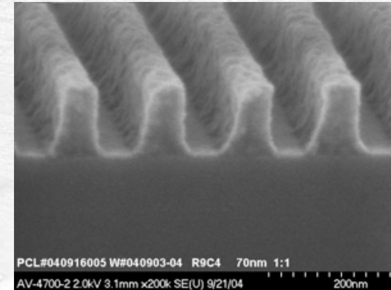
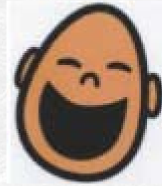
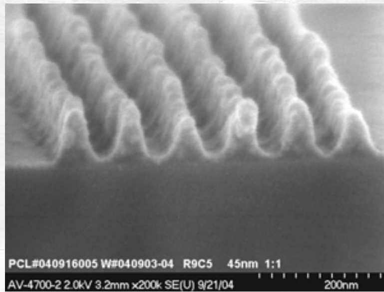
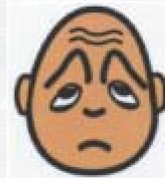
Line Edge Roughness Workshop
Resist Limitations Workshop

February 27, 2005









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Karen Turnquest
Kim Dean

Introduction

- Objective:
  - To understand the current status of resist limitations research in the industry
  - To better understand what knowledge is lacking
- Expected outcome:
  - Spawn new ideas that will lead to future projects and activities for both SEMATECH and the industry

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Structured Brainstorming

The best way to get good ideas is to have lots of ideas.

- What are specific resist limitation issues that need to be addressed?
- Prioritize the top 3 issues, then answer the following:
  - Are they wavelength dependent? If so, what wavelength(s)?
  - Are they node dependent? If so, what node(s)?
  - Who should play a major role in this research effort (consortia, universities, national laboratories, IC manufacturers, resist or tool vendors)?
  - What is the anticipated outcome?
  - When do we need the answer?

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Structured Brainstorming

The best way to get good ideas is to have lots of ideas.

Divide into 4 groups:

1. Resist/tool suppliers
   Facilitator: Karen Turnquest
2. IC Manufacturers
   Facilitator: Jan Makos-Brotherton
3. Consortia/researchers/universities/government labs
   Facilitator: Beth Kells
4. Variety group
   Facilitator: Jeff Meute

Breakout summary presentation template

Variety Group - LER

Group Variety

Specific LER Issues (I)

1. Metrology standards
2. Device impact
3. Integration/ post resist processing
4. Variability/ process control
5. Funding

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Specific LER Issues (II)

6. Develop/ dissolution
7. Material limits
8. Modeling standards/ integration
9. Aerial image/ contrast

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Top Issue#1

Metrology (standards)

- Wavelength: Independent
- Node: Yes, frequency/ measurement
- Who: IC makers, NIST, CDSEM eqpmt
- Anticipated outcome: Well developed standard
- When: asap

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Top Issues #2

Device impact

Problem now? LER frequency range? Value?

- Wavelength: Independent
- Node: Yes
- Who: Device makers, designers, suppliers
- Anticipated outcome: Value, Measure, Yield vs LER (freq), Device type
- When: ASAP

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Top Issues #3

Integration

Post processing, substrate, etch, multi layer processing,

- Wavelength: Dependent
- Node: Yes
- Who: Device makers, suppliers
- Anticipated outcome: new processes
- When: ASAP

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Breakout summary
Resist Limitations

Folks from variety of areas

Specific Resist limitation Issues (I)

1. Resist design
2. New imaging scheme
3. Pattern collapse
4. Simulation
5. Economic values/implementation time
6. Environmental
7. Metrology

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#1 Issues

Topic: Design of resist

1. Control of diffusion of small molecules in resist films
2. Molecular designs
3. Homogeneity
4. Photochemistry

Wavelength dependent: Yes

Node dependent:Yes

Who:Universities, consortium, Resist manufactures

Anticipated outcome: Identify new design concepts and tools for accelerating resist development

When: ASAP

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#2 Issues

Topic: New imaging scheme

1. Multi-layer scheme, top surface imaging
2. New devise scheme
3. Self assembly/pixel level molecular imaging

Wavelength dependent: Yes

Node dependent: Yes

Who: Universities, consortium, Resist manufactures , Device manufacturers

Anticipated outcome: Identify and demonstrate most attractive new imaging schemes

When:ASAP

#3 Issues

Topic: Pattern collapse

1. Resist modulus
2. Substrate effect
3. Capillary actions, rinsing solutions
4. Rigorous simulation

Wavelength dependent: No

Node dependent: Yes

Who: Universities, consortium, Resist manufactures , Device manufacturers

Anticipated outcome: Reduce pattern collapse and improve aspect ratio capability

When:ASAP

What's Next?

- Results will be compiled and distributed in the next two weeks
- These results will help give direction to SEMATECH and the industry

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