Accelerating the next technology revolution

February 2013 Resist TWG

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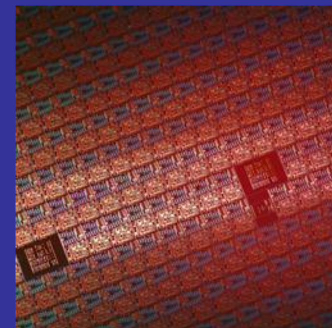

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Housekeeping

- Welcome to the IEUVI Resist TWG meeting

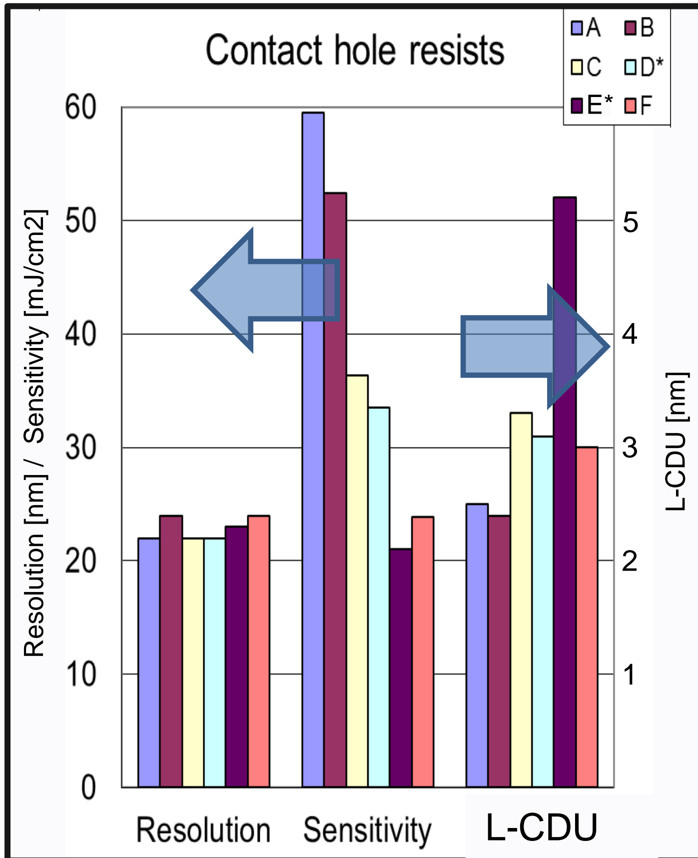
- Please sign in
- Please pick up your name tag. If one doesn't exist, please use one of the blank tags, and add your name and the company you work for
- At the end of the meeting, please return the name tags
- We would like this to be an interactive meeting. Please feel free to ask questions and make suggestions.
- All meeting presentations will be made available on the IEUVI web site after the meeting

Introduction

- **Resolution and Sensitivity are improving**
  - Resist vendors are now demonstrating **15 - 16nm hp** resolution with CAR on all EUV Micro Exposure Tools
  - Preliminary results from the NXE3300 are starting to become available
- **LWR and pattern collapse need improvement**
  - Current materials are have not met the LWR target
    - Many materials at ~3nm, target is <2nm
  - LWR improvement belongs to both litho and pattern transfer
    - Looking for an integrated solution to get to the target level
- **Contact hole imaging is becoming a focus item**
  - Materials showing resolution in the 22 – 24nm hp range
  - Improving Local CDU is very important
    - Trends show L-CDU improves as sensitivity decreases
- **Outgassing**
  - Major issue limiting materials research and development
    - Testing availability is improving
    - Ability to research topics related to outgassing is becoming available
- **Interest in DSA as a means to compliment traditional lithography**

Contact hole imaging on the LBNL MET tool

Berkeley MET
Quad, NA 0.3, sigma 0.48~0.68
FT 80nm, * 60nm
Underlayers
No mask bias, * (+20% Bias)



* L-CDU was measured at 26 or 25nm HP

	26nm	24nm	23nm	22nm	21nm	20nm
A	59.5mJ/cm² 2.5nm					
B	52.4mJ/cm² 2.4nm					
C	36.3mJ/cm² 3.3nm					
D*	33.5mJ/cm² 3.1nm (25nmHP)					
E*	21.0mJ/cm² 5.2nm (25nmHP)					
F	23.9mJ/cm² 3.0nm					

Sensitivity [mJ/cm²] / L-CDU [nm]

Contact hole resist progress and trends

Contact hole resists

L-CDU (nm)

15
12
9
6
3
0

0 20 40 60 80

Sensitivity (mJ/cm2)

2011
2012
New Condition

Trend shows improved L-CDU at the expense of sensitivity

Line/Space Performance

Best materials from each supplier

BMET, Pseudo PSM
FT 30nm, 35nm
Underlayers

	20nm	19nm	18nm	17nm	16nm	15nm	14nm	13nm
H 33.6mJ	19.3/4.3	18.4/3.5	17.6/3.7	16.4/3.9	15.1/3.7	14.7/3.7	12.5/3.8	
I 46.0mJ	15.9nm/3.9nm	16.5nm/4.2nm	15.8nm/4.1nm	14.5nm/4.0nm	13.1nm/3.6nm	11.6nm/4.2nm	11.3nm/4.5nm	
J 15.6mJ	19.2nm/4.8nm	18.5nm/4.3nm	17.7nm/4.4nm					
K 19.4mJ	19.2/6.2	17.8/4.9	17.2/4.3	15.6/4.9	14.7/4.7			
L 15.5mJ	20.7/4.8	19.6/6.0						
M 15.4mJ	21.1nm/4.2nm	19.9nm/4.5nm	18.3nm/4.8nm					

Pseudo PSM

- Resist H and I showed 15nm resolution.
- Many of suppliers are making progress with patterning performance

Z Value of EUV resists over time

(for lines and spaces)

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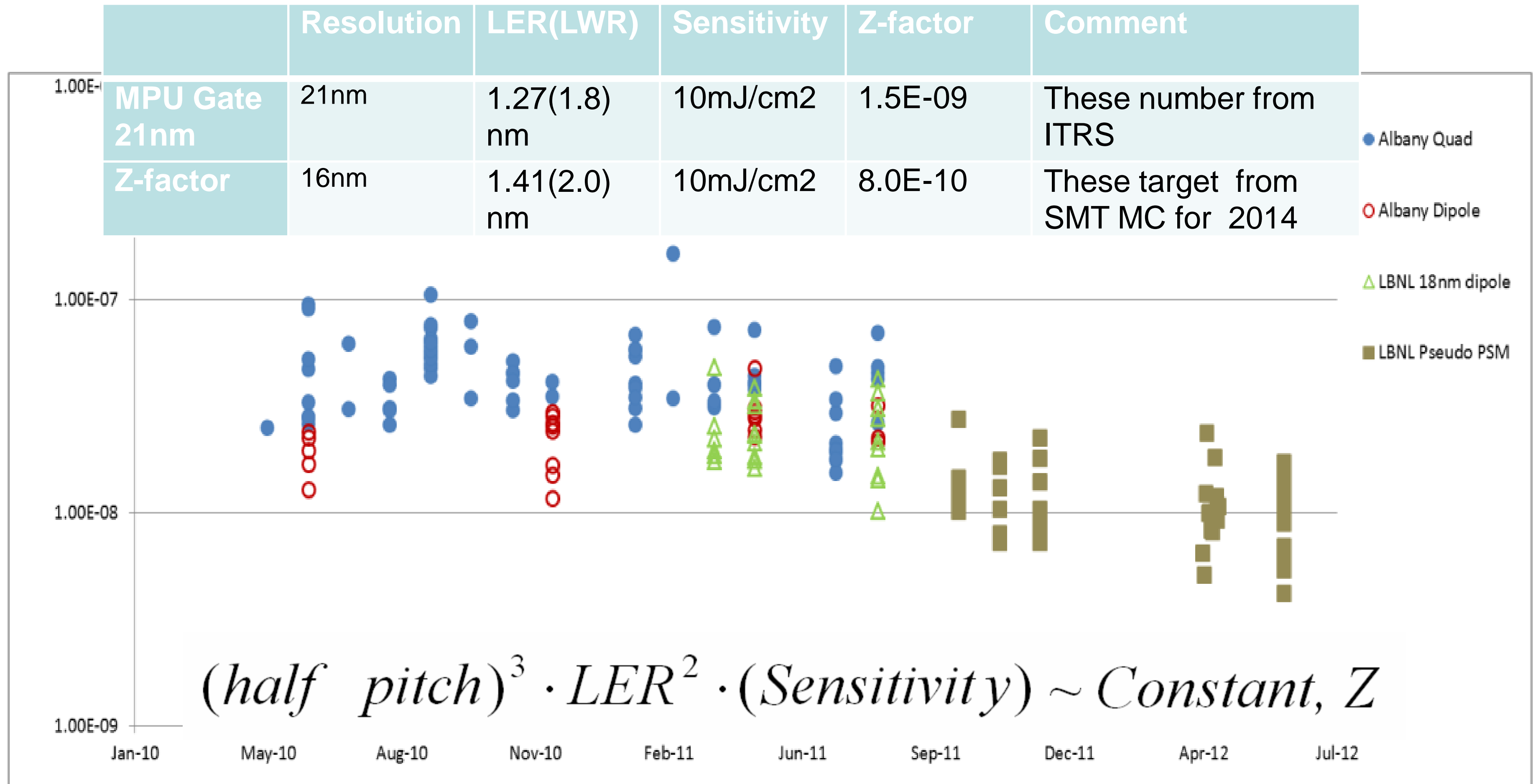
	Resolution	LER(LWR)	Sensitivity	Z-factor	Comment
MPU Gate 21nm	21nm	1.27(1.8) nm	10mJ/cm2	1.5E-09	These number from ITRS
Z-factor	16nm	1.41(2.0) nm	10mJ/cm2	8.0E-10	These target from SMT MC for 2014



- Data represents materials from six suppliers
- Improvement in Z value comes from improving the aerial image and material improvements
- Data here is not exactly comparable to ITRS roadmap values due to differences in half pitch and LER measurement details

Oct 2012 Outgas tool status & capacity

	Status	Tested to date	Current Throughput (samples per month)	Total anticipated need based on discussion (per month)
ROX	Up and running	53	8 → 24	
EUVT	August delivery, working towards Q4 certification & customer availability	0	40 - 80	
NIST	Certified Aug/Sept 2011	15 (9 customer samples)	6	
EIDEC	Certification complete, ready to start	0	30 - 40	
IMEC	Recently certified	10	~20	
LTJ	Certified	no data	no data	
Current capacity		**78**	**~70**	**250, Same as current MET tool capacity**
Projected Total Capacity			**145**	

Meeting Focus

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8:00 AM – 8:15 AM	Welcome and Introductions	*K. Petrillo, SEMATECH*
8:15 AM – 8:35 AM	NIST Outgas Testing Update	*S. Hill, NIST*
8:35 AM – 8:55 AM	EIDEC Outgas Test Results	*T. Takahashi, EIDEC*
8:55 AM – 9:15 AM	ROX Outgas Testing Update	*G. Denbeaux, CNSE*
9:15 AM – 9:35 AM	IMEC Outgas Testing Update	*I. Pollentier, IMEC*
9:35 AM – 10:05 AM	Break	
10:05 AM – 10:25 AM	EUVT Outgas Testing Update	*R. Perera, EUV Technology*
10:25 AM – 10:45 AM	DSA as a Mean for EUV Contact Rectification	*R. Gronheid, IMEC*
10:45 AM – 11:05 AM	DSA as Complementary Lithography: Guiding Pattern Requirements for Contact Shrink and Contact Multiplication	*R. Tiron, CEA-Leti*
11:05 AM – 11:30 AM	Summary	*S. Tedesco, CEA-Leti*