2011 International Workshop on EUV Lithography

June 13-17, 2011
Makena Beach Golf Resort ▪ Maui, Hawaii

Workshop Proceedings

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Workshop Proceedings

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2011 International Workshop on EUV Lithography

Makena Beach Golf Resort, Maui, Hawaii, USA
June 13-17, 2011

Workshop Agenda Outline

Short Courses (Makena Room, June 13, 2011)

EUV Lithography
8:00 AM -5:00 PM, Monday, June 13, 2011

EUVL Workshop (June 14-17, 2011)

Tuesday, June 14, 2011

3:00 PM- 5:00 PM	Registration (Kaeo Ballroom Entry Lanai) Speaker Prep (Wailea Room)
5:00 PM- 7:00 PM	Reception (Pacific Lawn)

Wednesday, June 15, 2011

7:00 AM	–	8:00 AM	Breakfast
8:00 AM	–	12:00 PM	Oral Presentations (Wailea Room)
12:00 PM	–	1:00 PM	Lunch (Holokai Pavilion)
1:00 PM	–	4:00 PM	Oral Presentations (Wailea Room)
4:00 PM			Afternoon off for Networking /Sunset Cruise

Thursday, June 16, 2011

7:00 AM	–	8:00 AM	Breakfast
8:00 AM	–	12:00 PM	Oral Presentations (Wailea Room)
12:00 PM	–	1:00 PM	Lunch (Holokai Pavilion)
1:00 PM	–	4:00 PM	Oral Presentations (Wailea Room)
5:00 PM	-	6:00 PM	Poster Session
6:00 PM			Poster Session Awards (Pacific Lawn)
6:00 PM			Dinner (Pacific Lawn)

Friday, June 17, 2011

8:30 AM	–	10:00 AM	EUVL Workshop Steering Committee Meeting (Kaeo Ballroom)

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Workshop Proceedings

(Click on links to download Papers)

Monday, June 13, 2011

Short Courses

EUV Lithography
by Vivek Bakshi (EUV Litho, Inc.), Patrick Naulleau (LBNL) and Jinho Ahn (Hanyang University)
8:00 AM -5:00 PM, Monday, June 13, 2011

Tuesday, June 14, 2011

Registration and Reception

3:00 PM- 5:00 PM	Registration & Speaker Prep
5:00 PM- 7:00 PM	Reception

Wednesday, June 15, 2011

8:30 AM **Welcome and Introduction** (Intro-1)

Vivek Bakshi, *EUV Litho, Inc.*

Session 1: Keynote Presentations

Session Chair: Obert Wood (Global Foundries)

EUV Lithography and EUVL Sources: From the Beginning to NXE and Beyond (P1)
Vadim Banine, *ASML*

Development and Optimization of EUV Emission from Laser Produced Plasmas (P2)
Gerry O'Sullivan, *University College Dublin*

Break

Doing Business in Maui (P39a)
Kimberly Haueisen, *Maui Economic Development Board (MEDB), Inc.*

Doing Business in Maui (P39b)
Mark Ausbeck, *High Tech Development Corporation (HTDC)*

Session 2: Patterning

Session Chairs: Takeo Watanabe (*University of Hyogo) and* Patrick Naulleau *(Center for X-Ray Optics)*

EUV Interference Lithography for 1X nm (P8)
Takeo Watanabe, *University of Hyogo*

EUV Lithography Simulation for the 16 nm Node (P17)
Eun-Jin Kim and Hye-Keun Oh, *Hanyang University*

LER Metrology: Can We Trust the Numbers? (P31) (Invited Paper)
Patrick Naulleau, *Center for X-Ray Optics*

Lunch (Holokai Pavilion)

Session 3: EUV Source Modeling

Session Chair: Mark Tillak (UCSD)

Radiative Hydrodynamic Simulation of Laser-produced Tin Plasma for Extreme Ultraviolet Lithography (P10)
Atsushi Sunahara, *Institute for Laser Technology*

Progress in Modelling of High Intensity Radiation Plasma Sources (P26)
S.V. Zakharov, *EPPRA*

Session 4: Next Generation EUV Sources

Session Chair: Sergey Zakharov (EPPRA) and Gerry O'Sullivan (UCD)

Rare-Earth Plasma EUV Source at 6.7 nm for Future Lithography (P5) (Invited Paper)
Takeshi Higashiguchi, *Utsunomiya University*

Atomic and Radiative Processes in Plasmas for the Shorter Wavelength Extreme ultra-violet (EUV) Light Sources (P7)
Akira Sasaki, *Japan Atomic Energy Agency*

Design of High Brightness Laser-Compton Light Source for EUV Lithography Research in Shorter Wavelength Region (P30) (Invited Paper)
Kazuyuki Sakaue, *Waseda University*

Break

Session 5: EUV Sources

Session Chairs: Vadim Banine (ASML) and Padraig Dunne (UCD)

Optimization of Laser-produced Plasma Light Sources for EUV Lithography (P6)
Mark Tillack, *UCSD*

High Brightness EUV & Soft-X-ray MPP Discharge Source System Development (P27)
Sergey V. Zakharov, *EPPRA*

EQ-10 Electrodeless Z-Pinch EUV Source for Metrology Applications
Deborah Gustafson (P38), *Energetiq*

Progress on Liquid Metal Collector Mirrors as Robust Plasma Facing EUV and Soft X-ray Optics (P18)
Padraig Dunne, *University College Dublin*

1st/2nd Generation Laser-Produced Plasma Light Source System for HVM EUV Lithography (P34) (Invited Paper)
Hakaru Mizoguchi, *Gigaphoton*

Adjourn at 4 PM

Thursday, June 16, 2011

9:00 AM Welcome and Announcements (Intro-2)

Vivek Bakshi, *EUV Litho, Inc.*

Session 6: EUVL R&D Status

Session Chair: Vivek Bakshi (EUV Litho, Inc.)

Panelists:

EUVL R&D in Japan (P14), Takeo Watanabe (P14) (Hyogo University)

EUVL R&D in Taiwan (P9), Bryan, B. Y. Shew (NSRCC)

EUVL R&D in Korea (P33), Jinho Ahn (Hanyang University)

EUVL R&D in Europe (P41), Padraig Dunne (University College Dublin)

EUVL R&D in USA (P35), Vivek Bakshi (EUV Litho, Inc.)

Break

Session 7: EUVL Mask

Session Chairs: Jinho Ahn (Hanyang University) and David Ruzic (UIUC)

Developing a New State of the Art EUV Mask Imaging Research Tool at Berkeley (P11) (Invited Paper)
Kenneth Goldberg, *Center for X-Ray Optics*

Overview of EUM Mask Inspection Systems in NewSUBARU (P15) (Invited Paper)
Hiroo Kinoshita and Takeo Watanabe, *University of Hyogo*

Development Status of EUVL Mask Blank and Substrate (P12) (Invited Paper)
Kazunobu Maeshige, *Asahi Glass Co. Ltd.*

EUV Mask Production and Cleaning (P13) (Invited Review Paper)
David N. Ruzic, *UIUC*

Lunch (Holokai Pavilion)

Session 8: EUV Resist and Resist Outgassing

Session Chairs: Obert Wood (GlobalFoundries) and Seiichi Tagawa (Osaka University)

Recent Progress in Nano-space Radiation Chemistry Research on Sensitivity Enhancements of EUV Resists (P37) (Invited Paper)
Seiichi Tagawa*, Osaka University*

Challenges in Development and Construction of Metrology, Calibration, and Resist Testing Tools for the Implementation of EUV Lithography (P3)
Rupert C. C. Perera, *EUV Technology*

Cleaning of Capped Multi-Layer Samples and Cleaning with Hydrogen using the Evactron® De-Contaminator (P23)
Christopher G. Morgan and Ronald Vane, *XEI Scientific, Inc.*

Mass Spectrometer Characterization of Reactions in Photoresists Exposed to Extreme Ultraviolet Radiation (P29)
Chimaobi Mbanaso, Gregory Denbeaux*, University at Albany*

Session 9: EUV Optics

Session Chairs: Eric Louis (FOM) and Yuriy Platonov (RIT)

Status of Multilayer Coatings for EUV Lithography (P25) (Invited Review Paper)
Yuriy Platonov, *Rigaku Innovative Technologies*

Surface Metrology and Polishing Techniques for Current and Future-generation EUVL Optics (P32) (Invited Review Paper)
Regina Soufli, *Lawrence Livermore National Laboratory*

Developing Reflective Multilayer Coatings, an Enabling Component of Extreme Ultraviolet Lithography and Beyond
(P24) (Invited Paper)
E. Louis, *FOM*

WORKSHOP SUMMARY

EUVL Workshop Summary and Announcements (P40)
Vivek Bakshi, *EUV Litho Inc.*

5: 00 PM Session 10: Poster Session

Session Chair: Ken Goldberg (CXRO)

Thin Half-tone Phase Shift Mask Stack for Extreme Ultraviolet Lithography (P19)
[1]Inhwan Lee, [2]Sangsul Lee, [2]Jae Uk Lee, [2]Chang Young Jeong,[3]Sunyoung Koo, [3]Changmoon Lim, and [1,2]Jinho Ahn
[1]Department of Nanoscale Semiconductor Engineering,
[2]Department of Material Science and Engineering, Hanyang University, Seoul, Korea
[3]Memory Research & Development Division, Hynix Semiconductor Inc., Icheon-si, Kyungki-do, Korea

EUVL Flare Modeling with an Improved Accuracy for Feasibility Study of Sub-22nm HP Node (P21)
Junhwan Lee, Sangheon Lee and Ohyun Kim
Department of Electronic and Electrical Engineering, Pohang University of Science and Technology, Korea

B_4C/Si based EUV Multilayer Mirror with Suppressed Reflectivity for CO_2 Laser Radiation (P4)

V.V. Medvedev[1,2], A.E. Yakshin[1], R.W.E. van de Kruijs[1], V.M. Krivtsun[2], A.M. Yakunin[3], F. Bijkerk[1,4]
[1] FOM Institute for Plasma Physics, Nanolayer- Surface and Interface Physics department, Nieuwegein, The Netherlands
[2] Institute for Spectroscopy RAS, Troitsk, Moscow region, Russia
[3] ASML, Veldhoven, The Netherlands
[4] MESA+, University of Twente, Enschede, The Netherlands

EUV Spectra of Gadolinium Laser Produced Plasmas **(P16)**

Colm O' Gorman[1], Takamitsu Otsuka[2], Takeshi Higashiguchi[1], Akira Endo[3], Tony Donnelly[1], Bowen Li[1], Thomas Cummins[1], Deirdre Kilbane[1], Emma Sokell[1], Padraig Dunne[1] and Gerry O' Sullivan[1]
[1] School of Physics, University College Dublin, Dublin, Ireland
[2] Department of Advanced Interdisciplinary Sciences and Centre of Optical Research and Education (CORE), Utsunomiya University, Utsunomiya, Tochigi, Japan
[3] Forschungszentrum Dresden, Dresden, Germany

Laser Plasma Pumping by Variable-length CO_2 Laser Pulses (P20)

Thomas Cummins, Marie Mazoyer, Gerry O'Sullivan, Padraig Dunne, Emma Sokell, Fergal O'Reilly, Colm O'Gorman and Tony Donnelly
Atomic, Molecular and Plasma Spectroscopy group, School of Physics, University College Dublin, Dublin, Ireland

Gas-based Spectral Filter for Mitigating 10.6 µm Radiation in CO_2 Laser Produced Plasma Extreme Ultraviolet Sources (P28)

Chimaobi Mbanaso[1], Gregory Denbeaux[1], Alin Antohe[1], Horace Bull[1]
Frank Goodwin[2], Ady Hershcovitch[3]
[1] College of Nanoscale Science and Engineering, University at Albany, Albany, New York, USA
[2] SEMATECH, Albany, New York, USA
[3] Brookhaven National Laboratory, Upton, New York, USA

POSTER SESSION AWARDS

First Place:

Laser Plasma Pumping by Variable-length CO_2 Laser Pulses (P20)
Thomas Cummins, Marie Mazoyer, Gerry O'Sullivan, Padraig Dunne, Emma Sokell, Fergal O'Reilly, Colm O'Gorman and Tony Donnelly
Atomic, Molecular and Plasma Spectroscopy group, School of Physics, University College Dublin, Dublin, Ireland

Second Place:

Thin Half-tone Phase Shift Mask Stack for Extreme Ultraviolet Lithography (P19)
[1]Inhwan Lee, [2]Sangsul Lee, [2]Jae Uk Lee, [2]Chang Young Jeong, [3]Sunyoung Koo, [3]Changmoon Lim, and [1,2]Jinho Ahn
[1]Department of Nanoscale Semiconductor Engineering,
[2]Department of Material Science and Engineering, Hanyang University, Seoul, Korea
[3]Memory Research & Development Division, Hynix Semiconductor Inc., Icheon-si, Kyungki-do, Korea

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