2011 International Workshop on EUV Lithography

June 13-17, 2011

Makena Beach Golf Resort ▪ Maui, Hawaii

Workshop Agenda

EUV LITHO, INC.

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			Dinner (Pacific Lawn)

Friday, June 17, 2011

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

2011 International Workshop on EUV Lithography

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

Workshop Agenda

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

8:00 AM Welcome and Introduction

Vivek Bakshi
EUV Litho, Inc., Austin, TX, USA

Session 1: Keynote Presentations

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

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

Break

Session 2: EUV Sources

1st/2nd Generation Laser-Produced Plasma Light Source System for HVM EUV Lithography (P34) (Invited Paper)
Hakaru Mizoguchi[1], Tamotsu Abe, Yukio Watanabe, Takanobu Ishihara, Takeshi Ohta, Tsukasa Hori, Tatsuya Yanagida, Hitoshi Nagano, Takayuki Yabu, Shinji Nagai, Georg Soumagne, Akihiko Kurosu, Krzysztof M. Nowak, Takashi Suganuma, Masato Moriya, Kouji Kakizaki, Akira Sumitani, Hidenobu Kameda[1], Hiroaki Nakarai[1], Junichi fujimoto[1]
EUVA/Komatsu (Japan): Hiratsuka, Kanagawa, Japan
[1]Gigaphoton (Japan): Oyama, Tochigi, Japan

Optimization of Laser-produced Plasma Light Sources for EUV Lithography (P6)
Mark Tillack and Yezheng Tao
University of California, San Diego, La Jolla, CA

High Brightness EUV & Soft-X-ray MPP Discharge Source System Development (P27)
Peter Choi[ab], Sergey V. Zakharov[ab+], Raul Aliaga-Rossel[a], Aldrice Bakouboula[a], Otman Benali[ab], Philippe Bove[a], Michèle Cau[a], Grainne Duffy[a], Blair Lebert[b], Ouassima Sarroukh[b], Clement Zaepffel[a], Vasily S. Zakharov[b]
[a] *Nano-UV sas, Villebon/Yvette, France*
[b] *EPPRA sas, Villebon/Yvette, France*
[+] *also with NRC Kurchatov Institute, Moscow, Russia*

EQ-10 Electrodeless Z-Pinch EUV Source for Metrology Applications
Deborah Gustafson, Stephen F. Horne, Matthew M. Besen, Donald K. Smith, Matthew J. Partlow, Paul A. Blackborow (P38)
Energetiq Technology, Inc., Woburn, MA, USA 01801

Progress on Liquid Metal Collector Mirrors as Robust Plasma Facing EUV and Soft X-ray Optics (P18)
Kenneth Fahy, Fergal O'Reilly, Enda Scally, Padraig Dunne, Paul Sheridan
University College Dublin, Dublin, Ireland

Lunch (Holokai Pavilion)

Session 3: EUV Source Modeling

Comprehensive Simulation and Experimental Studies of EUV Lithography Source Issues (P22) (Invited Paper)
A. Hassanein, T. Sizyuk, and S.S. Harilal
Center for Materials Under Extreme Environment, School of Nuclear Engineering
Purdue University, West Lafayette, Indiana, USA

Radiative Hydrodynamic Simulation of Laser-produced Tin Plasma for Extreme Ultraviolet Lithography (P10)

Atsushi Sunahara[1], Katsunobu Nishihara [2], A. Sasaki [3], and Tsukasa Hori [4]
[1] *Institute for Laser Technology, 2-6 Yamadaoka Suita Osaka 565-0871*
[2] *Institute of Laser Engineering, Osaka University, 2-6 Yamadaoka Suita Osaka 565-0871*
[3] *Quantum Beam Science Directorate, Japan Atomic Energy Agency, 8-1 Umemidai, Kizugawa Kyto 619-0215 Japan*
[4] *EUVA*

Progress in Modelling of High Intensity Radiation Plasma Sources (P26)

S.V. Zakharov[ab+], V.S. Zakharov[a], P. Choi[ab], G. O'Sullivan[d], A.Y. Krukovskiy[c], V.G. Novikov[c], A.D. Solomyannaya[c], A.V. Berezin[c], A.S. Vorontsov[c], M.B. Markov[c], S.V. Parot'kin[c]
[a] *EPPRA sas, Villebon/Yvette, France*
[b] *NANO-UV sas, Villebon/Yvette, France*
[c] *Keldysh Institute of Applied Mathematics RAS, Moscow, Russia*
[d] *University College Dublin (UCD), Ireland*
[+] *also with NRC Kurchatov Institute, Moscow, Russia*

Session 4: Next Generation EUV Sources

Rare-Earth Plasma EUV Source at 6.7 nm for Future Lithography (P5) (Invited Paper)

Takeshi Higashiguchi[1,2], Takamitsu Otsuka[1], Noboru Yugami[1,2], Deirdre Kilbane[3], Thomas Cummins[3], Colm O'Gorman[3], Tony Donnelly[3], Padraig Dunne[3], and Gerry O'Sullivan[3], Weihua Jiang[4], and Akira Endo[5]
[1]*Department of Advanced Interdisciplinary Sciences, and Center for Optical Research & Education (CORE) Utsunomiya University, Utsunomiya, Tochigi, Japan*
[2]*Japan Science and Technology Agency, CREST, Kanagawa, Saitama 332-0012, Japan*
[3]*School of Physics, University College Dublin, Belfield, Dublin 4, Ireland*
[4]*Department of Electrical Engineering, Nagaoka University of Technology , Nagaoka, Niigat, Japan*
[5]*Waseda University, Research Institute for Science and Engineering, Waseda University , Shinjuku, Tokyo, Japan*

Atomic and Radiative Processes in Plasmas for the Shorter Wavelength Extreme ultra-violet (EUV) Light Sources (P7)
Akira Sasaki
Quantum Beam Science Directorate, Japan Atomic Energy Agency, Kizugawa-shi, Kyoto, Japan

Design of High Brightness Laser-Compton Light Source for EUV Lithography Research in Shorter Wavelength Region (P30) (Invited Paper)
Kazuyuki Sakaue, Masakazu Washio, Akira Endo
Research Institute of Science and Engineering, Waseda University, Shinjuku, Tokyo, Japan

Break

Session 5: Patterning

EUV Interference Lithography for 1X nm (P8)
Takeo Watanabe, Yuya Yamaguchi, Takuro Urayama, Naohiro Matsuda, Tetsu Harada and Hiroo Kinosita
Center for EUVL, Laboratory of Advanced Science and Technology for Industry,
University of Hyogo, Hyogo, Japan

EUV Lithography Simulation for the 16 nm Node (P17)
Eun-Jin Kim, GukJin Kim, Seong-Sue Kim*, Han-Ku Cho*, Jinho Ahn**, Ilsin An,
and Hye-Keun Oh
Lithography Lab., Department of Applied Physics, Hanyang University, Ansan, S. Korea
**Samsung Electronics Co., LTD., Hwasung-City, Gyeonggi-Do, Korea*
***Department of Material Science and Engineering, Hanyang University, Seoul, S. Korea*

LER Metrology: Can We Trust the Numbers? (P31) (Invited Paper)
Patrick Naulleau
Center for X-Ray Optics, Lawrence Berkeley National Laboratory, Berkeley, CA, USA

Adjourn at 4 PM

Thursday, June 16, 2011

8:00 AM Welcome and Announcements

Vivek Bakshi
EUV Litho, Inc, Austin, TX USA

Session 6: EUVL R&D Status

Panelists:

Greg Denbeaux – USA (University of Albany)

Hiroo Kinoshita –Japan (Hyogo University)

Padraig Dunne – Europe (University College Dublin)

Bryan, B. Y. Shew – Taiwan (NSRCC)

Jinho Ahn – Korea (Hanyang University)

Break

Doing Business in Maui (P39)
Kimberly Haueisen, Mark Ausbeck*
Maui Economic Development Board (MEDB), Inc., Kihei, Hawaii, USA
** High Tech Development Corporation (HTDC), Kihei, Hawaii, USA*

Session 7: EUVL Mask

Developing a New State of the Art EUV Mask Imaging Research Tool at Berkeley (P11) (Invited Paper)
Kenneth Goldberg, Iacopo Mochi, Eric M. Gullikson, Erik H. Anderson, Patrick P. Naulleau
Center for X-Ray Optics, Lawrence Berkeley National Laboratory, Berkeley, CA, USA

Overview of EUM Mask Inspection Systems in NewSUBARU (P15) (Invited Paper)
Hiroo Kinoshita, Tetsuo Harada and Takeo Watanabe
Center for EUV Lithography, University of Hyogo, Japan

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

EUV Mask Production and Cleaning (P13) (Invited Review Paper)
David N. Ruzic, Wayne Lytle, Daniel Andruczyk
UIUC, Urbana-Champaign, IL, USA

Session 8: EUV Resists

Feasibility Study of Chemically Amplified Resists for Short Wavelength Extreme Ultraviolet Lithography (P36) (Invited Paper)
Takahiro Kozawa[1] and Andreas Erdmann[2]
[1]*The Institute of Scientific and Industrial Research, Osaka University, Ibaraki, Osaka, Japan*
[2]*Fraunhofer IISB, Erlangen, Germany*

Recent Progress in Nano-space Radiation Chemistry Research on Sensitivity Enhancements of EUV Resists (P37) (Invited Paper)
Seiichi Tagawa[1,2]
[1] *The Institute of Scientific and Industrial Research, Osaka University, Ibaraki, Osaka, Japan*
[2] *Japan Science and Technology Agency, CREST, c/o Osaka University, Ibaraki, Osaka, Japan*

Lunch (Holokai Pavilion)

Session 9: Optics Contamination

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, Martinez, CA, USA

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., Redwood City, CA, USA

Mass Spectrometer Characterization of Reactions in Photoresists Exposed to Extreme Ultraviolet Radiation (P29)
Chimaobi Mbanaso, Seth Kruger, Craig Higgins, Yashdeep Khopkar, Alin Antohe, Brian Cardineau, Gregory Denbeaux
College of Nanoscale Science and Engineering, University at Albany, Albany, New York, USA

Session 10: EUV Optics

Status of Multilayer Coatings for EUV Lithography (P25) (Invited Review Paper)
Yuriy Platonov[1], Eric Louis[2], Torsten Feigl[3], Sergiy Yulin[3], Jim Rodriguez[1], Michael Kriese[1]
[1] Rigaku Innovative Technologies, Auburn Hills, MI, USA,
[2] FOM Rijnhuizen, Nieuwegein, The Netherlands
[3] Fraunhofer IOF, Jena, Germany

Developing Reflective Multilayer Coatings, an Enabling Component of Extreme Ultraviolet Lithography and Beyond (P24) (Invited Paper)
E. Louis[1], S. Müllender[2], and F. Bijkerk[1,3]
[1]FOM Rijnhuizen, Nieuwegein, The Netherlands,
[2]Carl Zeiss SMT AG, Oberkochen, Germany
[3] MESA+ Institute for Nano Technology, University of Twente, The Netherlands

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

WORKSHOP SUMMARY

EUVL Workshop Summary and Announcements
Vivek Bakshi
EUV Litho Inc, Austin, TX, USA

5: 00 PM Session 11: Poster Session

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 133-791, Korea
[3]Memory Research & Development Division, Hynix Semiconductor Inc., San 136-1 Ami-ri, Bubal-eub, Icheon-si, Kyungki-do, 467-701, 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 4, Ireland
[2] Department of Advanced Interdisciplinary Sciences and Centre of Optical Research and Education (CORE), Utsunomiya University, Yoto 7-1-2, Utsunomiya, Tochigi, 321 – 8585, Japan
[3] Forschungszentrum Dresden, Bautznew Landstrs. 400, Dresden D-01238, 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*

6:00 Dinner and Adjourn

Friday, June 17, 2011

EUVL Workshop Steering Committee Meeting

8:30 AM	Breakfast
9:00 -10: 00 AM	EUVL Workshop Steering Committee Meeting


EUV
LITHO, INC.