb. 2004) was based on the “known” Esize of EUV-2D resist for 100-nm lines and spaces
- Since that time, the calibration standard has been switched over to MET-1K and an Esize at 50-nm lines and spaces

Problems with present method

- “Known” Esize value of EUV-2D (6.8 mJ/cm²) actually comes from non-traceable dose numbers from the now decommissioned Sandia 10x microstepper
- Aerial-image characteristics differences between the 10x and MET put into question the transfer of Esize from one tool to the other (required detailed wavefront and flare characteristics of the Sandia 10x not available)

Plan for absolute dose calibration of baseline resists and Berkeley MET

- Use Berkeley Calibrations and Standards EUV beamline to determine E0 by exposure and measurement of contrast curves in RHEM MET-1K and TOK-P1123
- Transfer the E0 calibration to the Berkeley MET
- Measure E0 to Esize ratios on Berkeley MET for RHEM MET-1K and TOK-P1123 to determine absolute Esize values for these two baseline resist
- Daily recalibration of Berkeley MET using Esize on baseline resist

Status of absolute dose calibration

- Feasibility of using Calibrations and Standards beamline (BL6.3) for contrast curve measurement demonstrated
 - Better than 5% E0 precision demonstrated over two-month period and significant changes of beamline parameters
- Final “absolute” calibration requires purchase of new NIST-calibrated photodiode to replace standard BL6.3 diode
 - photodiode on order