Resist Outgassing Working Group Introduction

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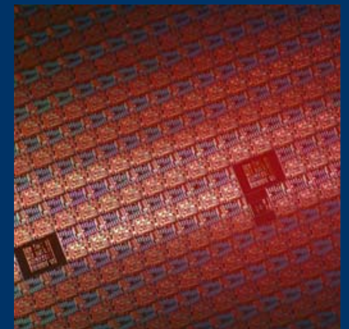

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Scope of Working Group

Purpose

- A forum to discuss issues related to testing methods of resist outgassing, understand the risks of resist outgassing, and drive consensus within the community.

Goals

- Standardize testing methods to achieve a common accepted testing methodology using best known/determined practices
- Drive consensus among tool manufacturers to a common metric and test method for resist outgassing
- Confirm or dismiss the risks of outgassing resist as a contributor to optics contamination
  - Identify the materials from the resist that cause contamination

Contributors

Tool Manufacturers

• ASML	Noreen Harned
• Canon	Akira Miyake
• Nikon	Takashi Aoki

Resources

• CNSE	Greg Denbeaux
• IMEC	Ivan Pollentier
• NIST	Charles Tarrio Thomas Lucatorto Shannon Hill
• SELETE	Iwao Nishiyama
• SEMATECH	Emil Piscani Jacque Georger

Resist Outgassing Concerns

for MET Tools

- Outgassing not a concern for these low power, low WPH tools
- Replacement of illuminator optics has been enough to restore power to the wafer, no degradation of the PO has been noted

for HVM Tools

- For overall optics contamination, there are potential sources from both hardware and resist
  - hardware outgassing may diminish over time (but repairs)
  - resist is a continuous source of outgassing (100WPH)
- Increased intensity throughout system increases risk of species conversion to carbonaceous layers

Resist Outgassing Specifications

ASML

- 2E14 molecules/(cm^{2}sec) for hydrocarbons >45AMU for ADT access
- Incident wafer plane power of 10mW/cm^2 for the ADT

Canon/Nikon

- 3E13 molecules/(cm^{2}sec) for hydrocarbons >45AMU
- Incident wafer plane power of 600mW/cm^2 for HVM
- Resist is ~10% contribution of total outgassing budget

SEMATECH

- 6.5E14 molecules/(cm^{2}sec)

Resist Outgassing Specifications

2E15 (10mW/cm²)

Outgas Rate @ 10mW/cm2

outgas rate - molecules/(cm2sec)

4.5E+14, 4.0E+14, 3.5E+14, 3.0E+14, 2.5E+14, 2.0E+14, 1.5E+14, 1.0E+14, 5.0E+13, 0.0E+00

51 49 47 45 43 41 39 37 35 33 31 29 27 25 23 21 19 17 15 13 11 9 7 5 3 1

resist number

SEMATECH spec converted to rate based upon 10 mW/cm² power level of Alpha/Beta tools

SEMATECH 2007 spec

2E14 (10mW/cm²)

ASML original spec

3E13 (600mW/cm²)

Nikon original spec

Orvek, TWG, 2008

Resist TWG Guidance

- Continue cycles of learning in resist and materials development to address challenges of RLS to achieve Z parameter (nZ_{32}) targets
- At this time, outgassing should not be a primary concern for resist development
  - MET tools will support material development
  - best performing materials may be overlooked

Thank you

Thank you for your attention!