

Summary of OS1 Outgassing Results

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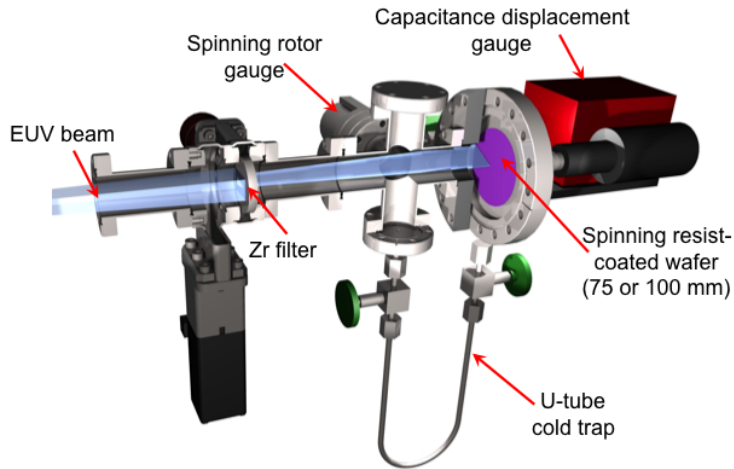
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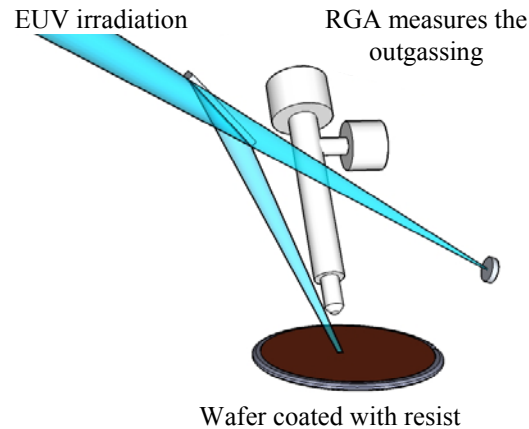
Methods adapted to measure outgassing

NIST



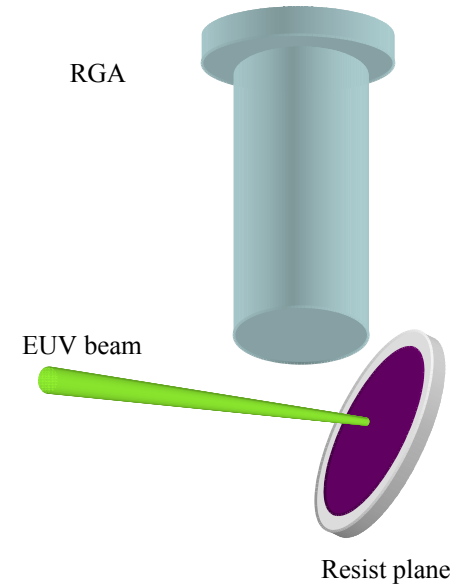
- CW (synchrotron) source, 13.3 ± 0.5 nm
- Expose 100 mm wafer to $2.5 \times E_0$ for 10 – 20 minutes.
- Sample Analysis - GCMS with Cryo-focus

IMEC



- Energetic EUV source, 13.5 nm $\pm 1\%$ bandwidth in 2π
- Expose 200 mm wafer at $2.5 \times E_0$ for 1 hour
- Sample Analysis - RGA

CNSE



- Energetic EUV source, 13.5 nm $\pm 1\%$ bandwidth in 2π
- Expose a strip of wafer at $2.5 \times E_0$ for 30 seconds
- Sample Analysis - RGA

Summary of species detected by each method

NIST

Isobutene
CO₂
Isobutane
Tert-butylbenzene
Acetone
Benzene

Traces: iodomethane, benzene,
alkanes, alkenes, diphenyl sulfide,
dimethyl furan

IMEC

Isobutene
Tert-butylbenzene
CO₂

Traces: Diphenyl sulfide

CNSE

Isobutene
CO
Tert-butylbenzene
CO₂

Traces: Acetaldehyde,
Alphamethylstyrene

Summary of total outgassing by each method

Organization	Total outgassing excluding CO and H ₂ O
NIST	2.5 X 10 ¹⁴ molecules/cm ²
IMEC	7.3 X 10 ¹⁴ molecules/cm ²
CNSE	2.5 X 10 ¹⁴ molecules/cm ²

Note: Previous outgassing tests on Round Robin(an EUV resist) from around the world showed 4 orders of magnitude difference.

Improvements/future directions

- CNSE and IMEC plan to develop better methods to calibrate their RGA measurements to account for the detection of species with different masses.
- NIST plans to complement the pressure rise/GCMS measurements with RGA measurements.

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