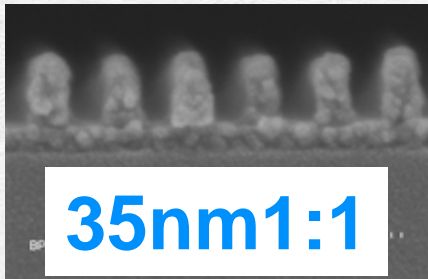


# SEMATECH Update

## IEUVI Resist TWG

Nov. 1, 2007

Sapporo, Japan



EUV data courtesy of AMD  
Exposed on Berkeley MET

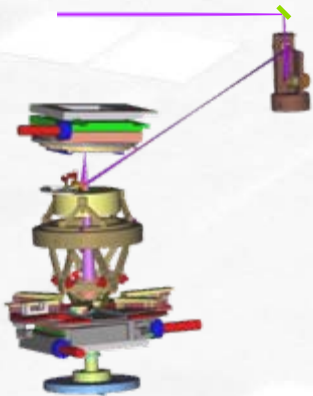
Kim Dean  
Andy Ma



Accelerating the next technology revolution.

# SEMATECH Microexposure Tools (METs)

SEMATECH Berkeley MET, Berkeley, CA



SEMATECH North MET, Albany, NY



# SEMATECH EUV Resist Projects

## Project Overviews

### ➤ SEMATECH Berkeley MET

- Symposium Presentation:
- “Advances at SEMATECH’s Berkeley MET,” Patrick Naulleau et al.



### ➤ SEMATECH Albany MET Resist Test Center

- Symposium Poster:
- “Imaging Capability of a 0.3NA EUV Micro-Exposure Tool,” Matt Malloy, et al.

### ➤ Albany Resist Outgassing (Prof. Denbeaux)

- Symposium Presentations:
- “EUV resist outgassing testing based on contamination of Mo/Si witness plates,” Greg Denbeaux



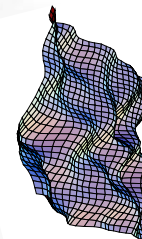
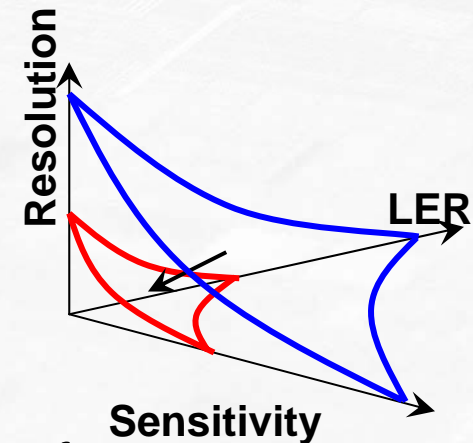
# SEMATECH EUV Resist Projects

## ➤ EUV Resist Benchmarking

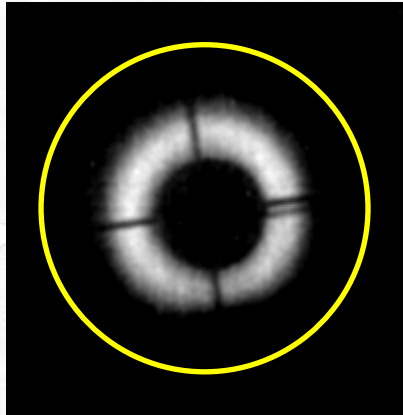
- Symposium Presentation:
- “SEMATECH EUV Resist Benchmarking Results,” Andy Ma, et al.

## ➤ EUV Resist Fundamentals for 32 nm HP

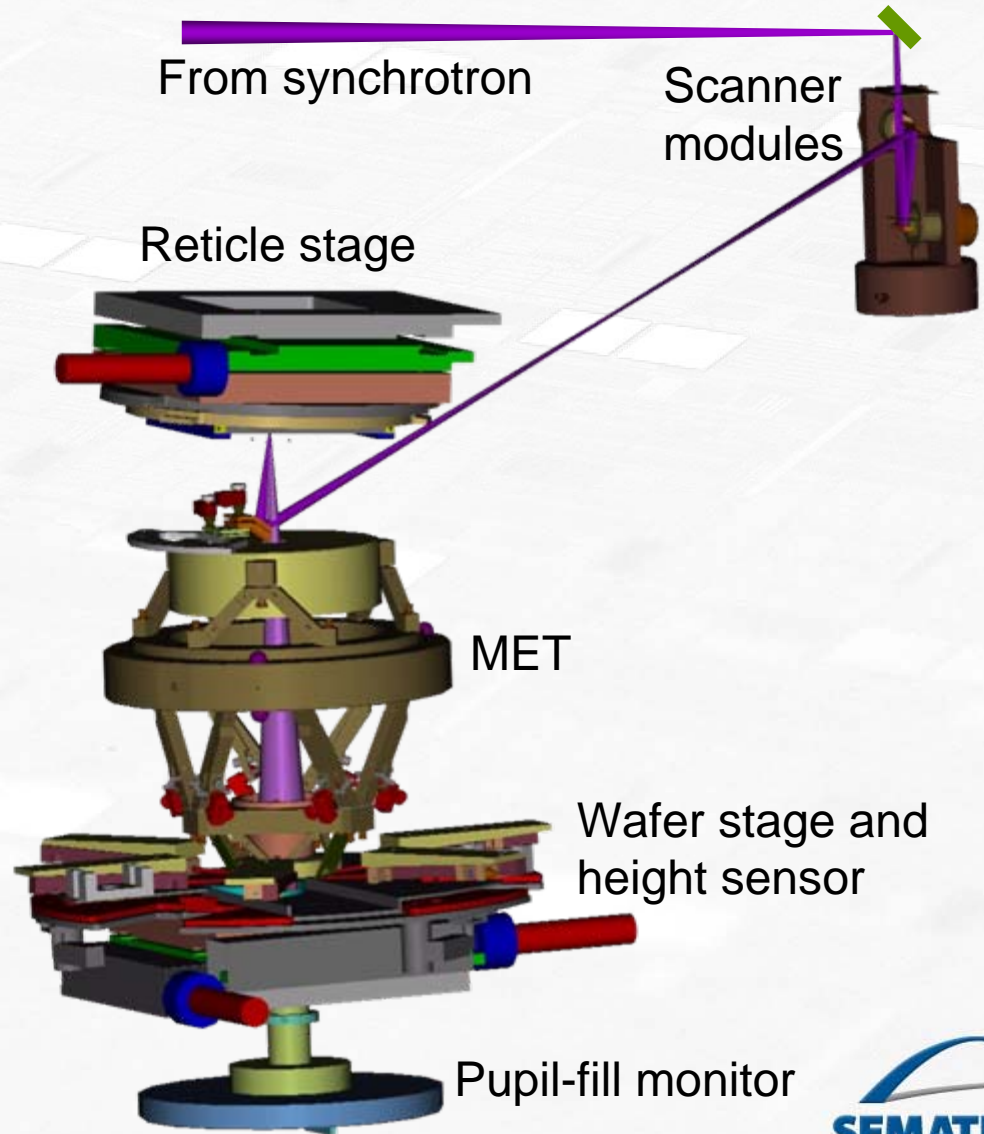
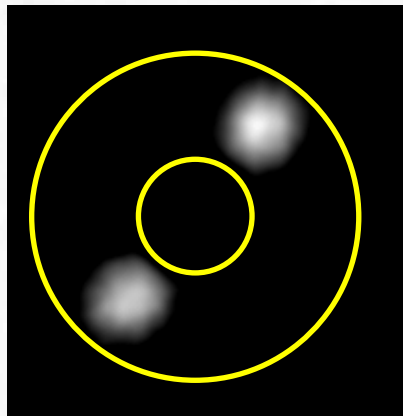
- Symposium Presentations:
- “Photons, Electrons and Acid Yields in EUV Photoresists,” Robert Brainard, et al.
- “Resolution, LER and Sensitivity Limitations of Photoresist,” Gregg Gallatin, et al.



# SEMATECH MET Printing Station at Berkeley



Examples of lossless programmable pupil fills



# SEMATECH Berkeley MET Specs

- 0.3NA, 200X600um field size on wafers, 5x reduction ratio, 4 inch wafer, programmable illuminator, synchrotron light source
- Throughput for 10X10 exposure matrix, 5 wafers per 8 hours
- Unlinked to resist processing track
- Outgassing requirement:  $< 6.5E+14$  molecules/cm<sup>2</sup> as measured by quadrupole mass spectrometry (35-200 amu, excluding 44 amu).



# Support Equipment at Berkeley

Resist outgas screening  
(SUNY)



Resist coat



Resist expose



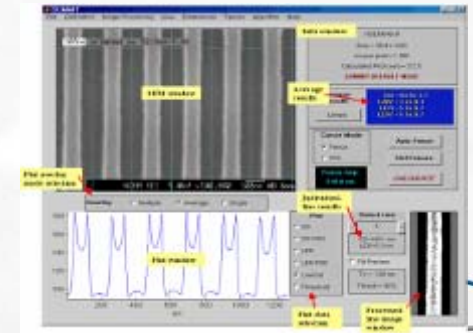
Resist develop



SEM- Hitachi-S4800 (4")



CD/ LWR measurement  
(SEMCD- SuMMit)  
SEMATECH-RTC



**SEMATECH**

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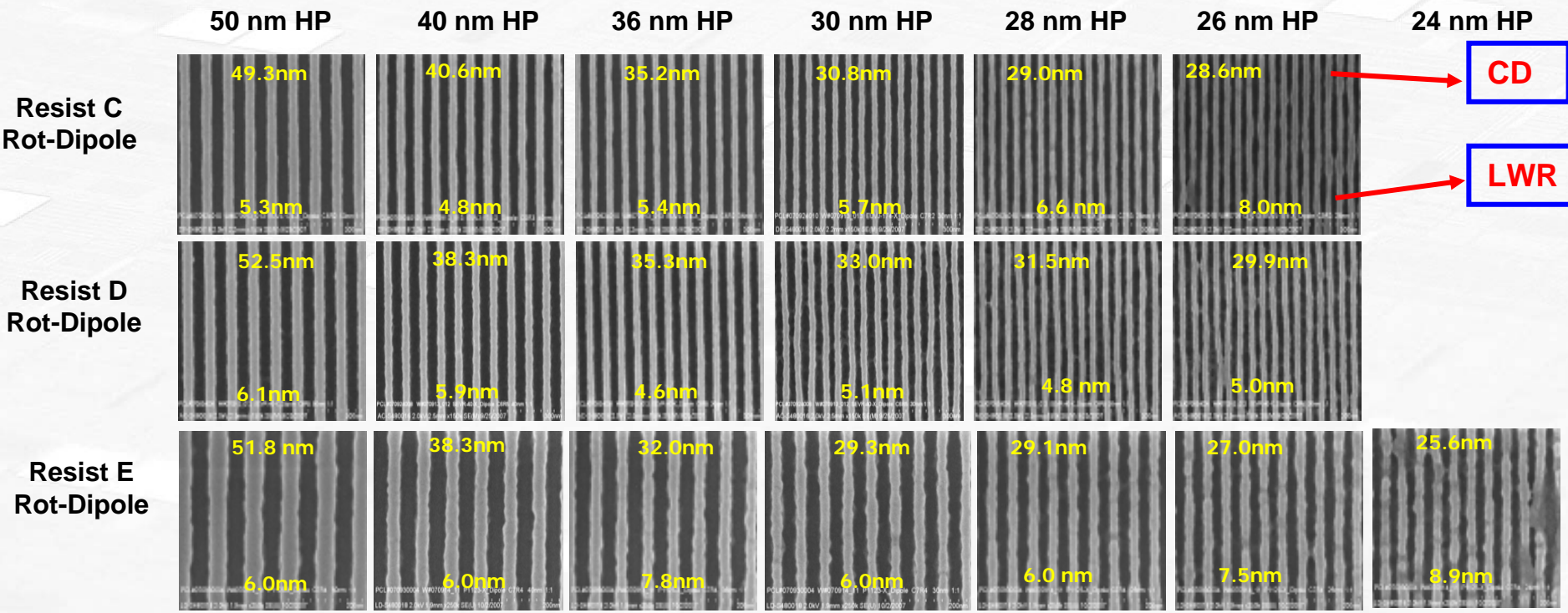
# SEMATECH MET Access @ Berkeley

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- **SEMATECH controls access, scheduling, and outgassing requirements on the Berkeley MET**
  - **Contact Kim Dean for information about access**  
**kim.dean@sematech.org**
  - **Contact Patrick Naulleau about technical issues, shipping resists, mask requirements, etc.**  
**pnaulleau@lbl.gov**



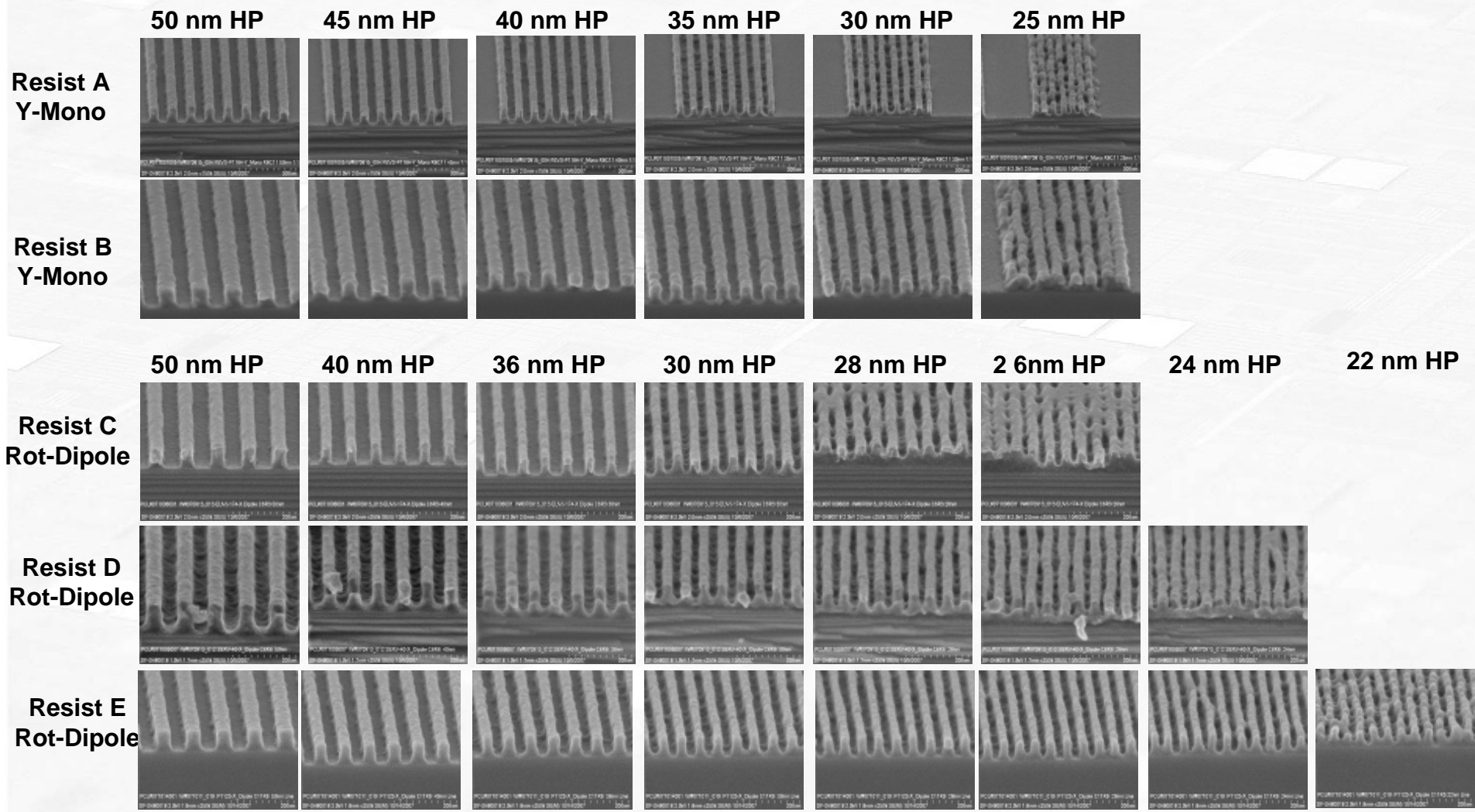
# SEMATECH Benchmarking Results from Berkeley



- Resist D demonstrated lowest LWR
- Resist E demonstrated best resolution



# SEMATECH Benchmarking Results from Berkeley



- All resists demonstrated 35-30 nm image resolution
- Resist E has 26 nm of image resolution and printing down to 22 nm



# Conclusions: Benchmarking Results

Specifications	2007 Goals	Resist A	Resist B	Resist C	Resist D	Resist E
Resolution lines1:1 (nm)	32	35	30	30	36-30	26
Low frequency LWR (nm, 3 $\sigma$ )	<2.5	7.0 @30nm	7.5 @30nm	5.7 @30nm	4.4 @30nm	5.5 @30nm
Photospeed, EUV (mJ/cm <sup>2</sup> )	10	23.2 @30nm	22.9 @30nm	19.0 @30nm	25.7 @30nm	17.0 @30nm
Outgassing (molecules/cm <sup>2</sup> )	6.5E+14	pass	pass	pass	pass	pass

- Resist E has best resolution and photospeed, LWR high
- Best LWR value (4.4) is almost 2X from this year's goal
- ~ 22 nm printing image can be demonstrated using rotated-dipole illumination
- Resists are not ready for 32nm HP pilot line

