2012 Advanced Lithography

Technical Program

spie.org/al12

Conference and Courses
12–16 February 2012
Exhibition
14–15 February 2012

Location
San Jose Marriott and
San Jose Convention Center
San Jose, California, USA

Welcome

Your attendance at SPIE Advanced Lithography increases your company's success in the lithography industry through access to the latest research, networking opportunities, and technology on display.

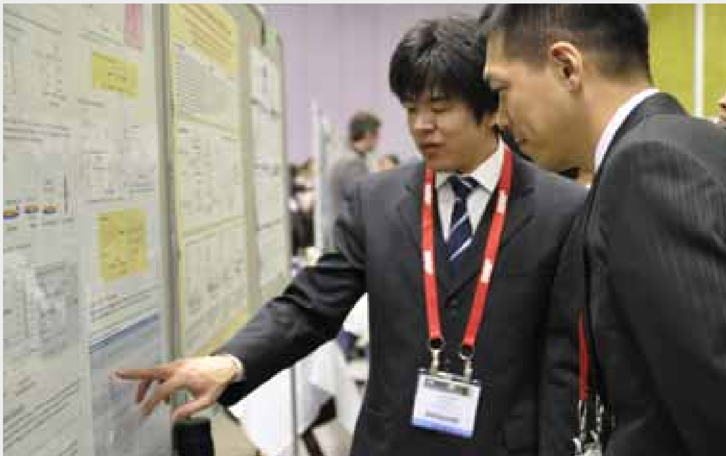
Technical Program

12–16 February 2012

San Jose Marriott and San Jose Convention Center
San Jose, California, USA

SPIE would like to express its deepest appreciation to the symposium chairs, conference chairs, program committees, and session chairs who have so generously given their time and advice to make this symposium possible.

The symposium, like our other conferences and activities, would not be possible without the dedicated contribution of our participants and members. This program is based on commitments received up to the time of publication and is subject to change without notice.



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Technical Conferences

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Advances in Resist Materials and Processing Technology XXIX. 16-41

Optical Microlithography XXV 17-55

Design for Manufacturability through Design-Process Integration VI 17-53

NEW **Advanced Etch Technology for Nanopatterning** 17-29

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Advanced Lithography 2012
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Future Fab International Magazine

Photonics Online

Solid State Technology

Welcome

The chip industry continues to name lithography as a critical challenge in fabricating next-generation integrated circuits. Historically, the lithography community has successfully met any challenge the semiconductor industry has faced, from bringing immersion lithography into mainstream production to working with chip designers on improving manufacturability. However, to continue the required IC technology progression will demand unprecedented ingenuity, the introduction of new lithographic technologies into production, greater cost efficiency, and communication within the lithography community and across interdisciplinary lines. With this in mind an additional conference on etch technology has been added to the Advanced Lithography Symposium.

For the past 35 years, SPIE Advanced Lithography has played a key role in bringing the lithography community together to solve challenges required by the semiconductor industry. Symposium participants come from an extensive array of backgrounds to share and learn about state-of-the-art lithographic tools, resists, metrology, materials characterization, and design and process integration. Through a series of provocative panel discussions and seminars, the symposium further probes current issues to be faced as we extend these technologies or try to switch to alternative technologies.

SPIE Advanced Lithography is organized into seven conferences:

- Alternative Lithographic Technologies
- Extreme Ultraviolet Lithography
- Metrology, Inspection, and Process Control for Microlithography
- Advances in Resist Materials and Processing Technology
- Optical Microlithography
- Design for Manufacturability through Design-Process Integration
- Advanced Etch Technology for Lithographic Patterning

All conferences are organized by current practitioners of the art, and numerous courses are taught by recognized industry experts. Additional information is available from the many manufacturers' exhibits, which allow tool makers and material suppliers to showcase new products while interacting one-on-one with customers.

We welcome you to the San Jose Convention Center, San Jose, California, for SPIE Advanced Lithography's 36th year.

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Donis G. Flagello
Nikon Research Corp. of America

Symposium Co-Chair

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GLOBALFOUNDRIES Inc.

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C. Grant Willson, The Univ. of Texas at Austin

Anthony Yen, Taiwan Semiconductor Manufacturing Co., Ltd.

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Extreme Ultraviolet (EUV) Lithography Conference

www.cymer.com

Internet Pavilion

www.jeolusa.com

Advances in Resist Materials and Processing Technology Conference

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Panel Discussion

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General Refreshments

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Plenary Session

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Tuesday Poster Reception

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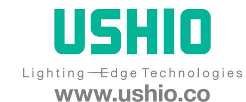

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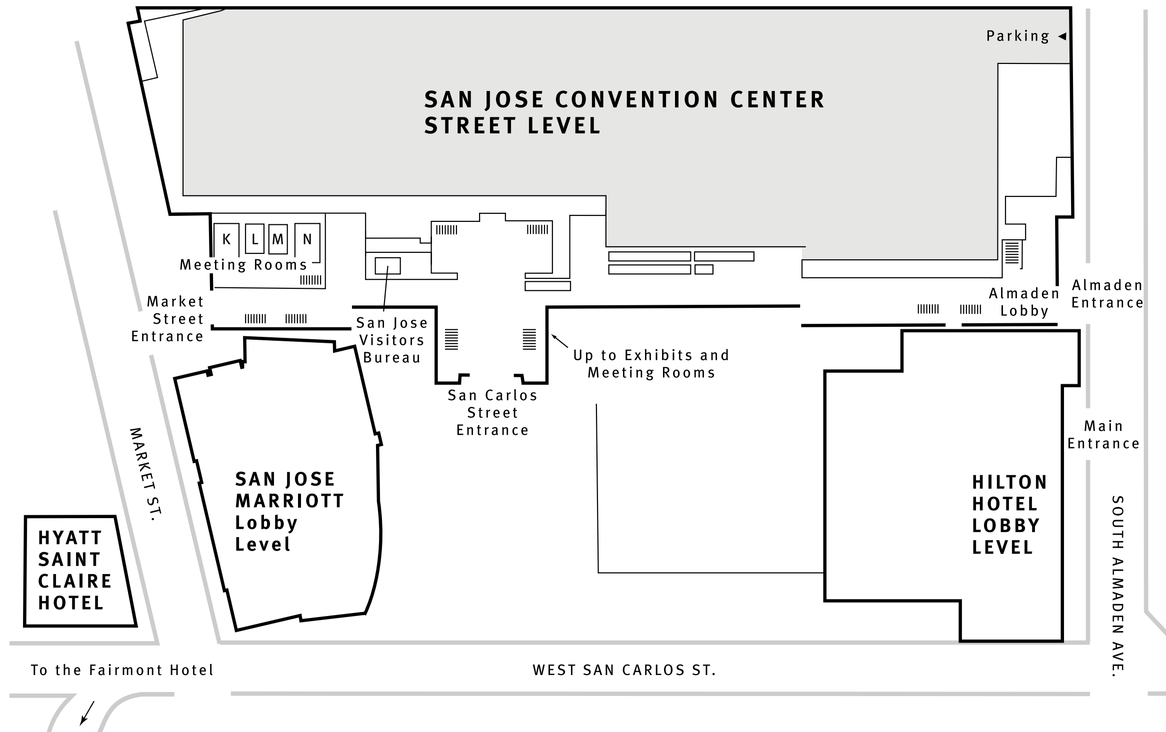
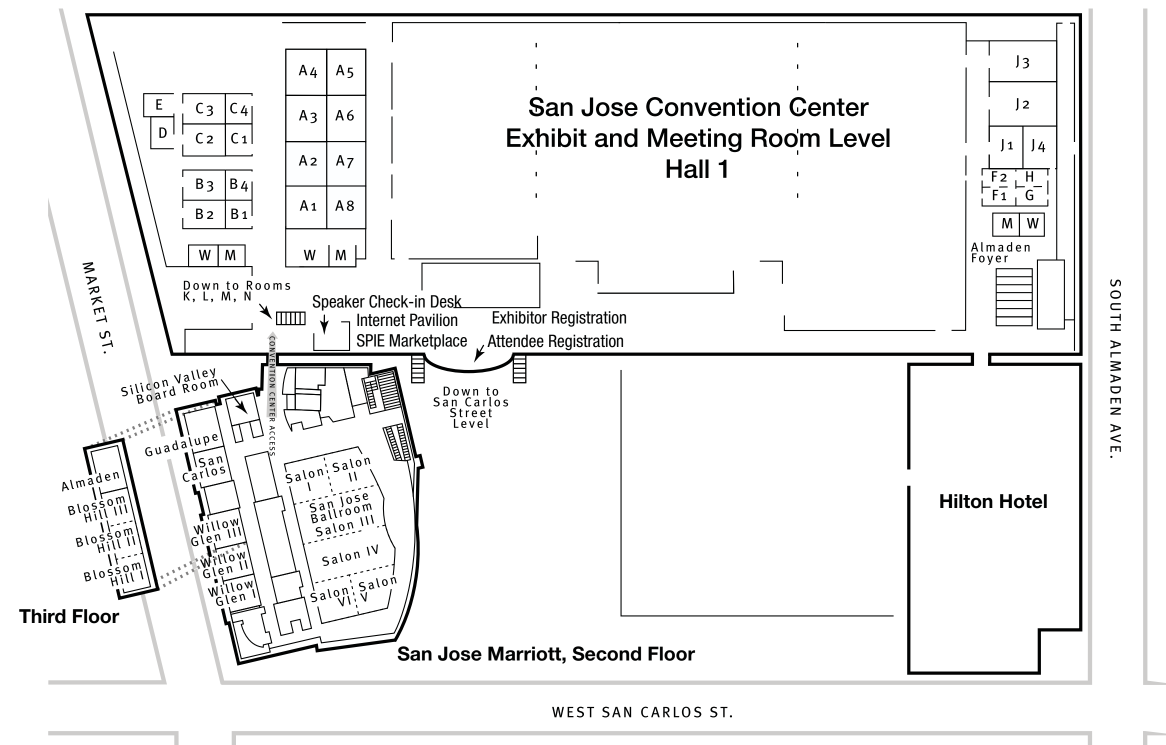
San Jose Convention Center and Marriott Hotel





Special Events

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY
	Welcome and Announcements *(Flagello),* 8:00 to 8:30 am, p. 6	**EXHIBITION,** p. 9 10:00 am to 5:00 pm	10:00 am to 4:00 pm	
	Plenary Presentation: **The Mobile Wireless Phenomenon: A Continued Need for Advanced Lithography** *(Clifford)* 8:30 to 9:10 am, p. 6	**Poster Reception** (Conferences 8324, 8325, 8328) 6:00 to 8:00 pm, p. 7	**Poster Reception** (Conferences 8322, 8323, 8326, 8327) 6:00 to 8:00 pm, p. 7	
	Plenary Presentation: **High-Resolution Patterning: A View of the Future** *(Willson)* 9:10 to 9:50 am, p. 6	*Panel Discussion:* **EUVL isn't the Solution: Are the Alternative Lithographics Technologies Ready?,** *Moderators:* Douglas J. Resnick, William M. Tong, 5:00 to 7:00 pm, p. 7		
	Plenary Presentation: **Squares Do Not Make Good Frisbees** *(Progler)* 9:50 to 10:30 am, p. 6	*Panel Discussion:* **Wild and Crazy Ideas,** *Moderators:* Nigel R. Farrar, Mircea V. Dusa, 7:45 to 9:00 pm, p. 7		
	Award Announcement for Conference Metrology, Inspections, and Process Control for Microlithography 11:00 to 11:10 am, p. 8			
	Award Announcements for Conference Advances in Resist Materials and Processing Technology 11:00 to 11:30 am, p. 8			
	Fellows Luncheon, 12:00 to 1:00 pm, p. 7			
	Nanotechnology in Microlithography Panel Discussion: Metrology Solutions for Sub-10nm Advanced 3D Integrated Memory and Logic Devices, *Moderators:* Christopher L. Soles, Richard M. Silver, 6:00 to 7:30 pm, p. 7			

Conferences

- 8322 **Extreme Ultraviolet (EUV) Lithography III** *(Naulleau),* p. 16-50
- 8323 **Alternative Lithographic Technologies IV** *(Tong),* p. 16-54
- 8324 **Metrology, Inspection, and Process Control for Microlithography XXVI** *(Starikov),* p. 16-54
- 8325 **Advances in Resist Materials and Processing Technology XXIX** *(Somervell),* p. 16-41
- 8326 **Optical Microlithography XXV** *(Conley),* p. 17-55
- 8328 **Advanced Etch Technology for Nanopatterning** *(Zhang),* p.17-29
- 8327 **Design for Manufacturability through Design-Process Integration VI** *(Mason),* p. 17-53

See Course Daily Schedule, page 13.

Welcome and Announcements

Convention Center Room A2

Monday 13 February . . . . 8:00 to 8:30 am

Symposium Chair: **Donis G. Flagello,** Nikon Research Corp. of America

Introduction of New SPIE Fellows

9th Frits Zernike Award for Advances in Optical Microlithography

Zernike Award Sponsored by:

Plenary Presentations

Convention Center Room A2

Monday 13 February . . . . 8:30 to 10:30 am

Sponsored by:

8:30 to 9:10 am

The Mobile Wireless Phenomenon: A Continued Need for Advanced Lithography

Jim C. Clifford
Senior Vice President and GM
Qualcomm CDMA Technologies

Abstract: Mobile wireless devices have become a necessity in everyday life, and are enabling significant societal changes. They have also become important product drivers for the semiconductor industry. The product market landscape has been driven by an insatiable demand for data speeds, device features, sleek appearances and increased battery life. This talk will outline the evolution of Qualcomm's chip sets, and will discuss important technology requirements. The development and cost-effective fabrication of ever more complex chip sets to meet the needs of future products will require increased innovation and integration. Enhancements in Advanced Lithography equipment and processes will continue to be crucial in the patterning of decreasing dimensions on future integrated circuits. Increased cooperation between process technologists, designers and architects will be a must for efficient implementation of new mobile wireless devices of the future.

9:10 to 9:50 am

High-Resolution Patterning: A View of the Future

C. Grant Willson
Professor of Chemical Engineering
The Univ. of Texas at Austin

9:50 to 10:30 am

Squares Do Not Make Good Frisbees

Christopher J. Progler
Chief Technology Officer, Photronics, Inc.

Abstract: The base of the technology pyramid needed to deliver a viable lithographic solution remains development and deployment of capable exposing equipment. However, with each node generation, increasing reliance on a core of co-optimized mask, resist and pattern enhancements is evident. Moreover, current and contemplated lithography flows deploying sidewall spacer and intermediate etch are pushing the single layer patterning challenge into neighboring process bays. Even adoption of EUV lithography is not expected to remove the requirement to deliver a system level approach to patterning. Still, regardless of the patterning flow indicated, the delivery of a specific photomask can be a gating item for production start of a new device and also limit total output in a litho-constrained fab.

We discuss emerging logistical challenges and opportunities for delivering state of the art photomask manufacturing flows by comparing multiple patterning to EUV lithography and highlight the impact each might have on productivity and net cycle time. The notion of efficiency in mask flow delivery is quantified and the benefits of understanding variability as a factor driving this efficiency are considered. Relevant for this discussion is a review of applications and device families poised to benefit most from extension of lithography below 22 nm HP and the various factors that correlate with demand cycle and mask usage models. Finally, a broader landscape of micro patterning based applications such as advanced IC packaging, displays and solid state lighting are considered against the same efficiency metrics to evaluate parallels with standard IC lithography.

Fellows Luncheon

Marriott, Willow Glen II

Monday 13 February . . . . 12:00 to 1:00 pm

All Fellows of SPIE are invited to join your colleagues for an SPIE hosted luncheon at Advanced Lithography. Please join us for this informal gathering and a chance to interact with other Fellows. Fellows planning to attend are asked to RSVP to Brent Johnson at brentj@spie.org.

Nanotechnology in Microlithography Panel Discussion: Metrology Solutions for Sub-10nm Advanced 3D Integrated Memory and Logic Devices

Convention Center Ballroom B4

Monday 13 February 2012 . . . . 6:00 to 7:30 pm

Moderators: **Christopher L. Soles, Richard M Silver**, National Institute of Standards and Technology

The current approach for semiconductor scaling is to push device integration into 3D where multiple materials are integrated together in more complicated shapes for both transistor and memory devices. The minimum feature sizes are rapidly approaching the sub-10 nm level that both challenge the extensibility of current metrology techniques and also introduce many new measurement challenges. Dimensional metrology techniques must now be capable of quantifying the 3D shape of buried structures such as FinFETs, trigates, and nanowire transistors. The integration of more complicated materials requires quantification of the phase and the atomic composition of these 3D structures at the nanoscale. Techniques to quantify local stress in these structures and their interfacial, electrical, and thermal properties are also critical to help realize these new technologies. As atomic-scale imperfections start to impact performance dramatically, defect detection will take on a whole new meaning. Our panel of experts will discuss possible solutions such as combined high resolution TEM and FIB, atom probe analysis for atomic device composition, small angle x-ray scattering, confocal Raman, and Brillioun light scattering for nanoscale stress. Experts in techniques such as TEM, 3D AFM, He Ion Microscopy and leading semiconductor manufacturers will discuss the role of these advanced technologies and identify key metrology needs without known solutions.

Panel Discussion: EUVL isn't the Solution: Are the Alternative Lithographics Technologies Ready?

Convention Center Room A3

Tuesday 14 February. . . . . 5:00 to 7:00 pm

Sponsored by

Moderators: **Douglas J. Resnick,** Molecular Imprints, Inc. **William M. Tong,** KLA-Tencor Corp.

Panelists: **Chris Bevis,** KLA-Tencor Corp.; **Tatsuhiko Higashiki,** Toshiba Corp.; **Burn Lin,** Taiwan Semiconductor Manufacturing Co., Ltd.; **Moshe Preil,** GLOBALFOUNDRIES Inc.; **S.V. Sreenivasan,** Molecular Imprints, Inc.

Over the last two years, the combination of 193nm immersion lithography and self aligned spacer double patterning (SADP) has reduced the half pitch by close to a factor of two. However, at the upcoming half pitches of 16nm and 12nm, double patterning is no longer sufficient. EUVL has been deemed by some to be the successor, and its development has advanced to the point where first generation EUV tools have been shipped and second generation tools are planned for late 2012. But throughput problems caused by insufficient source power remain the key roadblock for a technology that is needed as soon as the next two years. Even if this issue is resolved, other challenging requirements, such as actinic inspection and a viable resist, remain.

This leaves the door open to alternative solutions such as imprint, maskless/direct write, and directed self-assembly. If these potential solutions can address cost of ownership and demonstrate superior technical progress necessary for the industry to invest the proper resources, then there is an opportunity to insert these technologies into production. This panel discussion will review the progress made in each of the alternative lithographic technologies and identify the gaps that need to be addressed to move these technologies forward. Both equipment manufacturers and end users will be asked to address issues such as resolution, throughput, defectivity, and infrastructure readiness.

Part of the Alternative Lithographic Technologies conference.

Poster Receptions

Convention Center Hall 2

Tuesday 14 February. . . . . 6:00 to 8:00 pm
(Conferences 8324, 8325, 8328)

Tuesday Poster Reception sponsored by

Wednesday 15 February . . . . 6:00 to 8:00 pm
(Conferences 8322, 8323, 8326, 8327)

Registered conference attendees are invited to attend the poster sessions and receptions. Authors of poster papers will be present and at their posters during these sessions to answer questions and provide in-depth discussion concerning their posters.

Poster authors may set up their posters after 10:00 am on the day of their poster session. Poster supplies (push-pins) will be available. Posters can be previewed during the day before the formal poster sessions begin at 6:00 pm.

It is the authors' responsibility to remove their posters and all other materials at the conclusion of the poster reception for that day. Posters and all material not removed will be considered unwanted and will be discarded. SPIE assumes no responsibility for posters left up after the end of each night's poster reception.

Attendees and authors are required to wear their conference registration badges to the poster sessions.

Panel Discussion: Wild and Crazy Ideas

Convention Center Room B4

Tuesday 14 February. . . . . 7:45 to 9:00 pm

Moderators: **Nigel R. Farrar,** Cymer, Inc.; **Mircea V. Dusa,** ASML US. Inc.

Organizers: **Will Conley,** Consultant; **Mark E. Mason,** Texas Instruments Inc.; **Mark H. Somervell,** Tokyo Electron America, Inc.; **Kafai Lai,** IBM Corp.; **John L. Sturtevant,** Mentor Graphics Corp.

Part of the Optical Microlithography conference.

Award Announcements

Award Announcement for Conference on Metrology, Inspections, and Process Control for Microlithography

Convention Center Ballroom J2

Monday 13 February . . . . 11:00 to 11:10 am

Presentation of the **2011 Diana Nyyssonen Memorial Award** for the Best Paper on Metrology in the 2011 conference **Metrology, Inspection, and Process Control for Microlithography**

Award Announcements for Conference on Advances in Resist Materials and Processing Technology

Convention Center Ballroom A2

Monday 13 February . . . . 11:00 to 11:30 am

Presentation of the **2011 C. Grant Willson Award** for Best Paper in the 2011 conference **Advances in Resist Materials and Processing Technology**

Sponsored by

Presentation of the **2011 Jeffrey Byers Memorial Best Poster Award** in the 2011 conference **Advances in Resist Materials and Processing Technology**

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Presentation of the **Hiroshi Ito Memorial Award** for Best Student Paper for 2012 conference **Advances in Resist Materials and Processing Technology**

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Award Announcement for Conference on Optical Microlithography

Convention Center Ballroom B4

2012 Best Student Paper Award for 2012 conference **Optical Microlithography**

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Visit the exhibition. See the latest lithography research and development, devices, tools, fabrication, and services.

Exhibition:
14-15 February 2012
Tuesday 14 February 10:00 am to 5:00 pm
Wednesday 15 February 10:00 am to 4:00 pm

Exhibition Technologies

Lithography: immersion, double patterning, e-beam, EUV, optical/laser, and RET

Metrology, inspection, OPC, and process control

Design and manufacturing software

Materials and chemicals

Imaging equipment

Lasers

Resist materials and processing

Nano-imprint

IC and chip fabrication

Nanoscale imaging

2012 Exhibiting Company list

(current as of 12/21/2011)

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TNO Science and Industry
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Vacuum Research Corp.
Vistec Electron Beam Lithography Group
XEI Scientific, Inc.
XYALIS

General Information

San Jose McEnery Convention Center, 150 West San Carlos, San Jose, CA 95113 USA.

Registration

Registration Hours

Convention Center, Concourse 2

Sunday . . . . 7:00 am to 5:00 pm
Monday . . . . 7:00 am to 4:00 pm
Tuesday . . . . 7:30 am to 5:00 pm
Wednesday . . . . 7:30 am to 4:00 pm
Thursday . . . . 7:30 am to 4:00 pm

Exhibition Hours

Tuesday. . . . . 10:00 am to 5:00 pm
Wednesday . . . . 10:00 am to 4:00 pm

Course Materials Desk

Open during registration hours. Located at the SPIE Bookstore.

If you have registered to attend a course, stop by the Course Materials Desk after you pick up your badge, to obtain your course notes and course location. Pick up a copy of the latest Education Services catalog to see SPIE Courses at symposia, on video and CD, and to discover the opportunities of customized In-company courses.

Food and Beverage Services

Coffee Breaks

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Complimentary coffee will be served twice each day of the conference at approximately 10:00 am and 3:00 pm. Please check the individual technical conference listings for exact times and locations.

Breakfast Breads

Tuesday Breakfast Breads sponsored by

Breakfast breads and coffee will be served from 7:30 am to 8:30 am Monday through Thursday for Symposium attendees in the Convention Center, Ballroom Concourse Monday-Thursday.

Lunches

Tuesday Lunch sponsored by

Wednesday Lunch sponsored by

Full conference registrants will receive a lunch coupon redeemable towards a luncheon purchased Tuesday and Wednesday at designated areas of the Exhibition Hall 1. Coupons will be accepted from 11:30 am to 1:30 pm both days. Some restrictions apply; please refer to the coupons in your registration packet.

Cash Lunches and Exhibition Concessions

Exhibition Hall 1

A cash quick-lunch stand is available in the foyer of the Convention Center during the week.

Exhibition Concessions are located in the back of the exhibition halls on Tuesday-Wednesday, featuring domestic and international cuisine. Choices include hot and cold snacks, beverages, deli-type sandwiches, salads, hot entrees, and pastries. Concessions will be available during exhibition hours. Purchase tickets at the SPIE Cashier.

Desserts

Exhibition Hall

Tuesday and Wednesday

Sponsored by

Dessert snacks will be served from 3:00 to 3:30 pm. Complimentary tickets for the dessert snacks will be included in attendee registration packets.

Presenter Information

Poster Setup Information

Convention Center Hall 2

Tuesday 14 February and Wednesday 15 February

- Poster authors can set up their posters after 10:00 am.
- Paper numbers will be posted on the poster boards in numerical order; please find your paper number and post your poster in the designated space.
- Poster supplies (push-pins) will be available.
- A poster author or coauthor is required to stand by their poster during the scheduled poster session to answer questions from attendees.
- Presenters who have not placed their papers on their assigned board by 5:00 pm on the day of their presentation will be considered a “no show” and their manuscript will not be published.
- Presenters must remove their posters immediately after the poster session.
- Posters not removed will be considered unwanted and will be discarded.
- SPIE assumes no responsibility for posters left up after the end of each poster session.

Speaker Check-in Desk

Convention Center, Ballroom Concourse

Sunday . . . . 2:00 to 6:00 pm
Monday through Thursday . . . . 7:30 am to 5:00 pm

All Conference rooms will have a computer workstation, LCD projector, screen, lapel microphone, and laser pointer. All presenters are requested to come to the Speaker Check-in Desk to confirm display settings of their presentations from their memory devices or laptops with the audiovisual equipment being used at this symposium.

Onsite Services

Internet Pavilion

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SPIE will have a complimentary Internet Pavilion at the Convention Center from Sunday through Thursday during registration hours. Attendees can use provided workstations or hook up their laptop to an Ethernet connection to access the Internet.

Complimentary Internet Wireless Access

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SPIE is pleased to provide complimentary wireless access to the Internet for all conference attendees bringing 802.11b wireless-enabled laptops or PDAs. Coverage will be available Sunday through Thursday in the Convention Center Ballroom Concourse.

Properly secure your computer before accessing the public wireless network. Failure to do so may allow unauthorized access to your laptop as well as potentially introduce viruses to your computer and/or presentation.

SPIE Message Center

The SPIE Message Center telephone number is 408-759-7743. Urgent messages will be taken during registration hours Sunday through Thursday.

SPIE Bookstore and Membership Services

Convention Center, Concourse 1
Open during registration hours

The SPIE Bookstore is your source for the latest SPIE Press books, Proceedings, and Educational and Professional Development materials. Become a Member of SPIE, explore the Digital Library, and take home a souvenir.

Press and Media Center

The Press & Media Center provides press conference facilities, refreshments, and press releases from exhibitors. Credentialed media are invited to communicate news via the provided telephone and high-speed Internet connections. Preregister by e-mailing name, organization, title, address, e-mail, and phone number to media@spie.org.

Child Care Services

A few child sitting services available in San Jose are:

1. Bay Area 2nd MOM Inc., Hotel Nanny Service, Toll Free Phone: 1-888-926-3666, or (650) 858-2469, or 650-787-6518. Email: bayarea2ndmom@gmail.com, Website: www.2ndmom.com

2. Sitters Unlimited: Toll Free Phone: (408) 452-0225, E-mail: info@bayareasittersunlimited.com, website: www.bayareasittersunlimited.com

Note: SPIE does not imply an endorsement or recommendation of these services. They are provided on an “information-only” basis for your further analysis and decision. Other services may be available.

Restaurant Reservations and Information Desk

The San Jose Convention and Visitors Bureau operates a Restaurant Reservations and Information Desk on the street level of the Convention Center near the main entrance. The desk will be open Sunday through Thursday during core hours of the convention. For more information visit their website http://www.sanjose.org

Policies

Audio, Video, Digital Recording Policy

In the Meeting Rooms and Poster Sessions: For copyright reasons, recordings of any kind are strictly prohibited without prior written consent of the presenter in any conference session, short course or of posters presented. Each presenter being taped must file a signed written consent form. Individuals not complying with this policy will be asked to leave a given session and asked to surrender their film or recording media. Consent forms are available at the SPIE Speaker Check-in Desk.

In the Exhibition Hall: For security and courtesy reasons, photographing or videotaping individual booths and displays in the exhibit hall is allowed ONLY with explicit permission from on-site company representatives. Individuals not complying with this policy will be asked to surrender their film and to leave the exhibit hall.

Laser Pointer Safety Information

SPIE supplies tested and safety approved laser pointers for all conference meeting rooms, and for course rooms if instructors request one. For safety reasons, SPIE requests that presenters use our provided laser pointers available in each meeting room.

If using your personal laser pointer: We require that you to come to the Speaker Check-in Desk onsite and test your pointer on our power meter. If the pointer fails the safe power level (<5 mW) you may not use the pointer at the conference. You will be required to sign a waiver releasing SPIE of any liability for use of potentially non-safe laser pointers.

Use of a personal laser pointer at an SPIE event represents user’s acceptance of liability for use of a non-SPIE supplied laser pointer device. Misuse of any laser pointer could lead to eye damage. In California, it is a criminal misdemeanor to shine a laser pointer at individuals “who perceive they are at risk.”

Underage Persons on Exhibition Floor

For safety and insurance reasons, no persons under the age of 16 will be allowed in the exhibition area during move-in and move-out. During open exhibition hours, only children over the age of 12 accompanied by an adult will be allowed in the exhibition area.

Unauthorized Solicitation

Any manufacturer or supplier who is not an exhibitor and is observed to be soliciting business in the aisles, or in another company’s booth, will be asked to leave immediately. Unauthorized solicitation in the Exhibition Hall is prohibited.

General Information

Unsecured Items

Personal belongings such as briefcases, backpacks, coats, book bags, etc., should not be left unattended in meeting rooms or public areas. These items will be subject to removal by security upon discovery.

Travel and Hotel

Car Rental

Hertz Car Rental has been selected as the official car rental agency for this symposium. To reserve a car, identify yourself as an Advanced Lithography Conference attendee using the Hertz Meeting Code CV# 029B0017. Call 1-800-654-2240.

Parking

At the Convention Center: 150 W. San Carlos St. Max $20 per day. ($1 for each 20 min to max $20.) There are approximately 650 spaces for the public to use.

Alternate Parking Downtown San Jose: River Park Tower Garage, located on the corner of San Carlos and Woz Way, 333 W. San Carlos St. $1.25 per each 20 minutes, $18 daily maximum. Rates and hours subject to change without notice. Approx. 1,000 spaces available each day of the event. Hrs of operation: Mon-Fri - 6:30 am to 12:00 midnight, Sat - 8:00 am to 12 midnight; Sun - 8:00 am - may close at 10:00 pm if event over.

Parking at the Hotels

On space available basis
(rates subject to change without notice)

Fairmont San Jose
Valet Only
Overnight guests - $26 with in/out privileges.
Non-guests - $5 for 1st 30 min, $1.50 for each additional 20 min, max per day is $26. Parking garage is beneath the hotel.

San Jose Marriott
Overnight guests - $26 per day with in/out privileges.
Non-guests - $6.00 per hour with a maximum of $26/day.

Hilton San Jose & Towers
Overnight guests: Self - $19 max. with in/out privileges.
Valet $24 max. with in/out privileges.
Non Guests: Self - $19 max., Valet $24 max. and $8 for up to 5 hours with validation from the Affinity Restaurant.

Hyatt Place
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Sainte Claire
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In/out privileges for those guests who charge the parking to their rooms. Parking garage is not owned by hotel. Fees are subject to change.

Ramada
Complimentary parking based on availability.

Hotel Information

San Jose Marriott, Headquarters Hotel
301 South Market St., Tel: 408 280 1300; Fax: 408 278 4444.

Fairmont Hotel
170 South Market St., Tel: 408 998 1900; Fax: 408 287 1648.

Hilton San Jose and Towers
300 Almaden Blvd., Tel: 408 287 2100; Fax: 408 947 4489.

Hyatt Place
282 Almaden Blvd., Tel: 408 998 0400; Fax: 408 289 9081.

The Sainte Claire
302 S. Market St., Tel: 408 885 1234; Fax: 408 977 0403.

Ramada
455 S. Second St., Tel: 408 298 3500; Fax: 408 298 2477.

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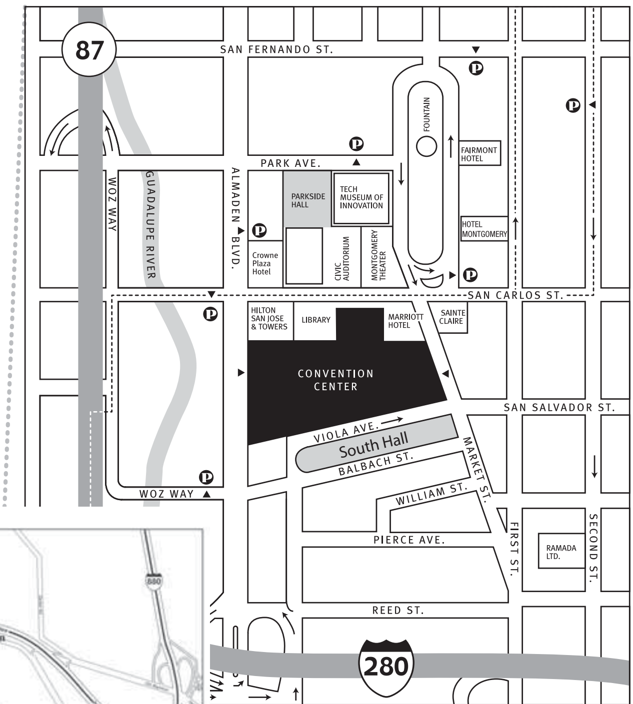
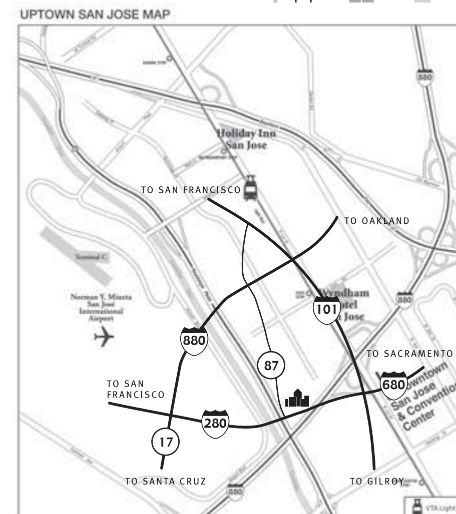
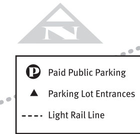
Since parking at the Convention Center can be quite congested at times, try the Park and Ride alternative transportation method, utilizing VTA's complimentary Park and Ride parking lots to commute to the Convention Center. To see a full listing of Park and Ride lots, visit www.vta.org and click on "Schedules, Maps & Fares" and then "Park and Ride." Free regular Park and Ride parking is limited to 72 hours.







SUNDAY	MONDAY	THURSDAY
NEW SC956 **Basics and Industrial Applications of AFM** *(Ukraintsev)* 8:30 am to 12:30 pm, $350 / $405	SC1030 **Interaction of Physical Design and Lithography** *(Yuan)* 1:30 to 5:30 pm, $350 / $405	SC103 **Chemically Amplified Resists** *(Willson)* 8:30 am to 5:30 pm, $575 / $685
SC888 **EUV Lithography** *(Bakshi, Ahn, Naulleau)* 8:30 am to 5:30 pm, $805 / $915		SC616 **Practical Photoresist Processing** *(Dammel)* 8:30 am to 12:30 pm, $350 / $405
SC101 **Introduction to Microlithography: Theory, Materials, and Processing** *(Bowden, Willson)* 8:30 am to 5:30 pm, $575 / $685		
SC116 **Lithographic Optimization: A Theoretical Approach** *(Mack)* 8:30 am to 5:30 pm, $625 / $735		
SC992 **Lithography Integration for Semiconductor FEOL & BEOL Fabrication** *(Lin, Zhang)* 8:30 am to 5:30 pm, $575 / $685		
NEW SC1066 **Practical Modeling and Computational Lithography** *(Lai)* 8:30 am to 5:30 pm, $575 / $685		
SC885 **Principles and Practical Implementation of Double Patterning** *(Dusa, Hsu)* 8:30 am to 5:30 pm, $575 / $685		
NEW SC1067 **Directed Self Assembly and its Application to Nanoscale Fabrication** *(de Pablo, Nealey, Ruiz)* 1:30 to 5:30 pm, $350 / $405		
SC1009 **Electron Beam Inspection - Principles and Applications in IC and Mask Manufacturing** *(Xiao)* 1:30 to 5:30 pm, $350 / $405		

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SPIE reserves the right to cancel a course due to insufficient advance registration.

Technical Conference Session Schedule

	Conference 8322 **Extreme Ultraviolet (EUV) Lithography III**	Conference 8323 **Alternative Lithographic Technologies IV**	Conference 8324 **Metrology, Inspection, and Process Control for Microlithography XXVI**
Monday 13 February	SESSION 1 · 1:30 to 3:30 pm Invited Session I SESSION 2 · 4:00 to 6:00 pm EUV: Joint Session with Conference 8325	Opening Remarks · 3:10 to 3:30 SESSION 1 · 3:30 to 5:15 pm Keynote Session	Opening Remarks and Award Presentations · 11:00 to 11:10 am SESSION 1 · 11:10 am to 12:10 pm Keynote Session SESSION 2 · 1:30 to 3:10 pm Lithography Metrology and Inspection SESSION 3 · 3:40 to 5:20 pm Overlay Topics in Advanced Optical Microlithography: Joint Session with Conference 8326
Tuesday 14 February	SESSION 3 · 8:00 to 10:00 am Mask Defects SESSION 4 · 10:30 am to 12:10 pm EUV Sources SESSION 5 · 1:30 to 3:10 pm Metrology and Inspection for EUVL; Joint Session with Conference 8324 SESSION 6 · 3:40 to 5:40 pm Mask Roughness and Cleaning	SESSION 2 · 8:00 to 9:50 am Imprint I: Processing SESSION 3 · 10:30 am to 12:20 pm Directed Self Assembly I: Resist Processing: Joint Session with Conference 8325 SESSION 4 · 1:30 to 3:00 pm Maskless/Direct-Write Lithography I SESSION 5 · 3:30 to 4:50 pm Modeling of Alternative Lithographic Processes	SESSION 4 · 8:00 to 9:40 am Inspection SESSION 5 · 10:30 am to 12:00 pm LER/LWR SESSION 6 · 1:30 to 3:10 pm Metrology and Inspection for EUVL: Joint Session with Conference 8322 SESSION 7 · 3:40 to 5:20 pm Scatterometry
Wednesday 15 February	SESSION 7 · 8:00 to 10:00 am EUV Resist I SESSION 8 · 10:20 am to 12:20 pm Mask/Extendability SESSION 9 · 1:50 to 3:30 pm Optics and Metrology SESSION 10 · 4:00 to 6:00 pm EUV Resist II	SESSION 6 · 8:00 to 10:10 am Metrology and Inspection for Alternative Lithographic Technologies: Joint Session with Conference 8324 SESSION 7 · 10:30 am to 12:20 pm Hybrid Directed Self-Assembly and Imprint Processes (DSA II and Imprint II) SESSION 8 · 1:30 to 3:10 pm Directed Self-Assembly III: Patterning SESSION 9 · 3:40 to 5:30 pm Maskless/Direct-Write Lithography II	SESSION 8 · 8:00 to 10:10 am Metrology and Inspection for Alternative Lithographic Technologies: Joint Session with Conference 8323 SESSION 9 · 10:40 to 11:50 am Scanning Probe Metrology SESSION 10 · 1:20 to 2:40 pm Accuracy and Standards SESSION 11 · 3:30 to 5:40 pm Metrology and Inspection for TSV and 3D Integration
Thursday 16 February	SESSION 11 · 8:00 to 10:00 am Invited Session II SESSION 12 · 10:30 am to 12:10 pm EUV Integration	SESSION 10 · 8:00 to 10:10 am Imprint III: Templates, Masks, and Molds SESSION 11 · 10:30 am to 12:20 pm Frontier Lithographic Techniques and Applications SESSION 12 · 1:30 to 3:20 pm Imprint IV: R2R Imprint Lithography and Applications SESSION 13 · 3:40 to 5:10 pm Directed Self-Assembly IV: Materials for Fine Process Control	SESSION 12 · 8:00 to 10:00 am Overlay SESSION 13 · 10:30 to 11:50 am SEM SESSION 14 · 1:20 to 2:40 pm Lithography Process Control SESSION 15 · 3:30 to 5:20 pm Novel Technologies and Late Breaking News

Conference 8325 **Advances in Resist Materials and Processing Technology XXIX**	Conference 8326 **Optical Microlithography XXV**	Conference 8327 **Design for Manufacturability through Design-Process Integration VI**	Conference 8328 **Advanced Etch Technology for Nanopatterning**
Opening Remarks and Award Presentations · 11:00 to 11:30 am SESSION 1 · 11:30 am to 12:30 pm Keynote Session SESSION 2 · 2:00 to 3:20 pm Negative Tone Processing SESSION 3 · 4:00 to 6:00 pm EUV: Joint Session with Conference 8322	SESSION 1 · 3:40 to 5:20 pm Overlay Topics in Advanced Optical Microlithography: Joint Session with Conference 8324		SESSION 1 · 1:30 to 5:50 pm Overview of Nanopatterning Challenges and Opportunities
SESSION 4 · 8:00 to 10:00 am Optical Extensions SESSION 5 · 10:30 am to 12:20 pm Directed Self-Assembly I: Resist Processing: Joint Session with Conference 8323 SESSION 6 · 1:30 to 3:10 pm Simulation of Resist Processes SESSION 7 · 3:40 to 6:00 pm Resist Fundamentals	Opening Remarks and Recognition · 8:00 to 8:20 am SESSION 2 · 8:20 to 9:40 am Invited Session SESSION 3 · 10:30 to 11:50 am SMO-Modeling SESSION 4 · 1:20 to 3:00 pm Multiple Patterning I SESSION 5 · 3:30 to 5:10 pm Source and Mask Optimization		SESSION 2 · 8:40 am to 12:00 pm Nanopatterning for Advanced Technology Nodes SESSION 3 · 1:30 to 6:00 pm Plasma and Photoresist Interactions
SESSION 8 · 8:00 to 10:00 am Novel Materials and Processing I SESSION 9 · 10:30 am to 12:10 pm Lithography at the Intersection of Optics and Chemistry: Joint Session with Conference 8326 SESSION 10 · 1:20 to 3:20 pm EUV Materials, Processing, and Analysis SESSION 11 · 3:40 to 5:20 pm Novel Materials and Processing II	SESSION 6 · 8:00 to 10:00 am Tools and Process Control I SESSION 7 · 10:30 am to 12:10 pm Lithography at the Intersection of Optics and Chemistry: Joint Session with Conference 8325 SESSION 8 · 1:40 to 3:20 pm Tools and Process Control II SESSION 9 · 3:50 to 5:30 pm Multiple Patterning/Innovative Lithography	Opening Remarks · 8:15 to 8:25 am SESSION 1 · 8:25 to 10:10 am Keynote Session SESSION 2 · 10:40 am to 12:00 pm DFDP: Design for Double Patterning SESSION 3 · 1:30 to 3:10 pm Design Rules and Routing SESSION 4 · 3:40 to 5:50 pm Design Implementation and Variability	
	SESSION 10 · 8:00 to 10:00 am Optical/DFM: Joint Session with Conference 8327 SESSION 11 · 10:30 am to 12:10 pm Joint Session with Conference 8327 SESSION 12 · 1:20 to 3:00 pm OPC SESSION 13 · 3:30 to 5:10 pm Tools	SESSION 5 · 8:00 to 10:00 am Optical/DFM: Joint Session with Conference 8326 SESSION 6 · 10:30 am to 12:10 pm Joint Session with Conference 8326 SESSION 7 · 1:40 to 3:20 pm Hotspots, CMP, and Fill	

Conference 8322

Monday-Thursday 13-16 February 2012 • Proceedings of SPIE Vol. 8322

Extreme Ultraviolet (EUV) Lithography III

Conference Chair: **Patrick P. Naulleau,** Lawrence Berkeley National Lab. (United States)

Conference Co-Chair: **Obert R. Wood II,** GLOBALFOUNDRIES Inc. (United States)

Program Committee: **Markus Bender,** Advanced Mask Technology Ctr. GmbH Co. KG (Germany); **Robert L. Brainard,** College of Nanoscale Science & Engineering, Univ. at Albany (United States); **Li-Jui Chen,** Taiwan Semiconductor Manufacturing Co. Ltd. (Taiwan); **Daniel A. Corliss,** IBM Corp. (United States); **Kevin D. Cummings,** Cymer, Inc. (United States); **Emily E. Gallagher,** IBM Corp. (United States); **Michael Goldstein,** Intel Corp. (United States); **Francis Goodwin,** SEMATECH Inc. (United States); **Naoya Hayashi,** Dai Nippon Printing Co., Ltd. (Japan); **Bryan S. Kasprowicz,** Photronics, Inc. (United States); **Seong-Sue Kim,** SAMSUNG Electronics Co., Ltd. (Korea, Republic of); **Bruno M. La Fontaine,** Cymer, Inc. (United States); **Michael J. Lercel,** Cymer, Inc. (United States); **Ted Liang,** Intel Corp. (United States); **Akira Miyake,** Canon Inc. (Japan); **Hiroaki Morimoto,** Toppan Printing Co., Ltd. (Japan); **Katsuhiko Murakami,** Nikon Corp. (Japan); **Iwao Nishiyama,** Semiconductor Leading Edge Technologies, Inc. (Japan); **Christopher S. Ngai,** Applied Materials, Inc. (United States); **Shinji Okazaki,** EUVA (Japan); **Uzodinma Okoroanyanwu,** GLOBALFOUNDRIES Inc. (United States); **Eric M. Panning,** Intel Corp. (United States); **Jan Hendrik Peters,** Carl Zeiss SMS GmbH (Germany); **Jorge J. Rocca,** Colorado State Univ. (United States); **Kurt G. Ronse,** IMEC (Belgium); **Tsutomu Shoki,** HOYA Corp. (Japan); **Stanley E. Stokowski,** KLA-Tencor Corp. (United States); **Thomas I. Wallow,** GLOBALFOUNDRIES Inc. (United States); **Jeong-Ho Yeo,** SAMSUNG Electronics Co., Ltd. (Korea, Republic of); **Masaki Yoshioka,** XTREME technologies GmbH (Germany)

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Conference 8323

Monday-Thursday 13-16 February 2012 • Proceedings of SPIE Vol. 8323

Alternative Lithographic Technologies IV

Conference Chair: **William M. Tong,** KLA-Tencor Corp. (United States)

Conference Co-Chair: **Douglas J. Resnick,** Molecular Imprints, Inc. (United States)

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Conference 8324

Monday-Thursday 13-16 February 2012 • Proceedings of SPIE Vol. 8324

Metrology, Inspection, and Process Control for Microlithography XXVI

Conference Chair: **Alexander Starikov,** I&I Consulting (United States)

Conference Co-Chair: **Jason P. Cain,** Advanced Micro Devices, Inc. (United States)

Program Committee: **Ofer Adan,** Applied Materials (Israel); **John A. Allgair,** GLOBALFOUNDRIES Inc. (United States); **Masafumi Asano,** Toshiba Corp. (Japan); **Benjamin D. Bunday,** International SEMATECH Manufacturing Initiative (United States); **Shaunee Y. Cheng,** IMEC (Belgium); **Timothy F. Crimmins,** Intel Corp. (United States); **Daniel J. C. Herr,** Semiconductor Research Corp. (United States); **David C. Joy,** The Univ. of Tennessee (United States); **Chih-Ming Ke,** Taiwan Semiconductor Manufacturing Co. Ltd. (Taiwan); **Yi-sha Ku,** Industrial Technology Research Institute (Taiwan); **Byoung-Ho Lee,** SAMSUNG Electronics Co., Ltd. (Korea, Republic of); **Christopher J. Raymond,** Nanometrics Inc. (United States); **John C. Robinson,** KLA-Tencor Corp. (United States); **Martha I. Sanchez,** IBM Almaden Research Ctr. (United States); **Matthew J. Sendelbach,** IBM Corp. (United States); **Richard M. Silver,** National Institute of Standards and Technology (United States); **Vladimir A. Ukraintsev,** Nanometrology International, Inc. (United States)

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Conference 8325

Monday-Wednesday 13-15 February 2012 • Proceedings of SPIE Vol. 8325

Advances in Resist Materials and Processing Technology XXIX

Conference Chair: **Mark H. Somervell,** Tokyo Electron America, Inc. (United States)

Conference Co-Chair: **Thomas I. Wallow,** GLOBALFOUNDRIES Inc. (United States)

Program Committee: **Robert Allen,** IBM Almaden Research Ctr. (United States); **Ramakrishnan Ayothi,** JSR Micro, Inc. (United States); **George G. Barclay,** Dow Advanced Materials (United States); **Luisa D. Bozano,** IBM Almaden Research Ctr. (United States); **Sean D. Burns,** IBM Corp. (United States); **Ralph R. Dammel,** AZ Electronic Materials USA Corp. (United States); **Roel Gronheid,** IMEC (Belgium); **Douglas J. Guerrero,** Brewer Science, Inc. (United States); **Clifford L. Henderson,** Georgia Institute of Technology (United States); **Christoph K. Hohle,** Fraunhofer-Ctr. Nanoelektronische Technologien (Germany); **Scott W. Jessen,** Texas Instruments Inc. (United States); **Yoshio Kawai,** Shin-Etsu Chemical Co., Ltd. (Japan); **Qinghuang Lin,** IBM Thomas J. Watson Research Ctr. (United States); **Nobuyuki N. Matsuzawa,** Sony Corp. (Japan); **Dah-Chung Owe-Yang,** Shin-Etsu MicroSi, Inc. (United States); **Daniel P. Sanders,** IBM Almaden Research Ctr. (United States); **Plamen Tzviatkov,** FUJIFILM Electronic Materials U.S.A., Inc. (United States); **Todd R. Younkin,** Intel Corp. (Belgium)

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Conference 8326

Monday-Thursday 13-16 February 2012 • Proceedings of SPIE Vol. 8326

Optical Microlithography XXV

Conference Chair: **Will Conley,** Dynamic Intelligence (United States)

Conference Co-Chair: **Kafai Lai,** IBM Corp. (United States)

Program Committee: **Pary Baluswamy,** Micron Technology, Inc. (United States); **Peter D. Brooker,** Synopsys, Inc. (United States); **Peter D. Buck,** Toppan Photomasks, Inc. (United States); **Mircea V. Dusa,** ASML US, Inc. (United States); **Andreas Erdmann,** Fraunhofer-Institut für Integrierte System und Bauelementetechnologie (Germany); **Nigel R. Farrar,** Cymer, Inc. (United States); **Carlos Fonseca,** Tokyo Electron America, Inc. (United States); **Tsai-Sheng Gau,** Taiwan Semiconductor Manufacturing Co. Ltd. (Taiwan); **Bernd Geh,** Carl Zeiss SMT Inc. (United States); **Yuri Granik,** Mentor Graphics Corp. (United States); **Soichi Inoue,** Toshiba Corp. (Japan); **Jongwook Kye,** GLOBALFOUNDRIES Inc. (United States); **Suk Joo Lee,** SAMSUNG Electronics Co., Ltd. (Korea, Republic of); **Wilhelm Maurer,** Infineon Technologies AG (Germany); **Soichi Owa,** Nikon Corp. (Japan); **Xuelong Shi,** Semiconductor Manufacturing International Corp. (China); **Sam Sivakumar,** Intel Corp. (United States); **Bruce W. Smith,** Rochester Institute of Technology (United States); **Kazuhiro Takahashi,** Canon Inc. (Japan); **Geert Vandenberghe,** IMEC (Belgium)

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Conference 8327

Wednesday-Thursday 15-16 February 2012 • Proceedings of SPIE Vol. 8327

Design for Manufacturability through Design-Process Integration VI

Conference Chair: **Mark E. Mason,** Texas Instruments Inc. (United States)

Conference Co-Chair: **John L. Sturtevant,** Mentor Graphics Corp. (United States)

Program Committee: **Robert Aitken,** ARM Inc. (United States); **Luigi Capodieci,** GLOBALFOUNDRIES Inc. (United States); **Juan-Antonio Carballo,** Netlogic Microsystems Inc. (United States); **Jason P. Cain,** Advanced Micro Devices, Inc. (United States); **Fang-Cheng Chang,** Cadence Design Systems, Inc. (United States); **Lars W. Liebmann,** IBM Corp. (United States); **Andrew Neureuther,** University of California Berkeley (United States); **David Z. Pan,** The Univ. of Texas at Austin (United States); **Chul-Hong Park,** SAMSUNG Electronics Co., Ltd. (Korea, Republic of); **Larry Pileggi,** Carnegie Mellon Univ. (United States); **Michael L. Rieger,** Synopsys, Inc. (United States); **Vivek K. Singh,** Intel Corp. (United States); **Chi-Min Yuan,** Freescale Semiconductor, Inc. (United States)

Conference 8328

Monday-Tuesday 13-14 February 2012 • Proceedings of SPIE Vol. 8328

Advanced Etch Technology for Nanopatterning

Conference Chair: **Ying Zhang,** Taiwan Semiconductor Manufacturing Co. Ltd. (Taiwan)

Conference Co-Chairs: **Gottlieb Oehrlein,** Univ. of Maryland, College Park (United States); **Qinghuang Lin,** IBM Thomas J. Watson Research Ctr. (United States)

Program Committee: **Julie Bannister,** Tokyo Electron America, Inc. (United States); **Maxime Darnon,** CNRS-LTM (France); **Sebastian U. Engelmann,** IBM Thomas J. Watson Research Ctr. (United States); **Eric A. Hudson,** Lam Research Corp. (United States); **Catherine B. Labelle,** GLOBALFOUNDRIES Inc. (United States); **Nae-Eung Lee,** Sungkyunkwan Univ. (Korea, Republic of); **Denis Shamiryan,** GLOBALFOUNDRIES Dresden Module Two, GmbH & Co. KG (Germany); **Jeffrey J. Xu,** Taiwan Semiconductor Manufacturing Co. Ltd. (Taiwan); **Anthony Yen,** Taiwan Semiconductor Manufacturing Co. Ltd. (Taiwan)

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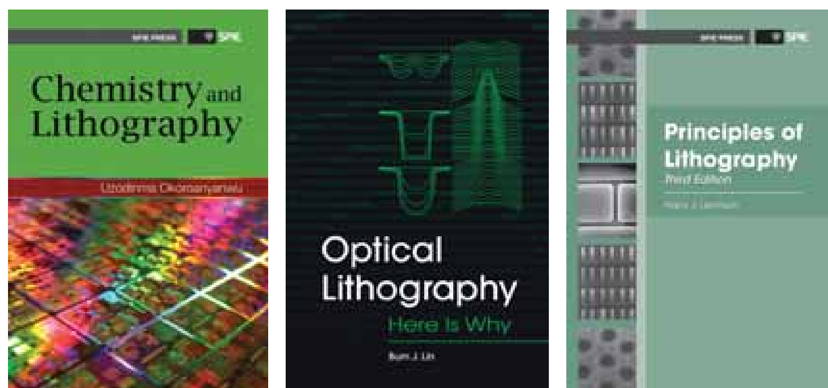
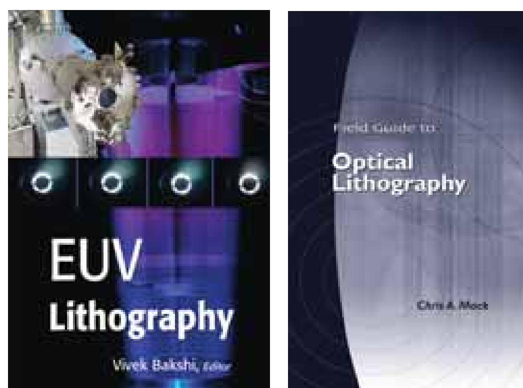




Conference 8324

Metrology, Inspection, and Process Control for Microlithography XXVI

Room: Conv. Ctr. Ballroom J2 . . . . . Mon. 11:00 to 11:10 am

Opening Remarks and Award Presentation

Session Chairs: **Alexander Starikov,** I&I Consulting (United States); **Jason P. Cain,** Advanced Micro Devices, Inc. (United States)

Presentation of the Diana Nyyssonen Memorial Award for the Best Paper in Metrology for 2011.

SESSION 1

Room: Conv. Ctr. Ballroom J2 . . Mon. 11:10 am to 12:10 pm

Keynote Session

Session Chairs: **Alexander Starikov,** I&I Consulting (United States); **Jason P. Cain,** Advanced Micro Devices, Inc. (United States)

11:10 am: **Can we get 3D CD metrology right?** *(Keynote Presentation)*, András E. Vladár, Petr Cizmar, John S. Villarrubia, Michael T. Postek, National Institute of Standards and Technology (United States). . . . . [8324-01]

11:40 am: **Inspection and metrology for through-silicon vias and 3D integration** *(Keynote Presentation)*, Andrew C. Rudack, SEMATECH North (United States). . . . . [8324-02]

Lunch Break . . . . 12:10 to 1:30 pm

Conference 8325

Advances in Resist Materials and Processing Technology XXIX

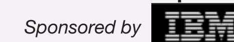
Room: Conv. Ctr. Ballroom A2. . . . . Mon. 11:00 to 11:30 am

Opening Remarks and Award Presentations

Session Chairs: **Mark H. Somervell,** Tokyo Electron America, Inc. (United States); **Thomas I. Wallow,** GLOBALFOUNDRIES Inc. (United States)

Award Presentations:

2011 C. Grant Willson Award for Best Paper

Sponsored by 

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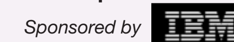
Sponsored by 

SESSION 1

Room: Conv. Ctr. Ballroom A2 . Mon. 11:30 am to 12:30 pm

Keynote Session

11:30 am: **The evolution of lithography materials from the perspective of a two term conference chair** *(Keynote Presentation)*, Robert Allen, IBM Almaden Research Ctr. (United States). . . [8325-01]

12:00 pm: **Factors that detemine the optimum dose for sub-20nm resist systems: DUV, EUV, and e-beam options** *(Keynote Presentation)*, Moshe E. Preil, GLOBALFOUNDRIES Inc. (United States) . . . . [8325-02]

Lunch Break . . . . 12:30 to 2:00 pm

Conference 8322

Extreme Ultraviolet (EUV) Lithography III

SESSION 1

Room: Conv. Ctr. Ballroom B4. . . . . . . Mon. 1:30 to 3:30 pm

Overflow rooms will be available. Look for signs onsite.

Invited Session I

Session Chairs: **Bruno La Fontaine,** Cymer, Inc. (United States); **Kurt G. Ronse,** IMEC (Belgium)

1:30 pm: **Progress of EUV lithography toward manufacturing** *(Invited Paper)*, Jan V. Hermans, David Laidler, IMEC (Belgium); Amir Sharomi, Andre van Dijk, Mircea V. Dusa, ASML Netherlands B.V. (Netherlands); Eric Hendrickx, IMEC (Belgium) . . . . [8322-01]

2:00 pm: **Insertion strategy for EUV lithography** *(Invited Paper)*, Obert R. Wood II, GLOBALFOUNDRIES Inc. (United States); John C. Arnold, Timothy A. Brunner, Martin Burkhardt, James H. C. Chen, Susan S. C. Fan, Emily E. Gallagher, Scott D. Halle, IBM Corp. (United States); Linus Jang, GLOBALFOUNDRIES Inc. (United States); Hirokazu Kato, Toshiba America Electronic Components, Inc. (United States); Chiew-Seng Koay, Guillaume Landie, IBM Corp. (United States); Gregory R. McIntyre, GLOBALFOUNDRIES Inc. (United States); Satoshi Nagai, Toshiba America Electronic Components, Inc. (United States); Karen E. Petrillo, IBM Corp. (United States); Sudharshanan Raghunathan, Lei Sun, Thomas I. Wallow, GLOBALFOUNDRIES Inc. (United States); Yunpeng Yin, IBM Corp. (United States); Xuelian Zhu, GLOBALFOUNDRIES Inc. (United States); Matthew Colburn, Daniel A. Corliss, IBM Corp. (United States). . . . . [8322-02]

2:30 pm: **Compact EUV radiation sources** *(Invited Paper)*, William Barletta, Massachusetts Institute of Technology (United States) . . . . [8322-03]

3:00 pm: **Pattern collapse mitigation strategies for EUV lithography** *(Invited Paper)*, Dario L. Goldfarb, Robert L. Bruce, James J. Bucchignano, David P. Klaus, Michael A. Guillorn, IBM Thomas J. Watson Research Ctr. (United States); Chung-Hsi J. Wu, IBM Corp. (United States) . . . . [8322-04]

Coffee Break . . . . 3:30 to 4:00 pm

Conference 8324

Metrology, Inspection, and Process Control for Microlithography XXVI

SESSION 2

Room: Conv. Ctr. Ballroom J2 . . . . Mon. 1:30 to 3:10 pm

Lithography Metrology and Inspection

Session Chairs: **Masafumi Asano,** Toshiba Corp. (Japan); **Ofer Adan,** Applied Materials (Israel)

1:30 pm: **Hybrid metrology solution for 1X node technology**, Alok Vaid, John A. Allgair, Mark Kelling, GLOBALFOUNDRIES Inc. (United States); Carsten Hartig, Peter Ebersbach, GLOBALFOUNDRIES Dresden Module Two, GmbH & Co. KG (Germany); Matthew J. Sendelbach, Erin McLellan, Nedal Saleh, Narender Rana, IBM Corp. (United States); Toru Ikegami, Masahiko Ikeno, Hitachi High-Technologies Corp. (Japan); Cornel Bozdog, Helen Kim, Nova Measuring Instruments Inc. (United States); Roy Koret, Nova Measuring Instruments Ltd. (Israel). . . . . [8324-03]

1:50 pm: **Dose-focus monitor technique using CD-SEM and application to local variation analysis**, Shoji Hotta, Hitachi America, Ltd. (United States); Timothy A. Brunner, Scott D. Halle, IBM Corp. (United States); Keiichiro Hitomi, Hitachi America, Ltd. (United States); Takeshi Kato, Hitachi High-Tech Trading Corp. (Japan); Atsuko Yamaguchi, Hitachi, Ltd. (Japan) . . . . [8324-04]

2:10 pm: **Potential new CD metrology metric for future node production**, Johann Foucher, Nivea G. S. Figueiro, CEA-LETI (France) . . . . [8324-05]

2:30 pm: **A comparison of alignment and overlay performance with varying hardmask materials**, Sang-Ho Yun, Soon Mok Ha, Young Min Nam, Cheol-Hong Kim, Suk-Woo Nam, SAMSUNG Electronics Co., Ltd. (Korea, Republic of) . [8324-06]

2:50 pm: **High-order wafer alignment in manufacturing**, Michael B. Pike, Vinayan C. Menon, Nelson Felix, Timothy J. Wiltshire, Christopher Ausschnitt, IBM Corp. (United States); Sheldon Meyers, GLOBALFOUNDRIES Inc. (United States); Blandine Minghetti, Won D. Kim, ASML US, Inc. (United States). . . . . [8324-07]

Coffee Break . . . . 3:10 to 3:40 pm

Conference 8325

Advances in Resist Materials and Processing Technology XXIX

SESSION 2

Room: Conv. Ctr. Ballroom A2. . . . . . . Mon. 2:00 to 3:20 pm

Negative Tone Processing

Session Chairs: **Scott W. Jessen,** Texas Instruments Inc. (United States); **Sean D. Burns,** IBM Corp. (United States)

2:00 pm: **Optical performance comparison between negative tone development and positive tone development**, Seung-Hune Yang, Eun Sung Kim, Seongho Moon, Sooryong Lee, Seong-Woon Choi, Young-Hee Kim, SAMSUNG Electronics Co., Ltd. (Korea, Republic of). . . . . [8325-03]

2:20 pm: **Functional resist materials for negative tone development in advanced lithography**, Shinji Tarutani, Kana Fujii, Kei Yamamoto, Kaoru Iwato, Michihiro Shirakawa, FUJIFILM Corp. (Japan). . . . . [8325-04]

2:40 pm: **Assessment of negative tone development challenges**, Sohan S. Mehta, GLOBALFOUNDRIES Inc. (United States); Yongan Xu, Guillaume Landie, IBM Corp. (United States); Vikrant Chauhan, GLOBALFOUNDRIES Inc. (United States); Sean D. Burns, Peggy Lawson, Bassem Hamieh, IBM Corp. (United States); Jerome Wandell, GLOBALFOUNDRIES Inc. (United States); Martin Glodde, IBM Thomas J. Watson Research Ctr. (United States); Mark Kelling, GLOBALFOUNDRIES Inc. (United States); Alan Thomas, IBM Corp. (United States); Yuyang Sun, GLOBALFOUNDRIES Inc. (United States); James H. C. Chen, IBM Corp. (United States); Hirokazu Kato, Toshiba America Electronic Components, Inc. (United States); Chiahsun Tseng, Chiew-Seng Koay, Yoshinori Matsui, IBM Corp. (United States); Martin Burkhardt, IBM Thomas J. Watson Research Ctr. (United States); Yunpeng Yin, David Horak, IBM Corp. (United States); Shyng-Tsong Chen, IBM Thomas J. Watson Research Ctr. (United States); Yann Mignot, Yannick Loquet, Matthew Colburn, John C. Arnold, Terry Spooner, Lior Huli, IBM Corp. (United States); David R. Hetzer, Jason Cantone, Shinichiro Kawakami, Shannon Dunn, TEL Technology Ctr., America, LLC (United States)[8325-05]

3:00 pm: **Evolution of negative tone development photoresists for ArF lithography**, Michael Reilly, Cecily E. Andes, Thomas Cardolaccia, Jong-Keun Park, Dow Advanced Materials (United States). . [8325-07]

Coffee Break . . . . 3:20 to 4:00 pm

Conference 8328

Advanced Etch Technology for Nanopatterning

SESSION 1

Room: Conv. Ctr. J1. Mon. 1:30 to 5:50 pm

Overview of Nanopatterning Challenges and Opportunities

Session Chairs: **Ying Zhang,** Taiwan Semiconductor Manufacturing Co. Ltd. (Taiwan); **Catherine B. Labelle,** GLOBALFOUNDRIES Inc. (United States)

1:30 pm: **Extreme-UV lithography for semiconductor manufacturing at <20 nm generations**, Anthony Yen, Taiwan Semiconductor Manufacturing Co. Ltd. (Taiwan). . . . . [8328-01]

2:10 pm: **Advanced plasma etch technologies for nanopatterning**, Richard Wise, IBM System and Technology Group (United States) . . . . . . [8328-02]

2:50 pm: **Ultimate top-down processes for future nanoscale devices** *(Invited Paper)*, Seiji Samukawa, Tohoku Univ. (Japan). . . . . [8328-07]

Coffee Break . . . . 3:20 to 3:50 pm

Monday 13 February

Conference 8322

Extreme Ultraviolet (EUV) Lithography III

SESSION 2

Room: Conv. Ctr. Ballroom B4. . . . . . . Mon. 4:00 to 6:00 pm

EUV: Joint Session with Conference 8325

Session Chairs: **Robert L. Brainard,** College of Nanoscale Science & Engineering (United States); **Yoshio Kawai,** Shin-Etsu Chemical Co., Ltd. (Japan)

4:00 pm: **Modeling and simulation of acid diffusion in chemically amplified resists with polymer-bound acid generator**, Takahiro Kozawa, Osaka Univ. (Japan); Julius J. S. Santillan, Toshiro Itani, Semiconductor Leading Edge Technologies, Inc. (Japan) . . . . [8322-05]

4:20 pm: **Optimization of low-diffusion EUV resist for linewidth roughness and pattern collapse on various substrates**, James W. Thackeray, James F. Cameron, Jin Wuk Sung, Michael Wagner, Dow Electronic Materials (United States); M. Warren Montgomery, College of Nanoscale Science & Engineering (United States). . . . . [8325-08]

4:40 pm: **Contact edge roughness: effect of photo-acid generator on EUV resist**, Vijaya-Kumar Murugesan Kuppuswamy, Vassilios Constantoudis, Evangelos Gogolides, National Ctr. for Scientific Research Demokritos (Greece); Alessandro Vaglio Pret, Roel Gronheid, IMEC (Belgium) . . . . [8322-06]

5:00 pm: **EUV resist materials for 20nm and below half-pitch applications**, Shinji Tarutani, Hideaki Tsubaki, Hiroo Takizawa, Takahiro Goto, FUJIFILM Corp. (Japan) . . . . [8325-09]

5:20 pm: **Mechanisms of LER degradation in ultrathin EUV resists**, Brian Cardineau, William Earley, Univ. at Albany (United States); Tomohisa Fujisawa, Ken Maruyama, Makato Shimizu, JSR Engineering Co., Ltd. (Japan); Shalini Sharma, JSR Micro, Inc. (United States); Karen E. Petrillo, SEMATECH North (United States); Robert L. Brainard, Univ. at Albany (United States) . [8322-07]

5:40 pm: **EUV resist development for 16nm half-pitch and beyond**, Ken Maruyama, Hiroki Nakagawa, Shalini Sharma, Yoshi Hishiro, JSR Micro, Inc. (United States); Makoto Shimizu, Tooru Kimura, JSR Engineering Co., Ltd. (Japan)[8325-10]

Conference 8323

Alternative Lithographic Technologies IV

Room: Conv. Ctr. Ballroom C1. . . . . . . Mon. 3:10 to 3:30 pm

Opening Remarks

Session Chairs: **William M. Tong,** KLA-Tencor Corp. (United States); **Douglas J. Resnick,** Molecular Imprints, Inc. (United States)

SESSION 1

Room: Conv. Ctr. Ballroom C1. . . . . . . Mon. 3:30 to 5:15 pm

Keynote Session

Session Chairs: **William M. Tong,** KLA-Tencor Corp. (United States); **Douglas J. Resnick,** Molecular Imprints, Inc. (United States)

Overflow rooms will be available. Look for signs onsite.

3:30 pm: **Future of multiple e-beam direct-write systems** *(Keynote Presentation)*, Burn J. Lin, Taiwan Semiconductor Manufacturing Co. Ltd. (Taiwan) . . . . [8323-01]

4:05 pm: **Block copolymer directed self-assembly enables sub-lithographic patterning for device fabrication** *(Keynote Presentation)*, H.-S. Philip Wong, Stanford Univ. (United States); Christopher Bencher, Applied Materials, Inc. (United States); He Yi, Stanford Univ. (United States); Xin-Yu Bao, Applied Materials, Inc. (United States); Li-Wen Chang, Stanford Univ. (United States) . . . [8323-02]

4:40 pm: **Jet and flash imprint lithography: status and roadmap to manufacturing adoption** *(Keynote Presentation)*, S. V. Sreenivasan, Molecular Imprints, Inc. (United States). . . . . [8323-03]

Conference 8324

Metrology, Inspection, and Process Control for Microlithography XXVI

SESSION 3

Room: Conv. Ctr. Ballroom J2. . . . . Mon. 3:40 to 5:20 pm

Overlay Topics in Advanced Optical Microlithography: Joint Session with Conference 8326

Session Chairs: **Bernd Geh,** Carl Zeiss SMT Inc. (United States); **John C. Robinson,** KLA-Tencor Corp. (United States)

3:40 pm: **Challenges and solutions for overlay in low-k1 imaging: model for the printing of large features with extreme illumination, and the subsequent inspection with edge-detection or scatterometry based metrology**, Jens T. Neumann, Carl Zeiss SMT GmbH (Germany); Kiho Yang, Jongsu Lee, Byounghun Lee, Taehyeong Lee, Jeongsu Park, Chang-Moon Lim, Donggyu Yim, Sung-Ki Park, Hynix Semiconductor Inc. (Korea, Republic of); Eric Janda, ASML US, Inc. (United States); Kaustuve Bhattacharyya, ASML Netherlands B.V. (Netherlands); Chan-Ho Ryu, Young-Hong Min, ASML Korea Co., Ltd. (Korea, Republic of); Bernd Geh, Carl Zeiss SMT Inc. (United States). . . . . [8326-01]

4:00 pm: **Study of high order distortion in intra field using extreme off-axis illumination on a manufacturing site**, Jongsu Lee, Byounghun Lee, Taehyeong Lee, Jeongsu Park, Chang-Moon Lim, Myoung Soo Kim, Hyosang Kang, Hynix Semiconductor Inc. (Korea, Republic of); Jens T. Neumann, Carl Zeiss SMT GmbH (Germany); Eric Janda, ASML US, Inc. (United States); Kaustuve Bhattacharyya, ASML Netherlands B.V. (Netherlands); Bernd Geh, Carl Zeiss SMT Inc. (United States); Chan-Ho Ryu, Young-Hong Min, ASML Korea Co., Ltd. (Korea, Republic of)[8326-02]

4:20 pm: **Spacer process and alignment assessment for SADP process**, Ludovic Lattard, CEA-LETI (France); Martin McCallum, Nikon Precision Europe GmbH (Germany) and Nikon Corp. (Japan); Robert Morton, Nikon Precision Europe GmbH (Germany); Katsushi Makino, Akira Tokui, Nobuyuki Takahashi, Tomoharu Fujiwara, Nikon Corp. (Japan). . . . . [8326-03]

4:40 pm: **Overlay accuracy with respect to device scaling**, Philippe J. Leray, Shaunee Y. Cheng, IMEC (Belgium). . . . . [8324-08]

5:00 pm: **New analytical algorithm for overlay accuracy**, Boo-Hyun Ham, Sang-Ho Yun, Min-Chul Kwak, Soon Mok Ha, Cheol-Hong Kim, Suk-Woo Nam, SAMSUNG Electronics Co., Ltd. (Korea, Republic of) . . . . [8324-09]

Conference 8325

Advances in Resist Materials and Processing Technology XXIX

SESSION 3

Room: Conv. Ctr. Ballroom A2. . . . . . . Mon. 4:00 to 6:00 pm

EUV: Joint Session with Conference 8322

Session Chair: **Yoshio Kawai,** Shin-Etsu Chemical Co., Ltd. (Japan)

4:00 pm: **Modeling and simulation of acid diffusion in chemically amplified resists with polymer-bound acid generator**, Takahiro Kozawa, Osaka Univ. (Japan); Julius J. S. Santillan, Toshiro Itani, Semiconductor Leading Edge Technologies, Inc. (Japan) . . . . [8322-05]

4:20 pm: **Optimization of low-diffusion EUV resist for linewidth roughness and pattern collapse on various substrates**, James W. Thackeray, James F. Cameron, Jin Wuk Sung, Michael Wagner, Dow Electronic Materials (United States); M. Warren Montgomery, College of Nanoscale Science & Engineering (United States). . . . . [8325-08]

4:40 pm: **Contact edge roughness: effect of photo-acid generator on EUV resist**, Vijaya-Kumar Murugesan Kuppuswamy, Vassilios Constantoudis, Evangelos Gogolides, National Ctr. for Scientific Research Demokritos (Greece); Alessandro Vaglio Pret, Roel Gronheid, IMEC (Belgium) . . . . [8322-06]

5:00 pm: **EUV resist materials for 20nm and below half-pitch applications**, Shinji Tarutani, Hideaki Tsubaki, Hiroo Takizawa, Takahiro Goto, FUJIFILM Corp. (Japan) . . . . [8325-09]

5:20 pm: **Mechanisms of LER degradation in ultrathin EUV resists**, Brian Cardineau, William Earley, Univ. at Albany (United States); Tomohisa Fujisawa, Ken Maruyama, Makato Shimizu, JSR Engineering Co., Ltd. (Japan); Shalini Sharma, JSR Micro, Inc. (United States); Karen E. Petrillo, SEMATECH North (United States); Robert L. Brainard, Univ. at Albany (United States) . [8322-07]

5:40 pm: **EUV resist development for 16nm half-pitch and beyond**, Ken Maruyama, Hiroki Nakagawa, Shalini Sharma, Yoshi Hishiro, JSR Micro, Inc. (United States); Makoto Shimizu, Tooru Kimura, JSR Engineering Co., Ltd. (Japan)[8325-10]

Conference 8326

Optical Microlithography XXV

SESSION 1

Room: Conv. Ctr. Ballroom J2 . . . . Mon. 3:40 to 5:20 pm

Overlay Topics in Advanced Optical Microlithography: Joint Session with Conference 8324

Session Chairs: **Bernd Geh,** Carl Zeiss SMT Inc. (United States); **John C. Robinson,** KLA-Tencor Texas (United States)

3:40 pm: **Challenges and solutions for overlay in low-k1 imaging: model for the printing of large features with extreme illumination, and the subsequent inspection with edge-detection or scatterometry based metrology**, Jens T. Neumann, Carl Zeiss SMT GmbH (Germany); Kiho Yang, Jongsu Lee, Byounghun Lee, Taehyeong Lee, Jeongsu Park, Chang-Moon Lim, Donggyu Yim, Sung-Ki Park, Hynix Semiconductor Inc. (Korea, Republic of); Eric Janda, ASML US, Inc. (United States); Kaustuve Bhattacharyya, ASML Netherlands B.V. (Netherlands); Chan-Ho Ryu, Young-Hong Min, ASML Korea Co., Ltd. (Korea, Republic of); Bernd Geh, Carl Zeiss SMT Inc. (United States). . . . . [8326-01]

4:00 pm: **Study of high order distortion in intra field using extreme off-axis illumination on a manufacturing site**, Jongsu Lee, Byounghun Lee, Taehyeong Lee, Jeongsu Park, Chang-Moon Lim, Myoung Soo Kim, Hyosang Kang, Hynix Semiconductor Inc. (Korea, Republic of); Jens T. Neumann, Carl Zeiss SMT GmbH (Germany); Eric Janda, ASML US, Inc. (United States); Kaustuve Bhattacharyya, ASML Netherlands B.V. (Netherlands); Bernd Geh, Carl Zeiss SMT Inc. (United States); Chan-Ho Ryu, Young-Hong Min, ASML Korea Co., Ltd. (Korea, Republic of). . . . . [8326-02]

4:20 pm: **Spacer process and alignment assessment for SADP process**, Ludovic Lattard, CEA-LETI (France); Martin McCallum, Nikon Precision Europe GmbH (Germany) and Nikon Corp. (Japan); Robert Morton, Nikon Precision Europe GmbH (Germany); Katsushi Makino, Akira Tokui, Nobuyuki Takahashi, Tomoharu Fujiwara, Nikon Corp. (Japan) . . . . [8326-03]

4:40 pm: **Overlay accuracy with respect to device scaling**, Philippe J. Leray, Shaunee Y. Cheng, IMEC (Belgium)[8324-08]

5:00 pm: **New analytical algorithm for overlay accuracy**, Boo-Hyun Ham, Sang-Ho Yun, Min-Chul Kwak, Soon Mok Ha, Cheol-Hong Kim, Suk-Woo Nam, SAMSUNG Electronics Co., Ltd. (Korea, Republic of) . . . . [8324-09]

Conference 8328

Advanced Etch Technology for Nanopatterning

SESSION 1 *continued*

Room: Conv. Ctr. J1 . . . . Mon. 1:30 to 5:50 pm

3:50 pm: **Improving patterning capability through etch** *(Invited Paper)*, Richard A. Gottscho, Keren J. Kanarik, John W. Cossins, Lam Research Corp. (United States). . . . . [8328-03]

4:20 pm: **Plasma etch challenges and solutions for advanced patterning** *(Invited Paper)*, Thorsten B. Lill, Applied Materials, Inc. (United States); Ying Zhang, Taiwan Semiconductor Manufacturing Co. Ltd. (Taiwan); Meihua Shen, Applied Materials, Inc. (United States); Olivier P. Joubert, CNRS/LTM (France); Benjamin Schwarz, Applied Materials, Inc. (United States); Nicolas Posseme, CNRS/LTM (France); Olivier Luere, Applied Materials, Inc. (United States); Ying Xiao, Taiwan Semiconductor Manufacturing Co. Ltd. (United States); Laurent Vallier, CNRS/LTM (France). . . . . [8328-04]

4:50 pm: **Nanopatterning impacts on devices for advanced technology nodes** *(Invited Paper)*, Raj Jammy, SEMATECH Inc. (United States) . [8328-05]

5:20 pm: **Plasma etch transfer of self-assembled polymer patterns** *(Invited Paper)*, Charles T. Black, Brookhaven National Lab. (United States) [8328-30]

Tuesday 14 February

Conference 8322

Extreme Ultraviolet (EUV) Lithography III

SESSION 3

Room: Conv. Ctr. Ballroom A2. . . . . . Tues. 8:00 to 10:00 am

Note room change to A2

Mask Defects

Session Chairs: **Frank Goodwin,** SEMATECH North (United States); **Chris Ngai,** Applied Materials, Inc. (United States)

8:00 am: **EUV mask multilayer defects and their printability under different multilayer deposition conditions**, Hyuk Joo Kwon, Jenah Harris-Jones, Ranganath Teki, Aaron M. Cordes, SEMATECH North (United States); Kenneth A. Goldberg, Lawrence Berkeley National Lab. (United States) . . . . [8322-08]

8:20 am: **Printability study of pattern defects in the EUV mask as a function of hp nodes**, Tae-Geun Kim, Hwan-Seok Seo, Chang Young Jeong, Sungmin Huh, Seong-Sue Kim, Han-Ku Cho, SAMSUNG Electronics Co., Ltd. (Korea, Republic of); Iacopo Mochi, Kenneth A. Goldberg, Lawrence Berkeley National Lab. (United States) . . . [8322-09]

8:40 am: **Smoothing layers for EUV substrate defectivity mitigation**, Ranganath Teki, Arun John Kadaksham, Andy Ma, Matt House, Jenah Harris-Jones, Francis Goodwin, SEMATECH North (United States) . . . . [8322-10]

9:00 am: **Closing the gap for EUV mask repair**, Markus Waiblinger, Tristan Bret, Carl Zeiss SMS GmbH (Germany); Rik M. Jonckheere, Dieter Van den Heuvel, IMEC (Belgium); Gabriel Baralia, Carl Zeiss SMS GmbH (Germany) . . . . [8322-11]

9:20 am: **A next-generation EMF simulator for EUV lithography based on the pseudo-spectral time-domain method**, Michael Yeung, Fastlitho Inc. (United States) . . . . [8322-12]

9:40 am: **Analysis of EUV mask multilayer defect printing characteristics**, Andreas Erdmann, Peter Evanschitzky, Fraunhofer-Institut für Integrierte System und Bauelementetechnologie (Germany); Tristan Bret, Carl Zeiss SMS GmbH (Germany); Rik M. Jonckheere, IMEC (Belgium) . . . . [8322-13]

Coffee Break . . . . 10:00 to 10:30 am

Conference 8323

Alternative Lithographic Technologies IV

SESSION 2

Room: Conv. Ctr. Ballroom A3. . . . . . . Tues. 8:00 to 9:50 am

Note room change to A3

Imprint I: Processing

Session Chairs: **John G. Maltabes,** Hewlett-Packard Labs. (United States); **Tatsuhiko Higashiki,** Toshiba Corp. (Japan)

8:00 am: **Design considerations for UV-NIL resists** *(Invited Paper)*, Kazuyuki Usuki, Tadashi Oomatsu, Akiko Hattori, Satoshi Wakamatsu, Kunihiko Kodama, Shinji Tarutani, Kouji Shitabatake, FUJIFILM Corp. (Japan) . . . . [8323-04]

8:30 am: **New method for selective transfer of nanostructured assemblies onto an arbitrary substrate by nanoimprinting**, Steven J. Barcelo, Min Hu, Ansoon Kim, Wei Wu, Zhiyong Li, Hewlett-Packard Labs. (United States). . . . . [8323-05]

8:50 am: **Single-digit nanofabrication by step-and-repeat nanoimprint lithography**, Christophe Peroz, Abeam Technologies (United States); Scott D. Dhuey, Marion Cornet, Lawrence Berkeley National Lab. (United States); Marko Vogler, micro resist technology GmbH (Germany); Deirdre L. Olynick, Stefano Cabrini, Lawrence Berkeley National Lab. (United States). . . . . [8323-06]

9:10 am: **A cost-effective nanoimprint machine**, Wei Wu, Robert G. Walmsley, Wen-Di Li, Xuema Li, R. Stanley Williams, Hewlett-Packard Labs. (United States) . . . . [8323-07]

9:30 am: **Nanoimprint and post nanoimprint process for 30nm full field CMOS process using replica quartz template**, Byung-Kyu Lee, Duhyun Lee, Woong Ko, Jae Kwan Kim, Kiyeon Yang, Samsung Advanced Institute of Technology (Korea, Republic of); Byunggook Kim, Chang-Min Park, Jeong-Ho Yeo, SAMSUNG Electronics Co., Ltd. (Korea, Republic of). . . . . [8323-08]

Coffee Break . . . . 9:50 to 10:30 am

Conference 8324

Metrology, Inspection, and Process Control for Microlithography XXVI

SESSION 4

Room: Conv. Ctr. Ballroom J2 . . . . . . Tues. 8:00 to 10:00 am

Inspection

Session Chairs: **Jason P. Cain,** Advanced Micro Devices, Inc. (United States); **Byoung-Ho Lee,** SAMSUNG Electronics Co., Ltd. (Korea, Republic of)

8:00 am: **ArFi lithogrphy optimizations for thin OMOG reticle with fast aerial imaging**, Ilan England, Applied Materials BV (Netherlands); Jo M. Finders, ASML Netherlands B.V. (Netherlands); Yaron Cohen, Shmoolik Mangan, Applied Materials (Israel); Brid Connolly, Toppan Photomasks, Inc. (Germany); Yosuke Kojima, Masaru Higuchi, Toppan Printing Co., Ltd. (Japan); Orion Mouraille, Maurice Janssen, ASML Netherlands B.V. (Netherlands) . . . . [8324-11]

8:20 am: **Semiconductor device integration scheme impact on wafer inspection**, Timothy F. Crimmins, Intel Corp. (United States). . . . . [8324-12]

8:40 am: **Ultrahigh resolution EUV coherent diffraction imaging using a tabletop 13nm HHG source**, Matthew D. Seaberg, Daniel E. Adams, Margaret M. Murnane, Henry C. Kapteyn, Univ. of Colorado at Boulder (United States). . . . . [8324-13]

9:00 am: **Beyond 22nm node patterned defect and CD metrology by TSOM**, Benjamin D. Bunday, International SEMATECH Manufacturing Initiative (United States); Ravikiran Attota, National Institute of Standards and Technology (United States); Victor H. Vartanian, SEMATECH North (United States) . . . . [8324-14]

9:20 am: **Scatterfield microscopy of 22nm node patterned defects using visible and DUV light**, Bryan M. Barnes, Yeung-Joon Sohn, Hui Zhou, Richard M. Silver, National Institute of Standards and Technology (United States); Abraham Arceo, SEMATECH North (United States) . . . . [8324-15]

9:40 am: **Multiple column high-throughput e-beam inspection**, Enden D. Liu, Cong Tran, Multibeam Corp. (United States); Kevin M. Monahan, Quantflow Strategies LLC (United States); Theodore A. Prescop, David K. Lam, Multibeam Corp. (United States) . . . . [8324-122]

Coffee Break . . . . 10:00 to 10:30 am

Conference 8325

Advances in Resist Materials and Processing Technology XXIX

SESSION 4

Room: Marriott San Jose Ballroom Salon III Tues. 8:00 to 10:00 am

Note room change to Marriott

Optical Extensions

Session Chairs: **Ralph R. Dammel,** AZ Electronic Materials USA Corp. (United States); **Clifford L. Henderson,** Georgia Institute of Technology (United States)

8:00 am: **Overview: continuous evolution on double-patterning process**, Hidetami Yaegashi, Tokyo Electron Ltd. (Japan); Kenichi Oyama, Shohei Yamauchi, Arisa Hara, Sakurako Natori, Tokyo Electron AT Ltd. (Japan) . . . . [8325-11]

8:20 am: **CD uniformity improvement on the self-aligned spacer double-patterning process by resist material modification**, Katsumi Ohmori, Naoto Motoike, Tokyo Ohka Kogyo Co., Ltd. (Japan); Hidetami Yaegashi, Kenichi Oyama, Tokyo Electron AT Ltd. (Japan) [8325-12]

8:40 am: **SADP for BEOL using chemical slimming with resist mandrel for beyond 22nm nodes**, Linus Jang, Sudharshanan Raghunathan, GLOBALFOUNDRIES Inc. (United States); Shannon Dunn, David R. Hetzer, Shinichiro Kawakami, Lior Huli, TEL Technology Ctr., America, LLC (United States). . . . . [8325-13]

9:00 am: **Synthesis and characterization of “two-stage” photobase generators for pitch-division lithography**, Ryan A. Mesch, Takanori Kawakami, Yuji Hagiwara, Taeho Kim, Xinyu Gu, The Univ. of Texas at Austin (United States); Arunkumar K. Sundaresan, Nicholas J. Turro, Columbia Univ. (United States); James M. Blackwell, Intel Corp. (United States); C. Grant Willson, The Univ. of Texas at Austin (United States) . . . . [8325-14]

9:20 am: **Applications of polymer blends DSA for lithography**, Takehiko Naruoka, Kentaro Goto, Yoshi Hishiro, JSR Micro, Inc. (United States); Hayato Namai, Fumihiro Toyokawa, Masayuki Motonari, Yoshikazu Yamaguchi, JSR Engineering Co., Ltd. (Japan) . [8325-15]

9:40 am: **Comparison of directed self-assembly integrations**, Mark H. Somervell, Tokyo Electron America, Inc. (United States); Roel Gronheid, IMEC (Belgium); Joshua S. Hooge, Kathleen Nafus, Tokyo Electron America, Inc. (United States); Paulina A. Rincon Delgadillo, Univ. of Wisconsin-Madison (United States); Todd R. Younkin, Intel Corp. (Belgium); Benjamen M. Rathsack, Steven A. Scheer, Tokyo Electron America, Inc. (United States); Paul F. Nealey, Univ. of Wisconsin-Madison (United States) . . . . [8325-16]

Coffee Break . . . . 10:00 to 10:30 am

Conference 8326

Optical Microlithography XXV

Room: Conv. Ctr. Ballroom B4. . . . . . . Tues. 8:00 to 8:20 am

Note room change to B4

Opening Remarks and Recognition

Session Chairs: **Will Conley,** Freescale Semiconductor, Inc. (United States); **Kafai Lai,** IBM Corp. (United States)

SESSION 2

Room: Conv. Ctr. Ballroom B4. . . . . . . Tues. 8:20 to 9:40 am

Invited Session

Session Chairs: **Will Conley,** Freescale Semiconductor, Inc. (United States); **Kafai Lai,** IBM Corp. (United States)

8:20 am: **Extending the Dramand Flash memory technologies to 10nm and beyond** *(Invited Paper)*, U. In Chang, SAMSUNG Electronics Co., Ltd. (Korea, Republic of). . . . . [8326-04]

9:00 am: **CMOS device technology: current status and future prospects** *(Invited Paper),* Tahir Ghani, Intel Corp. (United States). . . . . [8326-05]

Room: Conv. Ctr. Ballroom B4 . . .Tues. 9:40 to 10:00 am

Optical Microlithography Conference-25th Anniversary Presentation

Session Chairs: **Kafai Lai,** IBM Corp. (United States); **Will Conley,** Freescale Semiconductor, Inc. (United States); **Mircea V. Dusa,** ASML US, Inc. (United States)

Coffee Break . . . . 10:00 to 10:30 am

Conference 8328

Advanced Etch Technology for Nanopatterning

SESSION 2

Room: Conv. Ctr. J1 . . . . Tues. 8:40 am to 12:00 pm

Nanopatterning for Advanced Technology Nodes

Session Chairs: **Gottlieb S. Oehrlein,** Univ. of Maryland, College Park (United States); **Sebastian U. Engelmann,** IBM Thomas J. Watson Research Ctr. (United States)

8:40 am: **Patterning enhancement techniques by reactive ion** *(Invited Paper)*, Masanobu Honda, Tokyo Electron Miyagi Ltd. (Japan); Koichi Yatsuda, Tokyo Electron Ltd. (Japan) . . . . [8328-06]

9:10 am: **Patterning of device structures for 40-80nm pitch and beyond** *(Invited Paper)*, Sebastian U. Engelmann, Ryan M. Martin, Robert L. Bruce, Hiroyuki Miyazoe, Nicholas C. M. Fuller, William S. Graham, Edmund M. Sikorski, Martin Glodde, Markus Brink, James J. Bucchignano, David P. Klaus, Ernst Kratschmer, Michael A. Guillorn, Yu Zhu, IBM Thomas J. Watson Research Ctr. (United States) . . . . [8328-09]

9:40 am: **Plasma etch challenges for porous low-k materials for 32nm and beyond** *(Invited Paper)*, Catherine B. Labelle, Ravi P. Srivastava, GLOBALFOUNDRIES Inc. (United States); Yunpeng Yin, John C. Arnold, IBM Corp. (United States); Masao Ishikawa, Toshiba America Electronic Components, Inc. (United States); Yann Mignot, IBM Corp. (United States); Andrew Darlak, Kevin Zhou, Applied Materials, Inc. (United States); Yifeng Zhou, Applied Materials. Inc. (United States); Jeremiah T. Pender, Applied Materials, Inc. (United States) . . . . [8328-10]

Coffee Break . . . . 10:10 to 10:30 am

Tuesday 14 February

Conference 8322

Extreme Ultraviolet (EUV) Lithography III

SESSION 4

Room: Conv. Ctr. Ballroom A2. Tues. 10:30 am to 12:10 pm

EUV Sources

Session Chairs: **Michael J. Lercel,** Cymer, Inc. (United States); **Michael Goldstein,** SEMATECH North (United States)

10:30 am: **Development of laser-produced plasma-based EUV light source technology for HVM EUV lithography**, Junichi Fujimoto, Gigaphoton Inc. (Japan); Tsukasa Hori, Takeshi Ohta, Yasufumi Kawasuji, Yutaka Shiraishi, Tamotsu Abe, Takeshi Kodama, Tatsuya Yanagida, Hiroaki Nakarai, Taku Yamazaki, Komatsu Ltd. (Japan); Hakaru Mizoguchi, Gigaphoton Inc. (Japan). . . . . [8322-14]

10:50 am: **High-brightness LPP source for EUVL applications**, Samir S. Ellwi, Fariba Abreau, Adlyte (Switzerland) . . . . [8322-15]

11:10 am: **Wavelength dependence of prepulse laser beams on EUV emission from CO_2 reheated Sn plasma**, Justin R. Freeman, Sivanandan S. Harilal, Ahmed Hassanein, Purdue Univ. (United States) . . . . [8322-16]

11:30 am: **Extreme ultraviolet and out-of-band radiation emission from a tin droplet based LPP source**, Oran Morris, Nadia Gambino, Andrea Z. Giovannini, Ian Henderson, Reza S. Abhari, ETH Zurich (Switzerland). . . . . [8322-17]

11:50 am: **Debris concerns for actinic EUV metrology sources**, David N. Ruzic, John Sporre, Daniel Andruczyk, Tae Cho, Dan Elg, Univ. of Illinois at Urbana-Champaign (United States) . . . [8322-18]

Lunch/Exhibition Break . . . . 12:10 to 1:30 pm

Conference 8323

Alternative Lithographic Technologies IV

SESSION 3

Room: Conv. Ctr. Ballroom A3. Tues. 10:30 am to 12:20 pm

Directed Self-Assembly I: Resist Processing: Joint Session with Conference 8325

Session Chairs: **Kevin T. Turner,** Univ. of Wisconsin-Madison (United States); **Daniel P. Sanders,** IBM Almaden Research Ctr. (United States)

10:30 am: **Etch resistant block copolymers: high χ and orientation control** *(Invited Paper)*, Christopher J. Ellison, C. Grant Willson, Christopher M. Bates, Christopher H. Chen, Julia D. Cushen, William J. Durand, Logan J. Santos, Takehiro Seshimo, The Univ. of Texas at Austin (United States) . . . . [8323-09]

11:00 am: **Pattern scaling with directed self-assembly through lithography and etch process integration**, Benjamen M. Rathsack, Mark H. Somervell, Joshua S. Hooge, Tokyo Electron America, Inc. (United States); Makoto Muramatsu, Keiji Tanouchi, Takahiro Kitano, Tokyo Electron Kyushu Ltd. (Japan); Eiichi Nishimura, Tokyo Electron AT Ltd. (Japan); Koichi Yatsuda, Seiji Nagahara, Hiroyuki Iwaki, Keiji Akai, Takashi Hayakawa, Tokyo Electron Ltd. (Japan) . . . . [8323-10]

11:20 am: **Solvent annealing strategies for the directed self-assembly of poly(styrene-b-dimethylsiloxane)**, Kevin W. Gotrik, Jeong Gon Son, Adam Hannon, Caroline A. Ross, Massachusetts Institute of Technology (United States) . . . . . . [8323-11]

11:40 am: **All-track directed self-assembly of block copolymers: process flow and origin of defects**, Paulina A. Rincon Delgadillo, Univ. of Wisconsin-Madison (United States) and IMEC (Belgium); Roel Gronheid, IMEC (Belgium); Christopher J. Thode, Univ. of Wisconsin-Madison (United States); Mark H. Somervell, Kathleen Nafus, Tokyo Electron America, Inc. (United States); Paul F. Nealey, Univ. of Wisconsin-Madison (United States). . . . . [8323-12]

12:00 pm: **Synthesis and characterization of self-assembling block copolymers containing fluorine groups**, Nam Ho You, Cornell Univ. (United States); Rina Maeda, Tokyo Institute of Technology (Japan); Michelle A. Chavis, Christopher K. Ober, Cornell Univ. (United States) . . . . [8323-13]

Lunch/Exhibition Break . . . . 12:20 to 1:30 pm

Conference 8324

Metrology, Inspection, and Process Control for Microlithography XXVI

SESSION 5

Room: Conv. Ctr. Ballroom J2. Tues. 10:30 am to 12:00 pm

LER/LWR

Session Chairs: **Martha I. Sanchez,** IBM Almaden Research Ctr. (United States); **Timothy F. Crimmins,** Intel Corp. (United States)

10:30 am: **Roughness metrology of gate all around silicon nanowire devices** *(Invited Paper)*, Shimon Levi, Applied Materials (Israel); Guy M. Cohen, IBM Thomas J. Watson Research Ctr. (United States). . . . . [8324-16]

11:00 am: **High-throughput and nondestructive sidewall roughness measurement using 3-dimensional atomic force microscopy**, Yueming Hua, Cynthia Buenviaje-Coggins, Park Systems Inc. (United States); Yong-Ha Lee, Sang-Il Park, Park Systems Corp. (Korea, Republic of) . . . . [8324-113]

11:20 am: **Sensitivity analysis of line-edge roughness measured by means of scatterometry: a simulation-based investigation**, Bartosz J. Bilski, Karsten Frenner, Wolfgang M. Osten, Univ. Stuttgart (Germany) . . . . [8324-18]

11:40 am: **Noise effects on contact-edge roughness measurement**, Vassilios Constantoudis, Vijaya-Kumar Murugesan Kuppuswamy, Evangelos Gogolides, National Ctr. for Scientific Research Demokritos (Greece) . . . . [8324-19]

Lunch/Exhibition Break . . . . 12:00 to 1:30 pm

Conference 8325

Advances in Resist Materials and Processing Technology XXIX

SESSION 5

Room: Conv. Ctr. Ballroom A3. Tues. 10:30 am to 12:20 pm

Directed Self-Assembly I: Resist Processing: Joint Session with Conference 8323

Session Chairs: **Daniel P. Sanders,** IBM Almaden Research Ctr. (United States); **Kevin T. Turner,** Univ. of Wisconsin-Madison (United States)

Note room change for Session 5

10:30 am: **Etch resistant block copolymers: high χ and orientation control** *(Invited Paper)*, Christopher J. Ellison, C. Grant Willson, Christopher M. Bates, Christopher H. Chen, Julia D. Cushen, William J. Durand, Logan J. Santos, Takehiro Seshimo, The Univ. of Texas at Austin (United States) . . . . [8323-09]

11:00 am: **Pattern scaling with directed self-assembly through lithography and etch process integration**, Benjamen M. Rathsack, Mark H. Somervell, Joshua S. Hooge, Tokyo Electron America, Inc. (United States); Makoto Muramatsu, Keiji Tanouchi, Takahiro Kitano, Tokyo Electron Kyushu Ltd. (Japan); Eiichi Nishimura, Tokyo Electron AT Ltd. (Japan); Koichi Yatsuda, Seiji Nagahara, Hiroyuki Iwaki, Keiji Akai, Takashi Hayakawa, Tokyo Electron Ltd. (Japan) . . . . [8323-10]

11:20 am: **Solvent annealing strategies for the directed self-assembly of poly(styrene-b-dimethylsiloxane)**, Kevin W. Gotrik, Jeong Gon Son, Adam Hannon, Caroline A. Ross, Massachusetts Institute of Technology (United States) . . . . . . [8323-11]

11:40 am: **All-track directed self-assembly of block copolymers: process flow and origin of defects**, Paulina A. Rincon Delgadillo, Univ. of Wisconsin-Madison (United States) and IMEC (Belgium); Roel Gronheid, IMEC (Belgium); Christopher J. Thode, Univ. of Wisconsin-Madison (United States); Mark H. Somervell, Kathleen Nafus, Tokyo Electron America, Inc. (United States); Paul F. Nealey, Univ. of Wisconsin-Madison (United States). . . . . [8323-12]

12:00 pm: **Synthesis and characterization of self-assembling block copolymers containing fluorine groups**, Nam Ho You, Cornell Univ. (United States); Rina Maeda, Tokyo Institute of Technology (Japan); Michelle A. Chavis, Christopher K. Ober, Cornell Univ. (United States) . . . . [8323-13]

Lunch/Exhibition Break . . . . 12:20 to 1:30 pm

Conference 8326

Optical Microlithography XXV

SESSION 3

Room: Conv. Ctr. Ballroom B4. . . . . Tues. 10:30 to 11:50 am

SMO-Modeling

Session Chairs: **Andreas Erdmann,** Fraunhofer-Institut für Integrierte System und Bauelementetechnologie (Germany); **Nigel R. Farrar,** Cymer, Inc. (United States)

10:30 am: **Lens heating challenges for negative tone develop layers with freeform illumination: a comparative study of experimental versus simulated results**, Scott D. Halle, IBM Corp. (United States); Michael Crouse, ASML US, Inc. (United States); Timothy A. Brunner, IBM Corp. (United States); Aiqin Jiang, ASML US, Inc. (United States); Matthew Colburn, IBM Corp. (United States); Hua Cao, Brion Technologies, Inc. (United States); Blandine Minghetti, Youri van Dommelen, ASML US, Inc. (United States) . . . . [8326-06]

10:50 am: **Single method as OPC reference and fast tool with linear time and memory resort for exact reticle modelling**, Alexandre V. Tishchenko, Univ. de Lyon (France). . . . . [8326-07]

11:10 am: **Evaluation of various compact mask and imaging models for the efficient simulation of mask topography effects in immersion lithography**, Viviana Agudelo, Peter Evanschitzky, Andreas Erdmann, Tim Fühner, Fraunhofer-Institut für Integrierte System und Bauelementetechnologie (Germany) . . . . [8326-08]

11:30 am: **A full-chip 3D computational lithography framework**, Peng Liu, Mu Feng, Song Lan, Qian Zhao, Zhengfan Zhang, Hua-Yu Liu, Venu Vellanki, Yen-Wen Lu, Brion Technologies, Inc. (United States). . . . . [8326-09]

Lunch/Exhibition Break . . . . . . 11:50 am to 1:20 pm

Conference 8328

Advanced Etch Technology for Nanopatterning

SESSION 2 *continued*

Room: Conv. Ctr. J1 . . . . Tues. 8:40 am to 12:00 pm

10:30 am: **Toward new plasma technologies for 22nm gate etch processes and beyond** *(Invited Paper)*, Olivier P. Joubert, Maxine Darnon, Gilles Cunge, Erwine Pargon, Daivd Thibault, LTM CNRS (France); Camille Petit-Etienne, LTM CNRS (United States); Laurent Vallier, Nicolas Posseme, Paul Bodart, Laurent M. Azarnouche, Moritz Haas, LTM CNRS (France); Romuald Blanc, LTM CNRS (United States); Melisa Brihoum, LTM CNRS (France); Samer Banna, Thorsten B. Lill, Applied Materials, Inc. (United States). . . . . [8328-11]

11:00 am: **Key challenges in FEOL etch for 22 nm and below** *(Invited Paper)*, Phillip L. Jones, Catherine B. Labelle, GLOBALFOUNDRIES Inc. (United States). . . . . [8328-12]

11:30 am: **Etch challenges for 1xnm NAND flash** *(Invited Paper)*, Myung Kyu Ahn, Woo June Kwon, Chan Sun Hyun, Jin-Woong Kim, Hynix Semiconductor Inc. (Korea, Republic of) . [8328-13]

Lunch/Exhibition Break . . . . 12:00 to 1:30 pm

Tuesday 14 February

Conference 8322

Extreme Ultraviolet (EUV) Lithography III

SESSION 5

Room: Conv. Ctr. Ballroom J2 . . . . Tues. 1:30 to 3:10 pm

Note room change for Session 5

Metrology and Inspection for EUVL: Joint Session with Conference 8324

Session Chairs: **Stanley E. Stokowski,** KLA-Tencor Corp. (United States); **Benjamin D. Bunday,** International SEMATECH Manufacturing Initiative (United States)

1:30 pm: **Investigation of the performance of state-of-the-art defect inspection tools within EUV lithography**, Dieter Van den Heuvel, Rik M. Jonckheere, Shaunee Y. Cheng, Bart Baudemprez, IMEC (Belgium); Gino Marcuccilli, Andrew Cross, KLA-Tencor England (United Kingdom); Gregg A. Inderhees, KLA-Tencor Corp. (United States); Paolo Parisi, KLA-Tencor Italy SRL (Italy); Sungmin Huh, SAMSUNG Electronics Co., Ltd. (Korea, Republic of) . . . . [8324-20]

1:50 pm: **Printability and inspectability of defects on EUV blank for 2xnm hp HVM application**, Sungmin Huh, In-Yong Kang, Jihoon Na, Hwan-Seok Seo, Seong-Sue Kim, Han-Ku Cho, SAMSUNG Electronics Co., Ltd. (Korea, Republic of); Gregg A. Inderhees, KLA-Tencor Corp. (United States) . . . . [8322-19]

2:10 pm: **Closing the infrastructure gap: status of the AIMS™ EUV project**, Dirk Hellweg, Markus R. Weiss, Carl Zeiss SMT GmbH (Germany); Jan Hendrik Peters, Sascha Perlitz, Carl Zeiss SMS GmbH (Germany); Michael Goldstein, SEMATECH North (United States). . . . . [8322-20]

2:30 pm: **Scatterometry metrology challenges of EUV**, Prasad Dasari, Jie Li, Jiangtao Hu, Zhuan Liu, Nanometrics Inc. (United States); Oleg Kritsun, Catherine Volkman, GLOBALFOUNDRIES Inc. (United States). . . . . [8324-21]

2:50 pm: **Experimental quantification of shot noise contributions to contact hole local CD nonuniformity**, Roel Gronheid, Gustaf Winroth, Alessandro Vaglio Pret, IMEC (Belgium); Mircea V. Dusa, ASML US, Inc. (Belgium); Todd R. Younkin, Intel Corp. (United States). . . . . [8322-21]

Coffee Break . . . . 3:10 to 3:40 pm

Conference 8323

Alternative Lithographic Technologies IV

SESSION 4

Room: Conv. Ctr. Ballroom A3. . . . . . . Tues. 1:30 to 3:00 pm

Maskless/Direct-Write Lithography I

Session Chairs: **Hans Loeschner,** IMS Nanofabrication AG (Austria); **Shy-Jay Lin,** Taiwan Semiconductor Manufacturing Co. Ltd. (Taiwan)

1:30 pm: **Sub-20nm hybrid lithography using optical and pitch-division, and e-beam** *(Invited Paper)*, Jérôme Belledent, CEA-LETI (France); Michael C. Smayling, Tela Innovations, Inc. (United States); Sebastien Barnola, CEA-LETI (France); Lucile Mage, Commissariat à l'Énergie Atomique (France); Jonathan Pradelles, CEA-LETI-Minatec (France); Sébastien Soulan, Laurent Pain, CEA-LETI (France) . . . . [8323-14]

2:00 pm: **50 keV electron multibeam mask writer for the 11nm HP node: 1st results of the proof of concept tool (eMET POC)**, Christof Klein, Hans Loeschner, Elmar Platzgummer, IMS Nanofabrication AG (Austria). . . . . [8323-15]

2:20 pm: **Reflective electron-beam lithography: progress toward high-throughput production capability**, Regina Freed, Thomas Gubiotti, Jeff Sun, Francoise Kidwingira, Jason Yang, Upendra Ummethala, Layton C. Hale, John J. Hench, Shinichi Kojima, Walter D. Mieher, Chris F. Bevis, KLA-Tencor Corp. (United States); Shy-Jay Lin, Wen-Chuan Wang, Taiwan Semiconductor Manufacturing Co. Ltd. (Taiwan) . . . . [8323-16]

2:40 pm: **Implications of multiple e-beam maskless lithography on process, design, and CAD tools**, Jack J. H. Chen, Jen-Hom Chen, Raymond P. S. Chen, Shih-Chi Wang, Tsung-Chi Chien, Brian C. C. Lee, Yuh-Fu Lin, Hong-Chun Wang, Nien-Fu Cheng, Burn J. Lin, Taiwan Semiconductor Manufacturing Co. Ltd. (Taiwan) . . . . [8323-17]

Coffee Break . . . . 3:00 to 3:30 pm

Conference 8324

Metrology, Inspection, and Process Control for Microlithography XXVI

SESSION 6

Room: Conv. Ctr. Ballroom J2 . . . . Tues. 1:30 to 3:10 pm

Metrology and Inspection for EUVL: Joint Session with Conference 8322

Session Chairs: **Benjamin D. Bunday,** International SEMATECH Manufacturing Initiative (United States); **Stanley E. Stokowski,** KLA-Tencor Corp. (United States)

1:30 pm: **Investigation of the performance of state-of-the-art defect inspection tools within EUV lithography**, Dieter Van den Heuvel, Rik M. Jonckheere, Shaunee Y. Cheng, Bart Baudemprez, IMEC (Belgium); Gino Marcuccilli, Andrew Cross, KLA-Tencor England (United Kingdom); Gregg A. Inderhees, KLA-Tencor Corp. (United States); Paolo Parisi, KLA-Tencor Italy SRL (Italy); Sungmin Huh, SAMSUNG Electronics Co., Ltd. (Korea, Republic of) . . . . [8324-20]

1:50 pm: **Printability and inspectability of defects on EUV blank for 2xnm hp HVM application**, Sungmin Huh, In-Yong Kang, Jihoon Na, Hwan-Seok Seo, Seong-Sue Kim, Han-Ku Cho, SAMSUNG Electronics Co., Ltd. (Korea, Republic of); Gregg A. Inderhees, KLA-Tencor Corp. (United States) . . . . [8322-19]

2:10 pm: **Closing the infrastructure gap: status of the AIMS EUV project**, Dirk Hellweg, Markus R. Weiss, Carl Zeiss SMT GmbH (Germany); Jan Hendrik Peters, Sascha Perlitz, Carl Zeiss SMS GmbH (Germany); Michael Goldstein, SEMATECH North (United States). . . . . [8322-20]

2:30 pm: **Scatterometry metrology challenges of EUV**, Prasad Dasari, Jie Li, Jiangtao Hu, Zhuan Liu, Nanometrics Inc. (United States); Oleg Kritsun, Catherine Volkman, GLOBALFOUNDRIES Inc. (United States). . . . . [8324-21]

2:50 pm: **Experimental quantification of shot noise contributions to contact hole local CD nonuniformity**, Roel Gronheid, Gustaf Winroth, Alessandro Vaglio Pret, IMEC (Belgium); Mircea V. Dusa, ASML US, Inc. (Belgium); Todd R. Younkin, Intel Corp. (United States). . . . . [8322-21]

Coffee Break . . . . 3:10 to 3:40 pm

Conference 8325

Advances in Resist Materials and Processing Technology XXIX

SESSION 6

Room: Marriott San Jose Ballroom Salon III . . Tues. 1:30 to 3:10 pm

Note room change to Marriott

Simulation of Resist Processes

Session Chairs: **Roel Gronheid,** IMEC (Belgium); **Todd R. Younkin,** Intel Corp. (Belgium)

1:30 pm: **EUV resist formulation insight from stochastic lithography simulation**, Mark D. Smith, John J. Biafore, Stewart A. Robertson, KLA-Tencor Corp. (United States). . . . . [8325-17]

1:50 pm: **Correlated surface roughening during photoresist development**, Chris A. Mack, Lithoguru.com (United States). . . . . [8325-18]

2:10 pm: **Mesoscale simulation of the line-edge structure during positive and negative tone resist development process**, Hiroshi Morita, National Institute of Advanced Industrial Science and Technology (Japan); Ichiro Okabe, Intel Kabushiki Kaisha (Japan); Saurabh Agarwal, Vivek K. Singh, Intel Corp. (United States) . . . . [8325-19]

2:30 pm: **Line-pattern collapse mitigation status for EUV at 32nm HP and below**, Michael A. Carcasi, Wallace P. Printz, Derek Bassett, Tokyo Electron America, Inc. (United States); Yuichiro Miyata, Tokyo Electron Kyushu Ltd. (Japan). . . . . [8325-20]

2:50 pm: **Simultaneous calibration of acid diffusion and developer loading parameters for computational lithography**, Ashesh Parikh, Texas Instruments Inc. (United States) . . . . [8325-21]

Coffee Break . . . . 3:10 to 3:40 pm

Conference 8326

Optical Microlithography XXV

SESSION 4

Room: Conv. Ctr. Ballroom B4. . . . . . . Tues. 1:20 to 3:00 pm

Multiple Patterning I

Session Chairs: **Pary Baluswamy,** Micron Technology, Inc. (United States); **Peter D. Brooker,** Synopsys, Inc. (United States)

1:20 pm: **Interactions between imaging layers during double-patterning lithography**, Stewart A. Robertson, KLA-Tencor Corp. (United States); Patrick Wong, Peter De Bisschop, Nadia Vandenbroeck, Vincent Wiaux, IMEC (Belgium) . . . . [8326-10]

1:40 pm: **Stack effect implementation in OPC and mask verification for production environment**, Elodie Sungauer, Frederic Robert, STMicroelectronics (France) . . . . [8326-89]

2:00 pm: **Design compliance for spacer is dielectric (SID) patterning**, Alexander Miloslavsky, Gerard Luk-Pat, Kevin Lucas, Benjamin D. Painter, Levi D. Barnes, Synopsys, Inc. (United States) . . . . [8326-12]

2:20 pm: **Litho 1-litho 2 proximity differences for a litho-process-litho double-patterning process**, Patrick Wong, Peter De Bisschop, IMEC (Belgium); Stewart A. Robertson, KLA-Tencor Corp. (United States); Nadia Vandenbroeck, IMEC (Belgium); John J. Biafore, KLA-Tencor Texas (United States); Jeroen Van de Kerkhove, Vincent Wiaux, IMEC (Belgium) . . . . [8326-13]

2:40 pm: **Characterization and decomposition of self-aligned quadruple patterning friendly layout**, Hongbo Zhang, Yuelin Du, Martin D. F. Wong, Univ. of Illinois at Urbana-Champaign (United States); Rasit O. Topaloglu, GLOBALFOUNDRIES Inc. (United States). . . . . [8326-15]

Coffee Break . . . . 3:00 to 3:30 pm

Conference 8328

Advanced Etch Technology for Nanopatterning

SESSION 3

Room: Conv. Ctr. J1 . Tues. 1:30 to 6:00 pm

Plasma and Photoresist Interactions

Session Chairs: **Qinghuang Lin,** IBM Thomas J. Watson Research Ctr. (United States); **Julie Bannister,** Tokyo Electron America, Inc. (United States)

1:30 pm: **Plasma-polymer interactions for nanoscale patterning of materials** *(Invited Paper)*, Gottlieb Oehrlein, Univ. of Maryland, College Park (United States). . . . . [8328-14]

2:00 pm: **Plasma treatment to improve linewidth roughness during gate patterning** *(Invited Paper)*, Erwine Pargon, LTM CNRS (France); Laurent M. Azarnouche, STMicroelectronics (France); Marc Fouchier, Kevin Menguelti, Melisa Brihoum, LTM CNRS (France); Nicolas Posseme, CEA-LETI (France); Raphael Ramos, Laurent Vallier, Gilles Cunge, Maxime Darnon, Olivier P. Joubert, LTM CNRS (France); Pascal Gouraud, Christophe Verove, STMicroelectronics (France); Samer Banna, Thorsten B. Lill, Applied Materials, Inc. (United States) . . . . [8328-15]

2:30 pm: **The effects of plasma exposure on low-k dielectric materials** *(Invited Paper)*, J. Leon Shohet, He Ren, Michael T. Nichols, Harsh Sinha, Wenjie Lu, Konstantinos Mavrakakis, Univ. of Wisconsin-Madison (United States); Qinghuang Lin, IBM Corp. (United States); Noel M. Russell, Masayuki Tomoyasu, Tokyo Electron Ltd. (United States); George A. Antonelli, Novellus Systems, Inc. (United States); Sebastian U. Engelmann, Nicholas C. M. Fuller, IBM Corp. (United States); Vivian Ryan, GLOBALFOUNDRIES Inc. (United States); Yoshio Nishi, Stanford Univ. (United States). . . . . [8328-16]

3:00 pm: **Photoresist strip challenges for advanced lithography at 20nm technology node and beyond** *(Invited Paper)*, Ivan L. Berry III, Carlo Waldfried, Dwight Roh, Shijian Luo, David Mattson, James DeLuca, Orlando Escorcia, Axcelis Technologies, Inc. (United States). . . . . . . [8328-17]

Coffee Break . . . . 3:30 to 3:50 pm

Tuesday 14 February

Conference 8322

Extreme Ultraviolet (EUV) Lithography III

SESSION 6

Room: Conv. Ctr. Ballroom A2. . . . . . . Tues. 3:40 to 5:40 pm

Note room change to A2

Mask Roughness and Cleaning

Session Chairs: **Naoya Hayashi,** Dai Nippon Printing Co., Ltd. (Japan); **Wolf Staud,** Applied Materials, Inc. (United States)

3:40 pm: **Impact of EUV mask surface and absorber roughness on LWR**, Alessandro Vaglio Pret, Roel Gronheid, IMEC (Belgium); Todd R. Younkin, Michael J. Leeson, Pei-Yang Yan, Intel Corp. (United States) . . . . [8322-22]

4:00 pm: **EUV mask line-edge roughness**, Amy E. Zweber, Emily E. Gallagher, IBM Corp. (United States); Martha I. Sanchez, IBM Almaden Research Ctr. (United States); Tasuku Senna, Toshio Konishi, Toppan Photomasks, Inc. (United States); Anne E. McGuire, IBM Corp. (United States); Luisa D. Bozano, Phillip Brock, Hoa Truong, IBM Almaden Research Ctr. (United States) . . . . [8322-23]

4:20 pm: **Using the transport of intensity equation to predict mask-induced speckle through focus**, Brittany M. McClinton, Patrick P. Naulleau, Lawrence Berkeley National Lab. (United States) . . . . [8322-24]

4:40 pm: **Study of megasonic-induced damage on the surface of Ru-capped MoSi multilayer EUV blanks**, Zachary R. Robinson, Matt House, Abbas Rastegar, SEMATECH North (United States) . . . . [8322-25]

5:00 pm: **A multistep approach for reticle cleaning**, Norbert B. Koster, Jacques van der Donck, Jetske Stortelder, Ardjan de Jong, Freek Molkenboer, TNO (Netherlands) . . . . [8322-26]

5:20 pm: **Molecular behavior of mask cleaning chemicals on EUV mask surfaces**, Jaehyuck Choi, SEMATECH North (United States); Gregory Denbeaux, Steve Novak, Yudhishthir Kandel, Univ. at Albany (United States). . . . . [8322-27]

Conference 8323

Alternative Lithographic Technologies IV

SESSION 5

Room: Conv. Ctr. Ballroom A3. . . . . . . Tues. 3:30 to 4:50 pm

Modeling of Alternative Lithographic Processes

Session Chairs: **Frank M. Schellenberg,** Consultant (United States); **Ines A. Stolberg,** Vistec Electron Beam Lithography Group (Germany)

3:30 pm: **Influence of thermal load on 450mm Si-wafer IPD during lithographic patterning**, Thomas Peschel, Fraunhofer Institut für Angewandte Optik und Feinmechanik (Germany); Gerhard Kalkowski, Ramona Eberhardt, Fraunhofer-Institut für Angewandte Optik und Feinmechanik (Germany) . . . . [8323-18]

3:50 pm: **Self-consistent field theory of directed self-assembly in laterally confined lamellae-forming diblock copolymers**, Nabil Laachi, Hassei Takahashi, Kris T. Delaney, Su-Mi Hur, Univ. of California, Santa Barbara (United States); Corey J. Weinheimer, David Shykind, Intel Corp. (United States); Glenn H. Fredrickson, Univ. of California, Santa Barbara (United States) . . . . [8323-19]

4:10 pm: **Models for the power spectra of thermal composition fluctuations and line-edge roughness in an ordered lamellar diblock copolymer melt**, August W. Bosse, National Institute of Standards and Technology (United States) . . . . [8323-20]

4:30 pm: **Modeling block copolymer directed self-assembly on chemically patterned substrates: effect of mismatch between the morphology and pattern,** Jeffrey D. Weinhold, Phillip D. Hustad, Valeriy V. Ginzburg, The Dow Chemical Co. (United States); Peter Trefonas III, Dow Electronic Materials (United States) . . . . [8323-21]

Room: Conv. Ctr. Ballroom A3 . . . . . Tues. 5:00 to 7:00 pm

Panel Discussion: EUVL isn't the Solution: Are the Alternative Lithographics Technologies Ready?

Sponsored by

Panel Moderators: **Douglas J. Resnick,** Molecular Imprints, Inc. (United States); **William M. Tong,** KLA-Tencor Corp. (United States)

See page 7 for full details.

Conference 8324

Metrology, Inspection, and Process Control for Microlithography XXVI

SESSION 7

Room: Conv. Ctr. Ballroom J2 . . . . Tues. 3:40 to 5:20 pm

Scatterometry

Session Chairs: **Daniel J. C. Herr,** Semiconductor Research Corp. (United States); **Yi-sha Ku,** Industrial Technology Research Institute (Taiwan)

3:40 pm: **Phase sensitive parametric optical metrology: exploring the limits of 3-dimensional optical metrology**, Richard M. Silver, Jing Qin, Bryan M. Barnes, Hui Zhou, Ronald G. Dixson, Francois Goasmat, National Institute of Standards and Technology (United States) . . . . [8324-22]

4:00 pm: **Investigation of e-beam patterned nanostructures using Mueller matrix based scatterometry**, Gangadhara Raja Muthinti, Alain C. Diebold, Univ. at Albany (United States); Brennan L. Peterson, Nanometrics Inc. (United States) . . . . [8324-23]

4:20 pm: **Accurate optical CD profiler based on specialized finite element method**, Gokhan Percin, Jesus Carrero, Luminescent Technologies, Inc. (United States) . . . . [8324-24]

4:40 pm: **Coherent Fourier scatterometry: tool for improved sensitivity in semiconductor metrology**, Nitish Kumar, Omar El Gawhary, Sarathi Roy, Silvania F. Pereira, Technische Univ. Delft (Netherlands); Wim M. J. Coene, ASML Netherlands B.V. (Netherlands); H. Paul Urbach, Technische Univ. Delft (Netherlands) . . . . [8324-25]

5:00 pm: **High-speed, full 3D feature metrology, for litho monitoring, matching, and model calibration with scatterometry,** Hugo Cramer, ASML Netherlands B.V. (Netherlands); Alek C. Chen, ASML Taiwan Ltd. (Taiwan); Fahong Li, ASML Netherlands B.V. (Netherlands); Philippe J. Leray, Anne-Laure Charley, Lieve Van Look, Koen D'havé, Shaunee Y. Cheng, IMEC (Belgium) . . . . [8324-119]

Conference 8325

Advances in Resist Materials and Processing Technology XXIX

SESSION 7

Room: Marriott San Jose Ballroom Salon III . . Tues. 3:40 to 6:00 pm

Resist Fundamentals

Session Chairs: **Plamen Tzviatkov,** FUJIFILM Electronic Materials U.S.A., Inc. (United States); **Luisa D. Bozano,** IBM Almaden Research Ctr. (United States)

3:40 pm: **Examination of the role of PAG structure on acid diffusion during sub-millisecond post exposure bake of chemically amplified photoresists**, Marie E. Krysak, Byungki Jung, Michael O. Thompson, Christopher K. Ober, Cornell Univ. (United States) . . . . [8325-22]

4:00 pm: **Kinetic rates of deprotection and diffusion in chemically amplified photoresist using sub-millisecond post exposure bake**, Byungki Jung, Christopher K. Ober, Michael O. Thompson, Cornell Univ. (United States) . [8325-23]

4:20 pm: **Contrast improvement with balanced diffusion control of PAG and PDB**, Shu-Fang Chen, Li Lin Chang, I-Chung H. Chang, Ching-Yu Chang, Yao-Ching Ku, Taiwan Semiconductor Manufacturing Co. Ltd. (Taiwan) . . . . [8325-24]

4:40 pm: **An in situ analysis of the resist-pattern formation process**, Toshiro Itani, Julius J. S. Santillan, EUVL Infrastructure Development Ctr., Inc. (Japan). . . . . [8325-25]

5:00 pm: **Understanding dissolution behavior of 193nm photoresists in organic solvent developers**, Seung-Hyun Lee, Jong-Keun Park, Jibin Sun, Cecily E. Andes, Kathleen O'Connell, George G. Barclay, Dow Electronic Materials (United States) . . . . [8325-26]

5:20 pm: **Critical material properties for pattern collapse mitigation**, Gustaf Winroth, IMEC (Belgium); Todd R. Younkin, Intel Corp. (Belgium); James M. Blackwell, Intel Corp. (United States); Roel Gronheid, IMEC (Belgium). . . . . [8325-27]

5:40 pm: **Accelerated purge drying to prevent pattern collapse without surfactant rinse for high-aspect ratio resist patterns,** Tomohiro Goto, Charles N. Pieczulewski, Akihiko Morita, SOKUDO Co., Ltd. (Japan) . . . . [8325-28]

Conference 8326

Optical Microlithography XXV

SESSION 5

Room: Conv. Ctr. Ballroom B4. . . . . . . Tues. 3:30 to 5:10 pm

Source and Mask Optimization

Session Chairs: **Carlos Fonseca,** Tokyo Electron America, Inc. (United States); **Tsai-Sheng Gau,** Taiwan Semiconductor Manufacturing Co. Ltd. (Taiwan)

3:30 pm: **Source-mask optimization incorporating manufacturability constraints**, Thomas Mülders, Synopsys GmbH (Germany); Vitaliy Domnenko, Synopsys, Inc. (Russian Federation); Bernd Küchler, Hans-Jürgen Stock, Synopsys GmbH (Germany) . . . . [8326-16]

3:50 pm: **Achieving first-time-right mask layouts**, Bernd Küchler, Synopsys GmbH (Germany); Artem Shamsuarov, SAMSUNG Electronics Co., Ltd. (Korea, Republic of); Thomas Mülders, Ulrich Klostermann, Synopsys GmbH (Germany); Seung-Hune Yang, Seongho Moon, SAMSUNG Electronics Co., Ltd. (Korea, Republic of); Vitaliy Domnenko, Synopsys, Inc. (Russian Federation); Sung-Woon Park, Synopsys Korea Inc. (Korea, Republic of) . . . . [8326-17]

4:10 pm: **Mutual source, mask, and projector pupil optimization**, Tim Fühner, Peter Evanschitzky, Andreas Erdmann, Fraunhofer-Institut für Integrierte System und Bauelementetechnologie (Germany) . . . . [8326-18]

4:30 pm: **Convolution-variation separation theory for fast and rigorous first-principle modeling of optical lithography**, Xinjiang Zhou, Shiyuan Liu, Xiaofei Wu, Wei Liu, Huazhong Univ. of Science and Technology (China); Haiqing Wei, oLambda, Inc. (United States). . . . . [8326-19]

4:50 pm: **Application of illumination pupilgram control method with freeform illumination,** Tomoyuki Matsuyama, Naonori Kita, Junji Ikeda, Nikon Corp. (Japan) . . . . [8326-20]

Room: Conv. Ctr. Ballroom B4 . . . . . Tues. 7:45 to 9:00 pm

Wild and Crazy Ideas

Moderators: **Nigel R. Farrar,** Cymer, Inc.; **Mircea V. Dusa,** ASML US. Inc.

Organizers: **Will Conley,** Freescale Semiconductor, Inc.; **Mark E. Mason,** Texas Instruments Inc.; **Mark H. Somervell,** Tokyo Electron America, Inc.; **Kafai Lai,** IBM Corp.; **John L. Sturtevant,** Mentor Graphics Corp.

Conference 8328

Advanced Etch Technology for Nanopatterning

SESSION 3 continued

Room: Conv. Ctr. J1 . Tues. 1:30 to 6:00 pm

3:50 pm: **Wet clean challenges for advanced lithogrpahy nodes** *(Invited Paper)*, George G. Totir, IBM Thomas J. Watson Research Ctr. (United States) . . . . [8328-18]

4:20 pm: **Dry etching challenges for patterning smooth lines: LWR reduction of extreme ultraviolet photoresist**, Efrain Altamirano-Sánchez, Alessandro Vaglio Pret, Roel Gronheid, IMEC (Belgium); Werner Boullart, IMEC (Belgium)[8328-19]

4:40 pm: **Self-assembly patterning using block copolymer for advanced CMOS technology: optimisation of plasma etching process**, Thierry Chevolleau, Gilles Cunge, Xavier Chevalier, Raluca Tiron, CEA-LETI (France); Maxime Darnon, Ctr. National de la Recherche Scientifique (France); Christophe Navarro, Stephanie Magnet, Arkema S.A. (France) . . . . [8328-20]

5:00 pm: **EUV resist curing technique for LWR reduction and etch selectivity enhancement**, Kazuki Narishige, Takayuki Katsunuma, Masanobu Honda, Tokyo Electron Miyagi Ltd. (Japan); Koichi Yatsuda, Tokyo Electron Ltd. (Japan) . . . . [8328-21]

5:20 pm: **Mandrel and spacer engineering-based self-aligned triple patterning**, Yijian Chen, Peking Univ. Shenzhen Graduate School (China) . [8328-22]

5:40 pm: **Transfer optimized dry development process of sub-32nm HSQ/AR3 BLR resist pillar from low-K etcher to metal etcher,** Wei-Su G. Chen, Ming-Jinn Tsai, Hung-Wen Wei, Peng-Sheng Chen, Industrial Technology Research Institute (Taiwan) . . . . [8328-23]

Conference End.

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Conference 8324

Metrology, Inspection, and Process Control for Microlithography XXVI

Experimental approach by using CD-SEM to directly measure primal photoresist shrinkage, Hiroki Kawada, Yoshinori Nakada, Toru Ikegami, Norio Hasegawa, Hitachi High-Technologies Corp. (Japan); Yong-Ha Paul Lee, Andrew Jeon, Park Systems Corp. (Korea, Republic of) . . . . . [8324-59]

Defect distribution study at through silicon via (TSV) bottom by scanning white-light interference microscopy, Jeongho Ahn, SAMSUNG Electronics Co., Ltd. (Korea, Republic of); Jaeyoung Park, Nanometrics Korea Ltd. (Korea, Republic of); Dongchul Ihm, Byoung-Ho Lee, SAMSUNG Electronics Co., Ltd. (Korea, Republic of); Jiyoung Noh, Namki Suk, Nanometrics Korea Ltd. (Korea, Republic of) . . . . [8324-60]

A scatterometry-based CD uniformity control solution for spacer patterning technology, Jongsu Lee, Chang-Moon Lim, Hynix Semiconductor Inc. (Korea, Republic of); Chan-Ho Ryu, ASML Korea Co., Ltd. (Korea, Republic of); Myoung Soo Kim, Hyosang Kang, Hynix Semiconductor Inc. (Korea, Republic of); Hugo Cramer, Noelle Wright, Birgitt Hepp, Liesbeth Reijnen, Hans van der Laan, Martyn J. Coogans, ASML Netherlands B.V. (Netherlands) . . . [8324-61]

Design-based SEM recipe generation for OPC and manufacturing applications, Brian S. Ward, Synopsys, Inc. (United States); Sylvain Berthiaume, Synopsys, Inc. (Canada); Shimon Levi, Applied Materials (Israel) . . . . [8324-62]

Small particle defect characterization on critical layers of 22nm spacer self-aligned double patterning (SADP), Gurminder Singh, Kfir Dotan, Man-Ping C. Cai, Applied Materials, Inc. (United States); Saar Shabtay, Applied Materials (Israel); Yongmei Chen, Christopher Bencher, Applied Materials, Inc. (United States); Noam Shachar, Applied Materials (Israel); Christopher S. Ngai, Applied Materials, Inc. (United States) . . . [8324-63]

Integration and automation of DoseMapper in a logic fab APC system: application for 45/40/28nm node, Bertrand Le-Gratiet, STMicroelectronics (France) . . . . [8324-64]

Recess gate process control by using 3D SCD in 3xm vertical DRAM, Ching-Yueh Wang, KLA-Tencor Taiwan (Taiwan). . . . . [8324-65]

Apply multiple target for advanced gate ADI critical dimension measurement by scatterometry technology, Wei-Jhe Tzai, Howard Chen, Yu-Hao Huang, Chun-Chi Yu, United Microelectronics Corp. (Taiwan); Ching-Hung B. Lin, Shi-Ming J. Wei, KLA-Tencor Corp. (United States); Zhi-Qing J. Xu, KLA-Tencor China (China); Sungchul Yoo, Chien-Jen E. Huang, Chao-Yu H. Cheng, KLA-Tencor Corp. (United States); Juli Cheng, KLA-Tencor Taiwan (Taiwan). . . . . [8324-66]

Fast and accurate scatterometry metrology method for STI CMP step height process evaluation, Chih Hsun Lin, Teng Chun Tsai, Chia-Lin Hsu, Wu Sian Sie, J.-Y. Wu, United Microelectronics Corp. (Taiwan); Ching-Hung B. Lin, KLA-Tencor Corp. (United States); Zhi-Qing J. Xu, Qiong-Yan Yuan, KLA-Tencor China (China); Sungchul Yoo, Chien-Jen E. Huang, Chao-Yu H. Cheng, KLA-Tencor Corp. (United States); Juli Cheng, KLA-Tencor Taiwan (Taiwan) . . . . [8324-67]

Diffraction-based overlay measurement on dedicated mark using rigorous modeling method, Hailiang Lu, Fan Wang, Qingyun Zhang, Yonghui Chen, Chang Zhou, Shanghai Micro Electronics Equipment Co., Ltd. (China) . . [8324-68]

Contamination control: removing small particles from increasingly large wafers, Ardjan de Jong, Olaf Kievit, Norbert B. Koster, Jacques van der Donck, TNO (Netherlands) . . . . [8324-69]

Overlay accuracy improving device: Qmerit, Guy Cohen, Eran Amit, Dana Klein, Daniel Kandel, Vladimir B. Levinski, KLA-Tencor Israel (Israel) . . . . [8324-71]

Weighted least squares regression for advanced overlay control, John C. Robinson, KLA-Tencor Corp. (United States); Dana Klein, Guy Cohen, KLA-Tencor Israel (Israel); Chin-Chou Kevin Huang, Bill Pierson, KLA-Tencor Corp. (United States)[8324-72]

Toward faster and better litho-control in high-volume manufacturing, Chun-Yen Huang, Chui-Fu Chiu, Wen-Bin Wu, Chiang-Lin Shih, Nanya Technology Corp. (Taiwan); James Manka, KLA-Tencor Corp. (United States); Chao-Tien H. Huang, KLA-Tencor Taiwan (Taiwan); Dong-Sub Choi, KLA-Tencor Korea (Korea, Republic of); Arthur Lin, KLA-Tencor Taiwan (Taiwan); David Tien, KLA-Tencor Corp. (United States). . . . . [8324-73]

Overlay control methodology comparison: field-by-field and high-order methods, Chun-Yen Huang, Nanya Technology Corp. (Taiwan); Chin-Chou Kevin Huang, KLA-Tencor Corp. (United States); Chui-Fu Chiu, Wen-Bin Wu, Nanya Technology Corp. (Taiwan); Chao-Tien H. Huang, KLA-Tencor Corp. (United States); Chiang-Lin Shih, Nanya Technology Corp. (Taiwan); Bill Pierson, KLA-Tencor Texas (United States); Dong-Sub Choi, KLA-Tencor Korea (Korea, Republic of); John C. Robinson, KLA-Tencor Texas (United States) . . . . [8324-74]

CD-SEM and e-beam defect inspection of high-aspect ratio contact holes: measurement and simulation of precharge, Sergey V. Babin, Sergey S. Borisov, Abeam Technologies (United States); Gwangmin Kwon, Changhwan Lee, Jaehyoung Oh, Daiyoung Mun, Hyungwon Yoo, Hynix Semiconductor Inc. (Korea, Republic of) . [8324-75]

Multilevel overlay techniques for improving DPL overlay control, Charlie Chen, Y. C. Pai, Dennis Yu, Peter Pang, Chun-Chi Yu, United Microelectronics Corp. (Taiwan); David Tien, KLA-Tencor Corp. (United States); Robert Wu, Eros Huang, Marson Chen, KLA-Tencor Taiwan (Taiwan); Dong-Sub Choi, KLA-Tencor Korea (Korea, Republic of) . . . . [8324-77]

Process monitoring by measuring bias-free LER on EUV lithography, Changhwan Lee, Jongtae Kim, Yoonsik Kim, Hyungwon Yoo, Ilkeoun Han, Hynix Semiconductor Inc. (Korea, Republic of); Dongsu Kwak, Hitachi High-Technologies Korea Co., Ltd. (Korea, Republic of); Atsuko Yamaguchi, Hitachi, Ltd. (Japan); Hiroki Kawada, Hitachi High-Technologies Corp. (Japan) . . . . [8324-79]

The root cause of ArF resist CD shrinkage induced by defect inspection, Perry Kuo, United Microelectronics Corp. (Taiwan) . . . . [8324-80]

The study of high-sensitive and accurate metrology method by using CD-SEM, Kazuhiro Ueda, Shunsuke Koshihara, Takeshi Mizuno, Hitachi High-Technologies Corp. (Japan) . . . . [8324-81]

Nanoemitter: ultra-high-resolution electron source for CD metrology, Sebastian W. Schmidt, Christian Penzkofer, Bernd Irmer, nanotools GmbH (Germany) . . . . [8324-82]

Carbon contamination removal in larger chambers with low-power downstream plasma cleaning, C. Gabriel Morgan, Ronald Vane, XEI Scientific, Inc. (United States) . . . . [8324-83]

Applying design data to improve inspection tool recipe creation, Alon Turkaspa, Reuven Barel, Zvi Goren, Mark Geshel, Applied Materials (Israel); Neo Lin, Applied Materials Taiwan, Ltd. (Taiwan) . . . . [8324-84]

An improved technique for measuring LER and LWR, Motohiro Tanaka, Toru Ishimoto, Hitachi High-Technologies Corp. (Japan); Shaunee Y. Cheng, IMEC (Belgium) . . . . [8324-85]

An attempt to build an OPC model using yieldstar metrology, Anne-Laure Charley, Philippe J. Leray, Shaunee Y. Cheng, IMEC (Belgium); Mircea V. Dusa, Anita Fumar-Pici, ASML US, Inc. (United States). . . . . [8324-86]

E-beam inspection system for comparison of wafer and design data, Oliver D. Patterson, Julie Lee, Michael D. Monkowski, IBM Corp. (United States); Shih-Tsung Chen, Chris Lee, Wei Fang, Jack Y. Jau, Fei Wang, Hermes-Microvision Inc., USA (United States); Derek Tomlinson, TM2C (United States). . . . . [8324-87]

Electron-beam proximity effect model calibration for fabricating scatterometry calibration samples, Yu-Tian Shen, Chun-Hung Liu, Chih-Yu Chen, Hoi-Tou Ng, Kuen-Yu Tsai, Fu-Ming Wang, Yen-Min Lee, Hsin-Hung Cheng, Jia-Han Li, Chieh-Hsiung Kuan, National Taiwan Univ. (Taiwan); Alek C. Chen, ASML Taiwan Ltd. (Taiwan) . . . . [8324-88]

How to minimize CD variation and overlay degradation induced by film stress, Woo-Yung Jung, Yong-Hyun Lim, Hynix Semiconductor Inc. (Korea, Republic of). . . . . [8324-89]

Improving the measurement performance of angle-resolved scattermetry by use of pupil optimization, Fan Wang, Hailiang Lu, Qingyun Zhang, Lifeng Duan, Xiaoping Li, Shanghai Micro Electronics Equipment Co., Ltd. (China) . . [8324-90]

In situ critical dimension control during post exposure bake with spectroscopic ellipsometry, Yit Sung Ngo, Yifan Qu, Arthur Tay, Tong Heng Lee, National Univ. of Singapore (Singapore) . . [8324-91]

Parallel GPU scatterometry simulations with GA and RCWA, Hirokimi Shirasaki, Tamagawa Univ. (Japan). . . . . [8324-92]

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Application of review-SEM to high-resolution inspection for 3xnm nodes, Jaehyoung Oh, Hyungwon Yoo, Yongsik Choi, Taehui Kim, Hynix Semiconductor Inc. (Korea, Republic of); Mari Nozoe, Satoshi Umehara, Fumihiko Fukunaga, Hitachi High-Technologies Corp. (Japan) . [8324-93]

A nonuniform SEM contour sampling technique for OPC model calibration, Takuma Shibahara, Michio Oikawa, Hitachi, Ltd. (Japan); Hiroyuki Shindo, Hitoshi Sugahara, Yutaka Hojyo, Hitachi High-Technologies Corp. (Japan) . . . . [8324-94]

Advanced full-automatic inspection of copper interconnects, Satoshi Takada, Naoma Ban, Toru Ishimoto, Naomasa Suzuki, Satoshi Umehara, Hitachi High-Technologies Corp. (Japan); Laureen Carbonell, Nancy Heylen, Rudy Caluwaerts, Henny Volders, Kristof Kellens, Zsolt Tokei, IMEC (Belgium) . . . . [8324-95]

Classification and recognition of diffraction structures using support vector machine in optical scatterometry, Jinlong Zhu, Shiyuan Liu, Chuanwei Zhang, Yuan Ma, Xiuguo Chen, Huazhong Univ. of Science and Technology (China) . . . . [8324-96]

A study of optical penetration into the micro-periodic structure of semiconductor devices, Harutaka Sekiya, Mitsuhiro Togashi, Mitsunori Numata, Yasutsugu Usami, Samsung Yokohama Research Institute Co., Ltd. (Japan); Suejin Cho, Yongdeok Jeong, Yusin Yang, SAMSUNG Electronics Co., Ltd. (Korea, Republic of) . [8324-97]

Mechanism of photoresist shrinkage investigated by single-line scan of electron beam, Takeyoshi Ohashi, Hiroaki Oizumi, Junichi Tanaka, Hitachi, Ltd. (Japan); Hiroki Kawada, Hitachi High-Technologies Corp. (Japan) . [8324-98]

Influence of mask linewidth roughness on wafer performance, Yi Chou Chen, Cloud Cheng, United Microelectronics Corp. (Taiwan) . . . . [8324-99]

Optimization of blended virtual/actual metrology schemes, Claire Baek, Costas J. Spanos, Univ. of California, Berkeley (United States). . . . . [8324-100]

Reticle intensity-based critical dimension uniformity to improve efficiency for DOMA correction in a foundry, Huang Lei, Teng Hwee Ng, Susan Ng, Thomas Ku, GLOBALFOUNDRIES Singapore (Singapore); Aditya Dayal, KLA-Tencor Corp. (United States); Wee Teck Chia, Aaron G. Chin, KLA-Tencor Singapore (Singapore); Thomas Vavul, KLA-Tencor Corp. (United States); Chua Lin, KLA-Tencor Singapore (Singapore); Trent A. Hutchinson, KLA-Tencor Texas (United States) . . . . [8324-101]

Experiment analysis of absolute flatness testing, Xin Jia, Tingwen Xing, Wumei Lin, Zhijie Liao, Institute of Optics and Electronics (China)[8324-102]

Lithography process control using in-line metrology, Nicolas Spaziani, Jean Massin, STMicroelectronics (France) . . . . [8324-103]

Development of charging simulator and prediction of intensity profile of line and space pattern of resist, Toshiyuki Yokosuka, Chahn Lee, Kinya Kobayashi, Hitachi, Ltd. (Japan); Hideyuki Kazumi, Hitachi High-Technologies Corp. (Japan). . . . . [8324-104]

Investigations into an electrostatic chuck for 450mm wafer, Gerhard Kalkowski, Thomas Peschel, Fraunhofer-Institut für Angewandte Optik und Feinmechanik (Germany); Geoffrey Hassall, Oxford Instruments (United Kingdom); Stefan Risse, Fraunhofer-Institut für Angewandte Optik und Feinmechanik (Germany). . . . . [8324-105]

Real-time scanning detection system of defects on a photomask by using the light scattering and interference method, Sangon Lee, Jae Heung Jo, Hannam Univ. (Korea, Republic of); Hae Sung Wee, Jong Soo Kim, Nano Electro Opics Co., Ltd. (Korea, Republic of) . . . . [8324-106]

Overcoming silicon limitations: new 3D-AFM carbon tips with constant high-resolution for sub-28nm node semiconductor requirements, Johann Foucher, CEA-LETI (France); Sebastian W. Schmidt, Bernd Irmer, Christian Penzkofer, nanotools GmbH (Germany) . . . . [8324-108]

Surface scanning inspection system particle detection dependence on aluminum film morphology, Steve A. McGarvey, Hitachi High Technologies America, Inc. (United States); Natalie Tran, Walter Prater, Novellus Systems, Inc. (United States) . . . . [8324-109]

Residual layer thickness control and metrology in jet and flash imprint lithography, Shrawan Singhal, The Univ. of Texas at Austin (United States); Ravikiran Attota, National Institute of Standards and Technology (United States); S. V. Sreenivasan, The Univ. of Texas at Austin (United States) . . . . [8324-110]

Sub-40nm high-volume manufacturing overlay noncorrectable error characterization *(Invited Paper)*, Bryan Orf, Wolfgang Keller, Ranjan Khurana, Pary Baluswamy, Micron Technology, Inc. (United States) . . . . [8324-111]

Nanoparticle size and shape evaluation using the TSOM method, Bradley N. Damazo, Ravikiran Attota, Purushotham P. Kavuri, András E. Vladár, National Institute of Standards and Technology (United States). . . . . [8324-112]

Photoresist qualification using scatterometry CD, Roie Volkovich, KLA-Tencor Israel (Israel); Wenyan Yin, Patricia Fallon, Dow Electronic Materials (United States); Guy Cohen, Yosef Avrahamov, KLA-Tencor Israel (Israel) . . [8324-114]

Rigorous 3D electromagnetic field simulations for EUV mask metrology, Sven Burger, Konrad-Zuse-Zentrum für Informationstechnik Berlin (Germany); Jan Pomplun, Lin Zschiedrich, Frank Schmidt, JCMwave GmbH (Germany) . . [8324-115]

Improving lithography throughput and minimizing waste using predictive multi-area scheduling, James R. Moyne, Applied Materials, Inc. (United States) . . . . [8324-117]

Evaluating diffraction-based overlay, Jie Li, Asher Tan, JinWoo Jung, Gary Goelzer, Nigel P. Smith, Jiangtao Hu, Nanometrics Inc. (United States); Boo-Hyun Ham, SAMSUNG Electronics Co., Ltd. (Korea, Republic of) . . . . [8324-118]

Apply low-temperature plasma in the rework procedure of Al film structure to prevent pattern collapsed and $CuAl_2$ precipitation, Jau-Yu Tsai, Kung Hsun Tsao, Tsz Yuan Chen, Chih Chung Huang, Huan Hsin Yeh, Yu Huan Liu, United Microelectronics Corp. (Taiwan) . . . . [8324-120]

Automated heuristic defect classification (AHDC) for haze-induced defect growth management and mask requalification, Saghir Munir, Gul Qidwai, Reticle Labs. (United States) . . . [8324-121]

Conference 8325

Advances in Resist Materials and Processing Technology XXIX

EUV Materials

EUV photoresists formed by molecular layer deposition with sub-100nm resolution, Han Zhou, Stacey F. Bent, Stanford Univ. (United States) . . . . [8325-50]

Limitation of blend type of resist platform on EUV lithography, Taku Hirayama, Tokyo Ohka Kogyo Co., Ltd. (Japan); Su Min Kim, Hai Sub Na, Chawon Koh, Hyun Woo Kim, SAMSUNG Electronics Co., Ltd. (Korea, Republic of) . [8325-51]

High-resolution nonchemically amplified resists for extreme-ultraviolet lithography, Seung A Woo, Su Young Choi, Jin-Baek Kim, KAIST (Korea, Republic of) . . . . [8325-52]

Theoretical study on structural effects of polymer ionization for EUV resist, Masayuki Endo, Seiichi Tagawa, Osaka Univ. (Japan) and JST/CREST (Japan). . . . . [8325-53]

Development of a negative tone molecular resists based on hydroxyphenyl calix[4] resorcinarene derivative for EUVL, Masatoshi Echigo, Masako Yamakawa, Yumi Ochiai, Yu Okada, Masaaki Takasuka, Mitsubishi Gas Chemical Co., Inc. (Japan) . . . . [8325-54]

A novel single-component resist based on poly (4-hydroxylstyrene) applicable for EUV lithography, Juan Liu, Liyuan Wang, Beijing Normal Univ. (China) . . . . [8325-55]

Tuesday 14 February — Poster Sessions — 6:00 to 8:00 pm

The following posters will be on display after 10:00 am on Tuesday. The interactive poster session with authors in attendance will be Tuesday evening from 6:00 to 8:00 pm.

All symposium attendees are invited to attend the poster sessions. Come view the high-quality papers that are presented in this alternative format, and interact with the poster author who will be available for discussion. Enjoy light refreshments while networking with colleagues in your field. Attendees are required to wear their conference registration badges to the poster sessions.

Fundamentals

Laser anneal PEB: a viable route to RLS improvement?, Todd R. Younkin, Intel Corp. (Belgium); Roel Gronheid, Erik Rosseel, IMEC (Belgium) . . . . [8325-56]

Effective resist profile control for 20nm node and beyond, Chen-Yu Liu, Chun-Ching Huang, Ching-Yu Chang, Yao-Ching Ku, Taiwan Semiconductor Manufacturing Co. Ltd. (Taiwan) . . . . [8325-57]

Defining and measuring development rates for a stochastic resist, Chris A. Mack, Lithoguru.com (United States). . . . . [8325-58]

Diffusion of acid from resist to Si-hardmask layer, Masamitsu Shirai, Hiroki Takeda, Haruyuki Okamura, Osaka Prefecture Univ. (Japan); Hiroyuki Wakayama, Makoto Nakajima, Nissan Chemical Industries, Ltd. (Japan) . . . . [8325-59]

LER reduction by photoresist formulation optimization for 193nm immersion lithography, Shu-Hao D. Hsu, Wei-Hsien Hsieh, Chun-Yen Huang, Wen-Bin We, Chiang-Lin Shih, Nanya Technology Corp. (Taiwan) . . . . [8325-60]

Observation of swelling behavior of ArF resist during development by the QCM method, Atsushi Sekiguchi, Hiroko Konishi, Mariko Isono, Litho Tech Japan Co., Ltd. (Japan). . . . . [8325-61]

Study of the lithography characteristics of novolak resist at different PAC concentrations, Atsushi Sekiguchi, Litho Tech Japan Co., Ltd. (Japan); Nakao Akichika, Hideo Horibe, Kanazawa Institute of Technology (Japan); Hatsuyuki Tanaka, AZ Electronic Materials (Japan) K.K. (Japan). . . . . [8325-62]

Novel Resist Materials

Synthesis and properties of novel triphenylsulfonium salt bound polymer resists for electron-beam lithography, Haiwon Lee, Kyunghwa Sohn, Ojung Kwon, Ha Na Kang, Minjung Kim, Hanyang Univ. (Korea, Republic of) . . . . [8325-64]

Synthesis and photopolymerization kinetics of a novel oxime ester sulfonic acid photoacidgenerator, Yingquan Zou, Beijing Normal Univ. (China) . . . . [8325-65]

New two-stage photo-aromatization type photo-base generators for pitch-division photolithography, Yuji Hagiwara, Taeho Kim, Ryan A. Mesch, Takanori Kawakami, Xinyu Gu, The Univ. of Texas at Austin (United States); Arunkumar K. Sundaresan, Nicholas J. Turro, Columbia Univ. (United States); James M. Blackwell, Intel Corp. (United States); C. Grant Willson, The Univ. of Texas at Austin (United States) . . . . [8325-66]

Synthesis of stable acid amplifiers that produce strong, highly fluorinated polymer-bound acids, Kenji Hosoi, Central Glass Co., Ltd. (Japan); Seth Kruger, Brian Cardineau, Univ. at Albany (United States); Koichi Miyauchi, Central Glass Co., Ltd. (Japan); Robert L. Brainard, Univ. at Albany (United States) . . . . [8325-67]

Ionic carbamate photoacid/photobase generators for the advancement of dual-tone photolithography, Geniece L. Hallett-Tapley, Tse-Luen E. Wee, Juan C. Scaiano, Univ. of Ottawa (Canada); Joby Eldo, Edward A. Jackson, SAFC Hitech (United States) . . . . [8325-68]

Positive-tone chemically amplified Fullerene resist, Alex P. Robinson, Jedsada Manyam, Andreas Frommhold, Mayandithevar Manickam, Jon A. Preece, Richard E. Palmer, The Univ. of Birmingham (United Kingdom) . . . . [8325-69]

Synthesize and polymerization of novel photocurable vinyl ether monomers containing perfluorinated aromatic units, Wei Li, Yingquan Zou, Beijing Normal Univ. (China) . . . . [8325-70]

Reduced Zeta potential for improved polyimide process perfomance and minimizing material consumption, Lorna D. Hodgson, MOXTEK, Inc. (United States); Andrew Thompson, DisChem, Inc. (United States). . . . . [8325-95]

Novel Processing

Characteristics analysis of RELACS process from an OPC point of view, Jin-Young Choi, Hynix Semiconductor Inc. (Korea, Republic of) . [8325-46]

Inhomogeneous kinetics of solid state photochemical reactions of PAG or PBG and the molecular design for their high performance, Takashi Yamashita, Toshihiko Kato, Kunihiko Okano, Tokyo Univ. of Science (Japan) . . [8325-49]

Universal templates for nanostructure arrays using silicon-containing block copolymers, Gyeongcheon Jo, Changhong Bak, Jin-Baek Kim, KAIST (Korea, Republic of) . . . . [8325-71]

Dual-responsive photoresists for sequential pattering by thermal imprint and photolithography, Changhong Bak, Su Young Choi, KAIST (Korea, Republic of); Chang Su Min, ENF Technology Co., Ltd. (Korea, Republic of); Jin-Baek Kim, KAIST (Korea, Republic of) . . . [8325-72]

Development of Si-HM for NTD process, Satoshi Takeda, Yasunobu Someya, Makoto Nakajima, Yuta Kanno, Hiroyuki Wakayama, Rikimaru Sakamoto, Nissan Chemical Industries, Ltd. (Japan); Wen-Liang Huang, Yu-Chin Huang, Bo-Jou Lu, Yi-Jing Wang, Yeh-Sheng Lin, Chun-Chi Yu, United Microelectronics Corp. (Taiwan) . . . . [8325-73]

Negative-tone development of photoresists in environmentally friendly silicone fluids, Christine Y. Ouyang, Cornell Univ. (United States); Jin-Kyun Lee, Inha Univ. (Korea, Republic of); Christopher K. Ober, Cornell Univ. (United States) . . . . . . [8325-74]

High-etching selectivity of spin-on-carbon hard mask process for 22nm node and beyond, Fumiko Iwao, Satoru Shimura, Hideharu Kyouda, Tokyo Electron Kyushu Ltd. (Japan); Kenichi Oyama, Shohei Yamauchi, Arisa Hara, Sakurako Natori, Hidetami Yaegashi, Tokyo Electron AT Ltd. (Japan). . . . . [8325-76]

Applicability of double-patterning process for fine hole pattern, Shohei Yamauchi, Arisa Hara, Kenichi Oyama, Sakurako Natori, Hidetami Yaegashi, Tokyo Electron AT Ltd. (Japan) [8325-77]

Plasmon mediated polymerization on the surface of silver nanoparticles for advancements in photolithographic patterning, Kevin G. Stamplecoskie, Geniece L. Hallett-Tapley, Dayle Larson, Juan C. Scaiano, Univ. of Ottawa (Canada) . . . . [8325-78]

Advanced multipatterning using resist core spacer process for 22nm node and beyond, Yuhei Kuwahara, Satoru Shimura, Hideharu Kyouda, Tokyo Electron Kyushu Ltd. (Japan); Kenichi Oyama, Shohei Yamauchi, Arisa Hara, Sakurako Natori, Hidetami Yaegashi, Tokyo Electron AT Ltd. (Japan). . . . . [8325-79]

Enhanced self-aligned multiple patterning for 1xnm half pitch, Sakurako Natori, Shohei Yamauchi, Arisa Hara, Kenichi Oyama, Hidetami Yaegashi, Tokyo Electron AT Ltd. (Japan) [8325-80]

Combinatorial process optimization for negative photo-imageable spin-on dielectrics and investigation of post-apply bake and post-exposure bake interactions, Jihoon Kim, Ruzhi M. Zhang, Elizabeth Wolfer, Bharatkumar K. Patel, Medhat A. Toukhy, Tatsuro Nagahara, AZ Electronic Materials USA Corp. (United States). . . . . [8325-81]

Tunable resin reactivity of spin-on dielectric by controlling synthesis process, Kwenwoo Han, Cheil Industries Inc. (Korea, Republic of) . [8325-82]

Developable BARC for special applications, Jens Schneider, Felix Braun, Marcel Heller, Markus Gunia, Daniel Sarlette, Marcus Dankelmann, Infineon Technologies Dresden (Germany) [8325-83]

KrF resists for implant layers patterning extreme-high-aspect-ratio structures with a double focal plane exposure technique, Giorgio Rafaelli, Fabio Ferri, Micron Technology Italia S.r.l. (Italy); Stefano Volpi, FUJIFILM Electronic Materials (Europe) S.r.l. (Italy); Chisun Hong, FUJIFILM Electronic Materials U.S.A., Inc. (United States) . . . . [8325-84]

Gray-level 3D resist process and its application, Shyi-Long Shy, National Nano Device Labs. (Taiwan); Yung-Chiang Ting, Far East Univ. (Taiwan) . . . . [8325-85]

Measurement and reduction of micro-bubble formation in high-viscosity fluids, Glenn Tom, Wei Lui, ATMI, Inc. . . . . [8325-96]

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Defectivity and Manufacturing

Blob defect prevention in 193nm topcoat-free immersion lithography, Deyan Wang, Dow Electronic Materials (United States); C. F. Hua, Nicholas Wu, Ivor Fang, Will Tzeng, ChihHsing Hsin, United Microelectronics Corp. (Taiwan); Jinrong Liu, Doris Kang, Cong Liu, Tom Estelle, Cheng-Bai Xu, George G. Barclay, Peter Trefonas III, Dow Electronic Materials (United States) . . . . . [8325-86]

Solvent pre-wetting as an effective start-up method for point-of-use filter, Michael S. Sevegney, Pall Corp. (United States); Toru Umeda, Shuichi Tsuzuki, Toru Numaguchi, Nihon Pall Ltd. (Japan); Shinichi Sugiyama, Takashi Nakamura, Makoto Momota, FUJIFILM Corp. (Japan) [8325-87]

Study of filter adsorption mechanism in photoresist materials, Tetsu Kohyama, Nihon Entegris K.K (Japan) . . . . [8325-88]

Post-developed defect in word-line SADP process, Po-Jen Cheng, Feng-Nien Tsai, Chin-Cheng Yang, Elvis Yang, Ta-Hung Yang, Kuang-Chao Chen, Chih-Yuan Lu, Macronix International Co., Ltd. (Taiwan) . . . . [8325-89]

Pattern dependent satellite defects in via lithography, Chih-Chieh Yu, Chin-Cheng Yang, Elvis Yang, Ta-Hung Yang, Kuang-Chao Chen, Chih-Yuan Lu, Macronix International Co., Ltd. (Taiwan) . . . . [8325-91]

Resist process optimization for further defect reduction, Tomohiro Iseki, Keiichi Tanaka, Hiroshi Marumoto, Koji Takayanagi, Yuichi Yoshida, Ryouichi Uemura, Kosuke Yoshihara, Tokyo Electron Kyushu Ltd. (Japan) . . . . [8325-92]

Effects of nylon filter properties on contact-hole photoresist imaging performance and defectivity, Michael F. Cronin, Entegris, Inc. (United States); Nelson Vitorino, Victor Monreal, John Zook, AZ Electronic Materials USA Corp. (United States) . . . . [8325-93]

Consideration of equipment sequence in optimizing filter priming methods, Nick L. Brakensiek, Brewer Science, Inc. (United States); Brian W. Kidd, Integrated Designs, Inc. (United States); Michael S. Sevegney, Michael Mesawich, Donald B. Stevens, Jr., Barry Gotlinsky, Pall Corp. (United States). . . . . [8325-94]

Conference 8328

Advanced Etch Technology for Nanopatterning

How much further can lithography windows be improved?, Mary Ann Hockey, Brewer Science, Inc. (United States). . . . . [8328-24]

Removal of SU-8 resists using hydrogen radicals generated by tungsten hot-wire catalyzer, Akihiko Kono, Yu Arai, Yousuke Goto, Hideo Horibe, Kanazawa Institute of Technology (Japan) [8328-25]

Pattern transfer from the e-beam resist, over the nanoimprint resist and to the final silicon substrate, Jian He, Steffen Howitz, GeSiM Gesellschaft fuer Silizium-Mikrosysteme mbH (Germany); Karola Richter, Johann W. Bartha, Technische Univ. Dresden (Germany); Jens I. Moench M.D., Leibniz-Institut für Festkörper- und Werkstoffforschung Dresden (Germany). . [8328-27]

Exploration of suitable dry etch technologies for directed self-assembly, Fumiko Yamashita, Eiichi Nishimura, Tokyo Electron Miyagi Ltd. (Japan); Julie Bannister, Tokyo Electron America, Inc. (United States); Hiromasa Mochiki, Koichi Yatsuda, Tokyo Electron Ltd. (Japan) . . . . [8328-26]

Fullerene-based spin on carbon hardmask, Alex P. Robinson, Jedsada Manyam, Andreas Frommhold, Richard E. Palmer, The Univ. of Birmingham (United Kingdom) . . . . [8328-28]

3D modeling of line-edge roughness transfer from the underlying substrate: the effect of resist roughhness, George Kokkoris, Vassilios Constantoudis, Evangelos Gogolides, National Ctr. for Scientific Research Demokritos (Greece). . . . . [8328-29]

Conference 8322

Extreme Ultraviolet (EUV) Lithography III

SESSION 7

Room: Conv. Ctr. Ballroom A2 . .Wed. 8:00 to 10:00 am

EUV Resist I

Session Chairs: **Takahiro Kozawa,** Osaka Univ. (Japan); **Thomas I. Wallow,** GLOBALFOUNDRIES Inc. (United States)

8:00 am: **High-sensitivity chemically amplified EUV resists through enhanced EUV absorption**, Owendi Ongayi, Dow Electronic Materials (United States) . . . . [8322-28]

8:20 am: **A new inorganic EUV resist with high-etch resistance**, Markos Trikeriotis, Marie E. Krysak, Yeon-Sook Chung, Christine Y. Ouyang, Cornell Univ. (United States); Brian Cardineau, Robert L. Brainard, Univ. at Albany (United States); Christopher K. Ober, Emmanuel P. Giannelis, Cornell Univ. (United States); Kyoung-Yong Cho, SEMATECH North (United States) . . . . [8322-29]

8:40 am: **Tightly bound ligands for hafnium nanoparticle EUV resists**, Brian Cardineau, Univ. at Albany (United States); Markos Trikeriotis, Marie E. Krysak, Emmanuel P. Giannelis, Christopher K. Ober, Cornell Univ. (United States); Kyoung-Yong Cho, SEMATECH North (United States); Robert L. Brainard, Univ. at Albany (United States) . . . . [8322-30]

9:00 am: **Evaluation of resist performance with EUV interference lithography for sub-22nm patterning**, Yasin Ekinci, Michaela Vockenhuber, Bernd Terhalle, Mohamad Hojeij, Li Wang, Paul Scherrer Institut (Switzerland); Todd R. Younkin, Intel Corp. (United States) . . . . [8322-31]

9:20 am: **Effects of out-of-band radiation on EUV resist performance**, Koji Inukai, Makoto Shimizu, Tooru Kimura, JSR Corp. (Japan); Shalini Sharma, Hiroki Nakagawa, JSR Micro, Inc. (United States). . . . . [8322-32]

9:40 am: **Out-of-band insensitive polymer bound PAG for EUV resist**, Jun Iwashita, Taku Hirayama, Kensuke Matsuzawa, Yoshiyuki Utsumi, Katsumi Ohmori, Tokyo Ohka Kogyo Co., Ltd. (Japan). . . . . [8322-33]

Coffee Break . . . . 10:00 to 10:20 am

Conference 8323

Alternative Lithographic Technologies IV

SESSION 6

Room: Conv. Ctr. Ballroom J2 . .Wed. 8:00 to 10:10 am

Metrology and Inspection for Alternative Lithographic Technologies: Joint Session with Conference 8324

Session Chairs: **Joy Y. Cheng,** IBM Almaden Research Ctr. (United States); **Martha I. Sanchez,** IBM Almaden Research Ctr. (United States)

Note room change for Session 6 to J2

8:00 am: **Directed self-assembly defectivity assessment** *(Invited Paper)*, Christopher Bencher, Applied Materials, Inc. (United States); Joy Y. Cheng, IBM Almaden Research Ctr. (United States); He L. Yi, Man-Ping C. Cai, Applied Materials, Inc. (United States); Jessica Zhou, Applied Materials China (China); Daniel P. Sanders, Melia Tjio, IBM Almaden Research Ctr. (United States); Huixiong Dai, Jeffrey T. Smith, Applied Materials, Inc. (United States); Steven J. Holmes, IBM Almaden Research Ctr. (United States); Liyan Miao, Applied Materials, Inc. (United States) . . . . [8323-22]

8:30 am: **Pattern density multiplication by direct self-assembly of block copolymers: toward 300mm CMOS requirements**, Raluca Tiron, Xavier Chevalier, Stéphanie Gaugiran, Jonathan Pradelles, Celine Lapeyres, Christophe Couderc, CEA-LETI-Minatec (France); Laurent Pain, CEA-LETI (France); Christophe Navarro, Stephanie Magnet, Arkema S.A. (France); Thierry Chevolleau, Gilles Cunge, Guilleaume Fleury, Georges Hadziioannou, CEA-LETI-Minatec (France) . [8323-23]

8:50 am: **Measurement of placement error between self-assembled polymer patterns and guiding chemical prepatterns**, Gregory S. Doerk, Charles T. Rettner, Chi-Chun Liu, Noel Arellano, Jed W. Pitera, IBM Almaden Research Ctr. (United States); Neal V. Lafferty, Kafai Lai, IBM Corp. (United States); Daniel P. Sanders, Joy Y. Cheng, IBM Almaden Research Ctr. (United States). . . . . [8323-24]

9:10 am: **Characterization of cross-sectional profile of epitaxially assembled block copolymer domains using transmission small angle x-ray scattering**, Chengqing Wang, August W. Bosse, Joseph Kline, National Institute of Standards and Technology (United States); Gila E. Stein, Univ. of Houston (United States); Christopher Soles, Wen-li Wu, National Institute of Standards and Technology (United States). . . . . [8323-25]

9:30 am: **Characterization of nanostructures for imprinted dot/hole patterns by x-ray metrology**, Yoshiyasu Ito, Kazuhiko Omote, Rigaku Corp. (Japan) . . . . [8324-26]

9:50 am: **Challenges of SEM metrology at sub-10nm linewidth**, Sergey V. Babin, Sergey S. Borisov, Christophe Peroz, Peter Yushmanov, Abeam Technologies (United States) . . . . [8324-27]

Coffee Break. . . . . .10:10 to 10:30 am

Conference 8324

Metrology, Inspection, and Process Control for Microlithography XXVI

SESSION 8

Room: Conv. Ctr. Ballroom J2 . .Wed. 8:00 to 10:10 am

Metrology and Inspection for Alternative Lithographic Technologies: Joint Session with Conference 8323

Session Chairs: **Joy Y. Cheng,** IBM Almaden Research Ctr. (United States); **Martha I. Sanchez,** IBM Almaden Research Ctr. (United States)

8:00 am: **Directed self-assembly defectivity assessment** *(Invited Paper)*, Christopher Bencher, Applied Materials, Inc. (United States); Joy Y. Cheng, IBM Almaden Research Ctr. (United States); He L. Yi, Man-Ping C. Cai, Applied Materials, Inc. (United States); Jessica Zhou, Applied Materials China (China); Daniel P. Sanders, Melia Tjio, IBM Almaden Research Ctr. (United States); Huixiong Dai, Jeffrey T. Smith, Applied Materials, Inc. (United States); Steven J. Holmes, IBM Almaden Research Ctr. (United States); Liyan Miao, Applied Materials, Inc. (United States) . . . . [8323-22]

8:30 am: **Pattern density multiplication by direct self-assembly of block copolymers: toward 300mm CMOS requirements**, Raluca Tiron, Xavier Chevalier, Stéphanie Gaugiran, Jonathan Pradelles, Celine Lapeyres, Christophe Couderc, CEA-LETI-Minatec (France); Laurent Pain, CEA-LETI (France); Christophe Navarro, Stephanie Magnet, Arkema S.A. (France); Thierry Chevolleau, Gilles Cunge, Guilleaume Fleury, Georges Hadziioannou, CEA-LETI-Minatec (France) . . . . [8323-23]

8:50 am: **Measurement of placement error between self-assembled polymer patterns and guiding chemical prepatterns**, Gregory S. Doerk, Charles T. Rettner, Chi-Chun Liu, Noel Arellano, Jed W. Pitera, IBM Almaden Research Ctr. (United States); Neal V. Lafferty, Kafai Lai, IBM Corp. (United States); Daniel P. Sanders, Joy Y. Cheng, IBM Almaden Research Ctr. (United States) . . . [8323-24]

9:10 am: **Characterization of cross-sectional profile of epitaxially assembled block copolymer domains using transmission small angle x-ray scattering**, Chengqing Wang, August W. Bosse, Joseph Kline, National Institute of Standards and Technology (United States); Gila E. Stein, Univ. of Houston (United States); Christopher Soles, Wen-li Wu, National Institute of Standards and Technology (United States) . . . . [8323-25]

9:30 am: **Characterization of nanostructures for imprinted dot/hole patterns by x-ray metrology**, Yoshiyasu Ito, Kazuhiko Omote, Rigaku Corp. (Japan). . . . . [8324-26]

9:50 am: **Challenges of SEM metrology at sub-10nm linewidth**, Sergey V. Babin, Sergey S. Borisov, Christophe Peroz, Peter Yushmanov, Abeam Technologies (United States) . . . . [8324-27]

Coffee Break . . . . 10:10 to 10:40 am

Conference 8325

Advances in Resist Materials and Processing Technology XXIX

SESSION 8

Room: Marriott San Jose Ballroom Salon III . . . . Wed. 8:00 to 10:00 am

Novel Materials and Processing I

Session Chairs: **Ramakrishnan Ayothi,** JSR Micro, Inc. (United States); **Douglas Guerrero,** Brewer Science, Inc. (United States)

8:00 am: **Investigation of pattern wiggling for spin-on organic hardmask materials**, Goji Wakamatsu, JSR Micro, Inc. (United States) and IBM Almaden Research Ctr. (United States); Kentaro Goto, Yoshi Hishiro, JSR Micro, Inc. (United States); Taiichi Furukawa, Satoru Murakami, Masayuki Motonari, Yoshikazu Yamaguchi, Tsutomu Shimokawa, JSR Corp. (Japan); Gregory Breyta, Noel Arellano, Luisa D. Bozano, Ratnam Sooriyakamuran, Carl E. Larson, IBM Almaden Research Ctr. (United States); Martin Glodde, IBM Thomas J. Watson Research Ctr. (United States); Anuja DeSilva, IBM Almaden Research Ctr. (United States) . . . .[8325-29]

8:20 am: **Spin-on-carbon-hardmask with high wiggling resistance**, Yasunobu Someya, Tetsuya Shinjo, Keisuke Hashimoto, Hirokazu Nishimaki, Ryo Karasawa, Rikimaru Sakamoto, Takashi Matsumoto, Nissan Chemical Industries, Ltd. (Japan) . . . .[8325-30]

8:40 am: **Substrate and underlayer dependence of sub-32nm e-beam HSQ pillar patterning process for RRAM application**, Wei-Su G. Chen, Ming-Jinn Tsai, Hung-Wen Wei, Peng-Sheng Chen, Industrial Technology Research Institute (Taiwan) . . . .[8325-31]

9:00 am: **High-resolution dry development**, Pradeep N. Perera, Deirdre L. Olynick, Dimas G. de Oteyza, Prashant Kulshreshtra, Paul D. Ashby, Martin Schmidt, Scott D. Dhuey, Bruce D. Harteneck, R. M. Falch, Adam M. Schwartzberg, P. James Schuck, Stefano Cabrini, Lawrence Berkeley National Lab. (United States). . . . .[8325-32]

9:20 am: **Conductive layer for charge dissipation during electron-beam exposures**, Luisa D. Bozano, Ratnam Sooriyakumaran, Linda K. Sundberg, Martha I. Sanchez, Elizabeth M. Lofano, Charles T. Rettner, IBM Almaden Research Ctr. (United States); Takayuki Nagasawa, Satoshi Watanabe, Yoshio Kawai, Shin-Etsu Chemical Co., Ltd. (Japan); Nagarajan Palavesam, Politecnico di Torino (Italy); Gustavo Gandara Montano, Northern Arizona Univ. (United States). . . . .[8325-33]

9:40 am: **Fabrication of high-aspect-ratio patterns by thermal nanoimprint lithography and a new bilayer resist system**, Martin Messerschmidt, micro resist technology GmbH (Germany); Arne Schleunitz, Christian Spreu, Paul Scherrer Institut (Switzerland); Thomas Werner, Fraunhofer-Institut für Elektronische Nanosysteme (Germany); Matthias Küchler, Technische Univ. Chemnitz (Germany); Marko Vogler, Freimut Reuther, micro resist technology GmbH (United States); Andreas Bertz, Fraunhofer-Institut für Elektronische Nanosysteme (Germany); Helmut Schift, Paul Scherrer Institut (United States); Gabi Grützner, micro resist technology GmbH (United States) . . . .[8325-34]

Coffee Break. . . . . .10:00 to 10:30 am

Conference 8326

Optical Microlithography XXV

SESSION 6

Room: Conv. Ctr. Ballroom B4. . . . . Wed. 8:00 to 10:00 am

Tools and Process Control I

Session Chairs: **Yuri Granik,** Mentor Graphics Corp. (United States); **Soichi Inoue,** EUVL Infrastructure Development Ctr., Inc. (Japan)

8:00 am: **1.35 NA immersion lithography scanner evolution down to 1xnm nodes**, Igor Bouchoms, Martijn Leenders, Jan-Jaap Kuit, Robert Kazinczi, ASML Netherlands B.V. (Netherlands) . . [8326-21]

8:20 am: **EUV and 193nm mix and match overlay optimization for critical layers**, David Laidler, Jan V. Hermans, Koen D'havé, Shaunee Y. Cheng, IMEC (Belgium); Andre van Dijk, Oleg Voznyi, Mircea V. Dusa, ASM Belgium N.V. (Belgium) . . . . [8326-22]

8:40 am: **Imaging optics setup and optimization on scanner for SMO generation process**, Tomoyuki Matsuyama, Yasushi Mizuno, Yasuhiro Ohmura, Taro Ogata, Nikon Corp. (Japan) . . . . [8326-23]

9:00 am: **Model-based OPC for implant layer patterning considering wafer topography proximity (W3D) effects**, Songyi Park, Hyungjoo Youn, No-Young Chung, Jaeyeol Maeng, Suk Joo Lee, SAMSUNG Electronics Co., Ltd. (Korea, Republic of); Xiaobo Xie, Song Lan, Mu Feng, Venu Vellanki, Brion Technologies, Inc. (United States); Stefan Hunsche, Soung-Su Woo, Seung-Hoon Park, ASML Korea Co., Ltd. (Korea, Republic of). . . . . [8326-24]

9:20 am: **Implementation of reflectivity control on block mask lithography at 20 and 14nm nodes**, Steven J. Holmes, IBM Thomas J. Watson Research Ctr. (United States); Anuja De Silva, GLOBALFOUNDRIES Inc. (United States); Juan-Manuel Gomez, Bidan Zhang, Hong Kry, IBM Corp. (United States); Libor Vyklicky, IBM Thomas J. Watson Research Ctr. (United States); Ranee Kwong, Kuang-Jung Chen, Sen Liu, Matthew Colburn, Rao Varanasi, Daiji Kawamura, Gregory R. McIntyre, Narasim Kanike, Masanori Kato, IBM Corp. (United States); Xintuo Dai, GLOBALFOUNDRIES Inc. (United States); Romain Lallement, STMicroelectronics (United States). . . . . [8326-25]

9:40 am: **Process window control using CDU master**, Tomoharu Fujiwara, Tsuyoshi Toki, Daishi Tanaka, Maki Sato, Junichi Kosugi, Rika Tanaka, Naruo Sakasai, Toshio Ohashi, Ryoko Nakasone, Akira Tokui, Nikon Corp. (Japan) . . . . [8326-26]

Coffee Break . . . . 10:00 to 10:30 am

Conference 8327

Design for Manufacturability through Design-Process Integration VI

Room: Conv. Ctr. Ballroom C1 . . . . Wed. 8:15 to 8:25 am

Opening Remarks

Session Chair: **Mark E. Mason,** Texas Instruments Inc. (United States)

SESSION 1

Room: Conv. Ctr. Ballroom C1 . . . Wed. 8:25 to 10:10 am

Keynote Session

Session Chairs: **Mark E. Mason,** Texas Instruments Inc. (United States); **John L. Sturtevant,** Mentor Graphics Corp. (United States)

8:25 am: **Bridging the resolution gap in 14 nm: designing for efficient transition to EUV** *(Keynote Presentation),* Lars W. Liebmann, IBM Corp. (United States) . . . .[8327-01]

9:00 am: **Implications of triple patterning for 14 nm node design and patterning** *(Keynote Presentation),* Kevin Lucas, Synopsys, Inc. (United States). . . . .[8327-02]

9:35 am: **Yield enhancement with DFM** *(Keynote Presentation),* Seungweon Paek, SAMSUNG Electronics Co., Ltd. (Korea, Republic of) . . . .[8327-03]

Coffee Break . . . . .10:10 to 10:40 am

Wednesday 15 February

Conference 8322

Extreme Ultraviolet (EUV) Lithography III

SESSION 8

Room: Conv. Ctr. Ballroom A2. . . . . .Wed. 10:20 am to 12:20 pm

Mask/Extendability

Session Chairs: **Ted Liang,** Intel Corp. (United States); **Emily E. Gallagher,** IBM Corp. (United States)

10:20 am: **EUVL multilayer mask blank defect mitigation for defect-free EUVL mask fabrication**, Pei-Yang Yan, Yan A. Liu, Marilyn Kamma, Guojing Zhang, Robert J. Chen, Fabian C. Martinez, Intel Corp. (United States) . . . . [8322-118]

10:40 am: **Analytic treatment of the deformation behavior of EUVL masks during electrostatic chucking**, Gerd Brandstetter, Sanjay Govindjee, Univ. of California, Berkeley (United States) . . . . [8322-35]

11:00 am: **Effect of radiation on the defectivity and stability of Ru-capped MoSi multilayer blanks**, Abbas Rastegar, Aron Cepler, SEMATECH North (United States); Thomas Laursen, ASML US, Inc. (United States); Goksel Durkaya, SEMATECH North (United States) . . . . [8322-36]

11:20 am: **The SEMATECH Berkeley MET and DCT: a quest for 14nm half-pitch in chemically amplified resist, OOB contrast of EUV resists, and 6.xnm lithography**, Christopher N. Anderson, Patrick P. Naulleau, Lorie Mae Baclea-An, Paul E. Denham, Kenneth A. Goldberg, Michael S. Jones, Brittany M. McClinton, Ryan H. Miyakawa, Senajith B. Rekawa, Nathan S. Smith, Lawrence Berkeley National Lab. (United States); Hiroki Nakagawa, JSR Micro, Inc. (United States); Ken Maruyama, JSR Micro, Inc. (Japan) . [8322-37]

11:40 am: **Wavelength selection for multilayer coatings for the lithography generation beyond EUVL**, Igor A. Makhotkin, Erwin Zoethout, Eric Louis, FOM-Institute for Plasma Physics Rijnhuizen (Netherlands); Andrei Yakunin, ASML Netherlands B.V. (Netherlands); Fred Bijkerk, FOM-Institute for Plasma Physics Rijnhuizen (Netherlands) . . . . [8322-38]

12:00 pm: **A 6.xnm beyond EUV source as a future lithography source**, Takamitsu Otsuka, Utsunomiya Univ. (Japan); Bowen Li, Colm O'Gorman, Thomas Cummins, Univ. College Dublin (Ireland); Hao Tan, Utsunomiya Univ. (Japan); Deirdre Kilbane, Univ. College Dublin (Ireland); Takeshi Higashiguchi, Noboru Yugami, Utsunomiya Univ. (Japan); Weihua Jiang, Nagaoka Univ. of Technology (Japan); Akira Endo, Waseda Univ. (Japan); Padraig Dunne, Gerard D. O'Sullivan, Univ. College Dublin (Ireland) . . . . [8322-39]

Lunch/Exhibition Break . . . . 12:20 to 1:50 pm

Conference 8323

Alternative Lithographic Technologies IV

SESSION 7

Room: Conv. Ctr. Ballroom A3. . . . . .Wed. 10:30 am to 12:20 pm

Note room change to A3

Hybrid Directed Self-Assembly and Imprint Processes (DSA II and Imprint II)

Session Chairs: **Douglas J. Resnick,** Molecular Imprints, Inc. (United States); **Daniel J. C. Herr,** Semiconductor Research Corp. (United States)

10:30 am: **Patterned media: disk drive technology at the frointier of lithography** *(Invited Paper)*, Ricardo Ruiz, Hitachi Global Storage Technologies, Inc. (United States); Lei Wan, Hitachi Global Storage Technologies, Inc. (United States) and Univ. of Wisconsin (United States); Gabriel Zeltzer, Elizabeth A. Dobisz, Kanaiyalal C. Patel, He Gao, Jeffrey Lille, Hitachi Global Storage Technologies, Inc. (United States); Yasuhiko Tada, Hiroshi Yoshida, Hitachi, Ltd. (Japan); Thomas R. Albrecht, Hitachi Global Storage Technologies, Inc. (United States). . . . . [8323-26]

11:00 am: **Evaluation of ordering of block copolymers with pre-patterned guides for bit patterned media**, Takeshi Okino, Takuya Shimada, Akiko Yuzawa, Ryosuke Yamamoto, Naoko Kihara, Yoshiyuki Kamata, Akira Kikitsu, Toshiba Corp. (Japan); Takashi Akahane, You Yin, Sumio Hosaka, Gunma Univ. (Japan). [8323-27]

11:20 am: **Integration of nanoimprint lithography into block copolymer directed self-assembly for fabricating nanoimprint templates and bit-patterned media over 1 teradot/in^2**, Shuaigang Xiao, Kim Y. Lee, Xiaomin Yang, Hongying Wang, Yautzong E. Hsu, Henry H. Yang, Justin J. Hwu, Rene van de Veerdonk, David S. Kuo, Seagate Technology LLC (United States) . . . . [8323-28]

11:40 am: **Line-frequency doubling of directed self-assembly patterns for single-digit bit pattern media lithography**, Kanaiyalal C. Patel, Ricardo Ruiz, Jeffrey Lille, Lei Wan, Elizabeth A. Dobisz, He Gao, Thomas R. Albrecht, Neil Robertson, Hitachi Global Storage Technologies, Inc. (United States). . . . . [8323-29]

12:00 pm: **Imprint process performance for patterned media at densities greater than 1Tb/in^2**, Zhengmao Ye, Scott Carden, Paul Hellebrekers, Dwayne L. LaBrake, Douglas J. Resnick, S. V. Sreenivasan, Molecular Imprints, Inc. (United States) . . . [8323-30]

Lunch/Exhibition Break . . . . 12:20 to 1:30 pm

Conference 8324

Metrology, Inspection, and Process Control for Microlithography XXVI

SESSION 9

Room: Conv. Ctr. Ballroom J2 . . . . Wed. 10:40 to 11:50 am

Scanning Probe Metrology

Session Chairs: **Benjamin D. Bunday,** International SEMATECH Manufacturing Initiative (United States); **Chih-Ming Ke,** Taiwan Semiconductor Manufacturing Co. Ltd. (Taiwan)

10:40 am: **Contour metrology using critical dimension atomic force microscopy** *(Invited Paper)*, Ndubuisi G. Orji, Ronald G. Dixson, András E. Vladár, Bin Ming, Michael T. Postek, National Institute of Standards and Technology (United States) . . [8324-28]

11:10 am: **On CDAFM bias related to probe bending**, Vladimir A. Ukraintsev, Nanometrology International, Inc. (United States); Ndubuisi G. Orji, Ronald G. Dixson, Theodore V. Vorburger, Joseph Fu, Richard M. Silver, National Institute of Standards and Technology (United States); Brian Trentman, Texas Instruments Inc. (United States). . . . . [8324-29]

11:30 am: **Capturing resist dissolution dynamics with AFM**, Paul D. Ashby, Dominik Ziegler, Lawrence Berkeley National Lab. (United States) . . . . [8324-30]

Lunch/Exhibition Break . . . . 11:50 am to 1:20 pm

Conference 8325

Advances in Resist Materials and Processing Technology XXIX

SESSION 9

Room: Marriott San Jose Ballroom Salon III . . . . .Wed. 10:30 am to 12:10 pm

Lithography at the Intersection of Optics and Chemistry: Joint Session with Conference 8326

Session Chairs: **Mark H. Somervell,** Tokyo Electron America, Inc. (United States); **Will Conley,** Freescale Semiconductor, Inc. (United States)

10:30 am: **The development of a fast physical photoresist model for OPE and SMO applications from an optical engineering perspective**, Donis G. Flagello, Nikon Research Corp. of America (United States); Ryota Matsui, Kazuhiro Yano, Tomoyuki Matsuyama, Nikon Corp. (Japan) . . . . [8326-27]

10:55 am: **The Saga of Lambda: spectral influences throughout lithography generations** *(Invited Paper)*, Bruce W. Smith, Rochester Institute of Technology (United States) . . . . . . [8325-35]

11:20 am: **LER: the ultimate limiter for resolution in production?** *(Invited Paper)*, Chris A. Mack, Lithoguru.com (United States) . . . . [8325-36]

11:45 am: **Simulation study of LWR bounding of depth of focus of various lithographic techniques: interference, optical projection, EUV, e-beam and hybrid complementary lithography, and proposal for a new production interference tool**, John S. Petersen, Periodic Structures, Inc. (United States) . . . . [8326-28]

Lunch/Exhibition Break . . . . .12:10 to 1:20 pm

Conference 8326

Optical Microlithography XXV

SESSION 7

Room: Marriott San Jose Ballroom Salon III . . . . .Wed. 10:30 am to 12:10 pm

Lithography at the Intersection of Optics and Chemistry: Joint Session with Conference 8325

Note room change for Session 7

10:30 am: **The development of a fast physical photoresist model for OPE and SMO applications from an optical engineering perspective**, Donis G. Flagello, Nikon Research Corp. of America (United States); Ryota Matsui, Kazuhiro Yano, Tomoyuki Matsuyama, Nikon Corp. (Japan) . . . . [8326-27]

10:55 am: **The Saga of Lambda: spectral influences throughout lithography generations** *(Invited Paper)*, Bruce W. Smith, Rochester Institute of Technology (United States) . . . . . . [8325-35]

11:20 am: **LER: the ultimate limiter for resolution in production?** *(Invited Paper)*, Chris A. Mack, Lithoguru.com (United States) . . . . [8325-36]

11:45 am: **Simulation study of LWR bounding of depth of focus of various lithographic techniques: interference, optical projection, EUV, e-beam and hybrid complementary lithography, and proposal for a new production interference tool**, John S. Petersen, Periodic Structures, Inc. (United States). . . . . . [8326-28]

Lunch/Exhibition Break . . . . .12:10 to 1:40 pm

Conference 8327

Design for Manufacturability through Design-Process Integration VI

SESSION 2

Room: Conv. Ctr. Ballroom C1. . . . . .Wed. 10:40 am to 12:00 pm

DFDP: Design for Double Patterning

Session Chairs: **Lars W. Liebmann,** IBM Corp. (United States); **Juan-Antonio Carballo,** Netlogic Microsystems Inc. (United States)

10:40 am: **Layout optimization through robust pattern learning and prediction in SADP gridded designs**, Jen-Yi Wuu, Univ. of California, Santa Barbara (United States); Mark Simmons, Mentor Graphics Corp. (United States); Malgorzata Marek-Sadowska, Univ. of California, Santa Barbara (United States) . . . . [8327-04]

11:00 am: **Self-aligned double patterning (SADP) compliant design flow**, Yuangsheng Ma, GLOBALFOUNDRIES Inc. (United States); Jason Sweis, Gokhan Daglikoca, Cadence Design Systems, Inc. (United States); Hidekzau Yoshida, Yan Wang, Jongwook Kye, Harry J. Levinson, GLOBALFOUNDRIES Inc. (United States) . . . . [8327-05]

11:20 am: **Design-friendly double patterning**, Emek Yesilada, STMicroelectronics (France) . . . . [8327-06]

11:40 am: **Pattern matching for double-patterning technology compliant physical design flow**, Lynn T. Wang, Vito Dai, Luigi Capodieci, GLOBALFOUNDRIES Inc. (United States) . . . [8327-07]

Lunch/Exhibition Break . . . . 12:00 to 1:30 pm

Conference 8322

Extreme Ultraviolet (EUV) Lithography III

SESSION 9

Room: Conv. Ctr. Ballroom A2 . . . . Wed. 1:50 to 3:30 pm

Optics and Metrology

Session Chairs: **Jan Hendrik Peters,** Carl Zeiss SMS GmbH (Germany); **Shinji Okazaki,** Gigaphoton Inc. (Japan)

1:50 pm: **Development of EUV lithography tool technologies in Nikon**, Katsuhiko Murakami, Tetsuya Oshino, Hiroyuki Kondo, Hiroshi Chiba, Kazushi Nomura, Hideo Takino, Masahiko Kanaoka, Kazuya Ota, Katsura Otaki, Noriaki Kandaka, Atsushi Yamazaki, Takashi Yamaguchi, Nikon Corp. (Japan) . . . . [8322-40]

2:10 pm: **Low CoO grazing incidence collectors for EUVL HVM**, Giovanni Bianucci, Gian Luca Cassol, Media Lario Technologies (Italy); Natale M. Ceglio, Media Lario Technologies (United States); Giuseppe Valsecchi, Fabio E. Zocchi, Media Lario Technologies (Italy) . . . . [8322-41]

2:30 pm: **Optical performance of LPP multilayer collector mirrors**, Torsten Feigl, Marco Perske, Hagen Pauer, Sergiy A. Yulin, Marcus Trost, Sven Schroeder, Angela Duparré, Norbert Kaiser, Andreas Tünnermann, Fraunhofer-Institut für Angewandte Optik und Feinmechanik (Germany). . . . . [8322-42]

2:50 pm: **Aerial image monitor for wavefront metrology of high-NA EUV lithography tools**, Ryan H. Miyakawa, Patrick P. Naulleau, Lawrence Berkeley National Lab. (United States) . . . . [8322-43]

3:10 pm: **Sub-aperture phase reconstruction from a Hartmann wavefront sensor by phase retrieval method for application in EUV adaptive optics**, Alessandro Polo, Florian Bociort, Silvania F. Pereira, H. Paul Urbach, Technische Univ. Delft (Netherlands) . . . . [8322-44]

Coffee Break . . . . 3:30 to 4:00 pm

Conference 8323

Alternative Lithographic Technologies IV

SESSION 8

Room: Conv. Ctr. Ballroom A3 . . . . Wed. 1:30 to 3:10 pm

Directed Self-Assembly III: Patterning

Session Chairs: **Benjamen M. Rathsack,** Tokyo Electron America, Inc. (United States); **Joy Y. Cheng,** IBM Almaden Research Ctr. (United States)

1:30 pm: **Contact-hole patterning for random logic circuits using block copolymer directed self-assembly**, He Yi, Stanford Univ. (United States); Xin-Yu Bao, Applied Materials, Inc. (United States); Jie Zhang, Richard Tiberio, James W. Conway, Li-Wen Chang, Subhasish Mitra, H.-S. Philip Wong, Stanford Univ. (United States) . . . . [8323-31]

1:50 pm: **A computationally efficient model for DSA graphoepitaxy**, Chi-Chun Liu, Jed W. Pitera, Charles T. Rettner, Joy Y. Cheng, IBM Almaden Research Ctr. (United States); Neal V. Lafferty, Kafai Lai, IBM Corp. (United States) . . . . [8323-32]

2:10 pm: **Contact-hole shrink process using directed self-assembly (DSA)**, Yuriko Seino, Masahiro Kanno, Hironobu Sato, Katsutoshi Kobayashi, Ayako Kawanishi, Tsukasa Azuma, Toshiba Corp. (Japan); Makoto Muramatsu, Tokyo Electron Kyushu Ltd. (Japan); Seiji Nagahara, Tokyo Electron Ltd. (Japan); Takahiro Kitano, Takayuki Toshima, Tokyo Electron Kyushu Ltd. (Japan). . . . . [8323-33]

2:30 pm: **Material and process development for block copolymer lithography**, Guanyang Lin, Yi Cao, Hengpeng Wu, Jian Yin, Sungeun Hong, Margareta Paunescu, Mark Neisser, AZ Electronic Materials USA Corp. (United States); Joy Y. Cheng, Melia Tjio, Daniel P. Sanders, IBM Almaden Research Ctr. (United States) . . . . [8323-34]

2:50 pm: **Directed self-assembly patterning using PHOST-b-PS block copolymers**, Nathan D. Jarnagin, Jing Cheng, Andrew Peters, Wei-Ming Yeh, Richard A. Lawson, Laren M. Tolbert, Clifford L. Henderson, Georgia Institute of Technology (United States) . . . . [8323-35]

Coffee Break . . . . 3:10 to 3:40 pm

Conference 8324

Metrology, Inspection, and Process Control for Microlithography XXVI

SESSION 10

Room: Conv. Ctr. Ballroom J2 . . . . Wed. 1:20 to 2:40 pm

Accuracy and Standards

Session Chairs: **Richard M. Silver,** National Institute of Standards and Technology (United States); **Christopher J. Raymond,** Nanometrics Inc. (United States)

1:20 pm: **Sub-nanometer calibration of line width measurement and line edge detection by using STEM and sectional SEM**, Kiyoshi Takamasu, Haruki Okitou, Satoru Takahashi, The Univ. of Tokyo (Japan); Mitsuru Konno, Osamu Inoue, Hiroki Kawada, Hitachi High-Technologies Corp. (Japan) . . . . [8324-31]

1:40 pm: **Analysis and control of profile variation impact on focused ion-beam cross-sectional metrology**, Aaron M. Cordes, SEMATECH North (United States); Benjamin D. Bunday, International SEMATECH Manufacturing Initiative (United States); Jim Nadeau, FEI Co. (United States) . . . . [8324-32]

2:00 pm: **Automated S/TEM metrology on advanced semiconductor gate structures**, David Horspool, Kenny Nakahara, FEI Co. (United States); Chris Deeb, Intel Corp. (United States); Chris Hobbs, SEMATECH North (United States) . . . . [8324-33]

2:20 pm: **Compensation of CD-SEM image-distortion detected by View-Shift Method**, Osamu Inoue, Takahiro Kawasaki, Hiroki Kawada, Hitachi High-Technologies Corp. (Japan) . . . . . . [8324-34]

Coffee Break . . . . 2:40 to 3:30 pm

Conference 8325

Advances in Resist Materials and Processing Technology XXIX

SESSION 10

Room: Marriott San Jose Ballroom Salon III . . . . Wed. 1:20 to 3:20 pm

EUV Materials, Processing, and Analysis

Session Chairs: **Christoph K. Hohle,** Fraunhofer-Ctr. Nanoelektronische Technologien (Germany); **Nobuyuki N. Matsuzawa,** Sony Corp. (Japan)

1:20 pm: **Patterning developments in spin-on hard mask systems for 30nm half-pitch EUV technology**, Vincent P. Truffert, Ivan K. Pollentier, Philippe Foubert, Frederic Lazzarino, IMEC (Belgium); Yuusuke Anno, JSR Micro N.V. (Belgium) and IMEC (Belgium); Christopher J. Wilson, Monique Ercken, Roel Gronheid, Steven Demuynck, IMEC (Belgium); Xavier Buch, JSR Micro N.V. (Belgium) and IMEC (Belgium). . . . . [8325-37]

1:40 pm: **The novel spin-on hard mask and ultrathin UL material for EUVL**, Rikimaru Sakamoto, Hiroaki Yaguchi, Syuhei Shigaki, Suguru Sassa, Noriaki Fujitani, Takafumi Endo, Ryuji Onishi, Bang-Ching Ho, Nissan Chemical Industries, Ltd. (Japan). . . . . . [8325-38]

2:00 pm: **EUV resist processing with flash-lamp**, Julius J. S. Santillan, EUVL Infrastructure Development Ctr., Inc. (Japan); Koji Kaneyama, Akihiko Morita, SOKUDO Co., Ltd. (Japan); Hiroki Kiyama, Dainippon Screen Manufacturing Co., Ltd. (Japan); Masaya Asai, SOKUDO Co., Ltd. (Japan); Toshiro Itani, EUVL Infrastructure Development Ctr., Inc. (Japan) . . . . [8325-39]

2:20 pm: **Stable, fluorinated acid amplifiers for use in EUV lithography**, Seth Kruger, Univ. at Albany (United States); Kenji Hosoi, Central Glass Co., Ltd. (Japan); Brian Cardineau, Univ. at Albany (United States); Koichi Miyauchi, Central Glass Co., Ltd. (Japan); Robert L. Brainard, Univ. at Albany (United States)[8325-40]

2:40 pm: **Shrinkage distortions in EUV resists: CD-SEM and AFM investigations**, Thomas I. Wallow, GLOBALFOUNDRIES Inc. (United States); Martin Freitag, Fraunhofer-Ctr. Nanoelektronische Technologien (Germany); Oleg Kritsun, Catherine Volkman, GLOBALFOUNDRIES Inc. (United States); Christoph K. Hohle, Fraunhofer-Ctr. Nanoelektronische Technologien (Germany) . . . . [8325-41]

3:00 pm: **Improvement of EUV resist performance through develop threshold modifications**, Joshua S. Hooge, Carlos Fonseca, Tokyo Electron America, Inc. (United States); Hideo Shite, Tokyo Electron Kyushu Ltd. (Japan) . . . . [8325-42]

Coffee Break . . . . 3:20 to 3:40 pm

Conference 8326

Optical Microlithography XXV

SESSION 8

Room: Conv. Ctr. Ballroom B4 . . . . Wed. 1:40 to 3:20 pm

Note room change to B4

Tools and Process Control II

Session Chairs: **Jongwook Kye,** GLOBALFOUNDRIES Inc. (United States); **Wilhelm Maurer,** Infineon Technologies AG (Germany)

1:40 pm: **High-overlay accuracy for double patterning using an immersion scanner**, Yuji Shiba, Yosuke Shirata, Takahisa Kikuch, Katsushi Makino, Jin Udagawa, Hajime Yamamoto, Yasuhiro Morita, Chihaya Motoyoshi, Yuuki Ishii, Nikon Corp. (Japan) . . . . [8326-29]

2:00 pm: **Modeling for field-to-field overlay control**, Koen D'havé, IMEC (Belgium) . . . . [8326-30]

2:20 pm: **Free form source and mask optimization for negative-tone resist development for 22nm node contact holes**, Vishnu Kamat, Tamer H. Coskun, Cadence Design Systems, Inc. (United States); Huixiong Dai, Ching-Mei Hsu, Gaetano Santoro, Christopher S. Ngai, Applied Materials, Inc. (United States); Mario Reybrouck, Grozdan Grozev, FUJIFILM Electronic Materials (Europe) N.V. (Belgium) . . . . [8326-31]

2:40 pm: **Process development using negative tone development for the dark field critical layers in a 28nm node process**, Janko Versluijs, Vincent P. Truffert, Gayle Murdoch, Peter De Bisschop, Darko Trivkovic, Bart Laenens, Vincent Wiaux, Eddy Kunnen, Laurent Souriau, Steven Demuynck, Monique Ercken, IMEC (Belgium) . . . . [8326-32]

3:00 pm: **Process requirements for splitting pitch LELE double-patterning technique at advanced logic technology nodes**, R. C. Peng, I. H. Huang, H. H. Liu, H. James Lee, John Lin, Taiwan Semiconductor Manufacturing Co. Ltd. (Taiwan); Arthur Lin, KLA-Tencor Taiwan (Taiwan); Allen Chang, Benjamin S. M. Lin, Cymer Southeast Asia, Ltd. (Taiwan) . . . . [8326-33]

Coffee Break . . . . 3:20 to 3:50 pm

Conference 8327

Design for Manufacturability through Design-Process Integration VI

SESSION 3

Room: Conv. Ctr. Ballroom C1 . . . . .Wed. 1:30 to 3:10 pm

Design Rules and Routing

Session Chairs: **Andrew R. Neureuther,** Univ. of California, Berkeley (United States); **Luigi Capodieci,** GLOBALFOUNDRIES Inc. (United States)

1:30 pm: **Design-of-experiments-based design rule optimization**, Abde Ali H. Kagalwalla, Univ. of California, Los Angeles (United States); Swamy V. Muddu, GLOBALFOUNDRIES Inc. (United States); Puneet Gupta, Univ. of California, Los Angeles (United States); Luigi Capodieci, GLOBALFOUNDRIES Inc. (United States); Coby Zelnik, Sagantec North America (United States) . . . . [8327-08]

1:50 pm: **Fully integrated litho aware PnR design solution**, Charlotte Beylier, STMicroelectronics (France); Clement Moyroud, Mentor Graphics Corp. (France); Fabrice Bernard-Granger, Frederic Robert, Emek Yesilada, Yorick Trouiller, Jean-Claude Marin, STMicroelectronics (France) . . . . [8327-09]

2:10 pm: **Replacing design rules in the VLSI design cycle**, Paul Hurley, Krzysztof Kryszczuk, IBM Zürich Research Lab. (Switzerland) . . . . [8327-10]

2:30 pm: **Smart double-cut via insertion flow with dynamic design-rules compliance for fast new technology adoption**, Ahmad A. Omara, Mentor Graphics Egypt (Egypt); Rami Fathy, Mentor Graphics Corp. (United States); Shobhit Malik, Sriram Madhavan, Luigi Capodieci, Piyush Pathak, GLOBALFOUNDRIES Inc. (United States) . . . . [8327-11]

2:50 pm: **Local loops for robust inter-layer routing at sub-14nm nodes**, Wenbin Huang, Daniel Morris, Carnegie Mellon Univ. (United States); Neal V. Lafferty, Lars W. Liebmann, IBM Corp. (United States); Kaushik Vaidyanathan, Carnegie Mellon Univ. (United States); Kafai Lai, IBM Corp. (United States); Larry Pileggi, Andrzej J. Strojwas, Carnegie Mellon Univ. (United States) . . . . [8327-12]

Coffee Break . . . . 3:10 to 3:40 pm

Wednesday 15 February

Conference 8322

Extreme Ultraviolet (EUV) Lithography III

SESSION 10

Room: Conv. Ctr. Ballroom A2 . . . . Wed. 4:00 to 6:00 pm

EUV Resist II

Session Chairs: **Gregory M. Wallraff,** IBM Almaden Research Ctr. (United States); **James W. Thackeray,** Dow Electronic Materials (United States)

4:00 pm: **Comparison study for 3xnm contact hole CD uniformity between EUV lithography and ArF immersion double patterning**, Keundo Ban, Hynix Semiconductor Inc. (Korea, Republic of); Junggun Heo, ; Hyunkyung Shim, Minkyung Park, Kilyoung Lee, Sunyoung Koo, Jae-Heon Kim, Cheolkyu Bok, Myoung Soo Kim, Hyosang Kang, Hynix Semiconductor Inc. (Korea, Republic of) . . . . [8322-45]

4:20 pm: **Key parameters of EUV resists for contact hole application**, Kyoung-Yong Cho, SEMATECH North (United States); Hiroki Nakagawa, Ken Maruyama, JSR Micro, Inc. (United States); Makoto Shimizu, Tooru Kimura, JSR Corp. (Japan); Yoshi Hishiro, JSR Micro, Inc. (United States) . . . . [8322-46]

4:40 pm: **Modeling the effects of acid amplifiers on photoresist stochastics**, Gregg M. Gallatin, National Institute of Standards and Technology (United States); Patrick P. Naulleau, Lawrence Berkeley National Lab. (United States); Seth Kruger, Robert L. Brainard, Univ. at Albany (United States). . . . . [8322-47]

5:00 pm: **Calibration and verification of a stochastic model for EUV resist**, Weimin Gao, Synopsys GmbH (Belgium); Joachim Siebert, Ulrich Klostermann, Alexander Philippou, Synopsys GmbH (Germany); Vicky Philipsen, Eric Hendrickx, IMEC (Belgium) . . . . [8322-48]

5:20 pm: **Resist outgassing characterization for qualification in high-power EUV lithography**, Toshiya Takahashi, Norihiko Sugie, Kazuhiro Katayama, Isamu Takagi, Yukiko Kikuchi, Soichi Inoue, EUVL Infrastructure Development Ctr., Inc. (Japan); Takeo Watanabe, Tetsuo Harada, Hiroo Kinoshita, Univ. of Hyogo (Japan). . . . . [8322-49]

5:40 pm: **Direct comparison of resist outgassing and optics contamination using in-band EUV photon exposure and e-beam exposure from several EUV sensitive resists,** James H. Underwood, EUV Technology (United States); Ivan K. Pollentier, IMEC (Belgium); David C. Houser, Rupert C. Perera, EUV Technology (United States) . . . . [8322-50]

Conference 8323

Alternative Lithographic Technologies IV

SESSION 9

Room: Conv. Ctr. Ballroom A3 . . . . Wed. 3:40 to 5:30 pm

Maskless/Direct-Write Lithography II

Session Chairs: **Laurent Pain,** CEA-LETI (France); **Cynthia Hanson,** Space and Naval Warfare Systems Ctr. Pacific (United States)

3:40 pm: **REBL: design progress toward 16nm half-pitch electron-beam lithography** *(Invited Paper)*, Mark A. McCord, Paul Petric, Upendra Ummethala, Allen Carroll, Shinichi Kojima, Chris F. Bevis, KLA-Tencor Corp. (United States) . . . . [8323-36]

4:10 pm: **Active-matrix nc-Si electron emitter array for massively parallel direct-write electron-beam system**, Naokatsu Ikegami, Tokyo Univ. of Agriculture and Technology (Japan); Takashi Yoshida, Tohoku Univ. (Japan); Akira Kojima, Hideyuki Ohyi, Crestec Corp. (Japan); Nobuyoshi Koshida, Tokyo Univ. of Agriculture and Technology (Japan); Masayoshi Esashi, Tohoku Univ. (Japan). . . . . [8323-37]

4:30 pm: **Complementary patterning demonstration with e-beam direct writer and spacer DP process of 11nm node**, Hideaki Komami, Masahiro Takizawa, Hideaki Isobe, Masaki Kurokawa, Akio Yamada, Advantest Corp. (Japan); Hidetami Yaegashi, Kenichi Oyama, Shohei Yamauchi, Tokyo Electron AT Ltd. (Japan)[8323-38]

4:50 pm: **CP element-based design for 14nm node EBDW high-volume manufacturing**, Takashi Maruyama, Shinji Sugatani, Yasuhide Machida, e-Shuttle, Inc. (Japan); Hiroshi Takita, Hiromi Hoshino, Toshio Hino, Masaru Ito, Fujitsu Semiconductor Ltd. (Japan); Akio Yamada, Advantest Corp. (Japan); Tetsuya Iizuka, Satoshi Komatsu, Makoto Ikeda, Kunihiro Asada, The Univ. of Tokyo (Japan). . . . . [8323-39]

5:10 pm: **Status on resist development for 5kV mapper multibeam application: correlation using different accelerating beam voltage,** Béatrice Icard, Laurent Pain, Claire Sourd, Bernard Dalzotto, Christophe Constancias, CEA-LETI, MINATEC (France); Erwin Slot, Willem Mook, Pablo Wiedemann, Niels Vergeer, MAPPER Lithography (Netherlands) . . . . [8323-40]

Conference 8324

Metrology, Inspection, and Process Control for Microlithography XXVI

SESSION 11

Room: Conv. Ctr. Ballroom J2 . . . . Wed. 3:30 to 5:40 pm

Metrology and Inspection for TSV and 3D Integration

Session Chairs: **Yi-sha Ku,** Industrial Technology Research Institute (Taiwan); **Richard M. Silver,** National Institute of Standards and Technology (United States)

3:30 pm: **In-line metrology of 3D interconnect processes** *(Invited Paper)*, Yi-sha Ku, Deh-Ming Shyu, Po-Yi Chang, Wei-Te Hsu, Industrial Technology Research Institute (Taiwan) . . . . . . [8324-35]

4:00 pm: **Measuring thermally induced void growth in conformally filled through silicon vias (TSVs) by laboratory x-ray microscopy**, LayWai Kong, Alain C. Diebold, James Lloyd, Michael Liehr, Univ. at Albany (United States); Ehrenfried Zschech, Fraunhofer-Institut für Zerstörungsfreie Prüfverfahren (Germany); Sitaram Arkalgud, Andrew C. Rudack, SEMATECH North (United States) . . . . [8324-36]

4:20 pm: **Through-silicon via plating void metrology using focused ion-beam mill**, Andrew C. Rudack, SEMATECH North (United States); Richard Young, Jim Nadeau, Rob Routh, FEI Co. (United States). . . . . [8324-37]

4:40 pm: **Measurement of through silicon via etch profile by dark-field optical microscope**, Deh-Ming Shyu, Yi-sha Ku, Industrial Technology Research Institute (Taiwan) . . . . . . [8324-38]

5:00 pm: **Wafer level warpage characterization of 3D interconnect**, Po-Yi Chang, Industrial Technology Research Institute (Taiwan) . . . . [8324-39]

5:20 pm: **Three-dimensional nanoscale metrology of CDs and TSVs using the TSOM method**, Ravikiran Attota, Ronald G. Dixson, National Institute of Standards and Technology (United States) . . . . [8324-40]

Conference 8325

Advances in Resist Materials and Processing Technology XXIX

SESSION 11

Room: Marriott San Jose Ballroom Salon III . . . . Wed. 3:40 to 5:20 pm

Novel Materials and Processing II

Session Chairs: **Dah-Chung Owe-Yang,** Shin-Etsu MicroSi, Inc. (United States); **George G. Barclay,** Dow Advanced Materials (United States)

3:40 pm: **CD error budget analysis for self-aligned multipatterning**, Kenichi Oyama, Sakurako Natori, Shohei Yamauchi, Arisa Hara, Hidetami Yaegashi, Tokyo Electron AT Ltd. (Japan). . . . . [8325-43]

4:00 pm: **Demonstration of 22nm SRAM features with patternable hafnium oxide based resist materials using electron-beam lithography**, Xaver Thrun, Kang-Hoon Choi, Martin Freitag, Fraunhofer-Ctr. Nanoelektronische Technologien (Germany); Andrew Grenville, Inpria Corp. (United States); Manuela S. Gutsch, Christoph K. Hohle, Fraunhofer-Ctr. Nanoelektronische Technologien (Germany); Jason Stowers, Inpria Corp. (United States) . . . . [8325-44]

4:20 pm: **Direct implant through BARC**, Tomoya Ohashi, Takahiro Kishioka, Makiko Umezaki, Yoshiomi Hiroi, Shigeo Kimura, Yuki Usui, Nissan Chemical Industries, Ltd. (Japan). . . . . [8325-45]

4:40 pm: **Focus improvement with NIR absorbing underlayer attenuating substructure reflectivity**, Wu-Song Huang, IBM Corp. (United States); Dario L. Goldfarb, IBM Thomas J. Watson Research Ctr. (United States); Waikin Li, IBM Corp. (United States); Martin Glodde, IBM Thomas J. Watson Research Ctr. (United States); Kazumi Noda, Seiichiro Tachibana, Masaki Ohashi, Shin-Etsu Chemical Co., Ltd. (Japan); Dah-Chung Owe-Yang, Shin-Etsu MicroSi, Inc. (United States); Takeshi Kinsho, Shin-Etsu Chemical Co., Ltd. (Japan) . . . . [8325-47]

5:00 pm: **Design, synthesis, and characterization of KrF negative developable bottom antireflective coating materials**, Sen Liu, Kuang-Jung Chen, Wu-Song Huang, IBM Corp. (United States); Steven J. Holmes, IBM Thomas J. Watson Research Ctr. (United States); Karen Huang, Nicolette Fender, JSR Micro, Inc. (United States); Ranee Kwong, IBM Corp. (United States); Brian Osborn, Cherry Tang, JSR Micro, Inc. (United States); Chung-Hsi J. Wu, IBM Corp. (United States); Mark Slezak, JSR Micro, Inc. (United States) . . . . [8325-48]

Confernece End.

Conference 8326

Optical Microlithography XXV

SESSION 9

Room: Conv. Ctr. Ballroom B4 . . . . Wed. 3:50 to 5:30 pm

Multiple Patterning/Innovative Lithography

Session Chairs: **Xuelong Shi,** Semiconductor Manufactuing International Corp. (China); **Sam Sivakumar,** Intel, Corp. (United States)

3:50 pm: **Scanning interference evanescent-wave lithography for sub-22nm generations**, Peng Xie, Bruce W. Smith, Rochester Institute of Technology (United States) . . . . [8326-34]

4:10 pm: **Using a numerical aperture of 1.85 to image high-aspect ratio structures in photoresist**, Prateek Mehrotra, Richard J. Blaikie, Univ. of Canterbury (New Zealand) and The MacDiarmid Institute for Advanced Materials and Nanotechnology (New Zealand); Chris A. Mack, Lithoguru.com (United States) and The Univ. of Texas at Austin (United States) . . . . [8326-35]

4:30 pm: **Doubling the spatial frequency with cavity resonance lithography**, Hyesog Lee, Tanner Research, Inc. (United States) . . . . [8326-36]

4:50 pm: **Pupil wavefront manipulation for optical nanolithography**, Monica Kempsell Sears, Bruce W. Smith, Rochester Institute of Technology (United States) . . . . . . [8326-37]

5:10 pm: **14nm M1 triple patterning,** Qiao Li, Pradiptya Ghosh, David A. Abercrombie, Pat J. LaCour, Suniti M. Kanodia, Mentor Graphics Corp. (United States) . . . . [8326-38]

Conference 8327

Design for Manufacturability through Design-Process Integration VI

SESSION 4

Room: Conv. Ctr. Ballroom C1 . . . . Wed. 3:40 to 5:50 pm

Design Implementation and Variability

Session Chairs: **Rob Aitken,** ARM Inc. (United States); **Michael L. Rieger,** Synopsys, Inc. (United States)

3:40 pm: **A primer of physical design for lithographers** *(Invited Paper)*, Chi-Min Yuan, Freescale Semiconductor, Inc. (United States) . . . . [8327-13]

4:10 pm: **Analysis, quantification, and mitigation of electrical variability due to layout-dependent effects in SOC designs**, Yangang Wang, Mark Zwolinski, Univ. of Southampton (United Kingdom); Andrew Appleby, Mark Scoones, Sonia Caldwell, Cambridge Silicon Radio Ltd. (United Kingdom); Philippe Hurat, Cadence Design Systems, Inc. (United States); Chris Pitchford, Cadence Design Systems, Inc. (United Kingdom) . . . . . . [8327-14]

4:30 pm: **Development of connectivity based checks for analog circuits**, Will Conley, Freescale Semiconductor, Inc. (United States) . . . . [8327-15]

4:50 pm: **Design level variability analysis and parametric yield improvement methodology**, Reinhard Maerz, Martin C. Keck, Intel GmbH (Germany) . . . . [8327-16]

5:10 pm: **Analysis of layout-dependent context effects on timing and leakage in 28 nm**, Patrick McGuinness, Puneet Sharma, Freescale Semiconductor, Inc. (United States); Philippe Hurat, Larry Layton, Cadence Design Systems, Inc. (United States) . . [8327-17]

5:30 pm: **Variability aware compact model characterization for statistical circuit design optimization,** Ying Qiao, Costas J. Spanos, Univ. of California, Berkeley (United States) . . . . [8327-18]

The following posters will be on display after 10:00 am on Wednesday. The interactive poster session with authors in attendance will be Wednesday evening from 6:00 to 8:00 pm. All symposium attendees are invited to attend the poster sessions. Come view the high-quality papers that are presented in this alternative format, and interact with the poster author who will be available for discussion. Enjoy light refreshments while networking with colleagues in your field. Attendees are required to wear their conference registration badges to the poster sessions.

Conference 8322

Extreme Ultraviolet (EUV) Lithography III

Session Chairs: **Obert R. Wood,** GLOBALFOUNDRIES Inc. (United States); **Patrick P. Naulleau,** Lawrence Berkeley National Lab. (United States)

EUV actinic imaging tool aerial image evaluation of EUVL embedded phase-shift mask performance, Pei-Yang Yan, Intel Corp. (United States); Iacopo Mochi, Kenneth A. Goldberg, Lawrence Berkeley National Lab. (United States) . . . . . [8322-34]

Study of line-end printing of very low-K1 process, Lei Yuan, Thomas I. Wallow, Linus Jang, Jongwook Kye, Harry J. Levinson, Sohan Singh, Mark Kelling, GLOBALFOUNDRIES Inc. (United States) . . . . . [8322-60]

The role resist plays in EUVL extensibility, Shinn-Sheng Yu, Anthony Yen, Taiwan Semiconductor Manufacturing Co. Ltd. (Taiwan) . . . . . [8322-61]

The factor affecting on LWR and sensitivity in EUV resist material, Junehee Han, Korea Kumho Petrochemical Co., Ltd. (Korea, Republic of) . . . . . [8322-62]

Steady progress on laser-assisted discharge produced plasma (LDP) technology, Masaki Yoshioka, Jeroen Jonkers, Rolf Apetz, Olivier R. N. Semprez, Marc Corthout, Yusuke Teramoto, XTREME technologies GmbH (Germany); Takahiro Shirai, Kunihiko Kasama, Tatsushi Igarashi, Ushio Inc. (Japan) . . . . . [8322-63]

Sub-atmospheric gas purification for EUVL vacuum environment control, Abneesh Srivastava, Stenio Pereira, Thomas Gaffney, Entegris, Inc. (United States) . . . . . [8322-64]

Low-energy electron bombardment induced surface contamination of Ru mirrors, Al-Montaser Bellah A. Al-Ajlony, Aloke Kanjilal, Mark A. Catalfano, Sivanandan S. Harilal, Ahmed Hassanein, Purdue Univ. (United States) . . . . . [8322-65]

Coat-develop track process for inorganic EUV resist, Masahiko Harumoto, Tadashi Miyagi, Koji Kaneyama, Akihiko Morita, Charles N. Pieczulewski, Masaya Asai, SOKUDO Co., Ltd. (Japan); Benjamin Clark, Inpria Corp. (United States) . . . . . [8322-67]

Phase defect mitigation strategy: fiducial mark requirements on EUVL mask, Tetsunori Murachi, Tsuyoshi Amano, Sung Hyun Oh, EUVL Infrastructure Development Ctr., Inc. (Japan) . . . . . [8322-68]

Analysis and control of thermal and structural deformation of projection optics for 22nm EUV lithography, Guanghua Yang, Yanqiu Li, Beijing Institute of Technology (China) . . . . . [8322-69]

Imaging performance of the SEMATECH Albany MET after upgrading the illumination optics, Yu-Jen Fan, Dominic Ashworth, Scott Wright, Liping Ren, Karen E. Petrillo, Michael Goldstein, Stefan Wurm, Bryan J. Rice, SEMATECH North (United States); Erik M. Sohmen, Carl Zeiss SMT GmbH (Germany) . . . . . [8322-70]

Laser-produced plasma UTA emission in 3-7nm spectral region, Takeshi Higashiguchi, Takamitsu Otsuka, Noboru Yugami, Utsunomiya Univ. (Japan); Weihua Jiang, Nagaoka Univ. of Technology (Japan); Akira Endo, Waseda Univ. (Japan); Bowen Li, Colm O'Gorman, Thomas Cummins, Deirdre Kilbane, Padraig Dunne, Gerard D. O'Sullivan, Univ. College Dublin (Ireland) . . . . . [8322-71]

Impact of the phase defect structure on an actinic dark-field blank inspection signal and wafer printability, Tsuyoshi Amano, Tetsunori Murachi, Yukiyasu Arisawa, Takeshi Yamane, Tsuneo Terasawa, EUVL Infrastructure Development Ctr., Inc. (Japan) . . . . . [8322-72]

Study of actinic dark-field inspection with programmed amplitude defects, Noriaki Takagi, Takeshi Yamane, Tsuneo Terasawa, EUVL Infrastructure Development Ctr., Inc. (Japan) . . . . . [8322-73]

The novel top-coat material for RLS trade-off reduction in EUVL, Ryuji Onishi, Rikimaru Sakamoto, Noriaki Fujitani, Takafumi Endo, Bang-Ching Ho, Nissan Chemical Industries, Ltd. (Japan) . . . . . [8322-74]

Is extreme-ultraviolet pellicle possible? in terms of heat absorption, Hyung Cheol Lee, Ji Won Kim, Hye-Keun Oh, Hanyang Univ. (Korea, Republic of) . . . . . [8322-75]

Phase defect printability analyses: dependence of defect type and EUV exposure condition, Tsuneo Terasawa, Takeshi Yamane, Yukiyasu Arisawa, Hidehiro Watanabe, EUVL Infrastructure Development Ctr., Inc. (Japan) . . . . . [8322-76]

Latest cluster performance for EUV lithography, Hideo Shite, IMEC (Japan); Koichi Matsunaga, Tokyo Electron Kyushu Ltd. (Japan) and IMEC (Belgium); Kathleen Nafus, IMEC (Belgium); Hitoshi Kosugi, Tokyo Electron Kyushu Ltd. (Japan); Philippe Foubert, Jan V. Hermans, Eric Hendrickx, Mieke Goethals, Dieter Van Den Heuvel, IMEC (Belgium) . . . . . [8322-77]

Smoothing of substrate pits using ion-beam deposition for EUV lithography, Jenah Harris-Jones, Vibhu Jindal, Patrick A. Kearney, Ranganath Teki, Arun John Kadaksham, Hyuk Joo Kwon, SEMATECH North (United States) . . . . . [8322-78]

TiO_2-SiO_2 ultra-low-expansion glasses for EUVL system evaluated by ultrasonic zero-CTE temperature measurement system, Jun-ichi Kushibiki, Mototaka Arakawa, Yuji Ohashi, Yuko Maruyama, Tohoku Univ. (Japan) . . . . . [8322-79]

Extension of PTB's EUV metrology facilities, Christian Laubis, Martin Biel, Christian Buchholz, Andreas Fischer, Annett Kampe, Akiko Kato, Jana Puls, Christian Stadelhoff, Frank Scholze, Physikalisch-Technische Bundesanstalt (Germany) . . . . . [8322-80]

Mirror contamination and oscillatory behavior during EUV reflectivity analysis, Mark A. Catalfano, Matt Fields, Aloke Kanjilal, Al-Montaser Bellah A. Al-Ajlony, Sivanandan S. Harilal, Ahmed Hassanein, Purdue Univ. (United States) . [8322-81]

Modeling and optimization of mass-limited targets for EUV lithography, Tatyana Sizyuk, Ahmed Hassanein, Purdue Univ. (United States) . . . . . [8322-82]

In-situ Sn contamination removal by hydrogen plasma, John Sporre, Dan Elg, Daniel Andruczyk, Tae Cho, David N. Ruzic, Univ. of Illinois at Urbana-Champaign (United States); Shailendra Srivastava, David C. Brandt, Cymer, Inc. (United States) . . . . . [8322-83]

Energetic ion and neutral energy analyzer for extreme-ultraviolet light actinic inspection sources, Daniel Andruczyk, John Sporre, Dan Elg, Tae Cho, David N. Ruzic, Univ. of Illinois at Urbana-Champaign (United States) . . . . . [8322-84]

EUV assist layers for use in multilayer processes, Tanti Ouattara, Carlton Washburn, Aline Collin, Vandana Krishnamurthy, Douglas J. Guerrero, Brewer Science, Inc. (United States) . . . . . [8322-85]

High-brightness electrodeless Z-Pinch ™ EUV source for mask inspection tools, Deborah Gustafson, Matthew Partlow, Stephen Horne, Donald Smith, Matthew Besen, Paul Blackborow, Energetiq Technology, Inc. (United States) [8322-86]

Reducing EUV mask blank defects originated at target surface during ion-beam multilayer deposition process, He Yu, Univ. of Illinois at Urbana-Champaign (United States) and SEMATECH (United States) and Univ. of Electronic Science and Technology of China (China); Daniel Andruczyk, David N. Ruzic, Univ. of Illinois at Urbana-Champaign (United States); Vibhu Jindal, Patrick A. Kearney, Thomas J. Cardinal, SEMATECH North (United States); Yadong Jiang, Univ. of Electronic Science and Technology of China (China) [8322-87]

Comparison of the impact of SPM-based and acid-free cleaning PORs on EUV mask performance, Jaehyuck Choi, Takeya Shimomura, SEMATECH North (United States); Han-shin Lee, Jin-sang Yoon, SAMSUNG Electronics Co., Ltd. (Korea, Republic of); Alexander Friz, Cecilia Montgomery, SEMATECH North (United States) . . . . . [8322-88]

Understanding the ion beam in EUV mask blank production, Patrick A. Kearney, Vibhu Jindal, SEMATECH North (United States); Alphred Weaver, Pat Teora, Veeco Ion Beam Equipment Inc. (United States); John Sporre, David N. Ruzic, Univ. of Illinois at Urbana-Champaign (United States); Francis Goodwin, SEMATECH North (United States) . . . . . [8322-90]

Light sources for EUVL patterning at 22nm node and beyond, Igor V. Fomenkov, David C. Brandt, Alex I. Ershov, David W. Myers, Daniel J. Brown, Bruno M. La Fontaine, Michael J. Lercel, Alexander N. Bykanov, Norbert R. Bowering, Cymer, Inc. (United States) . . . . . [8322-91]

Particle contamination effects in EUVL: enhanced theory for the analytical determination of critical particle sizes, Gerd Brandstetter, Sanjay Govindjee, Univ. of California, Berkeley (United States) . . . . . [8322-92]

Ion-beam deposition system for depositing low-defect density extreme-ultraviolet mask blanks, Vibhu Jindal, Patrick A. Kearney, Jaewoong Sohn, Francis Goodwin, SEMATECH North (United States) . . . . . [8322-93]

Development of the reliable high-power pulsed carbon dioxide laser system for LPP EUV light source, Takeshi Ohta, Gigaphoton Inc. (Japan) . . . . . [8322-94]

The following posters will be on display after 10:00 am on Wednesday. The interactive poster session with authors in attendance will be Wednesday evening from 6:00 to 8:00 pm. All symposium attendees are invited to attend the poster sessions. Come view the high-quality papers that are presented in this alternative format, and interact with the poster author who will be available for discussion. Enjoy light refreshments while networking with colleagues in your field. Attendees are required to wear their conference registration badges to the poster sessions.

Comparison of EUV and e-beam lithographic technologies for sub-22nm node patterning, James F. Cameron, James W. Thackeray, Jin Wuk Sung, Mike D. Wagner, Suzanne M. Coley, Vipul Jain, Owendi Ongayi, Paul LaBeaume, Amy Kwok, David Valeri, Dow Electronic Materials (United States); Béatrice Icard, Bernard Dalzotto, Claire Sourd, Laurent Pain, CEA-LETI (France). . [8322-95]

Liftoff lithography of metals for extreme-ultraviolet lithography mask absorber layer patterning, Adam Lyons, John G. Hartley, Univ. at Albany (United States). . . . . [8322-96]

The study of synthesis and photocuring behaviors of organic silicon modified methylacrylate and acrylate, Siyuan Wang, Yingquan Zou, Beijing Normal Univ. (China) . . . . [8322-97]

Tin droplets for EUV sources, Bob Rollinger, Andrea Z. Giovannini, Reza S. Abhari, ETH Zurich (Switzerland) . . . . [8322-98]

EUV mask blank cleaning process optimization using M7360, Takeya Shimomura, DNP Corp. USA (United States); Arun John Kadaksham, Matt House, Andy Ma, Francis Goodwin, SEMATECH North (United States). . . . . [8322-99]

Modeling ion-beam target interaction to reduce defects generated on target surfaces for EUV mask blanks via ion-beam deposition, Thomas J. Cardinal, SEMATECH North (United States); Daniel Andruczyk, Univ. of Illinois at Urbana-Champaign (United States); He Yu, Univ. of Illinois at Urbana-Champaign (United States) and State Key Lab. of Electronic Thin Films and Integrated Devices, School of Optoelectronic Information (China); Vibhu Jindal, Patrick A. Kearney, SEMATECH North (United States); David N. Ruzic, Univ. of Illinois at Urbana-Champaign (United States) . . . . [8322-100]

The validity of a simplified model for mask roughness induced LER under off-axis illumination and with dense and isolated lines, Brittany M. McClinton, Patrick P. Naulleau, Lawrence Berkeley National Lab. (United States) . . . . [8322-101]

Tradeoffs in mask architecture: dealing with future illumination angular diversity, Brittany M. McClinton, Patrick P. Naulleau, Lawrence Berkeley National Lab. (United States). . . . . [8322-102]

Mask shadowing and the line-edge transfer function, Brittany M. McClinton, Patrick P. Naulleau, Lawrence Berkeley National Lab. (United States); Thomas I. Wallow, GLOBALFOUNDRIES Inc. (United States) . . . . [8322-103]

Cleaning of EUV substrates for mask blank defect reduction, Arun John Kadaksham, SEMATECH North (United States); Shimomura Takeya, DNP Corp. USA (United States); Matt House, Andy Ma, Francis Goodwin, SEMATECH North (United States) . . . . [8322-104]

Longer wavelength EUV lithography (LW-EUVL), Christopher W. Maloney, Rochester Institute of Technology (United States) . . . . [8322-105]

A simulation study of cleaning-induced EUV reflectivity loss mechanisms on mask blanks, Mihir Upadhyaya, Gregory Denbeaux, College of Nanoscale Science & Engineering (United States); Arun John Kadaksham, Vibhu Jindal, Jenah Harris-Jones, Francis Goodwin, SEMATECH North (United States) . . . . [8322-106]

A pathway to resolving RLS tradeoff in EUV lithography: underlying assist layers, Timothy Wu, Shu-Hao Chang, Jimmy Hu, Chih-Tsung Shih, Anthony Yen, Taiwan Semiconductor Manufacturing Co. Ltd. (Taiwan) . . . . [8322-107]

Effect of extreme-ultraviolet pellicle support to patterned mask, Hye-Keun Oh, So-Yeon Baek, Sang-Seog Lee, Eun-Jin Kim, Sung-Gyu Lee, Ji Won Kim, Hanyang Univ. (Korea, Republic of); Jun-Taek Park, Chang-Moon Lim, Hynix Semiconductor Inc. (Korea, Republic of). . . . . [8322-108]

Defect-aware reticle floorplanning in EUVL considering side-to-side wafer dicing, Yuelin Du, Hongbo Zhang, Martin D. F. Wong, Univ. of Illinois at Urbana-Champaign (United States); Rasit O. Topaloglu, GLOBALFOUNDRIES Inc. (United States) . . . . [8322-109]

Microplasma-pulsed discharge EUV source characteristics, Peter Choi, Raul Aliaga-Rossel, Aldrice Bakouboula, Otman Benali, Philippe Bove, Grainne Duffy, Osamu Ivase, NANO-UV SAS (France); Blair Lebert, EPPRA SAS (France); Keith Powell, NANO-UV SAS (France); Ouassima Sarroukh, EPPRA SAS (France); Sergey V. Zakharov, NANO-UV SAS (France) and EPPRA sas (France) and NRC Kurchatov Institute (Russian Federation); Vasily S. Zakharov, EPPRA SAS (France) . . . . [8322-110]

Properties of high-intensity EUV radiation plasma sources, Sergey V. Zakharov, NANO-UV SAS (France); Vasily S. Zakharov, EPPRA SAS (France); Peter Choi, NANO-UV SAS (France); Andrey Berezin, Alexander S. Vorontsov, Sergey Parotkin, Mikhail Markov, Alexander Y. Krukovskiy, Vladimir G. Novikov, M. V. Keldysh Institute of Applied Mathematics (Russian Federation) . . . . . [8322-111]

50X, 75X mask cleaning effects on EUV lithography process and lifetime: lines and spaces, contacts, and LER, Brittany M. McClinton, Lawrence Berkeley National Lab. (United States); Robert J. Chen, Intel Corp. (United States); Simi A. George, SCHOTT North America, Inc. (United States); Yongbae Kim, Intel Corp. (United States); Lorie-Mae Baclea-an, Patrick P. Naulleau, Lawrence Berkeley National Lab. (United States) . . [8322-112]

3D mask modeling for EUV lithography, Julien Mailfert, Christian D. Zuniga, Mentor Graphics Corp. (United States); Vicky Philipsen, imec (Belgium); Kostas Adam, Michael Lam, James C. Word, Mentor Graphics Corp. (United States); Eric Hendrickx, Geert Vandenberghe, imec (Belgium); Bruce W. Smith, Rochester Institute of Technology (United States). [8322-113]

Particle mitigation in mask blank deposition tools, Yashdeep Khopkar, Henry Herbol, Univ. at Albany (United States); Vibhu Jindal, Patrick Kearny, SEMATECH North (United States); Gregory Denbeaux, Univ. at Albany (United States) . . . . [8322-114]

Development of fiducial marks on EUV blanks for defect mitigation process, Takahiro Onoue, Kazuhiro Hamamoto, Toshihiko Orihara, Tsutomu Shoki, Junichi Horikawa, Osamu Maruyama, HOYA Corp. (Japan). . . . . [8322-115]

Impact of shadowing effect on OPC strategy for contact layer, Yang Ping, Hua Song, Synopsys, Inc. (United States); Wen-Kang Lei, Irene Y. Su, Synopsys Taiwan Ltd. (Taiwan); Robert Lugg, Liya lai, Synopsys, Inc. (United States). . . . . [8322-116]

Line-width roughness control for EUV patterning, Karen E. Petrillo, George Huang, Dominic Ashworth, Liping Ren, Kyoung-Yong Cho, Stefan Wurm, SEMATECH North (United States); Shinichiro Kawakami, Lior Huli, Shannon Dunn, Akiteryu Ko, TEL Technology Ctr., America, LLC (United States) . . . . [8322-117]

Applicability of e-beam mask inspection to EUV mask production, Shmoolik Mangan, Lior Shoval, Ishai Schwarzband, Sergey Khristo, Vivek Balasubramanian, Shay Goldstein, Ran Brikman, Nir Shoshani, Applied Materials (Israel) . . . . [8322-119]

Coherent short-wavelength plasma light for EUV metrology, Maria I. Lopez-Ruiz, Felix Staub, Leili Masoudnia, Davide Bleiner, Univ. Bern (Switzerland) . . . . [8322-120]

AIT and print validation of EUV multi-layer defect recovery using computational lithography, Vikram L. Tolani, Masaki Satake, Peter Hu, Danping Peng, Ying Li, Linyong Pang, Anthony D. Vacca, Luminescent Technologies, Inc. (United States); Hyuk Joo Kwon, Aaron Cordes, Vibhu Jindal, SEMATECH North (United States) . . . . . [8322-121]

Conference 8323

Alternative Lithographic Technologies IV

Silicon-containing block copolymers for sub-10nm patterning, Christopher J. Ellison, Julia D. Cushen, The Univ. of Texas at Austin (United States); Issei Otsuka, Ctr. de Recherches sur les Macromolécules Végétales (France); Christopher M. Bates, The Univ. of Texas at Austin (United States); Sami Halila, Sébastien Fort, Ctr. de Recherches sur les Macromolécules Végétales (France); Jeffrey A. Easley, Erica L. Rausch, Anthony Thio, The Univ. of Texas at Austin (United States); Redouane Borsali, Ctr. de Recherches sur les Macromolécules Végétales (France); C. Grant Willson, The Univ. of Texas at Austin (United States) . . . . [8323-60]

Maskless EUV lithography: an already difficult technology made even more complicated?, Yijian Chen, Peking Univ. Shenzhen Graduate School (China); Yashesh A. Shroff, Intel Corp. (United States) . . . . [8323-61]

A phase segregating polymer blend for 2xnm feature applications, Jin Li, Tatsuro Nagahara, AZ Electronic Materials (Japan) K.K. (Japan); Munirathna Padmanaban, John Sagan, AZ Electronic Materials USA Corp. (United States) . . . . [8323-62]

2nm quantum optical lithography, Eugen Pavel, Storex Technologies Inc. (Romania) . . . . . [8323-63]

Detailed mesoscale dynamic simulation of block polymer directed self-assembly processes: application of protracted colored noise dynamics, Andrew Peters, Richard A. Lawson, Peter J. Ludovice, Clifford L. Henderson, Georgia Institute of Technology (United States) . . . [8323-64]

Novel fluorinated polymers for releasing material in nanoimprint lithography, Tsuneo Yamashita, Masamichi Morita, Daikin Industries, Ltd. (Japan). . . . . [8323-65]

Wednesday 15 February — Poster Sessions — 6:00 to 8:00 pm

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25nm pitch master and replica mold fabrication for nanoimprinting lithography for 1Tbit/inch ^{2} bit patterned media, Hideo Kobayashi, Shinji Kishimoto, Kouta Suzuki, Hiromasa Iyama, Kazutake Taniguchi, Sakae Nakatsuka, Takashi Sato, Tsuyoshi Watanabe, HOYA Corp. (Japan). . . . . [8323-66]

Combined dose and geometry correction for multi-electron-beam lithography: application to the 22nm node, Luc Martin, Patrick Schiavone, Sébastien Bayle, Aselta Nanographics (France); Jérôme Belledent, Sébastien Soulan, CEA-LETI-MINATEC (France); Pablo Wiedemann, Abdi Farah, MAPPER Lithography (Netherlands); Serdar Manakli, Aselta Nanographics (France). . . [8323-67]

Multiple columns for high-throughput complementary e-beam lithography (CEBL), Enden D. Liu, Theodore A. Prescop, David K. Lam, Multibeam Corp. (United States). . . . . [8323-69]

Addressing LER through atomistic self-assembly, Victor Moroz, Synopsys, Inc. (United States); Lars H. Bomholt, Synopsys Switzerland, LLC (Switzerland) . . . . [8323-70]

Plasmonic lithography modeling and measurement of near-field distribution of plasmonic nano-aperture, Yongwoo Kim, Howon Jung, Seok Kim, Jinhee Jang, Yonsei Univ. (Korea, Republic of); Jae Yong Lee, Korea Research Institute of Standards and Science (Korea, Republic of); Jae W. Hahn, Yonsei Univ. (Korea, Republic of) . . . . [8323-71]

Analysis of line-width error in digital micromirror device-based maskless lithography, Dong Won Kang, Yonsei Univ. (Korea, Republic of); Hoonchul Ryoo, Samsung Mobile Display Co., Ltd. (Korea, Republic of); Jae W. Hahn, Yonsei Univ. (Korea, Republic of) . . . . [8323-72]

Design of a high positioning contact probe for plasmonic lithography, Jinhee Jang, Yongwoo Kim, Seok Kim, Howon Jung, Jae W. Hahn, Yonsei Univ. (Korea, Republic of) . . . . [8323-73]

Sub-30nm resolution plasmonic patterning with a circular contact probe, Seok Kim, Yongwoo Kim, Howon Jung, Jinhee Jang, Jae W. Hahn, Yonsei Univ. (Korea, Republic of) . . . . [8323-74]

Optimization of chemically amplified resist for high-volume manufacturing by electron-beam direct writing toward 14nm node and beyond, Jun-ichi Kon, Fujitsu Labs., Ltd. (Japan); Takashi Maruyama, Yoshinori Kojima, Yasushi Takahashi, Shinji Sugatani, e-Shuttle, Inc. (Japan); Kozo Ogino, Hiromi Hoshino, Fujitsu Semiconductor Ltd. (Japan); Hideaki Isobe, Masaki Kurokawa, Akio Yamada, Advantest Corp. (Japan) . . . . [8323-75]

Novel neutralized layers for DSA lithography by using reactive self-assembled monolayers, Atsushi Hieno, Hiroko Nakamura, Shigeki Hattori, Koji Asakawa, Yuriko Seino, Masahiro Kanno, Tsukasa Azuma, Toshiba Corp. (Japan) . . [8323-76]

Study of device mass production capability of the character projection based electron-beam direct-writing process technology toward 14nm node and beyond, Yoshinori Kojima, Yasushi Takahashi, Masaki Takakuwa, Shuzo Ohshio, Shinji Sugatani, e-Shuttle, Inc. (Japan); Ryo Tujimura, Hiroshi Takita, Kozo Ogino, Hiromi Hoshino, Fujitsu Semiconductor Ltd. (Japan); Yoshio Ito, Masaaki Miyajima, Fujitsu VLSI Ltd. (Japan); Jun-ichi Kon, Fujitsu Labs., Ltd. (Japan). . . . . [8323-77]

Block co-polymer guided self-assembly by surface chemical modification: optimization of multiple patterning process and pattern transfer, Lorea Oria, Ctr. Nacional de Microelectrónica (Spain); Alaitz Ruiz de Luzuriaga, Juan Antonio Alduncín, CIDETEC IK4 (Spain); Francesc X. Pérez-Murano, Ctr. Nacional de Microelectrónica (Spain). [8323-78]

Proximity effect correction using multilevel area density map for character projection-based electron-beam direct writing toward 14nm node and beyond, Kozo Ogino, Hiromi Hoshino, Fujitsu Semiconductor Ltd. (Japan); Takashi Maruyama, Yasuhide Machida, Shinji Sugatani, e-Shuttle, Inc. (Japan). . . . . [8323-79]

Feasibility study of character projection-based electron-beam direct writing for logic LSI wiring including automatically routed area with 14nm node technology case, Takashi Maruyama, Shinji Sugatani, Yoshinori Kojima, Yasushi Takahashi, Masaki Takakuwa, Shuzo Ohshio, e-Shuttle, Inc. (Japan); Masaru Ito, Fujitsu Semiconductor Ltd. (Japan). . . . . [8323-80]

High-resolution laser direct writing with a plasmonic contact probe, Howon Jung, Yongwoo Kim, Seok Kim, Jinhee Jang, Jae W. Hahn, Yonsei Univ. (Korea, Republic of) . . . . [8323-81]

A new polymer working stamp material investigated for replication fidelity, Kristian Smistrup, Lasse H. Thamdrup, Jesper Nørregaard, Andrej Mironov, Brian Bilenberg, NIL Technology ApS (Denmark); Anil H. Thilsted, Johan Eriksen, Ole Hansen, Anders Kristensen, Technical Univ. of Denmark (Denmark); Theodor Nielsen, NIL Technology ApS (Denmark). . . . . [8323-82]

Feasibility study of optical/e-beam complementary lithography, Christoph K. Hohle, Kang-Hoon Choi, Martin Freitag, Manuela S. Gutsch, Jan Paul, Fraunhofer-Ctr. Nanoelektronische Technologien (Germany); Philipp Jaschinsky, Frank Kahlenberg, GLOBALFOUNDRIES Dresden Module One, GmbH & Co. KG (Germany) . . . . [8323-83]

Report of progress on the mapper technology in the frame of the open consirtium imagine, Laurent Pain, Béatrice Icard, Christophe Constancias, Jérôme Belledent, CEA-LETI (France); Bert J. Kampherbeek, Pablo Wiedemann, MAPPER Lithography (Netherlands) . . . . [8323-84]

Optimization of the MSB approach for future technology nodes, Ines A. Stolberg, Hans-Joachim Doering, Wolfgang H. Dorl, Thomas Elster, Joachim Heinitz, Matthias W. Klein, Marc Schneider, Matthias Slodowski, Ulf Weidenmüller, Vistec Electron Beam Lithography Group (Germany) . . . . [8323-85]

Integrated lithography to prepare arrays of rounded nano-objects, Maria Czirjakne Csete, Aron Sipos, Aniko Szalai, Univ. of Szeged (Hungary). . . . . [8323-86]

Improved electron backscattering representation using a new class of distribution: application to EUV masks, Patrick Schiavone, Thiago Figueiro, Mohamed Saib, Aselta Nanographics (France) . . . . [8323-87]

Multistage nanofocusing with 22nm resolution, Liang Pan, Yongshik Park, Yi Xiong, Erick Ulin-Avila, Yuan Wang, Li Zeng, Shaomin Xiong, Junsuk Rho, Univ. of California, Berkeley (United States); Cheng Sun, Northwestern Univ. (United States); David B. Bogy, Xiang Zhang, Univ. of California, Berkeley (United States). . . . . [8323-88]

Fabrication nanopillars pattern on PDMS using anodic aluminum oxide film as template, Yung-Chiang Ting, Far East Univ. (Taiwan); Shyi-Long Shy, National Nano Device Labs. (Taiwan) [8323-89]

Spin-on surface treatments for thin film block copolymer orientation control, Christopher M. Bates, Takehiro Seshimo, Christopher H. Chen, Julia D. Cushen, William J. Durand, Logan J. Santos, Christopher J. Ellison, C. Grant Willson, The Univ. of Texas at Austin (United States) . . [8323-90]

Environmental control during solvent annealing of silicon-containing block copolymers, Logan J. Santos, Christopher M. Bates, Christopher H. Chen, Julia D. Cushen, William J. Durand, Takehiro Seshimo, Christopher J. Ellison, C. Grant Willson, The Univ. of Texas at Austin (United States) . . . . [8323-91]

Block copolymer orientation control using top-coat surface treatments, William J. Durand, Christopher M. Bates, Christopher H. Chen, Julia D. Cushen, Logan J. Santos, Takehiro Seshimo, Christopher J. Ellison, C. Grant Willson, The Univ. of Texas at Austin (United States) . . . . [8323-92]

Nanosphere lithography technique for fabrication of large area, well-ordered metal particle arrays, Steven J. Barcelo, Si-Ty Lam, Gary A. Gibson, Xia Sheng, Dick Henze, Hewlett-Packard Labs. (United States) . . . . [8323-93]

Ultimate lithographic performances of advanced resists CAR or non-CAR resist?, Jan Frederik van Steenbergen, Noboru Otsuka, Xavier Buch, JSR Micro N.V. (Belgium); Béatrice Icard, Claire Sourd, Christophe Constancias, Bernard Dalzotto, Laurent Pain, CEA-LETI (France) . . . . [8323-95]

Dithering in raster-scan multiple electron-beam maskless lithography system, Raymond P. S. Chen, Taiwan Semiconductor Manufacturing Co. Ltd. (Taiwan) . . . . [8323-96]

Hardware implementation of Corner2 lossless compression algorithm for maskless lithography systems, Jeehong Yang, Univ. of Michigan (United States); Xiaohui Li, Serap A. Savari, Texas A&M Univ. (United States) . . . . [8323-97]

Scalable simulations for directed self-assembly patterning with the use of GPU parallel computing, Kenji Yoshimoto, GLOBALFOUNDRIES Inc. (United States); Brandon L. Peters, Gurdaman S. Khaira, Juan J. de Pablo, Univ. of Wisconsin-Madison (United States) . . . . [8323-99]

Modeling line-edge roughness in lamellar block copolymer systems, Paul N. Patrone, Univ. of Maryland, College Park (United States) and National Institute of Standards and Technology (United States); Gregg M. Gallatin, National Institute of Standards and Technology (United States) . . . . [8323-100]

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Patterning via directed self-assembly of polystyrene-block-polyacid copolymers for sub-20nm pitch patterning, Jing Cheng, Richard A. Lawson, Wei-Ming Yeh, Nathan D. Jarnagin, Andrew Peters, Laren M. Tolbert, Clifford L. Henderson, Georgia Institute of Technology (United States) . . . . [8323-101]

Sub-wavelength holographic lithography: the possibilities and advantages, Michael Borisov, Dmitry Cheljubeev, Vitaly Chernik, Alexander Gavrikov, Dmitry Knyazkov, Peter Mikheev, Vadim I. Rakhovsky, Alexey Shamaev, NANOTECH SWHL Ltd. (Russian Federation) . . . . [8323-102]

Fabrication of polymer microneedle array using bulk lithography, Prasanna S. Gandhi, Kiran S. Bhole, Indian Institute of Technology Bombay (India). . . . . [8323-103]

Conference 8326

Optical Microlithography XXV

Modelling of side-wall angle for optical proximity correction for self-aligned double patterning, Sylvain Moulis, Vincent Farys, STMicroelectronics (France); Jérôme Belledent, CEA-LETI (France); Laurent Depre, Brion Technologies, Inc. (United States); Johann Foucher, CEA-LETI (France); Antoine J. Bruguier, Song Lan, Qian Zhao, Mu Feng, Brion Technologies, Inc. (United States) . . [8326-11]

New methodology to predict pattern collapse for 14nm and beyond, Aasutosh Dave, John L. Sturtevant, Mentor Graphics Corp. (United States); Kenji Yoshimoto, GLOBALFOUNDRIES Inc. (United States) . . . . [8326-55]

Building 3D aerial image in photoresist with reconstructed mask image acquired with optical microscope, Chih-Shiang Chou, Yu-Po Tang, Fu-Sheng Chu, Wen-Chun Huang, Ru-Gun Liu, Tsai-Sheng Gau, Taiwan Semiconductor Manufacturing Co. Ltd. (Taiwan) . . . . [8326-56]

Proximity diffraction correction for generating three-dimensional structures using graded-tone mask lithography, Young-Je Yun, Min Sung Kim, Taek-Seung Yang, Han Choon Lee, Jae Won Han, Dongbu HiTek Co., Ltd. (Korea, Republic of) . . . . [8326-57]

Wafer CD variation for randomly correlated track units and polarization, GuoXiang Ning, GLOBALFOUNDRIES Dresden Module Two, GmbH & Co. KG (Germany); Paul W. Ackmann, GLOBALFOUNDRIES Inc. (United States); Frank Richter, Karin Kurth, Stephanie Maelzer, Michael HSIEH, GLOBALFOUNDRIES Dresden Module Two, GmbH & Co. KG (Germany); Frank Schurack, Advanced Mask Technology Ctr. GmbH Co. KG (Germany); Fang Hong Gn, GLOBALFOUNDRIES Singapore (Singapore). . . . . [8326-58]

Field performance availability improvements in lithography light sources using the iGLX™ gas management system, Kevin O'Brien, Daniel J. Riggs, Amit Chakravorty, Cymer, Inc. (United States) . . . . [8326-59]

Can fast rule-based assist feature generation in random-logic contact layout provide sufficient process window?, Ahmed S. Omran, Mentor Graphics Egypt (Egypt); George Friedrich, Mentor Graphics Corp. (United States); Jochen Schacht, Mentor Graphics Taiwan, Ltd. (Taiwan); Junjiang Lei, Le Hong, Loran Friedrich, Mentor Graphics Corp. (United States); Regina Shen, Ryan Chou, Mentor Graphics Taiwan, Ltd. (Taiwan). . . [8326-60]

ZERODUR®: bending strength data for tensile stress loaded support structures, Peter Hartmann, Tanja Bizjak, SCHOTT AG (Germany) . . . . [8326-61]

OPC model prediction capability improvements by accounting for mask 3D-EMF effects, John L. Sturtevant, Mentor Graphics Corp. (United States); Jessy Schramm, Yong Wah Cheng, DongQing Zhang, GLOBALFOUNDRIES Singapore (Singapore); Christian D. Zuniga, Thuy Do, Edita Tejnil, Angeline Chung, Kenneth R. Jantzen, Mentor Graphics Corp. (United States) . . . . [8326-62]

Defects reduction at BEOL interconnect within 300mm manufacturing environment, Chien-Hsien S. Lee, Yayi Wei, Mark Kelling, Shao Beng Law, Washington Mobley, Kuok Chin Chai, GLOBALFOUNDRIES Inc. (United States) [8326-63]

CD signature monitoring based on AMAI sensor measurements, Anatoly Y. Bourov, Lifeng Duan, Jianrui Cheng, Shanghai Micro Electronics Equipment Co., Ltd. (China) . . . . [8326-64]

Edge placement error reduction and ringing effect suppression using model-based targeting techniques, Christopher M. Cork, Synopsys SARL (France); Xiaohai Li, Stephen Jang, Synopsys, Inc. (United States). . . . . [8326-65]

Source mask optimization methodology (SMO) and application to real full-chip optical proximity correction, DongQing Zhang, Gek-Soon Chua, Yee Mei Foong, GLOBALFOUNDRIES Singapore (Singapore); Yi Zou, GLOBALFOUNDRIES Inc. (United States); Jessy Schramm, GLOBALFOUNDRIES Dresden Module Two, GmbH & Co. KG (Germany); Yun Tang, GLOBALFOUNDRIES Singapore (Singapore); Carl Babcock, GLOBALFOUNDRIES Inc. (United States); Byoung IL Choi, GLOBALFOUNDRIES Singapore (Singapore); Stefan Roling, Alessandra Navarra, Tanja Fischer, Andre Leschok, GLOBALFOUNDRIES Dresden Module Two, GmbH & Co. KG (Germany) . . . . [8326-66]

Source optimization incorporating margin image average with conjugate gradient method, Jue-Chin Yu, Peichen Yu, National Chiao Tung Univ. (Taiwan) . . . . [8326-67]

Integration of pattern matching into verification flows, Tamer S. Desouky, Omnia Saeed, Mentor Graphics Egypt (Egypt) . . . . [8326-68]

Advanced mask aligner lithography (AMALITH), Reinhard Völkel, Uwe Vogler, SUSS MicroOptics SA (Switzerland); Kristian Motzek, Andreas Erdmann, Fraunhofer-Institut für Integrierte System und Bauelementetechnologie (Germany); Andrew R. Romano, SUSS MicroTec Inc. (United States); Ralph Zoberbier, SUSS MicroTec Lithography GmbH (Germany) . . . . [8326-69]

Improved flexibility with grayscale fabrication of calcium fluoride homogenizers, Jeremiah D. Brown, Peter Dorn, JENOPTIK Optical Systems, Inc. (United States); Peter Brakhage, JENOPTIK Optical Systems GmbH (Germany) . . . . [8326-70]

Technological merit, process complexity, and cost analysis of self-aligned multiple patterning, Yijian Chen, Peking Univ. (China) . . . . [8326-71]

The near-field characteristics of the focused-field embedded in a superresolution layer applied to lithography, Alberto da Costa Assafrao, Silvania F. Pereira, H. Paul Urbach, Technische Univ. Delft (Netherlands) . . . . [8326-72]

Quantum mechanics in optoelectronic efficient material, Subhamoy Singha Roy, JIS College of Engineering (India). . . . . [8326-73]

Impact of non-uniform polarized illumination on hyper-NA lithography, Xuejia Guo, Yanqiu Li, Beijing Institute of Technology (China) . . . [8326-74]

Three-dimensional polarization aberration in hyper-numerical aperture lithography optics, Jingmin Wang, Yanqiu Li, Beijing Institute of Technology (China) . . . . [8326-75]

Overlay performance optimization based on the auto grid correction system, Gang Sun, Jian Zhu, Shuxin Li, Fanglin Mao, Lifeng Duan, Shanghai Micro Electronics Equipment Co., Ltd. (China) . . . . [8326-76]

A hybrid model/pattern-based OPC approach for improved consistency and TAT, Tamer S. Desouky, Mentor Graphics Egypt (Egypt). [8326-77]

High-hydrophobic topcoat approach for high-volume production and yield enhancement of immersion lithography, Natsuko Sagawa, Katsushi Nakano, Yuuki Ishii, Nikon Corp. (Japan); Kazunori Kusabiraki, Motoyuki Shima, JSR Corp. (Japan). . . . . [8326-78]

A computation of partially coherent imaging illuminated by a polarized source via the stack pupil shift matrix approach, Yu Chen, Yong Liu, Wuxi Nanotech Inc. (China). . . . . [8326-79]

In-situ measurement of lens aberrations in lithographic tools using CTC-based quadratic aberration model, Xiaofei Wu, Shiyuan Liu, Shuang Xu, Xinjiang Zhou, Wei Liu, Huazhong Univ. of Science and Technology (China). . . . . [8326-80]

Robust resolution enhancement optimization methods to process variations based on vector imaging model, Xu Ma, Yanqiu Li, Xuejia Guo, Lisong Dong, Beijing Institute of Technology (China) . . . . [8326-81]

Gradient-based resolution enhancement optimization methods based on vector imaging model, Xu Ma, Yanqiu Li, Lisong Dong, Beijing Institute of Technology (China) . . . . [8326-82]

Consideration for application of NTD from OPC and simulation perspective, Mihye Kim, James J. Moon, Byoung-Sub Nam, Donggyu Yim, Sung-Ki Park, Hynix Semiconductor Inc. (Korea, Republic of) . . . . [8326-83]

Predictable turn-around time for post tape-out flow, Pradiptya Ghosh, Toshikazu Endo, Minyoung Park, Steffen Schulze, Mentor Graphics Corp. (United States). . . . . [8326-85]

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Optimal modeling for model-based OPC using genetic algorithms, Jaeyoon Jeong, Sejin Park, Suk Joo Lee, Sungwoo Lee, SAMSUNG Electronics Co., Ltd. (Korea, Republic of) . . . . [8326-87]

A full-chip NILS aware OPC solution, Xiaohai Li, Yang Ping, Robert Lugg, Synopsys, Inc. (United States) . . . . [8326-88]

Lithographic tool dynamic coordinate calibration for CDU improvement, Zhiyong Yang, Fanglin Mao, Anatoly Y. Bourov, Jianrui Cheng, Le He, Shanghai Micro Electronics Equipment Co., Ltd. (China) . . . . [8326-90]

RET and DFM techniques for sub-30 nm, Emek Yesilada, Jean Noel Pena, Alexandre Villaret, Christian Gardin, Vincent Farys, Charlotte Beylier, STMicroelectronics (France); Jorge Entradas, Mentor Graphics (Ireland) Ltd. (France); Frederic Robert, STMicroelectronics (France); Sergey Postnikov, Ana Maria Armeanu, Clement Moyroud, Fahd Chaoui, Olivier Toublan, Mentor Graphics (Ireland) Ltd. (France). . . . . [8326-91]

Resist model validity regarding source variation in SMO, Clovis Alleaume, Emek Yesilada, Vincent Farys, STMicroelectronics (France). . . . . . [8326-93]

Studies of the source and mask optimization for 20nm node in the active layer, Chih-I Wei, United Microelectronics Corp. (Taiwan) . . . . [8326-94]

Influence of SRAF size on main feature CD variation on advanced node, Wei-Cyuan Lo, Yi Chou Chen, Yung Feng Cheng, Ming Jui Chen, United Microelectronics Corp. (Taiwan) . . [8326-95]

Complementary polarity exposures for cost-effective line-cutting in multiple patterning lithography, Frederick T. Chen, Wei-Su G. Chen, Ming-Jinn Tsai, Tzu-Kun Ku, Industrial Technology Research Institute (Taiwan) . . . . [8326-96]

Rigorous Maxwell solver for real-time optical metrology, Jan Pomplun, JCMwave GmbH (Germany); Sven Burger, Konrad-Zuse-Zentrum für Informationstechnik Berlin (Germany) and JCMwave GmbH (Germany); Lin Zschiedrich, JCMwave GmbH (Germany); Frank Schmidt, Konrad-Zuse-Zentrum für Informationstechnik Berlin (Germany) and JCMwave GmbH (Germany) . . . . [8326-97]

Determination of dynamic perturbations in optical systems from wavefront data based on opto-mechanical simulations, Holger Gilbergs, Nicolai Wengert, Karsten Frenner, Peter Eberhard, Wolfgang M. Osten, Univ. Stuttgart (Germany) . . . . [8326-98]

Enhancing lithography process control through advanced, on-board beam parameter metrology for wafer level monitoring of light source parameters, Jin-Phil Choi, SAMSUNG Electronics Co., Ltd. (Korea, Republic of); Joshua Thornes, Yookeun Won, Slava Rokitski, Bernd Burfeindt, Cymer, Inc. (United States) . . . . [8326-99]

Lithography target optimization with source-mask optimization, Yunfei Deng, GLOBALFOUNDRIES Inc. (United States); Tamer H. Coskun, Vishnu Kamat, Cadence Design Systems, Inc. (United States); Jongwook Kye, Harry J. Levinson, GLOBALFOUNDRIES Inc. (United States) . . . . [8326-100]

Weighting evaluation for a hybrid OPC modeling by using advanced SEM-contours from wafer and mask, Daisuke Hibino, Hiroyuki Shindo, Yutaka Hojyo, Hitachi High-Technologies Corp. (Japan); Thuy Do, Ir Kusunadi, John L. Sturtevant, Mentor Graphics Corp. (United States) . . . . [8326-101]

Full-chip correction of implant layer accounting for underlying topography, Minchul Oh, Hyungjoo Youn, No-Young Chung, Jaeyeol Maeng, Suk Joo Lee, SAMSUNG Electronics Co., Ltd. (Korea, Republic of); Aasutosh Dave, John L. Sturtevant, Uwe Hollerbach, Thuy Do, Yuri Granik, Kostas Adam, Juhwan Kim, Cynthia Zhu, Sun-Wook Jung, Mentor Graphics Corp. (United States). . [8326-103]

Pattern collapse improvement in LDD, S/D implant photo process, Eunsoo Jeong, Seonghun Jeong, Youngrok Kim, Myungsoo Kim, Manjae Park, Taek-Seung Yang, Dongbu HiTek Co., Ltd. (Korea, Republic of) . . . . [8326-104]

Symmetric polarization aberration compensation method based on scalar aberration control for lithographic projection lens, Yuanying Tu, Xiangzhao Wang, Lifeng Duan, Peng Bu, Shanghai Institute of Optics and Fine Mechanics (China) . . . . [8326-105]

Influence of sub-resolution assist feature size on main feature linewidth variation on 28nm node, Yi Chou Chen, Yung Feng Cheng, United Microelectronics Corp. (Taiwan) . . . . [8326-106]

Computing exact Fourier series coefficients of IC rectilinear polygons from low-resolution fast Fourier coefficients, Paul Hurley, Robin Scheibler, IBM Zürich Research Lab. (Switzerland) . [8326-107]

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Design for Manufacturability through Design-Process Integration VI

Framework for identifying recommended rules and DFM scoring model to improve manufacturability of sub-20nm layout design, Piyush Pathak, Sriram Madhavan, Shobhit Malik, Lynn T. Wang, Luigi Capodieci, GLOBALFOUNDRIES Inc. (United States) [8327-29]

Self-aligned double-patterning layout principle, Chikaaki Kodama, Koichi Nakayama, Toshiya Kotani, Toshiba Microelectronics Corp. (Japan); Shigeki Nojima, Shoji Mimotogi, Toshiba Materials Co., Ltd. (Japan); Shinji Miyamoto, Toshiba Microelectronics Corp. (Japan) . . . . [8327-30]

In-design hierarchical DFM closure for DFM-clean IP, Vikas Tripathi, Freescale Semiconductor India Pvt. Ltd. (India); Jayathi Subramanian, Puneet Sharma, Freescale Semiconductor, Inc. (United States); Kuang-Han Chen, Bala Kasthuri, Philippe Hurat, Larry Layton, Cadence Design Systems, Inc. (United States). . . . . [8327-31]

Automated yield enhancements implementation on full 28nm chip: challenges and statistics, Shobhit Malik, Sriram Madhavan, Piyush Pathak, Luigi Capodieci, GLOBALFOUNDRIES Inc. (United States); Ahmad A. Omara, Mentor Graphics Egypt (Egypt); Rami Fathy, Mentor Graphics Corp. (United States) . . . . [8327-32]

A study of pattern variability for device performance, TaeHeon Kim, Dae-Han Han, Ae-Ran Hong, Yong-Hyeon Kim, Yun-Hye Chu, Kweon-Jae Lee, Yong-Jik Park, SAMSUNG Electronics Co., Ltd. (Korea, Republic of) . . . . [8327-33]

Intracell process variability: from self-aligned multiple patterning to multiple-gate MOSFETs, Yijian Chen, Qi Cheng, Wailing Kang, Peking Univ. (China) . . . . [8327-34]

Consideration of correlativity between litho and etching shape, Ryoichi Matsuoka, Hitachi High-Technologies Corp. (Japan) . . . . [8327-35]

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Advanced techniques for design assembly and characterization for the 14nm node with LFD using a black box API, Juliann Opitz, J. Andres Torres, Mentor Graphics Corp. (United States); Ioana C. Graur, IBM Corp. (United States); Wael El Manhawy, Suniti M. Kanodia, Mentor Graphics Corp. (United States); Sarah Mohamed, Mentor Graphics Egypt (Egypt); Ahmed Hassan, Mentor Graphics Corp. (Egypt) . . . . [8327-36]

CMP effect due to perimeter: a perimeter drive dummy fill optimization approach, Jinwoo Lee, Naya Ha, Ja Eung Koo, Boumyoung Park, Ju-Hyun Kim, SAMSUNG Electronics Co., Ltd. (Korea, Republic of); Kuang-Han Chen, Tamba Gbondo-Tugbawa, Aaron Gower-Hall, Brian Lee, Philippe Hurat, Cadence Design Systems, Inc. (United States) . . . . [8327-37]

Lithography hotspot detection and classification through FEM and pattern matching, Wang Liang, Qingwei Liu, Xuelong Shi, Yiming Gu, Zexi Deng, Li-Fu Chang, Semiconductor Manufacturing International Corp. (China); Guojie Cheng, Gary Zhang, Anchor Semiconductor, Inc. (China); Bo Su, Anchor Semiconductor, Inc. (United States) . . . . [8327-38]

Fast optical proximity correction with timing optimization ready standard cells, Yifan Qu, Chun Huat Heng, Arthur Tay, Tong Heng Lee, National Univ. of Singapore (Singapore) . . . . [8327-39]

Electrical design for manufacturability and layout-dependent variability hotspot detection flows at 28 nm and 20 nm, Philippe Hurat, Cadence Design Systems, Inc. (United States); Jianhao Zhu, Edward Teoh, GLOBALFOUNDRIES Singapore (Singapore). . . . . [8327-40]

Yield impacting systematic defects search and management, Jay Ning, Jing Zhang, Qing-Xiu Xu, Xing Zhao, Xin Zhang, Semiconductor Manufacturing International Corp. (China); Guojie Cheng, Shijie Chen, Gary Zhang, Anchor Semiconductor, Inc. (China); Abhishek Vikram, Bo Su, Anchor Semiconductor, Inc. (United States) . . . . [8327-41]

Model-based searching method to find the integrated critical failure on the wafer, Bong-Soo Kang, No-Young Chung, Suk Joo Lee, SAMSUNG Electronics Co., Ltd. (Korea, Republic of) . [8327-43]

A scoring methodology for quantitatively evaluating the quality of double-patterning technology compliant layouts, Lynn T. Wang, Sriram Madhavan, Shobhit Malik, Piyush Pathak, Luigi Capodieci, GLOBALFOUNDRIES Inc. (United States) . . . . [8327-44]

Optimization of standard cell-based placement for self-aligned double-patterning process, Hongbo Zhang, Yuelin Du, Martin D. F. Wong, Univ. of Illinois at Urbana-Champaign (United States); Rasit O. Topaloglu, GLOBALFOUNDRIES Inc. (United States). . . . . [8327-45]

Design-based methodology for defect prioritization, Laurent Karsenti, James R. Kramer, Magma Design Automation, Inc. (United States) . . . . [8327-46]

Conference 8322

Extreme Ultraviolet (EUV) Lithography III

SESSION 11

Room: Conv. Ctr. Ballroom A2 . . Thurs. 8:00 to 10:00 am

Invited Session II

Session Chairs: **Katsuhiko Murakami,** Nikon Corp. (Japan); **Fred Bijkerk,** FOM-Institute for Plasma Physics Rijnhuizen (Netherlands)

8:00 am: **From performance validation to volume introduction of ASML's NXE platform** *(Invited Paper)*, Hans Meiling, ASML Netherlands B.V. (Netherlands) and Carl Zeiss SMT AG (Germany); Wim P. de Boeij, Frank Bornebroek, Jo M. Finders, Noreen Harned, Rudy Peeters, Eelco van Setten, Stuart Young, Judon Stoeldraijer, Christian Wagner, Ron Kool, Henk Meijer, ASML Netherlands B.V. (Netherlands); Peter Kurz, Martin Lowisch, Carl Zeiss SMT GmbH (Germany) . . . . [8322-51]

8:30 am: **Status of the laser-assisted discharge produced plasma (LDP) technology** *(Invited Paper)*, Marc Corthout, Jeroen Jonkers, Rolf Apetz, XTREME technologies GmbH (Germany); Olivier R. N. Semprez, XTREME technologies GmbH (Germany) and Ushio Inc. (Japan); Masaki Yoshioka, Yusuke Teramoto, XTREME technologies GmbH (Germany); Takahiro Shirai, Kunihiko Kasama, Tatsushi Igarashi, Ushio Inc. (Japan). . . . . [8322-52]

9:00 am: **Laser-produced plasma EUV sources for device development and HVM** *(Invited Paper)*, David C. Brandt, Igor V. Fomenkov, Alex I. Ershov, David W. Myers, Daniel J. Brown, Bruno M. La Fontaine, Michael J. Lercel, Alexander N. Bykanov, Norbert R. Bowering, Cymer, Inc. (United States) . . . . [8322-53]

9:30 am: **EUV resist performance: current assessment for sub-20nm imaging on NXE: 3300** *(Invited Paper)*, Thomas I. Wallow, Deniz Civay, GLOBALFOUNDRIES Inc. (United States); Suping Wang, Rik Hoefnagels, Coen Verspaget, Gazi Tanriseven, ASML Netherlands B.V. (Netherlands); Anita Fumar-Pici, Steve Hansen, ASML US, Inc. (United States); Raymond Maas, ASML Netherlands B.V. (Netherlands); Youri van Dommelen, ASML US, Inc. (United States); Joerg Mallman, ASML Netherlands B.V. (Netherlands) . . . . [8322-54]

Coffee Break . . . . 10:00 to 10:30 am

Conference 8323

Alternative Lithographic Technologies IV

SESSION 10

Room: Conv. Ctr. Ballroom A3 . . Thurs. 8:00 to 10:10 am

Imprint III: Templates, Masks, and Molds

Session Chairs: **Wei Wu,** Hewlett-Packard Labs. (United States); **James Alexander Liddle,** National Institute of Standards and Technology (United States)

8:00 am: **Paradigm shift in nanoimprint lithography** *(Invited Paper)*, Naoya Hayashi, Dai Nippon Printing Co., Ltd. (Japan). . . . . [8323-41]

8:30 am: **Cleaning-induced imprint template erosion**, Zhaoning Yu, Nobuo Kurataka, Gene G. Gauzner, Seagate Technology LLC (United States); SherJang Singh, SUSS MicroTec Inc. (United States); Peter Dress, Tobias Wähler, HamaTech APE GmbH & Co. KG (Germany); Hongying Wang, Henry H. Yang, Yautzong E. Hsu, Kim Y. Lee, David S. Kuo, Seagate Technology LLC (United States) . . . . [8323-42]

8:50 am: **Nanoimprint template replication from directed self-assembled block copolymer patterns for bit patterned media at 1Tdot/in²**, He Gao, Jeffery Lille, Ricardo Ruiz, Lei Wan, Gabriel Zeltzer, Kanaiyalal C. Patel, Tsai-Wei Wu, Thomas R. Albrecht, Hitachi Global Storage Technologies, Inc. (United States) [8323-43]

9:10 am: **Fabrication of templates with rectangular bits on circular tracks by combining directed block copolymer self-assembly and nanoimprint lithography**, Lei Wan, Ricardo Ruiz, Gabriel Zeltzer, Elizabeth A. Dobisz, Kanaiyalal C. Patel, He Gao, Jeffery Lille, Hitachi Global Storage Technologies, Inc. (United States); Paul F. Nealey, Univ. of Wisconsin-Madison (United States); Thomas R. Albrecht, Hitachi Global Storage Technologies, Inc. (United States). . . . . [8323-44]

9:30 am: **Nanoimprint templates of 6nm half-pitch lines fabricated by helium ion-beam lithography**, Wen-Di Li, Wei Wu, R. Stanley Williams, Hewlett-Packard Labs. (United States)[8323-45]

9:50 am: **Deformations of soft imprint templates in the nanoimprint lithography**, Jian He, GeSiM Gesellschaft fuer Silizium-Mikrosysteme mbH (Germany); Karola Richter, Technische Univ. Dresden (Germany); Steffen Howitz, GeSiM Gesellschaft fuer Silizium-Mikrosysteme mbH (Germany); Sebastian Killge, Johann W. Bartha, Technische Univ. Dresden (Germany) . . . . [8323-46]

Coffee Break . . . . 10:10 to 10:30 am

Conference 8324

Metrology, Inspection, and Process Control for Microlithography XXVI

SESSION 12

Room: Conv. Ctr. Ballroom J2 . . Thurs. 8:00 to 10:00 am

Overlay

Session Chairs: **Chih-Ming Ke,** Taiwan Semiconductor Manufacturing Co. Ltd. (Taiwan); **Vladimir A. Ukraintsev,** Nanometrology International, Inc. (United States)

8:00 am: **Overlay accuracy fundamentals**, Daniel Kandel, Vladimir B. Levinski, Noam Sapiens, Guy Cohen, Eran Amit, Dana Klein, Irina Vakshtein, KLA-Tencor Israel (Israel). . . . . [8324-41]

8:20 am: **Size matters in overlay measurement**, Nigel P. Smith, Brennan L. Peterson, Gary Goelzer, Nanometrics Inc. (United States) . . . . [8324-42]

8:40 am: **Feasibility study of matched machine overlay enhancement toward next-generation device development**, Jeongjin Lee, Seung Yoon Lee, Chan Hwang, SAMSUNG Electronics Co., Ltd. (Korea, Republic of) . . . . [8324-43]

9:00 am: **Evaluation of a novel ultrasmall target technology supporting on-product overlay measurements**, Jacky Huang, Chih-Ming Ke, Guo-Tsai Huang, Kai-Hsiung Chen, Taiwan Semiconductor Manufacturing Co. Ltd. (Taiwan); Henk-Jan Smilde, Arie den Boef, Michael Kubis, Martin J. Jak, Mark van Schijndel, Andreas Fuchs, Maurits van der Schaar, ASML Netherlands B.V. (Netherlands); Steffen Meyer, ASML Taiwan Ltd. (Taiwan); Stephen Morgan, ASML Netherlands B.V. (Netherlands); Jon Wu, Vincent Tsai, Cathy Wang, ASML Taiwan Ltd. (Taiwan); Kaustuve Bhattacharyya, ASML Netherlands B.V. (Netherlands) . . . [8324-44]

9:20 am: **Application of DBM system to overlay and wiggling quantification in advanced process**, Taehyeong Lee, Jungchan Kim, Gyun Yoo, Areum Jung, Hyunjo Yang, Donggyu Yim, Sung-Ki Park, Hynix Semiconductor Inc. (Korea, Republic of) . . . . [8324-45]

9:40 am: **Quality indicators of image-based overlay**, Yen-Liang Chen, Jacky Huang, Rita Lee, Chen-Ming Wang, Chih-Ming Ke, Tsai-Sheng Gau, Taiwan Semiconductor Manufacturing Co. Ltd. (Taiwan) . . . . [8324-46]

Coffee Break . . . . 10:00 to 10:30 am

Conference 8326

Optical Microlithography XXV

SESSION 10

Room: Conv. Ctr. Ballroom B4 . . . . Thurs. 8:00 to 10:00 am

Optical/DFM: Joint Session with Conference 8327

Session Chairs: **Will Conley,** Freescale Semiconductor, Inc. (United States); **Mark E. Mason,** Texas Instruments Inc. (United States)

8:00 am: **Sub-20nm logic lithography optimization with simple OPC and multiple pitch division**, Michael C. Smayling, Tela Innovations, Inc. (United States); Valery Axelrad, Sequoia Design Systems, Inc. (United States); Koichiro Tsujita, Canon Inc. (Japan); Hidetami Yaegashi, Tokyo Electron AT Ltd. (Japan); Ryo Nakayama, Canon Inc. (Japan); Kenichi Oyama, Tokyo Electron AT Ltd. (Japan); Yuichi Gyoda, Canon Inc. (Japan) . . . . [8326-39]

8:20 am: **Fast source independent estimation of lithographic difficulty supporting large scale source optimization**, David L. DeMaris, IBM Austin Research Lab. (United States); Maria Gabrani, Sankha Sarkar, Nathalie Casati, Ronald Luijten, IBM Zürich Research Lab. (Switzerland); Kafai Lai, Kehan Tian, IBM Corp. (United States). . . . . [8326-40]

8:40 am: **Generator of predictive verification pattern using vision system based on higher-order local autocorrelation**, Tetsuaki Matsunawa, Shimon Maeda, Toshiba Materials Co., Ltd. (Japan); Hirotaka Ichikawa, Toshiba Microelectronics Corp. (Japan); Shigeki Nojima, Toshiba Corp. (Japan); Satoshi Tanaka, Toshiba Materials Co., Ltd. (Japan); Shoji Mimotogi, Toshiba Corp. (Japan); Hirokazu Nosato, Hidenori Sakanashi, Masahiro Murakawa, Eiichi Takahashi, National Institute of Advanced Industrial Science and Technology (Japan) . . . . [8326-41]

9:00 am: **Demonstration of an effective flexible mask optimization (FMO) flow**, Franck Foussadier, Vincent Farys, Emek Yesilada, STMicroelectronics (France); Nicolas Martin, Stanislas Baron, Russell Dover, Hua-Yu Liu, Brion Technologies, Inc. (United States) . . . [8326-42]

9:20 am: **Full-field lithographical verification using scanner and mask intrafield fingerprint**, Jonathan Planchot, Jr., STMicroelectronics (France); Laurent Depre, Brion Technologies, Inc. (United States); Emek Yesilada, Frank Sundermann, STMicroelectronics (France); Frank Chen, Hua-Yu Liu, Lynn Cai, Brion Technologies, Inc. (United States) [8326-43]

9:40 am: **Pattern selection in high-dimensional parameter spaces,** Georg A. Viehoever, Hans-Jürgen Stock, Synopsys GmbH (Germany). . . . . [8326-44]

Coffee Break . . . . 10:00 to 10:30 am

Conference 8327

Design for Manufacturability through Design-Process Integration VI

SESSION 5

Room: Conv. Ctr. Ballroom B4 . . Thurs. 8:00 to 10:00 am

Note room change for Sessions 5 and 6

Optical/DFM: Joint Session with Conference 8326

Session Chairs: **Mark E. Mason,** Texas Instruments Inc. (United States); **Will Conley,** Freescale Semiconductor, Inc. (United States)

8:00 am: **Sub-20nm logic lithography optimization with simple OPC and multiple pitch division**, Michael C. Smayling, Tela Innovations, Inc. (United States); Valery Axelrad, Sequoia Design Systems, Inc. (United States); Koichiro Tsujita, Canon Inc. (Japan); Hidetami Yaegashi, Tokyo Electron AT Ltd. (Japan); Ryo Nakayama, Canon Inc. (Japan); Kenichi Oyama, Tokyo Electron AT Ltd. (Japan); Yuichi Gyoda, Canon Inc. (Japan). . . . . [8326-39]

8:20 am: **Fast source independent estimation of lithographic difficulty supporting large scale source optimization**, David L. DeMaris, IBM Austin Research Lab. (United States); Maria Gabrani, Sankha Sarkar, Nathalie Casati, Ronald Luijten, IBM Zürich Research Lab. (Switzerland); Kafai Lai, Kehan Tian, IBM Corp. (United States). . . . . [8326-40]

8:40 am: **Generator of predictive verification pattern using vision system based on higher-order local autocorrelation**, Tetsuaki Matsunawa, Shimon Maeda, Toshiba Materials Co., Ltd. (Japan); Hirotaka Ichikawa, Toshiba Microelectronics Corp. (Japan); Shigeki Nojima, Toshiba Corp. (Japan); Satoshi Tanaka, Toshiba Materials Co., Ltd. (Japan); Shoji Mimotogi, Toshiba Corp. (Japan); Hirokazu Nosato, Hidenori Sakanashi, Masahiro Murakawa, Eiichi Takahashi, National Institute of Advanced Industrial Science and Technology (Japan). . . . . [8326-41]

9:00 am: **Demonstration of an effective flexible mask optimization (FMO) flow**, Franck Foussadier, Vincent Farys, Emek Yesilada, STMicroelectronics (France); Nicolas Martin, Stanislas Baron, Russell Dover, Hua-Yu Liu, Brion Technologies, Inc. (United States) . . . . [8326-42]

9:20 am: **Full-field lithographical verification using scanner and mask intrafield fingerprint**, Jonathan Planchot, Jr., STMicroelectronics (France); Laurent Depre, Brion Technologies, Inc. (United States); Emek Yesilada, Frank Sundermann, STMicroelectronics (France); Frank Chen, Hua-Yu Liu, Lynn Cai, Brion Technologies, Inc. (United States) . . . . [8326-43]

9:40 am: **Pattern selection in high-dimensional parameter spaces**, Georg A. Viehoever, Hans-Jürgen Stock, Synopsys GmbH (Germany) . . . . [8326-44]

Coffee Break . . . . 10:00 to 10:30 am

Conference 8322

Extreme Ultraviolet (EUV) Lithography III

SESSION 12

Room: Conv. Ctr. Ballroom A2. . . . . .Thurs. 10:30 am to 12:10 pm

EUV Integration

Session Chairs: **Daniel A. Corliss,** IBM Corp. (United States); **Seong-Sue Kim,** SAMSUNG Electronics Co., Ltd. (Korea, Republic of)

10:30 am: **Model calibration and full-mask process and proximity correction for extreme-ultraviolet lithography**, Hsu-Ting Huang, Cadence Design Systems, Inc. (United States); Huixiong Dai, Applied Materials, Inc. (United States); Ali Mokhberi, Cadence Design Systems, Inc. (United States); Christopher S. Ngai, Applied Materials, Inc. (United States); Anwei Liu, Cadence Design Systems, Inc. (United States) . . . . [8322-55]

10:50 am: **Model calibration and validation for pre-production EUVL**, Gian F. Lorusso, Eric Hendrickx, IMEC (Belgium); Jiong Jiang, Brion Technologies, Inc. (United States); David Rio, Brion Technologies, Inc. (Belgium); Wei Liu, Hua-Yu Liu, Brion Technologies, Inc. (United States). . . . . [8322-56]

11:10 am: **EUV OPC for the 20nm node and beyond**, Chris H. Clifford, Yi Zou, Ralph E. Schlief, Azat M. Latypov, Oleg Kritsun, Thomas I. Wallow, Harry J. Levinson, Lei Sun, Obert R. Wood II, Sudharshanan Raghunathan, Pawitter J. Mangat, Hui Peng Koh, Jeffrey A. Schefske, GLOBALFOUNDRIES Inc. (United States) . . . . [8322-57]

11:30 am: **Development of practical flare correction tool for full chip in EUV lithography**, Taiga Uno, Hiromitsu Mashita, Masahiro Miyairi, Toshiya Kotani, Toshiba Materials Co., Ltd. (Japan)[8322-58]

11:50 am: **Study on CD variation in the vicinity of the exposure field edge in EUV lithography**, Seokkyun Kim, Sunyoung Koo, Jun-Taek Park, Geunhak Kim, Yoonsuk Hyun, Chang-Moon Lim, Donggyu Yim, Sung-Ki Park, Hynix Semiconductor Inc. (Korea, Republic of) . . . . [8322-59]

Confernece End.

Conference 8323

Alternative Lithographic Technologies IV

SESSION 11

Room: Conv. Ctr. Ballroom A3. . . . . .Thurs. 10:30 am to 12:20 pm

Frontier Lithographic Techniques and Applications

Session Chairs: **Daniel J. C. Herr,** Semiconductor Research Corp. (United States); **Hans Loeschner,** IMS Nanofabrication AG (Austria)

10:30 am: **Airbrushing, ink jet printing, replica molding, and microcontact printing of chitin nanofibers with a "chitin nanofiber ink"** *(Invited Paper)*, Marco Rolandi, Univ. of Washington (United States). . . . . [8323-47]

11:00 am: **Zone plate focused soft x-ray lithography for fabrication of nanofluidic devices**, Adam F. G. Leontowich, Adam P. Hitchcock, McMaster Univ. (Canada) . . . . [8323-48]

11:20 am: **New lithographically patterned templates for positioning DNA nanostructures**, Gregory M. Wallraff, IBM Almaden Research Ctr. (United States); Rossella Giradi, Politecnico di Torino (Italy); Sally A. Swanson, Blake Davis, Charles T. Rettner, Kumar Virwani, Luisa D. Bozano, Rohit Shenoy, Krystal Clarke, IBM Almaden Research Ctr. (United States); E. Mele, Politecnico di Torino (Italy); Paul W. K. Rothemund, California Institute of Technology (United States). . . . . [8323-49]

11:40 am: **Alignment method in plasmonic lithography with a contact optical scanning probe at resonant condition**, Seonghyeon Oh, Taekyeong Lee, Jae W. Hahn, Yonsei Univ. (Korea, Republic of) . . . . [8323-50]

12:00 pm: **Progress in scanning proximal probe nanolithography on calixarene**, Marcus Kaestner, Ivo W. Rangelow, Ilmenau Univ. of Technology (Germany) . . . . [8323-51]

Lunch Break . . . . 12:20 to 1:30 pm

Conference 8324

Metrology, Inspection, and Process Control for Microlithography XXVI

SESSION 13

Room: Conv. Ctr. Ballroom J2 . . . . Thurs. 10:30 to 11:50 am

SEM

Session Chairs: **Ofer Adan,** Applied Materials (Israel); **Byoung-Ho Lee,** SAMSUNG Electronics Co., Ltd. (Korea, Republic of)

10:30 am: **Scanning electron-microscope image processing for accurate analysis of line-edge and line-width roughness**, Atsushi Hiraiwa, Waseda Univ. (Japan) . . . . [8324-47]

10:50 am: **Static and dynamic photoresist shrinkage effects in EUV photoresists**, Benjamin D. Bunday, International SEMATECH Manufacturing Initiative (United States) . . . . [8324-48]

11:10 am: **SEM metrology on bit patterned media nanoimprint template: issues and improvements**, Justin J. Hwu, Seagate Technology LLC (United States) . . . . [8324-49]

11:30 am: **Methodology for establishing CD-SEM robust metrology algorithm for development cycles applications**, Keiichiro Hitomi, Hitachi America, Ltd. (United States); Erin Mclellan, IBM Corp. (United States); Shoji Hotta, Hitachi America, Ltd. (United States); Yoshinori Momonoi, Atsuko Yamaguchi, Hitachi, Ltd. (Japan); Katsuhiro Sasada, Tatsuya Maeda, Hitachi High-Technologies Corp. (Japan) . . . . [8324-50]

Lunch Break . . . . 11:50 am to 1:20 pm

Conference 8326

Optical Microlithography XXV

SESSION 11

Room: Conv. Ctr. Ballroom B4. . . . . .Thurs. 10:30 am to 12:10 pm

Joint Session with Conference 8327

Session Chairs: **John L. Sturtevant,** Mentor Graphics Corp. (United States); **Kafai Lai,** IBM Corp. (United States)

10:30 am: **Design and manufacturability tradeoffs in unidirectional and bidirectional standard cell images in 14nm**, Kaushik Vaidyanathan, Daniel Morris, Carnegie Mellon Univ. (United States); Neal V. Lafferty, Lars W. Liebmann, IBM Corp. (United States); Siew Hoon, Wenbin Huang, Mitchell Bender, Carnegie Mellon Univ. (United States); Kafai Lai, IBM Corp. (United States); Larry Pileggi, Andrzej J. Strojwas, Carnegie Mellon Univ. (United States) . . . . [8327-19]

10:50 am: **Design rule driven source mask co-optimization methodology for sub-20nm logic and SRAM**, Dongsoo Kang, SAMSUNG Electronics Co., Ltd. (Korea, Republic of) . . . [8327-20]

11:10 am: **A novel methodology for triple/multiple-patterning layout decomposition**, Rani S. Ghaida, Univ. of California, Los Angeles (United States); Kanak B. Agarwal, IBM Austin Research Lab. (United States); Lars W. Liebmann, IBM Corp. (United States); Sani R. Nassif, IBM Austin Research Lab. (United States); Puneet Gupta, Univ. of California, Los Angeles (United States) . . [8327-21]

11:30 am: **Overlay, decomposition, and synthesis methodology of hybrid self-aligned triple and negative tone double-patterning**, Yijian Chen, Peking Univ. Shenzhen Graduate School (China) . . . . [8327-22]

11:50 am: **Computational lithography work flows and design rule exploration automation**, Sethi S. Satyendra, William A. Stanton, Jay A. Hiserote, Kevin Lucas, Synopsys, Inc. (United States). [8327-23]

Lunch Break . . . . 12:10 to 1:10 pm

Conference 8327

Design for Manufacturability through Design-Process Integration VI

SESSION 6

Room: Conv. Ctr. Ballroom B4. . . . . .Thurs. 10:30 am to 12:10 pm

Joint Session with Conference 8326

Session Chairs: **John L. Sturtevant,** Mentor Graphics Corp. (United States); **Kafai Lai,** IBM Corp. (United States)

10:30 am: **Design and manufacturability tradeoffs in unidirectional and bidirectional standard cell images in 14nm**, Kaushik Vaidyanathan, Daniel Morris, Carnegie Mellon Univ. (United States); Neal V. Lafferty, Lars W. Liebmann, IBM Corp. (United States); Siew Hoon, Wenbin Huang, Mitchell Bender, Carnegie Mellon Univ. (United States); Kafai Lai, IBM Corp. (United States); Larry Pileggi, Andrzej J. Strojwas, Carnegie Mellon Univ. (United States) . . . . [8327-19]

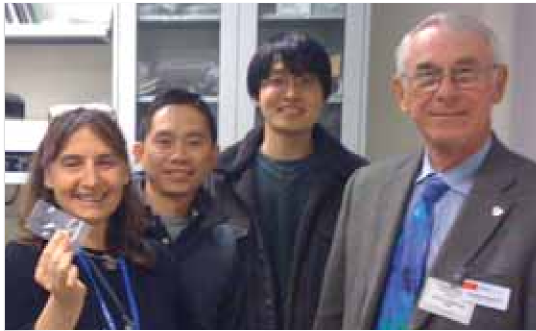
10:50 am: **Design rule driven source mask co-optimization methodology for sub-20nm logic and SRAM**, Dongsoo Kang, SAMSUNG Electronics Co., Ltd. (Korea, Republic of) . . . [8327-20]

11:10 am: **A novel methodology for triple/multiple-patterning layout decomposition**, Rani S. Ghaida, Univ. of California, Los Angeles (United States); Kanak B. Agarwal, IBM Austin Research Lab. (United States); Lars W. Liebmann, IBM Corp. (United States); Sani R. Nassif, IBM Austin Research Lab. (United States); Puneet Gupta, Univ. of California, Los Angeles (United States) . . [8327-21]

11:30 am: **Overlay, decomposition, and synthesis methodology of hybrid self-aligned triple and negative tone double-patterning**, Yijian Chen, Peking Univ. Shenzhen Graduate School (China) . . . . [8327-22]

11:50 am: **Computational lithography work flows and design rule exploration automation**, Sethi S. Satyendra, William A. Stanton, Jay A. Hiserote, Kevin Lucas, Synopsys, Inc. (United States). [8327-23]

Lunch Break . . . . 12:10 to 1:40 pm



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Conference 8323

Alternative Lithographic Technologies IV

SESSION 12

Room: Conv. Ctr. Ballroom A3 . . . Thurs. 1:30 to 3:20 pm

Imprint IV: R2R Imprint Lithography and Applications

Session Chairs: **John G. Maltabes,** Hewlett-Packard Labs. (United States); **Ivo W. Rangelow,** Technische Univ. Ilmenau (Germany)

1:30 pm: **Roll-to-roll manufacturing of electronic devices** *(Invited Paper)*, Neil A. Morrison, Applied Materials GmbH (Germany) . . . . [8323-52]

2:00 pm: **Continuous large area nanoscale patterning using cylindrical phase masks**, Boris Kobrin, Edward S. Barnard, Rolith, Inc. (United States); Moon-Kyu Kwak, Jong G. Ok, L. Jay Guo, Univ. of Michigan (United States). . . . . [8323-53]

2:20 pm: **Sub-100nm pattern formation by roll-to-roll nanoimprint lithography**, Ryoichi Inanami, Tomoko Ojima, Daisuke Kawamura, Akiko Mimotogi, Takuya Kono, Tsukasa Azuma, Tetsuro Nakasugi, Toshiba Corp. (Japan). . . . . [8323-54]

2:40 pm: **Planarization coating for polyimide substrates used in roll-to-roll fabrication of active matrix backplanes for flexible displays**, Marcia Almanza-Workman, Ohseung Kwon, Robert Garcia, Hanjun Kim, Phicot, Inc. (United States); Steve Braymen, Frank Jeffrey, Jason Hauschildt, Kelly Junge, Dan Stieler, Powerfilm, Inc. (United States); Albert Jeans, Edward R. Holland, Richard E. Elder, Warren B. Jackson, Mehrban Jam, Hao Luo, John G. Maltabes, Ping Mei, Mark Smith, Carl Taussig, Hewlett-Packard Labs. (United States); Steve W. Trovinger, Hewlett-Packard Co. (United States) . . . . [8323-55]

3:00 pm: **Roll-to-roll nanopatterning using jet and flash imprint lithography**, Sean Ahn, Mahadevan G. Subramanian, Michael L. Miller, Byung Jin Choi, Douglas J. Resnick, S. V. Sreenivasan, Molecular Imprints, Inc. (United States) . . . . [8323-56]

Coffee Break . . . . 3:20 to 3:40 pm

Conference 8324

Metrology, Inspection, and Process Control for Microlithography XXVI

SESSION 14

Room: Conv. Ctr. Ballroom J2 . . . Thurs. 1:20 to 2:40 pm

Lithography Process Control

Session Chairs: **John A. Allgair,** GLOBALFOUNDRIES Inc. (United States); **Shaunee Y. Cheng,** IMEC (Belgium)

1:20 pm: **Data feed-forward for improved optical CD and film metrology**, John C. Robinson, Ming Di, Qiang Zhao, Zhengquan Tan, Lanny Mihardja, KLA-Tencor Corp. (United States) . [8324-51]

1:40 pm: **Faster diffraction-based overlay measurements with smaller targets using 3D gratings**, Jie Li, Nanometrics Inc. (United States); Oleg Kritsun, GLOBALFOUNDRIES Inc. (United States); Yongdong Liu, Prasad Dasari, Nanometrics Inc. (United States); Catherine Volkman, GLOBALFOUNDRIES Inc. (United States); Jiangtao Hu, Nanometrics Inc. (United States). . . . . [8324-52]

2:00 pm: **Novel prediction methodology in etched hole-patterning failure**, Seiro Miyoshi, Hideaki Abe, Kazuhiro Takahata, Tomoko Ojima, Masanari Kajiwara, Shoji Mimotogi, Kohji Hashimoto, Toshiba Corp. (Japan) . . . . [8324-53]

2:20 pm: **Direct-scatterometry-enabled lithography model calibration**, Chih-Yu Chen, Kuen-Yu Tsai, Yu-Tian Shen, Yen-Min Lee, Jia-Han Li, National Taiwan Univ. (Taiwan); Jason J. Shieh, ASML Taiwan Ltd. (Taiwan). . . . . [8324-54]

Coffee Break . . . . 2:40 to 3:30 pm

Conference 8326

Optical Microlithography XXV

2012 Best Student Paper Award . . . . .1:10 to 1:20 pm

Convention Center Ballroom B4

This award generously sponsored by

SESSION 12

Room: Conv. Ctr. Ballroom B4 . .Thurs. 1:20 to 3:00 pm

OPC

Session Chairs: **Bruce W. Smith,** Rochester Institute of Technology (United States); **Kazuhiro Takahashi,** Canon Inc. (Japan)

1:20 pm: **Multiple-image-depth modeling for hotspot and AF printing detections**, Yu-Po Tang, Chih-Shiang Chou, Wen-Chun Huang, Ru-Gun Liu, Tsai-Sheng Gau, Taiwan Semiconductor Manufacturing Co. Ltd. (Taiwan) . . . . [8326-45]

1:40 pm: **Process optimization through model-based SRAF printing prediction**, Ramya Viswanathan, Jaione Tirapu-Azpiroz, IBM Corp. (United States); Punitha Selvam, IBM Almaden Research Ctr. (United States) . . . . [8326-46]

2:00 pm: **Finite element models of lithographic mask topography**, Jacek K. Tyminski, Raluca F. Popescu, Nikon Precision Inc. (United States); Sven Burger, Lin Zschiedrich, JCMwave GmbH (Germany); Tomoyuki Matsuyama, Tomoya Noda, Nikon Corp. (Japan). . . . . [8326-47]

2:20 pm: **Resist loss in 3D compact modeling**, Xin Zheng, Jensheng H. Huang, Fook Chin, Aram Kazarian, Synopsys, Inc. (United States); Chun-Chieh Kuo, Synopsys Taiwan Ltd. (Taiwan) . . . . [8326-48]

2:40 pm: **Binary modeling method to check the sub-resolution assist features (SRAFs) printability**, Jianliang Li, Synopsys, Inc. (United States); Weimin Gao, Synopsys GmbH (Belgium); Yongfa Fan, Jing Xue, Qiliang Yan, Kevin Lucas, Lawrence S. Melvin III, Synopsys, Inc. (United States) . . . . [8326-49]

Coffee Break . . . . 3:00 to 3:30 pm

Conference 8327

Design for Manufacturability through Design-Process Integration VI

SESSION 7

Room: Conv. Ctr. Ballroom C1 . . Thurs. 1:40 to 3:20 pm

Note room change to C1

Hotspots, CMP, and Fill

Session Chairs: **Chul-Hong Park,** SAMSUNG Electronics Co., Ltd. (Korea, Republic of); **Jason P. Cain,** Advanced Micro Devices, Inc. (United States)

1:40 pm: **Thickness-aware LFD for the hotspot detection induced by topology**, Jae-Hyun Kang, Naya Ha, Joo-Hyun Park, Byung-Moo Kim, Seungweon Paek, Hungbok Choia, Kee Sup Kim, SAMSUNG Electronics Co., Ltd. (Korea, Republic of); Ahmed Mohy, Shady Abdelwahed Elshafie, Mohamed A. Imam, Mentor Graphics Egypt (Egypt) . . . . [8327-24]

2:00 pm: **The complexity of fill at 28nm and beyond**, Bill Graupp, Mentor Graphics Corp. (United States); Norma P. Rodriguez, Jie Yang, Advanced Micro Devices, Inc. (United States); Jeffrey S. Wilson, Eugene Anikin, Mentor Graphics Corp. (United States) . . . . [8327-25]

2:20 pm: **Utilizing chemical-mechanical polishing models in IC design evaluation and mask sign-off flows**, Rasit O. Topaloglu, GLOBALFOUNDRIES Inc. (United States) . . . . [8327-26]

2:40 pm: **In-design process hotspot repair by pattern matching**, Dae-Hyun Jang, Naya Na, Jae-Hyun Kang, Seungweon Paek, Hungbok Choia, Kee Sup Kim, SAMSUNG Electronics Co., Ltd. (Korea, Republic of); Ya-Chieh Lai, Philippe Hurat, Wilbur Luo, Cadence Design Systems, Inc. (United States). . . . . [8327-27]

3:00 pm: **Clean pattern matching for full-chip verification**, Satomi Nakamura, Tetsuaki Matsunawa, Chikaaki Kodama, Takanori Urakami, Nozomu Furuta, Shunsuke Kagaya, Shigeki Nojima, Shinji Miyamoto, Toshiba Materials Co., Ltd. (Japan) . . . . [8327-28]

Conference End.

Conference 8323

Alternative Lithographic Technologies IV

SESSION 13

Room: Conv. Ctr. Ballroom A3 . . . Thurs. 3:40 to 5:10 pm

Directed Self-Assembly IV: Materials for Fine Process Control

Session Chairs: **Ricardo Ruiz,** Hitachi Global Storage Technologies, Inc. (United States); **Elizabeth A. Dobisz,** Hitachi Global Storage Technologies, Inc. (United States)

3:40 pm: **Optimizing materials and processes for directed self-assembly applications** *(Invited Paper)*, Phillip D. Hustad, Jeffrey D. Weinhold, Rahul Sharma, Jessica P. Evans, Valeriy V. Ginzburg, Erin E. Vogel, Daniel J. Murray, John W. Kramer, The Dow Chemical Co. (United States); Vivian P. W. Chuang, Shih-Wei Chang, Peter Trefonas III, Dow Electronic Materials (United States) . . . [8323-57]

4:10 pm: **Directed self-assembly of laterally confined lamellae-forming diblock copolymers: polydispersity and substrate interaction effects**, Hassei Takahashi, Nabil Laachi, Su-Mi Hur, Univ. of California, Santa Barbara (United States); Corey J. Weinheimer, David Shykind, Intel Corp. (United States); Glenn H. Fredrickson, Univ. of California, Santa Barbara (United States) . . . . [8323-58]

4:30 pm: **Directed self-assembly of PS-b-PDLA for patterning of sub-10nm half-pitch structures using EUV resist templates**, Andrew K. Whittaker, Han-Hao E. Cheng, Imelda O. Keen, Anguang Yu, Kevin Jack, The Univ. of Queensland (Australia); Michael J. Leeson, Todd R. Younkin, Intel Corp. (United States); Idriss Blakey, The Univ. of Queensland (Australia) . . . . [8323-59]

Conference End.

Conference 8324

Metrology, Inspection, and Process Control for Microlithography XXVI

SESSION 15

Room: Conv. Ctr. Ballroom J2 . . . Thurs. 3:30 to 5:20 pm

Novel Technologies and Late Breaking News

Session Chairs: **Alexander Starikov,** I&I Consulting (United States); **Matthew J. Sendelbach,** IBM Corp. (United States)

3:30 pm: **Bridging CD metrology gaps of advanced patterning with assistance of nanomolding** *(Invited Paper)*, Narender Rana, IBM Corp. (United States); Dario L. Goldfarb, IBM Thomas J. Watson Research Ctr. (United States) . . . . [8324-55]

4:00 pm: **SEM imaging of ultrahigh aspect ratio trench and hole features**, Benjamin D. Bunday, International SEMATECH Manufacturing Initiative (United States) . . . . [8324-56]

4:20 pm: **Impacts of overlay correction model and metrology sampling scheme on device yield**, Chui-Fu Chiu, Chun-Yen Huang, Nanya Technology Corp. (Taiwan); Jason J. Shieh, Tsann-Bim Chiou, Albert Li, ASML Taiwan Ltd. (Taiwan); Chiang-Lin Shih, Nanya Technology Corp. (Taiwan); Alek C. Chen, ASML Taiwan Ltd. (Taiwan) . . . . [8324-57]

4:40 pm: **Characterization of ultrathin films by laser-induced sub-picosecond photoacoustics with coherent extreme-ultraviolet detection**, Qing Li, Kathleen Hoogeboom-Pot, Damiano Nardi, Univ. of Colorado at Boulder (United States); Chris Deeb, Sean King, Marie K. Tripp, Intel Corp. (United States); Erik H. Anderson, Lawrence Berkeley National Lab. (United States); Margaret M. Murnane, Henry C. Kapteyn, Univ. of Colorado at Boulder (United States) [8324-58]

5:00 pm: **Technology review of silicon imagers-based application study for see-through silicon inspection and metrology**, Wei Zhou, Darcy Hart, Rudolph Technologies, Inc. (United States) . . . . [8324-116]

Conference End.

Conference 8326

Optical Microlithography XXV

SESSION 13

Room: Conv. Ctr. Ballroom B4 . . . Thurs. 3:30 to 5:10 pm

Tools

Session Chairs: **Mircea V. Dusa,** ASML US, Inc. (United States); **Soichi Owa,** Nikon Corp. (Japan)

3:30 pm: **A study of vertical lithography for high-density 3D structures**, Shin-Ichiro Hirai, Nobuyuki Saito, Yoshio Goto, Hiromi Suda, Ken-Ichiro Mori, Seiya Miura, Canon Inc. (Japan) . [8326-50]

3:50 pm: **A reliable higher power ArF laser with advanced functionality for immersion lithography**, Akihiko Kurosu, Masaki Nakano, Masanori Yashiro, Masaya Yoshino, Hiroaki Tsushima, Hiroyuki Masuda, Takahito Kumazaki, Shinichi Matsumoto, Kouji Kakizaki, Takashi Matsunaga, Junichi Fujimoto, Hakaru Mizoguchi, Gigaphoton Inc. (Japan) . . . . [8326-51]

4:10 pm: **Advanced light source technologies that enable high-volume manufacturing of DUV lithography extensions**, Theodore Cacouris, Rajasekhar Rao, Rostislav I. Rokitski, Rui Jiang, John T. Melchior, Bernd Burfeindt, Kevin O'Brien, Cymer, Inc. (United States) . . . . [8326-52]

4:30 pm: **Immersion and dry ArF scanners enabling 22nm HP production and beyond**, Yusaku Uehara, Yuichi Shibazaki, Jun Ishikawa, Hirotaka Kohno, Eiichiro Tanaka, Ohba Masanori, Nikon Corp. (Japan). . . . . [8326-53]

4:50 pm: **Driving imaging and overlay performance to the limits with advanced lithography optimization**, Jan Mulkens, Marcel Beems, Paul C. Hinnen, Hans van der Laan, Jo M. Finders, Michael Kubis, Hugo Cramer, ASML Netherlands B.V. (Netherlands) . . . . [8326-54]

Conference End.

2012 Photomask Technology

10–13 September 2012

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Mask design, production, integration, and next-generation mask technologies

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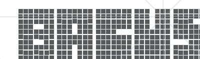
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