2016 International Symposium on Extreme Ultraviolet Lithography

Hiroshima, Japan
24 - 26 October, 2016

http://www.euvl2016.org

Program and Information
Time Diagram of Symposium

Monday
October 24, 2016

9:00 Opening address
9:20 Session 1 Invited
9:50 Invited
10:20 Invited
10:50 Coffee break
11:20 Session 2 EUV Insertion and resist
12:20 Lunch @ Room "Cosmos" & "Ran"
13:20 Invited
13:50 Session 3 EUV patterning and process enhancement
15:10 Coffee break
15:40 Session 4 EUV extendibility and mask technology development
17:40 Poster Session @ Room "Dahlia"
18:00
20:00

Tuesday
October 25, 2016

8:40 Keynote
9:15 Session 1 EUV insertion and sources
10:15 Coffee break
10:50 Invited
11:25 Session 2 EUV masks, inspection and review
12:45 Lunch @ Room "Cosmos" & "Ran"
13:45 Invited
15:05 Coffee break
15:45 Networking
16:55 Closing address
18:15 Dinner @Orchid
(ANA Crowne Plaza 3F)
20:15

Wednesday
October 26, 2016

8:30 Keynote
9:05 Session 1 EUV masks and pellicle
10:25 Coffee break
10:55 Invited
11:25 Session 2 EUV extendibility
12:25 Lunch @ Room "Cosmos" & "Ran"
13:25 Session 3 EUV resists, materials and extendibility
15:05 Coffee break
15:35 Session 4 EUV resists, materials and their contamination
16:55 Closing address
18:15 Dinner @Orchid
(ANA Crowne Plaza 3F)
20:15

Abstracts are available at the Symposium website:
http://www.euvl2016.org/
Welcome Address

Welcome to the 2016 International Symposium on Extreme Ultraviolet Lithography in Hiroshima, Japan. This year’s symposium happens in a place that represents Japan’s resilience and fortitude. Characteristics that is appropriate in describing this community’s research and development efforts in moving forward a patterning technology that is admittedly difficult, but without a doubt; significant and practical.

With very encouraging developments being reported in the past years, we are experiencing a more intensive thrust for EUVL as the dominant lithographic technology for high volume manufacturing (HVM). This symposium, hosted by EIDEC (Japan) in cooperation with imec (EU) and EUREKA (US), provides a forum to discuss and assess the worldwide status of EUVL technology and infrastructure readiness.

As majority of articles pointed out in last year's symposium, there is a general consensus that the EUVL technology will definitely be applied for 7nm logic technology node in the coming years. Steady progress has been reported on source stability, resist pattern-ability, mask infrastructure, and so on. Further improvements are still necessary for HVM readiness but as shown in the submissions this year, possible solutions are also available and are continuously being pursued. This year’s symposium has also solicited contributions focusing on extending EUVL technology to sub- 7 nm logic technology nodes. To better understand the necessary breakthroughs and possible obstacles, papers on more fundamental studies and innovative research were encouraged. With almost 120 papers to be presented this year, we hope that the symposium gives you an up to date view of EUVL’s present status, and an overview of this technology’s future.

We thank the city of Hiroshima for their cooperation and warm welcome to their beautiful city. Also, we thank our corporate sponsors for their generous support of this year’s symposium. Finally, we thank you; the authors and attendees, for the invaluable contributions you will make through presentations / discussions this week.

We wish you all a pleasant and mentally stimulating stay. Welcome to Hiroshima!

Toshiro Itani
2016 Conference Chair

Satoshi Tanaka
2016 Program Chair
To all 2016 International Symposium on
Extreme Ultraviolet Lithography participants

I would like to express my sincere gratitude on the occasion of 2016 International Symposium on Extreme Ultraviolet Lithography, and offer a heartfelt welcome to each and every participant who has come to Hiroshima.

As you may know, Hiroshima City is familiar worldwide as a place of peace. Peace Memorial Park—home of Hiroshima’s symbol, the UNESCO world heritage site of the Atomic Bomb Dome—draws many visitors from around the world, and there is no end in sight to the offerings of flowers and paper cranes at the Cenotaph for the A-bomb Victims and the Children’s Peace Monument. Holding this symposium in such a city will undoubtedly help the event to deliver a strong impression to the world, in terms of the transmission of the symposium’s outcome and more.

Hiroshima originated around 400 years ago as a castle town, and has developed as one of the pivotal cities for industry, economics, and administration in western Japan. Six rivers flow through the city, which is blessed with a warm climate and rich nature. The riverside scenery, seen from tour boats and open cafes, changes with the four seasons, and the beautiful waterfront views of the “City of Water, Hiroshima” delight citizens and tourists alike.

I do hope every one of you will take the time to experience Hiroshima’s rich natural sites and cityscape, food culture, and traditional arts, so that you may feel the full satisfaction inspired by Hiroshima’s particular type of hospitality. Furthermore, it is my sincere wish for participants to share in Hiroshima’s enduring desire and hope for peace, which U.S. President Barack Obama also partook of during his historic visit to our city on May 27, 2016.

In closing, I extend my best wishes for the success of this symposium, as well as for everyone’s health and good luck in their endeavors.

Sincerely yours,

MATSUI Kazumi
Mayor
The City of Hiroshima
# EUVL Symposium Committee Membership

## Conference Chairs

<table>
<thead>
<tr>
<th>Chair</th>
<th>Toshiro Itani</th>
<th>EIDEC</th>
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<tbody>
<tr>
<td>Co-Chairs</td>
<td>Paolo Gargini</td>
<td>Stanford University</td>
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<td>Kurt Ronse</td>
<td>imec</td>
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<td>Patrick Naulleau</td>
<td>EUREKA / LBNL</td>
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## Program Chairs

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<tr>
<th>Chair</th>
<th>Satoshi Tanaka</th>
<th>EIDEC</th>
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<td>Eric Hendrickx</td>
<td>imec</td>
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<td></td>
<td>Winfried Kaiser</td>
<td>Carl Zeiss</td>
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<td>Eric Panning</td>
<td>Intel / EUREKA</td>
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## Program Steering Committee

<table>
<thead>
<tr>
<th>Jinho Ahn</th>
<th>Akira Miyake</th>
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<tr>
<td>Alek Chen</td>
<td>Ichiro Mori</td>
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<td>Daniel Corliss</td>
<td>Patrick Naulleau</td>
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<td>Paolo Gargini</td>
<td>Katsunobu Nishihara</td>
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<td>Janice Golda</td>
<td>Eric Panning</td>
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<td>Eric Hendrickx</td>
<td>Rudy Peeters</td>
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<td>Soichi Inoue</td>
<td>Alberto Pirati</td>
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<td>Toshiro Itani</td>
<td>Abbas Rastegar</td>
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<td>Winfried Kaiser</td>
<td>Kurt Ronse</td>
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<td>Kunihiko Kasama</td>
<td>Yumiko Takamori</td>
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<td>Hidemi Kawai</td>
<td>Satoshi Tanaka</td>
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<td>Seong-Sue Kim</td>
<td>Takayuki Uchiyama</td>
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<td>Chiew-seng Koay</td>
<td>Geert Vandenberghe</td>
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<td>Takahiro Kozawa</td>
<td>Hidehiro Watanabe</td>
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<td>Bruno La Fontaine</td>
<td>Obert Wood</td>
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<td>Sang Hun Lee</td>
<td>Stefan Wurm</td>
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<td>Changmoon Lim</td>
<td>Anthony Yen</td>
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ANA CROWNE PLAZA HIROSHIMA

*8 minutes’ walk from conference center

B2F

B1F

Room “Himawari”:
Oral Session

Room “Dahlia”:
Poster Session

Breakfast

Coffee Break

Registration Desk

Hiroshima Information Desk

“Conference Management Room”

Secretariat

Room “Cosmos” & “Ran”:
Lunch

MAP
Session Schedule

Monday, October 24

9:00 Opening address

Session 1. EUV Insertion
Session Chairs: Kurt Ronse (imec), Eric Panning (Intel/EUREKA)

9:20 Invited EUVL Readiness for High Volume Manufacturing
Britt Turkot
Intel

9:50 Invited Assessment of EUV lithography progress for HVM introduction
Yoonsuk Hyun
SK Hynix

10:20 Invited Imec iN7 EUV platform: M2-Block and Via patterning developments
Joost P.M. Bekaert
imec

10:50 Coffee break

Session 2. EUV Insertion and resist
Session Chairs: Kurt Ronse (imec), Eric Panning (Intel / EUREKA)

11:20 EUV materials for sub 20nm half pitch
Shiyong Yi
Samsung Electronics Co., Ltd.

11:40 Novel EUV resist materials for N7 and beyond
Toru Fujimori
Fujifilm corporation

12:00 Development of EUV Chemically Amplified Resist
Masahito Yahagi
TOKYO OHKA KOGYO CO., LTD.

12:20 Lunch @ Room "Cosmos" & "Ran"

Session 3. EUV patterning and process enhancement
Session Chairs: Obert Wood (GLOBALFOUNDRIES), Jan van Schoot (ASML)

13:20 Invited EUV Lithography Industrialization Progress
Christophe Smeets
ASML

13:50 In-situ optical testing of a 0.5-NA EUV optic with the AIS wavefront sensor
Ryan Miyakawa
Lawrence Berkeley National Laboratory
14:10 Flexible illumination for ultra-fine resolution with 0.33 NA EUV lithography
Joerg Zimmermann
Carl Zeiss SMT GmbH

14:30 Understanding impact of neighbor field flare on imaging in EUV lithography
John McNamara
ASML

14:50 Mask 3D Effect Mitigation by Source Optimization and Assist Feature Placement
Lieve Van Look
imec

15:10 Coffee break

Session 4. EUV extendibility and mask technology development
Session Chairs: Rik Jonckheere (imec), Ted Liang (Intel)

15:40 Development of thin absorber for EUV blanks
Yohei Ikebe
HOYA Corporation

16:00 Mitigating EUV Mask 3D effects by alternative metal absorbers
Vicky Philipsen
imec

16:20 Optimized EUV mask absorber stack for improved imaging by reducing roughness and crystallinity of alternative absorber materials
Vu Kim Luong
imec
Catholic University Of Leuven

16:40 Evaluation of etched multilayer mask for 0.33NA EUVL extension
Takashi Kamo
Toshiba Corporation

17:00 High throughput contact-hole printing with an EUV chromeless phase shift mask
Patrick Naulleau
Berkeley Lab

17:20 High Accuracy Photomask Flatness Data for Write Compensation and Process Development for EUV Image Placement Error Relief
Katherine Ballman
Corning Tropel

18:00 Poster Session @ Room "Dahlia"
## Tuesday, October 25

### Session 1. EUV insertion and sources
Session Chairs: Hidehiro Watanabe (EIDEC), Igor Fomenkov (Cymer LLC, An ASML Company)

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
<th>Title</th>
<th>Speaker</th>
<th>Company/Institution</th>
</tr>
</thead>
<tbody>
<tr>
<td>8:40</td>
<td>Keynote</td>
<td>EUVL - Progress towards HVM</td>
<td>Li-Jui Chen</td>
<td>TSMC</td>
</tr>
<tr>
<td>9:15</td>
<td>Development</td>
<td>Development of 250W EUV Light Source for HVM Lithography</td>
<td>Hakaru Mizoguchi</td>
<td>Gigaphoton Inc.</td>
</tr>
<tr>
<td>9:35</td>
<td>Stable and</td>
<td>Stable and scalable CO2 laser drivers for high-volume-manufacturing extreme ultraviolet</td>
<td>Koji Yasui</td>
<td>Mitsubishi Electric Corporation,</td>
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<td></td>
<td>scalable CO2</td>
<td>lithography applications</td>
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<td>Head quarter</td>
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<td>laser drivers</td>
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<tr>
<td>9:55</td>
<td>Laser-produced</td>
<td>Laser-produced plasma EUV source productivity in high-volume manufacturing</td>
<td>Erik Robert Hosler</td>
<td>GLOBALFOUNDRIES</td>
</tr>
<tr>
<td>10:15</td>
<td>Coffee break</td>
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### Session 2. EUV masks, inspection and review
Session Chairs: Naoya Hayashi (Dai Nippon Printing Co., Ltd.), Emily Gallagher (imec)

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<thead>
<tr>
<th>Time</th>
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<tbody>
<tr>
<td>10:55</td>
<td>Invited</td>
<td>Progress of EUV Blanks Development</td>
<td>Takahiro Onoue</td>
<td>HOYA Corporation</td>
</tr>
<tr>
<td>11:25</td>
<td>Lensless</td>
<td>Lensless actinic inspection of EUV reticles with RESCAN</td>
<td>Iacopo Mochi</td>
<td>Paul Scherrer Institut</td>
</tr>
<tr>
<td>11:45</td>
<td>ABI tool</td>
<td>ABI tool performance confirmation by NXE3300 printing results for native EUV blank defects at 16nm half pitch</td>
<td>Rik Jonckheere</td>
<td>imec</td>
</tr>
<tr>
<td>12:05</td>
<td>Defect review</td>
<td>Defect review capability enhancement for actinic blank inspection tool</td>
<td>Kiwamu Takehisa</td>
<td>Lasertec corporation</td>
</tr>
<tr>
<td>12:25</td>
<td>EUV Mask</td>
<td>EUV Mask infrastructure: Performance Data and Status of the AIMSTM EUV System for actinic mask review</td>
<td>Jan Hendrik Peters</td>
<td>Carl Zeiss SMT GmbH</td>
</tr>
<tr>
<td>12:45</td>
<td>Lunch</td>
<td>Lunch @ Room &quot;Cosmos&quot; &amp; &quot;Ran&quot;</td>
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<tr>
<td>13:45</td>
<td>Networking</td>
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# Wednesday, October 26

**Session 1. EUV masks and pellicle**
Session Chairs: Bryan Kasprowicz (Photronics. Inc.), Winfried Kaiser (Carl Zeiss SMT GmbH)

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
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<th>Speaker</th>
<th>Institution</th>
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<tbody>
<tr>
<td>8:30</td>
<td>Keynote</td>
<td>EUV Lithography: past, present and future</td>
<td>Obert R Wood</td>
<td>GLOBALFOUNDRIES</td>
</tr>
<tr>
<td>9:25</td>
<td></td>
<td>Introducing the EUV CNT pellicle</td>
<td>Emily Gallagher</td>
<td>imec</td>
</tr>
<tr>
<td>9:45</td>
<td></td>
<td>NXE pellicle development update</td>
<td>Paul Janssen</td>
<td>ASML</td>
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<tr>
<td>10:05</td>
<td></td>
<td>Thermal stress analysis of the extreme ultraviolet multi-stack pellicle with high emissivity coating by finite element method</td>
<td>Eunsang Park</td>
<td>Hanyang University</td>
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<tr>
<td>10:25</td>
<td>Coffee</td>
<td>break</td>
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**Session 2. EUV extendibility**
Session Chairs: Alberto Pirati (ASML), Vicky Philipsen (imec)

<table>
<thead>
<tr>
<th>Time</th>
<th>Invited</th>
<th>Characterization and Mitigation of 3D Mask Effects in EUV Lithography</th>
<th>Speaker</th>
<th>Institution</th>
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<tr>
<td>10:55</td>
<td></td>
<td>Characterization and Mitigation of 3D Mask Effects in EUV Lithography</td>
<td>Andreas Erdmann</td>
<td>Fraunhofer IISB</td>
</tr>
<tr>
<td>11:25</td>
<td></td>
<td>EUV roadmap extension by higher Numerical Aperture</td>
<td>Jan van Schoot</td>
<td>ASML</td>
</tr>
<tr>
<td>11:45</td>
<td></td>
<td>High NA anamorphic imaging: It is all about the angles</td>
<td>Eelco van Setten</td>
<td>ASML</td>
</tr>
<tr>
<td>12:05</td>
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<td>Mask imaging for current and future nodes of EUV lithography on the SHARP microscope</td>
<td>Markus Benk</td>
<td>Lawrence Berkeley National Laboratory</td>
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<tr>
<td>12:25</td>
<td>Lunch</td>
<td>break</td>
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Lunch @ Room "Cosmos" & "Ran"
**Session 3. EUV resists, materials and extendibility**
Session Chairs: Takahiro Kozawa (ISIR, Osaka university), Andrew Grenville (Inpria Corporation)

13:25  **Progress in Fab Integration for Metal-Oxide Resists on the Path to HVM**
       Michael Kocsis
       *Inpria Corporation*

13:45  **DDR Process and Materials for NTD Photo Resist toward 1Xnm Patterning and beyond**
       Shuhei Shigaki
       *Nissan Chemical Industries, LTD.*

14:05  **EUV photoresists for the sub-10 nm node: EUV interference lithography as a powerful characterization tool**
       Elizabeth Buitrago
       *PSI*

14:25  **Non-linearity of the dissolution in advanced EUV photoresists**
       Yannick Vesters
       *Dept. Molecular Design and Synthesis, KU Leuven imec*

14:45  **Experimental and Theoretical Studies of Primary Excitation and Relaxation in EUVL Molecular Resists**
       D. Frank Ogletree
       *Molecular Foundry, Lawrence Berkeley National Lab*

15:05  **Coffee break**

**Session 4. EUV resists, materials and their contamination**
Session Chairs: Frank Ogletree (Molecular Foundry, Lawrence Berkeley National Lab), Shinji Okazaki (Gigaphoton Inc.)

15:35  **Analysis of metal resist used for extreme ultraviolet lithography**
       Takahiro Kozawa
       *The Institute of Scientific and Industrial Research, Osaka University*

15:55  **Simulation of Secondary Electron Blur and Quantum Efficiency Statistics in EUV Resists**
       Suchit Bhattarai
       *UC Berkeley, EECS*

16:15  **New resist process improving sensitivity, resolution, roughness and photon shot noise simultaneously**
       Seiichi Tagawa
       *Graduate School of Engineering, Osaka University*

16:35  **Development and application of 'metal resists' for EUVL patterning**
       Julius Joseph Santillan
       *EIDEC*

16:55  **Closing address**

18:15  **Dinner @Orchid (ANA Crowne Plaza 3F)**
EUV Tools, including sources

P-ET-01 Achromatic Talbot lithography with partially coherent EUV radiation
Sascha Brose
*RWTH Aachen University, Chair for the Technology of Optical Systems*

P-ET-02 Study of Sn Removal Processes for in-situ Collector Cleaning
Gianluca Panici
*University of Illinois at Urbana-Champaign*

P-ET-03 Theoretical analysis of particle emission during initial interaction between laser pulses and tin droplet target
Akira Sasaki
*National Institutes for Quantum and Radiological Science and Technology*

P-ET-04 LPP EUV Light Source for HVM: status and outlook
Igor Fomenkov
*Cymer LLC, An ASML Company*

P-ET-05 Comparison between Thomson scattering measurements and plasma simulation results for a EUV lithography source plasma
Georg Soumagne
*Gigaphoton Inc.*

P-ET-06 High power drive laser development for EUV Lithography
Takashi Suganuma
*Gigaphoton Inc.*

P-ET-07 Modeling of Laser-produced Tin plasmas for Extreme Ultraviolet Lithography
Atsushi Sunahara
*Institute for Laser Engineering, Osaka University*

P-ET-08 Multiphysics model of plasma interaction with gas flow in EUV source chamber
Slava Medvedev
*RnD-ISAN*
*Institute for Spectroscopy RAS*

P-ET-09 Development of Large EUV reflectometer in NewSUBARU Synchrotron Facility
Tetsuo Harada
*University of Hyogo*

P-ET-10 Proposal of a Nb/Si multilayer as a damageless mirror for a high intensity EUV lights irradiation
Satoshi Ichimaru
*NTT Advanced Technology Corporation*

P-ET-11 80 µ J, 522 fs Laser Pulses Inside a Kerr Lens Mode-locked Thin-disk Ring Oscillator Targeting Intra-cavity High-order Harmonic Generation
Amani A Elanlou
*RIKEN Center for Advanced Photonics*
EBL2: An EUV tool for testing components, photomasks, and pellicles
Edwin te Sligte
TNO

EUV mask and inspection

High-radiance LDP source: clean, reliable and stable EUV source for mask inspection
Yusuke Teramoto
Ushio Inc.
BLV Licht- und Vakuumtechnik GmbH

Cost-of-ownership improvements for Droplet-based LPP Light Sources for HVM EUV Mask Inspection Applications
Reza S Abhari
Swiss Federal Institute of Technology Zurich

A high frame-rate pixel detector with extended dynamic range for EUV imaging and mask metrology
Rajeev Rajendran
Paul Scherrer Institut

Actual Defect Imaging Result with Quantitative Intensity and Phase Contrast Using Micro Coherent EUV Scatterometry Microscope
Tetsuo Harada
University of Hyogo

Improved EUV Aerial Image Reconstruction using mixed-states iterative algorithms and maximum likelihood refinement
Patrick Helfenstein
Paul Scherrer Institut

Actinic EUV Mask Metrology with RESCAN using a monochromatic beam
Patrick Helfenstein
Paul Scherrer Institut

Accumulated thermal behavior analysis of various LTEM during the scanning process
Sollee Hwang
Hanyang University

Multilayer defect dependency on pattern direction in extreme ultraviolet lithography with anamorphic optical system
Jae-Hun Park
Hanyang University

Radiation-induced contamination topography and its impacts on EUV mask 3D effects
Yu-Jen Fan
GLOBALFOUNDRIES
CNSE of SUNY Poly

Development of ellipsometry for inspection of mask in EUV lithography
Seulki Kim
Department of Applied physics, Hanyang University
P-MA-11  Progress with EUV-Reflectometer Tooling with Upgraded V4 Platform
Rainer Lebert  
RI Research Instruments GmbH

P-MA-12  Evaluation of optical material parameters for advanced absorbers on EUV masks
Christian Laubis  
PTB

P-MA-13  Improvement of Projection Electron Microscope system for mask inspection
Shinichi Okada  
EBARA CORPORATION

P-MA-14  EUV Reticle Inspection Test platform
Peter van der Walle  
TNO

P-MA-15  High-resolution registration metrology on patterned EUV masks
Steffen Steinert  
Carl Zeiss SMT GmbH

P-MA-16  EUV mask with Hybrid Black Border suppressing EUV and DUV OoB light reflection
Toru Komizo  
Toppan Printing Co., Ltd

EUV Pellicles and mask cleaning

P-PE-01  A quick, local, dry and minimum contact method for backside reticle cleaning
Jetske Stortelder  
TNO

P-PE-02  Critical Dimension Degradation Caused by Higher Particle Defect Density on Extreme-Ultraviolet Pellicle
Sung-Gyu Lee  
Department of Applied physics, Hanyang University

P-PE-03  The effect of particles and EUV mask materials on the particle adhesion and removal
Min-Su Kim  
Department of Bio-Nano Technology, Hanyang University ERICA

P-PE-04  Interaction between carbon contaminant and EUV mask surface and its removal using organic solvent and base chemical cleaning solution
Hyun-Tae Kim  
Department of Bio-Nano Technology, Hanyang University ERICA

P-PE-05  The influence of damaged multi-stack pellicle during exposure process in terms of critical dimension error
Guk-Jin Kim  
Hanyang University

P-PE-06  Thermal stress of the multi-stack EUV pellicle during the exposure
Minha Kim  
Hanyang University
P-PE-07 Super Clean & Ultra-High-Vacuum Aluminum Vacuum Chamber for EUVL tools.
Naoki Ogawa
RORZE Company

P-PE-08 Concept Studies for Actinic Pellicle Characterization Metrology in an Industrial Environment
Rainer Lebert
RI Research Instruments GmbH

EUV resist and material

P-RE-01 The recent study of resist outgassing in the hydrogen environment
Eishi Shiobara
EIDEC

P-RE-02 Progress report on the use of underlayers for dose reduction in chemically amplified and inorganic resists
Tantiboro Ouattara
Brewer Science, Inc.

P-RE-03 A Study of EUV Resist Sensitivity by using metal materials(2)
Atushi Sekiguchi
Litho Tech Japan Corp

P-RE-04 Tin oxo cages: model EUV photoresists
Albert Manfred Brouwer
Advanced Research Center for Nanolithography
University of Amsterdam

P-RE-05 Novel Pattern Trimming Material for EUV extension and breaking RLS Trade-offs
Tokio Nishita
Nissan Chemical Industries, Ltd.

P-RE-06 Development of the negative-tone molecular resists for EB/EUVL having high EUV absorption capacity
Tomoaki Takigawa
Mitsubishi Gas Chemical Company, Inc.

Yuta Togashi
Mitsubishi Gas Chemical Company, Inc.

P-RE-08 EUV Resist Transmittance Measurement Using Photodiode Direct-Resist Coating Method
Daiki Mamezaki
University of Hyogo

P-RE-09 Progress for single nm resolution by applying Dry development rinse process (DDRP) and materials (DDRM)
Wataru Shibayama
Nissan Chemical Industries, LTD

P-RE-10 High resolution approach from EUV-specialized Si containing Hard Mask (Si-HM)
Wataru Shibayama
Nissan Chemical Industries, LTD
P-RE-11 Study on Resist Performance of Noria Derivatives Modified with Various Protection Ratios of Acetal Moieties for EUV lithography
Hiroki Yamamoto
ISIR, Osaka university

P-RE-12 Modeling the interaction of EUV radiation with photoresist materials from first principles
D Frank Ogletree
Molecular Foundry, Lawrence Berkeley National Lab

P-RE-13 EUV radiation chemistry fundamentals: Gas-phase probing techniques
Oleg Kostko
Lawrence Berkeley National Laboratory

EUV patterning and process enhancement

P-EP-01 Impact of EUV SRAF on Bossung Tilt
Yow-Gwo Wang
University of California, Berkeley
Lawrence Berkeley National Laboratory

P-EP-02 Improvement of SRAF application margin and imaging performance of isolated patterns by using attenuated phase shift mask
Jung Sik Kim
Hanyang University

P-EP-03 Feasibility of sub-resolution assist feature in terms of image quality improvement
Jeong-Gu Hwang
Department of Applied physics, Hanyang University

P-EP-04 The impact of sub-resolution assist feature for pattern directions in anamorphic system
Jae-Keun Choi
Hanyang University

P-EP-05 The suggestion of phase shift mask improving mask manufacturing process margin
Yong Ju Jang
Hanyang University

P-EP-06 Track process optimization for EUV HVM
Yuya Kamei
Tokyo Electron Ltd.

P-EP-07 EUV patterning for 7nm enablement
Koichi Hontake
TEL Technology Center, America, LLC

P-EP-08 EUV Process Improvement with Novel Litho Track Hardware
Harold W. Stokes
SCREEN SPE Germany

P-EP-09 Effects of UV flood exposure intensity, fluence, and wavelength on patterning performance of photosensitized chemically amplified resists using EB / EUV lithography
Akihiro Oshima
Graduate School of Engineering, Osaka University
Institute of Scientific and Industrial Research, Osaka University
P-EP-10 Molecular dynamics study of pattern edge structures in extreme ultraviolet lithography
Akinori Iwai
*Osaka Prefecture University*

**EUV lithography extendibility**

P-EE-01 ERL-based High-power FEL Source for EUV Lithography
Norio Nakamura
*High Energy Accelerator Research Organization (KEK)*

P-EE-02 Strategy to realize the EUV-FEL high power light source - Present status on the EUV-FEL R&D activities -
Hiroshi Kawata
*High Energy Accelerator Research Organization (KEK)*

P-EE-03 EUV free-electron laser requirements for semiconductor manufacturing
Erik Robert Hosler
*GLOBALFOUNDRIES*

P-EE-04 Multilayer coatings for Beyond-EUV lithography
Philipp Naujok
*Fraunhofer Institute for Applied Optics and Precision Engineering*
*Friedrich-Schiller-University Jena, Institute of Applied Physics, Abbe School of Photonics*

P-EE-05 Recent status of the High-NA Small Field Exposure Tool (HSFET) at EIDEC
Shunko Magoshi
*EIDEC*

P-EE-06 HSFET characterization of factors for imaging
Hidemi Kawai
*EIDEC*

P-EE-07 The optimization of absorber thickness and absorber material for anamorphic NA system
Byung-Hun Kim
*Hanyang University*

P-EE-08 Status of high numerical aperture EUV lithography development: The Berkeley MET5
Patrick Naulleau
*Center for X-ray Optics, Lawrence Berkeley National Laboratory*

P-EE-09 Fabrication of EUVL Micro-field Exposure Optics with 0.5 NA
Luc Girard
*Zygo Corporation, Extreme Precision Optics (EPO)*

P-EE-10 Multilayer coatings for the first Micro-Exposure Tools with NA=0.5
Regina Soufli
*Lawrence Livermore National Laboratory*
Room "Dahlia"

Poster Session Layout

Coffee Break Area
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