

2012 International Symposium on Extreme Ultraviolet Lithography

Brussels, Belgium
30 September – 4 October 2012



CLOSING ADDRESS

ANNOUNCEMENT 2013 EUVL SYMPOSIUM

KURT RONSE, ICHIRO MORI

BRUSSELS, BELGIUM

4 OCTOBER 2012

ATTENDANCE BY REGION

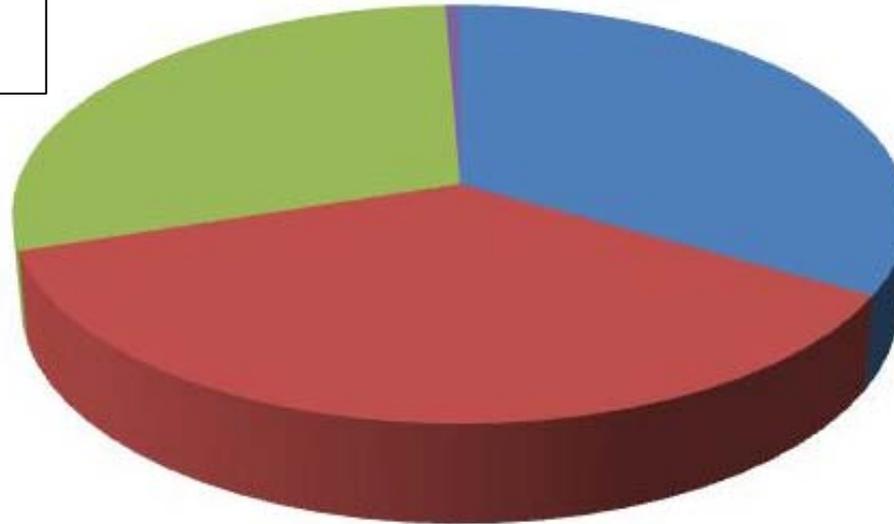
338 PEOPLE REGISTERED

Brussels, Belgium
30 September – 4 October 2012



United States
29%

Asia / Pacific
33%



- Asia
- Europe
- US
- ROW

Europe
37%

LOOKING BACK AT THIS SYMPOSIUM

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- ▶ 4 days symposium
 - Trying to include presentations focusing on the real integration of EUVL in the advanced process nodes
 - Trying to include also a view on extendibility (6.xnm, high NA, ...)
- ▶ Clearly EUVL has entered the competitive era
- ▶ Survey asking your feedback
 - Format
 - Duration
 - Other suggestions

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11TH INTERNATIONAL PROGRAM STEERING COMMITTEE MEETING

BRUSSELS

OCTOBER 4TH, 2012

2012 International Symposium on Extreme Ultraviolet Lithography

2011 EUV FOCUS AREAS

Brussels, Belgium
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2007 / 22hp	2008 / 22hp	2009 / 22hp	2010 / 22hp	2011 / 22hp
1. Reliable high power source & collector module	1. Long-term source operation with 100 W at IF and 5MJ/day	1. Mask yield & defect inspection/review infrastructure	1. Mask yield & defect inspection/review infrastructure	1. Long-term reliable source operation with 200 W at IF*
2. Resist resolution, sensitivity & LER met simultaneously	2. Defect free masks through lifecycle & inspection/review infrastructure	2. Long-term reliable source operation with 200 W at IF	1. Long-term reliable source operation with 200 W at IF	2. Mask yield & defect inspection/review infrastructure
3. Availability of defect free mask	3. Resist resolution, sensitivity & LER met simultaneously	3. Resist resolution, sensitivity & LER met simultaneously	2. Resist resolution, sensitivity & LER met simultaneously	3. Resist resolution, sensitivity & LER met simultaneously
4. Reticle protection during storage, handling and use	• Reticle protection during storage, handling and use	• EUVL manufacturing integration	• EUVL manufacturing integration	• EUVL manufacturing integration
5. Projection and illuminator optics quality & lifetime	• Projection/ illuminator optics and mask lifetime			

*) This requires a 20 X improvement from current source power status



HVM introduction in late 2013 if productivity challenge can be met

STEERING COMMITTEE OBSERVATIONS

SOURCES

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- ▶ Source productivity must increase dramatically over the next 1-2 years to enable EUVL HVM introduction (it's show time)
 - 200 W at IF in 2014 is where EUVL HVM can start
 - 500 W - 1000 W is what will be needed for EUV to be cost effective
- ▶ The increase in Conversion Efficiency to the 4-5% range is very encouraging
- ▶ Sources have seen reliability improvements that are key to increasing the EUV litho learning rate (number of wafers still very low for development)

STEERING COMMITTEE OBSERVATIONS

MASKS (1/2)

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- ▶ Availability of yielding masks / mask blanks to support pilot line and HVM introduction remains a major concern
 - We have seen good improvement in mask blank defectivity but a next generation multilayer deposition tool will be required to meet HVM needs
 - Mask defect learning has become competitive; most data shared now publicly is from consortia work (mitigation, printability)
 - Mask handling is making progress with multiple supplier solutions being implemented
- ▶ The industry must successfully complete the mask tool development programs (blank inspection, patterned mask inspection and review) by 2013-15

STEERING COMMITTEE OBSERVATIONS

MASKS (2/2)

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- ▶ Pellicle solutions are being explored as a back-up solution to help mitigate the defect challenge
- ▶ Potential high-NA path and its impact on mask technology and demagnification needs much more discussion before a high NA path can be down selected

- ▶ There is incremental improvements in resists meeting resolution, LWR, and sensitivity simultaneously – but there is no breakthrough
- ▶ For champion sub-20 nm resist materials photospeed is decreasing
 - The best L/S resist show between $\sim 20 - 40$ mJ/cm²
 - The best C/H resists show between $\sim 30 - 50$ mJ/cm² (using mask bias)
 - This is not consistent with the 15 mJ/cm² requirement assumed in the exposure tool suppliers productivity roadmap
- ▶ It is expected that much more additional work will be required to enable new platforms for the 11 nm half-pitch imaging (using high-NA EUV)

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Key Focus Areas	Rank* (StdDev)
Long-term reliable source operation with: <ul style="list-style-type: none">• 200 W at IF in 2014• 500 W – 1,000 W at IF in 2016	1.0 (0.00)
Mask yield & defect inspection/review infrastructure	2.2 (0.38)
Resist resolution, sensitivity & LER met simultaneously	3.2 (0.66)
EUVL manufacturing integration	3.7 (1.21)

Source has been ranked as the #1 concern by all steering committee members.

*) Average of 19 steering committee member votes

2008-2012 EUV FOCUS AREAS

22NM HP INSERTION

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SQUARE

2008 / 22hp	2009 / 22hp	2010 / 22hp	2011 / 22hp	2012 / 22hp
1. Long-term source operation with 100 W at IF and 5MJ/day	1. Mask yield & defect inspection/review infrastructure	1. Mask yield & defect inspection/review infrastructure	1. Long-term reliable source operation with 200 W at IF*	1. Long-term reliable source operation with a. 200 W at IF in 2014 b. 500 W-1,000 W in 2016
2. Defect free masks through lifecycle & inspection/review infrastructure	2. Long-term reliable source operation with 200 W at IF	1. Long-term reliable source operation with 200 W at IF	2. Mask yield & defect inspection/review infrastructure	2. Mask yield & defect inspection/review infrastructure
3. Resist resolution, sensitivity & LER met simultaneously	3. Resist resolution, sensitivity & LER met simultaneously	2. Resist resolution, sensitivity & LER met simultaneously	3. Resist resolution, sensitivity & LER met simultaneously	3. Resist resolution, sensitivity & LER met simultaneously
• Reticle protection during storage, handling and use	• EUVL manufacturing integration			
• Projection / illuminator optics and mask lifetime				

THANKS TO OUR SPONSORS



2012 International Symposium on

2012 EUVL SYMPOSIUM SUPPORT TEAM AT THE SYMPOSIUM

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Beverly

Ariane

Marcy

Annemie

Liesbet

Mieke

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2013 EUVL SYMPOSIUM ANNOUNCEMENT

ICHIRO MORI