2014 International Workshop on EUV Lithography

June 23-27, 2014

Makena Beach & Golf Resort ▪ Maui, Hawaii

Workshop Agenda

EUV Litho, Inc.

2014 International Workshop on EUV Lithography

Makena Beach & Golf Resort, Maui, Hawaii, USA

June 23-27, 2014

Workshop Agenda Outline

Monday, June 23, 2014

8:30 AM -5:00 PM

EUV Lithography Short Course

Tuesday, June 24, 2014

3:00 PM - 5:00 PM

Registration (Kaeo Ballroom Foyer)
Speaker Prep (Wailea Salon)

6:00 PM - 7:30 PM

Reception (Pacific Lawn)

Wednesday, June 25, 2014

7:30 AM – 8:30 AM	Breakfast (Café Kiowai)
8:30 AM – 11:40 AM	Oral Presentations (Wailea Salon)
11:40 AM – 12:40 PM	Lunch (Molokini Room)
12:25 PM – 3:30 PM	Oral Presentations (Wailea Salon)
3:30 PM	Afternoon off for Networking

Thursday, June 26, 2014

7:30 AM – 8:30 AM Breakfast (Café Kiowai)

8:30 AM – 12:00 PM Oral Presentations (Wailea Salon)

11:30 PM – 12:30 PM Lunch (Molokini Room)

12:30 PM – 4:05 PM Oral Presentations (Wailea Salon)

4:30 PM - 5:30 PM Poster Session

6:30 PM – 8:00 PM Dinner (Pacific Lawn)

Friday, June 27, 2014

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

2014 International Workshop on EUV Lithography

Makena Beach & Golf Resort, Maui, Hawaii, USA
June 23-27, 2014

Workshop Agenda

Monday, June 23, 2014

Short Courses

EUV Lithography
by Vivek Bakshi (EUV Litho, Inc.), Patrick Naulleau (LBNL) and Jinho Ahn (Hanyang University)

8:30 AM -5:00 PM

Tuesday, June 24, 2014

Registration and Reception

3:00 PM- 5:00 PM	Registration & Speaker Prep
6:00 PM- 7:30 PM	Reception

Wednesday, June 25, 2014

8:30 AM Welcome and Introduction

Introductions (Intro-1)
Vivek Bakshi
EUV Litho, Inc., Austin, TX, USA

Session 1: Keynote – 1

EUV: The Computational Landscape (P1)

Vivek Singh
Intel Corporation, MS: RA3-254, 2501 N.W. 229th Ave, Hillsboro, OR 97124

One hundred Watt Operation Demonstration of HVM LPP-EUV Source (P2)

Hakaru Mizoguchi, Hiroaki Nakarai, Tamotsu Abe, Takeshi Ohta, Krzysztof M Nowak, Yasufumi Kawasuji, Hiroshi Tanaka, Yukio Watanabe, Tsukasa Hori, Takeshi Kodama, Yutaka Shiraishi, Tatsuya Yanagida, Georg Soumagne, Tsuyoshi Yamada, Taku Yamazaki, Shinji Okazaki and Takashi Saitou
Gigaphoton Inc. Hiratsuka facility: 3-25-1 Shinomiya Hiratsuka Kanagawa, 254-8567, JAPAN

Break

Session 2: EUV Sources

Development of Scalable Laser Technology for EUVL applications (Invited Talk) (P21)

Tomas Mocek, Akira Endo, Taisuke Miura
HiLASE Project, Institute of Physics ASCR, Prague, Czech Republic

Gain Enhancements of CO_2 Laser Amplifiers by Using Transverse-gas-flow Configuration to Boost up Driving Powers for EUV Generation (Invited Talk) (P24)

Koji Yasui[1] and Jun-ichi Nishimae[2]
[1]*Mitsubishi Electric Corporation, Head quarter, Tokyo, Japan*
[2]*Mitsubishi Electric Corporation, Advanced technology R&D center, Hyogo, Japan*

Colliding Laser-Produced Plasmas as Targets for Laser-Generated EUV Sources (P25)

T. Cummins[1], C. O'Gorman[1], P. Dunne[1], E. Sokell[1], G. O'Sullivan[1] and P. Hayden[1,2].
1)*School of Physics, University College Dublin, Belfield, Dublin 4, Ireland.*
2)*National Centre for Plasma Science and Technology, Dublin City University, Glasnevin, Dublin 9, Ireland*

In-Situ Cleaning of Sn EUV Sources (Invited Talk) (P42)

David N. Ruzic, Daniel Elg, Ivan Shchelkanov
Center for Plasma-Material Interactions; Department of Nuclear, Plasma and Radiological Engineering, University of Illinois at Urbana-Champaign, Illinois, USA

EUV Source: Progress & Challenges (Invited Talk) (P27)

Klaus Schuegraf et al
Cymer, San Diego, CA, USA

12:00 PM – 1:00 PM

Lunch

Session 3: Regional Reviews

Korea (Jinho Ahn)
Japan (Hiroo Kinoshita)
Taiwan (TBD)
China (Yanqui Li)
USA (Greg Denbeaux)
Europe (Padraig Dunne)

Break

Session 4: EUV Optics

Progress of Optical Design for EUV Lithography tools in BIT (Invited talk) (P56)

Yanqiu Li, Fei Liu, Qiuli Mei, Zhen Cao, Yan Liu
Key Laboratory of Photoelectron Imaging Technology and System (Ministry of Education of China), School of Optoelectronics, Beijing Institute of Technology, Beijing 10081, P.R. China

CNC Fabrication of High NA Aspheric Optics for EUVL Applications (P53)

Phil Baker, Richard Pultar, Dr. Riley Aumiller

HNu Photonics, LLC, 350Hoohana St, Kahului HI 96732

Error Compensation Phase Extraction Algorithm Used in Phase Shifting Point Diffraction Interferometer (P52)

Jie Yu, Haitao Zhang, Dongmei Ma, Chunshui Jin
State Key Laboratory of Applied Optics, Changchun Institute of Optics, Fine Mechanics & Physics, Chinese Academy of Sciences, No. 3888, Dongnanhu Road, Changchun, Jilin, People's Republic of China

Large Reflectometer for EUV Optics (P55)

Hiroo Kinoshita[1,2], Tetsuo Harada[1,2], Takeo Watanabe[1,2]
1) Center for EUV Lithography, University of Hyogo, Kamigori, Hyogo 678-1205, Japan
2) JST, CREST, Kawaguchi, Saitama 331-0012, Japan

Progress with EUV optics deposition at RIT (Invited Talk) (P56)

Yuriy Platonov, Michael Kriese, Vladimir Martynov, Raymond Crucet, Yang Li, Jim Rodriguez, Licai Jiang, Gary Fournier, Jerry Hummel
Rigaku Innovative Technologies, 1900 Taylor Rd., Auburn Hills, MI 48326, USA

Adjourn: Time off for Networking

End Day 1

Day 2: Thursday, June 26, 2014

Welcome and Announcements (Intro-2)
Vivek Bakshi
EUV Litho, Inc.

Session 5: Keynote-2

Current status and expectation of EUV lithography (P3)

Takayuki UCHIYAMA
Lithography Process Development Department, Center for Semiconductor Research and Development, TOSHIBA Corporation

Break

Session 6: EUV Masks

A New EUV Mask Blank Defect Inspection Method with Coherent Diffraction Imaging (Invited Talk) (P63)

Ding Qi[a], Kuen-Yu Tsai[a] and Jia-han Li [b]
[a] Department of Electrical Engineering, National Taiwan University, Taipei 106, Taiwan
[b] Department of Engineering Science and Ocean Engineering, National Taiwan University, Taipei 106, Taiwan

Recent Results from the Measurement of Reflectivity of EUV Lithography Masks Blanks and Absorbers (Invited Talk) (P64)

Rupert C. C. Perera
EUV Tech, 2840 Howe Road Suite A, Martinez, CA 94553, USA

Improved Stochastic Imaging Properties in Contact Hole Pattern by Using Attenuated PSM for EUVL (P65)

Jung Sik Kim[1], Seongchul Hong[2], Jae Uk Lee[2], Seung Min Lee[2], Jung Hwan Kim[2], Hyun Min Song[1], and Jinho Ahn[1,2]
[1]Department of Nanoscale Semiconductor Engineering
[2]Department of Materials Science and Engineering
Hanyang University, 222 Wangsimni-ro, Seongdong-gu, Seoul 133-791, Korea

Advanced Mask Patterning: Inspection/Metrology and Cleans Requirements & Approaches (P68)
Sushil Padiyar et al
AMAT

Overview of Actinic Mask Inspection System in NewSUBARU (Invited Talk) (P67)

Hiroo Kinoshita[1,3], Tetsuo Harada[1,3], Yutaka Nagata[2,3], Takeo Watanabe[1,3] and Katsumi Midorikawa[2]
1) Center for EUV Lithography, University of Hyogo, Kamigori, Hyogo 678-1205, Japan
2) Riken ASI, Wako, Saitama 351-0198, Japan
3) JST, CREST, Kawaguchi, Saitama 331-0012, Japan

Lunch

Session 7: EUV Resists

Theoretical Study on Stochastic Effects in Chemically Amplified Resist Process for Extreme Ultraviolet Lithography (Invited Talk) (P71)

Takahiro Kozawa[1], Julius Joseph Santillan[2], and Toshiro Itani[2]
[1]The Institute of Scientific and Industrial Research, Osaka University,
8-1 Mihogaoka, Ibaraki, Osaka 567-0047, Japan
[2]EUVL Infrastructure Development Center, Inc. (EIDEC)

Direct Visualization of the Impacts of EUV Mask Roughness (Invited Talk) (P72)

Patrick Naulleau
LBNL, Berkeley, CA, USA

Novel EUV Resist Materials and EUV Resist Defects (Invited Talk) (P74)

Yoshi Hishiro
JSR Micro INC, 1280 N. Mathilda Ave, Sunnyvale, CA 94089, USA

The Role of Secondary Electrons in EUV Resist (Invited Talk) (P75)

Greg Denbeaux et al
University of Albany, Albany, NY, USA

Optics Contamination from Resist Outgassing: Lessons Learned (Invited Talk) (P41)

C. Tarrio, S. B. Hill, R. F. Berg, S. Grantham, and T. B. Lucatorto
National Institute of Standards and Technology, Gaithersburg, MD, USA

Additional Paper(s) in the EUV Resist session to be announced.

Break

Session 8: Panel Discussion

Topic: Can EUVL deliver patterning solutions for 7nm node?

Moderators

Sushil Padiyar
Applied Materials

Vivek Bakshi
EUV Litho, Inc.

Panelists

Vivek Singh
Intel

Hakaru Mizoguchi
Gigaphoton

Takayuki UCHIYAMA
Toshiba

EUVL Workshop Summary (P90)
Vivek Bakshi
EUV Litho, Inc.

Break

4:30- 5:30 PM Poster Session

Session 9: Poster Session

Modulation of the Langmuir Oscillation on the plasma radiation by Rabi oscillation (P22)

Xiangdong Li
State Key Laboratory of High Field Laser Physics, Shanghai Institute of Optics and Fine Mechanics, Shanghai (201800), People's Republic of China

EUV Radiation Characteristics of Xe Cluster Ensemble Irradiated by Nanosecond and Femtosecond Lasers (P23)

Cheng Wang, Zongxin Zhang, Guande Wang, Yuxin Leng, Quanzhong Zhao, Ruxin Li
State Key Laboratory of High Field Laser Physics, Shanghai Institute of Optics and Fine Mechanics, Chinese Academy of Sciences (CAS), Shanghai 201800, China

The Energetiq EQ-10 EUV Source for Metrology (P26)

Stephen F. Horne, Matthew J. Partlow, Deborah S. Gustafson, Matthew M. Besen, Donald K. Smith, Paul A. Blackborow
Energetiq Technology Inc., 7 Constitution Way, Woburn MA 01801 USA

A Novel Model for Coated System Analysis in Extreme Ultra-Violet Lithography (P51)

Wang Jun
State Key Laboratory of Applied Optics, Changchun Institute of Optics, Fine Mechanics and Physics, Chinese Academy of Sciences, 3888# Dong Nanhu Road, Changchun, Jilin, 130033, China

Comparison of High Precision Profilometry to Lateral Shearing Interferometry Collected from High NA Aspheric Surfaces with Materials from SIC, Aluminum, ULE and Zerodur (P54)

Richard Pultar, Phil Baker, Dr. Riley Aumiller
HNu Photonics, LLC, 350 Hoohana St, Kahului HI 96732, USA

Simplified Model for Spectrum Simulation of Multilayer with Buried Defect in EUV Lithography (P61)

Xiangzhao Wang, Sikun Li, Xiaolei Liu
Laboratory of Information Optics and Opt-Electronic Technology, Shanghai Institute of Optics and Fine Mechanics, Chinese Academy of Sciences, Shanghai 201800, China

Measurement of Deflection of the Full scale Free Standing EUV Pellicle (P62)

Eun-Sang Park, Zahid Hussain Shamsi, Ji-Won Kim, Dai-Gyoung Kim, and Hye-Keun Oh
Hanyang University, 222 Wangsimni-ro, Seongdong-gu, Seoul 133-791, Korea

Friday, June 27, 2014

8:30 AM - 10:00 AM

EUVL Workshop Steering Committee Meeting (Kaeo Ballroom)

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

EUV
LITHO, INC.