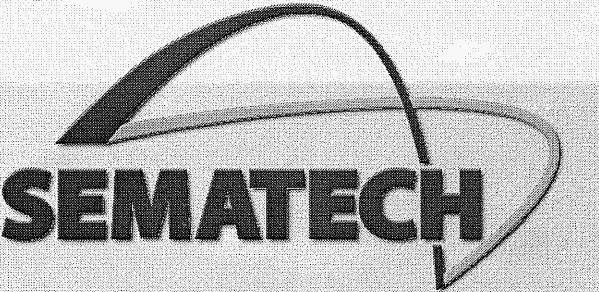


Analysis of Optics and Mask Contamination in SEMATECH EUV Micro-Exposure Tools

**IIEUVI Optics Contamination/Lifetime TWG
Sapporo, November 1, 2007**

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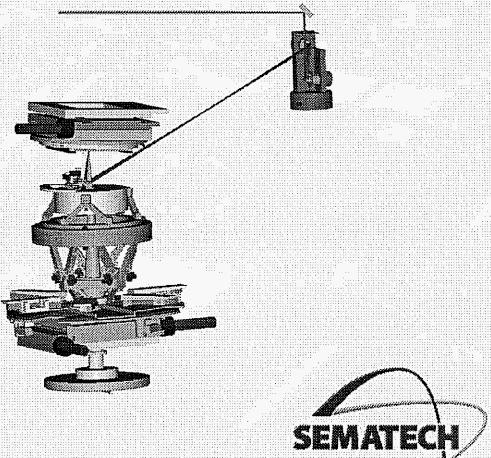


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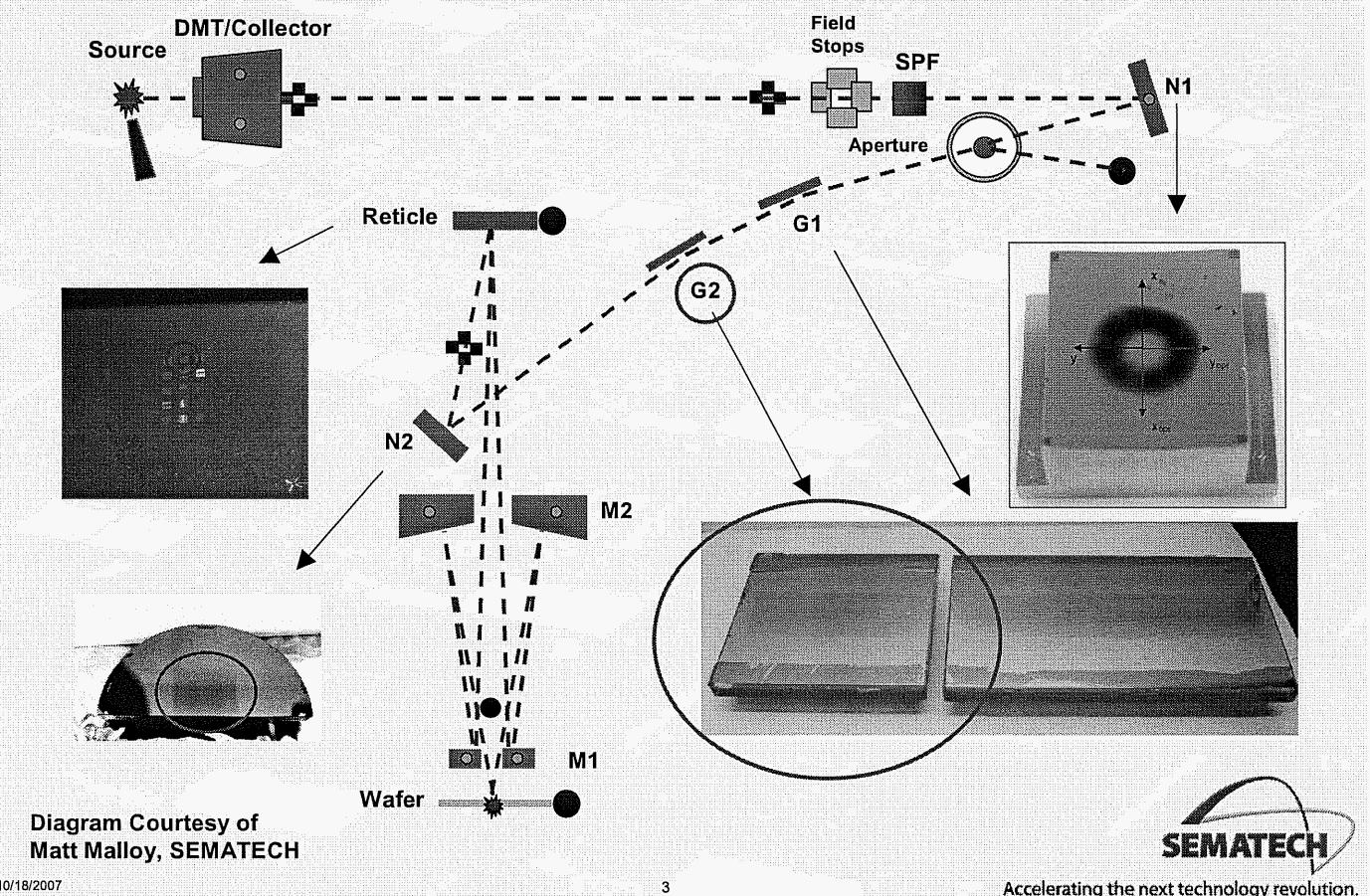
SEMATECH EUV Micro-Exposure Tools

- SEMATECH North, Albany, NY
 - 0.3 NA
 - Stand-alone
- Lawrence Berkeley National Laboratory, Berkeley, CA
 - 0.3 NA
 - Synchrotron-based
- High-throughput resist testing tools provide leading-edge EUV lithography capabilities.
- Tools operations:
 - Albany: Mid 2005 - present
 - Berkeley: Feb 2004 - present



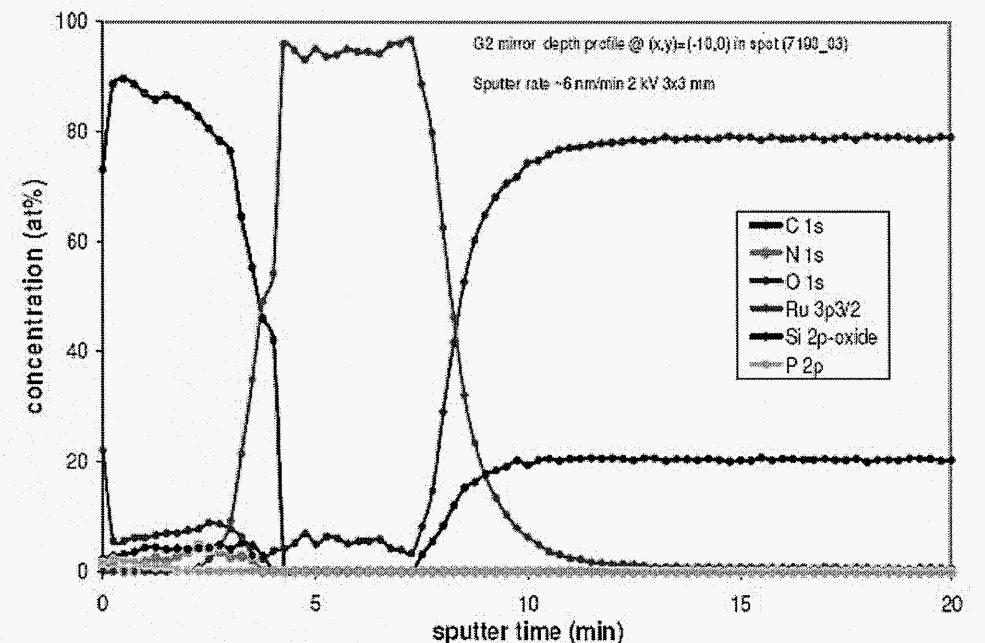
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Optical layout SEMATECH EUV MET



Albany EUV MET – G2 Mirror

Measured depth profile of spot *inside* visible contamination.



- Carbon contamination layer ~18 nm thick.
- Phosphorous present in large part of C contamination layer.
- Silicon present as SiO_2 , likely to originate from 'cracked silicones'.

C	O	Si	P	N
%	74	20	2	2

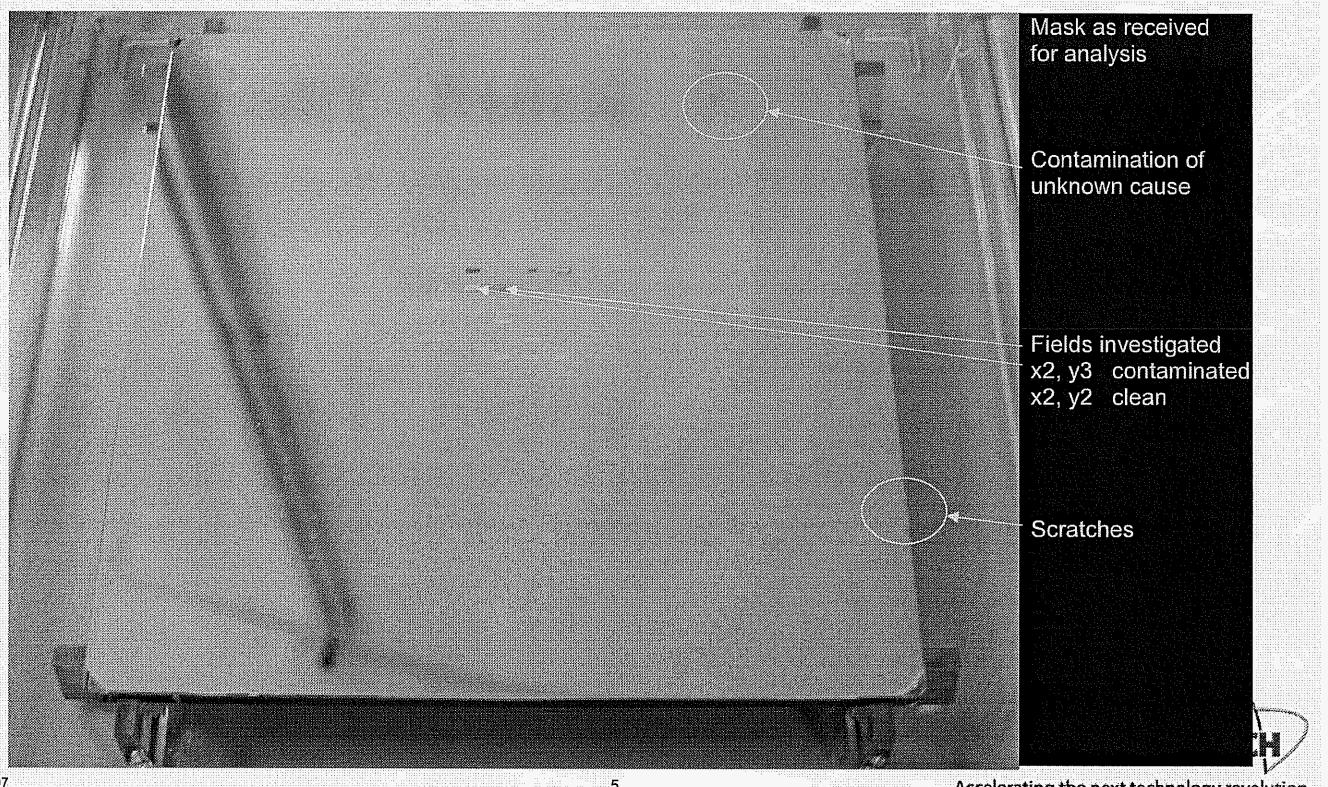
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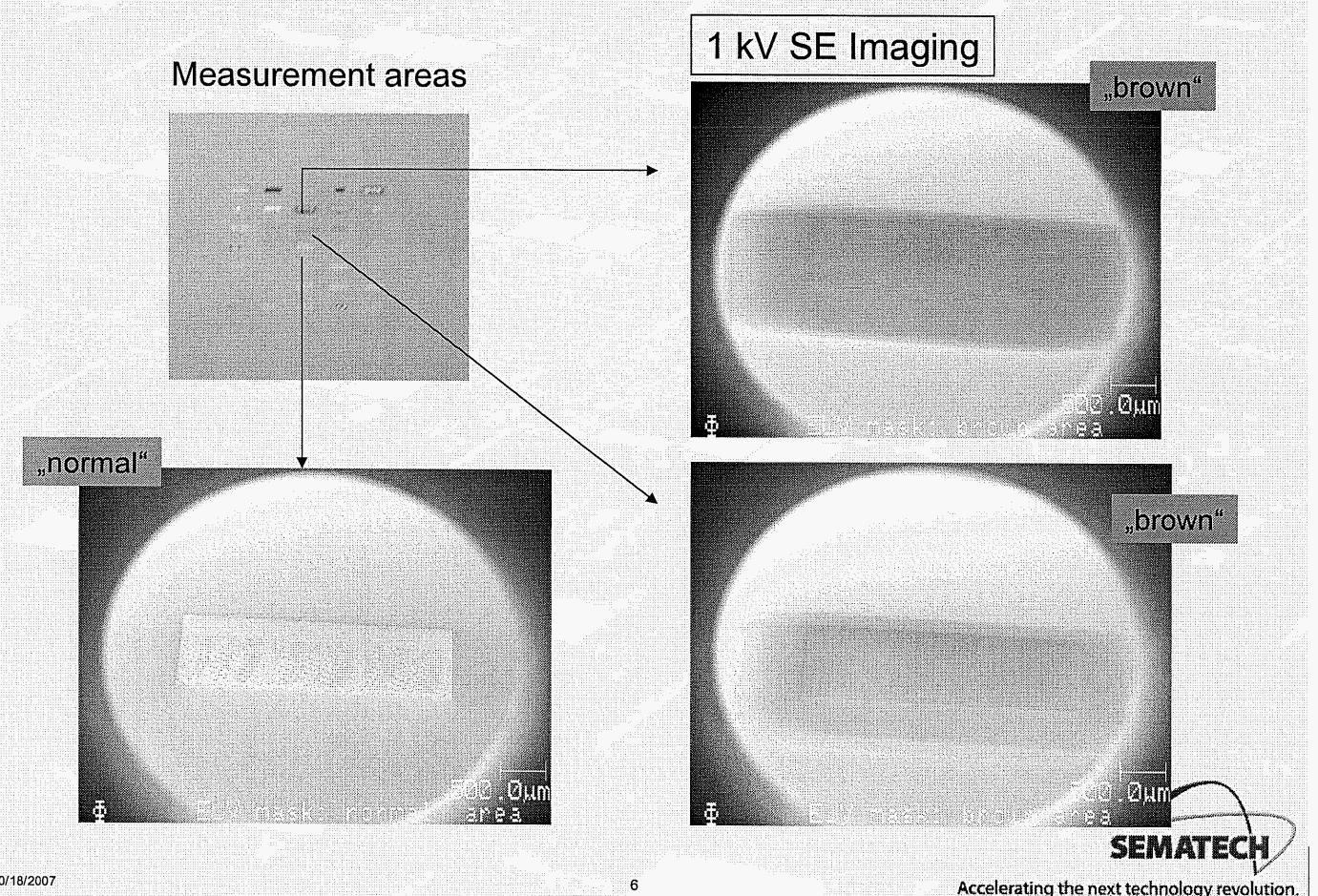
Berkeley MET - Reticle

- Analyze contaminants with different imaging, surface and chemical techniques
- Clean mask using standard cleaning protocol for EUVL mask

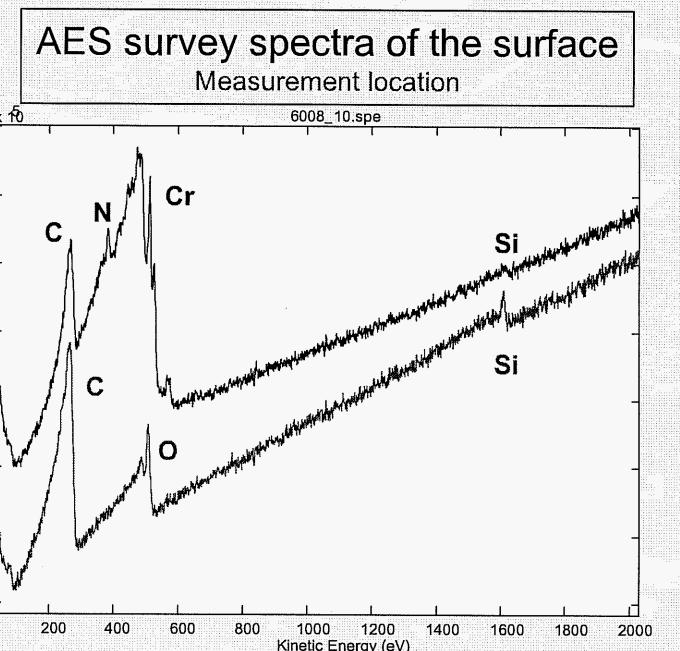
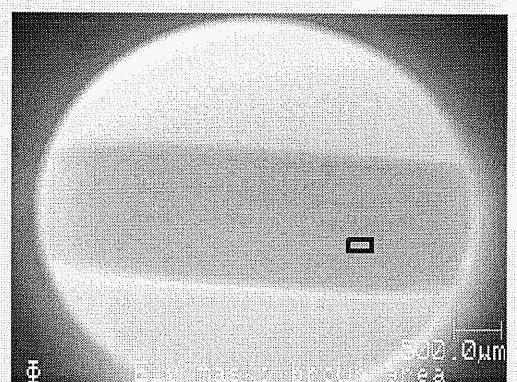
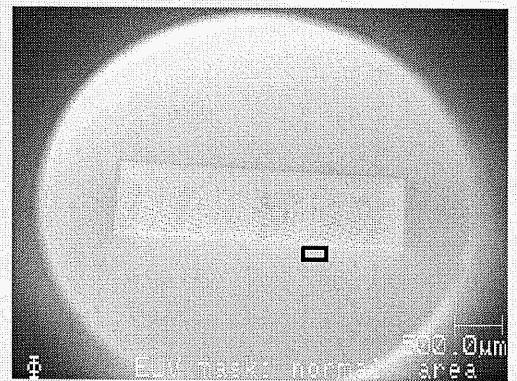
Optical picture



Berkeley MET Reticle – AES Analysis



Berkeley MET Reticle – AES Results



- C,O, Si detected in contaminated field.
- Cr, C, N, Si detected in clean field.
- Cr, N are from absorber layer.
- Si possibly from the Mo/Si multilayer, and buffer layer (SiO_2).
- C (>6nm) is the contaminant.



Summary

- For both the Albany mirrors and Berkeley mask

Main contaminant is carbon.

Further analysis techniques will be applied.

Cleaning will be tested.

