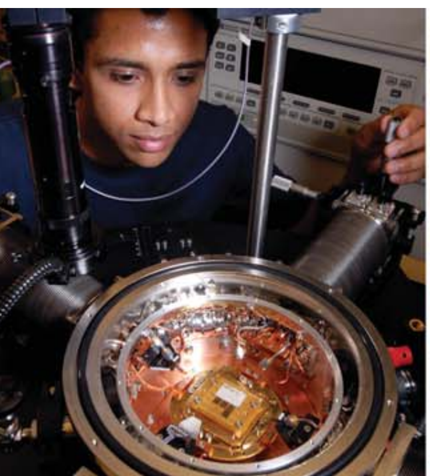
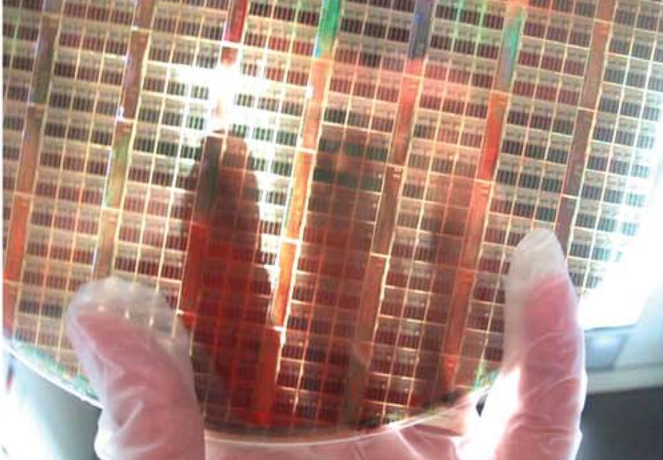
Technical Program

Conferences + Courses: 22-27 February 2009
Exhibition: 24-25 February 2009
San Jose Convention Center
San Jose, California, USA

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Welcome to

SPIE Advanced Lithography

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Semiconductor International Magazine
Small Times
Solid State Technology

Left cover image: courtesy of Georgia Tech, Gary Meek.
Center cover image: courtesy of IBM.

SPIE would like to express its deepest appreciation to the program chairs, conference chairs, cochairs, program committees, and session chairs who have so generously given of 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.

Contents

Invitation 2
Advanced Lithography Sponsors 3
Floorplans 4
Daily Schedule 5
Plenary Presentations 6-7
Special Events 8-9
Course Daily Schedule 10-11
Exhibition Information 12
General Information 13-15
Technical Conference Session Schedule 16-17

Technical Conferences:

Alternative Lithographic Technologies *(Schellenberg)* 18-48
Metrology, Inspection, and Process Control for Microlithography XXIII *(Allgair)* 18-48
Advances in Resist Materials and Processing Technology XXVI *(Henderson)* 19-43
Optical Microlithography XXII *(Levinson)* 19-57
Design for Manufacturability through Design-Process Integration III *(Singh)* . . . 19-57

Authors, Chairs, Committee Members. . . 58-69
Publication Order Form 70
Proceedings Information 72

Welcome

The semiconductor industry continues to be a critical engine for global economic development, and ongoing advancement in IC lithography remains one key enabler for that engine. Despite the importance of lithography, the industry today stands at a crossroad of uncertainty. Lithographic techniques that can be cost-effective and move the IC roadmap forward for another decade or more remain elusive. Moreover, market considerations require the end users of lithography to constantly evolve their business models, R&D, and manufacturing strategies on a global basis. 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 technology progression will demand unprecedented ingenuity, cost efficiency, and communication within the lithography community and across interdisciplinary lines.

For the past 33 years, SPIE Advanced Lithography has played a key role in bringing the lithography community together to solve challenges required by the semiconductor industry. This highly successful symposium delivers the right combination of practical know how and cutting-edge research presented across 5 complementary conferences. Participants from academia to current production engineers are represented 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.

The symposium is organized into five conferences:

* Alternative Lithographic Technologies

* Metrology, Inspection, and Process Control for Microlithography

* Advances in Resist Materials and Processing Technology

* Optical Microlithography

* Design for Manufacturability through Design-Process Integration

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 San Jose, California for SPIE Advanced Lithography's 34th year.

Christopher J. Progler
2009 Symposium Chair

Donis G. Flagello
2009 Symposium Co-chair

Executive Committee

John A. Allgair, SEMATECH, Inc. and Advanced Micro Devices, Inc.

Mircea Dusa, ASML US, Inc.

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Clifford L. Henderson, Georgia Institute of Technology

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Thanks to the following sponsors for their generous support of SPIE Advanced Lithography 2009

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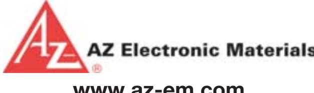

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National Institute for Standards and Technology Panel Discussion

Booth #522 • www.nist.gov

NanoTechnology in Microlithography Technical Group Panel Discussion

Booth #516 • www.molecularimprints.com

Conference and Exhibition Bag Inserts

Booth #117 • www.nanouv.com

Exhibitor Lounge

KLA Tencor

www.kla-tencor.com

Poster Reception

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www.luminescent.com

Booth #716 • www.mentor.com

Plenary

SOKUDO

Photolithography Coat/Develop Track

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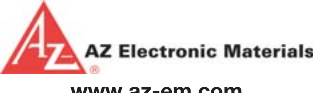
2008 C. Grant Willson Best Paper Announcement (Conf.7273)



www.az-em.com

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Optical Microlithography Best Student Paper Award Announcement (Conf 7274)

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DFM Panel

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General Refreshments

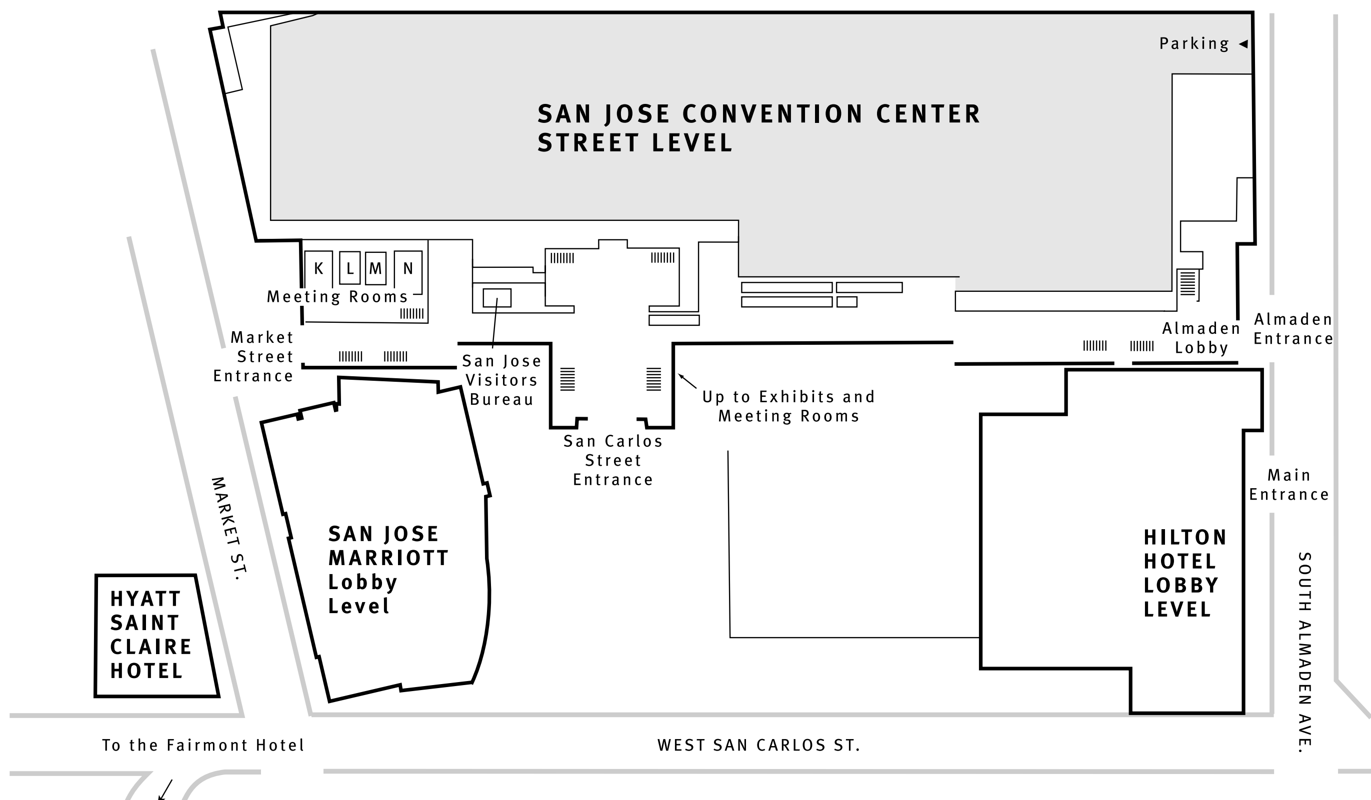
Micro Lithography Inc.
Booth #325

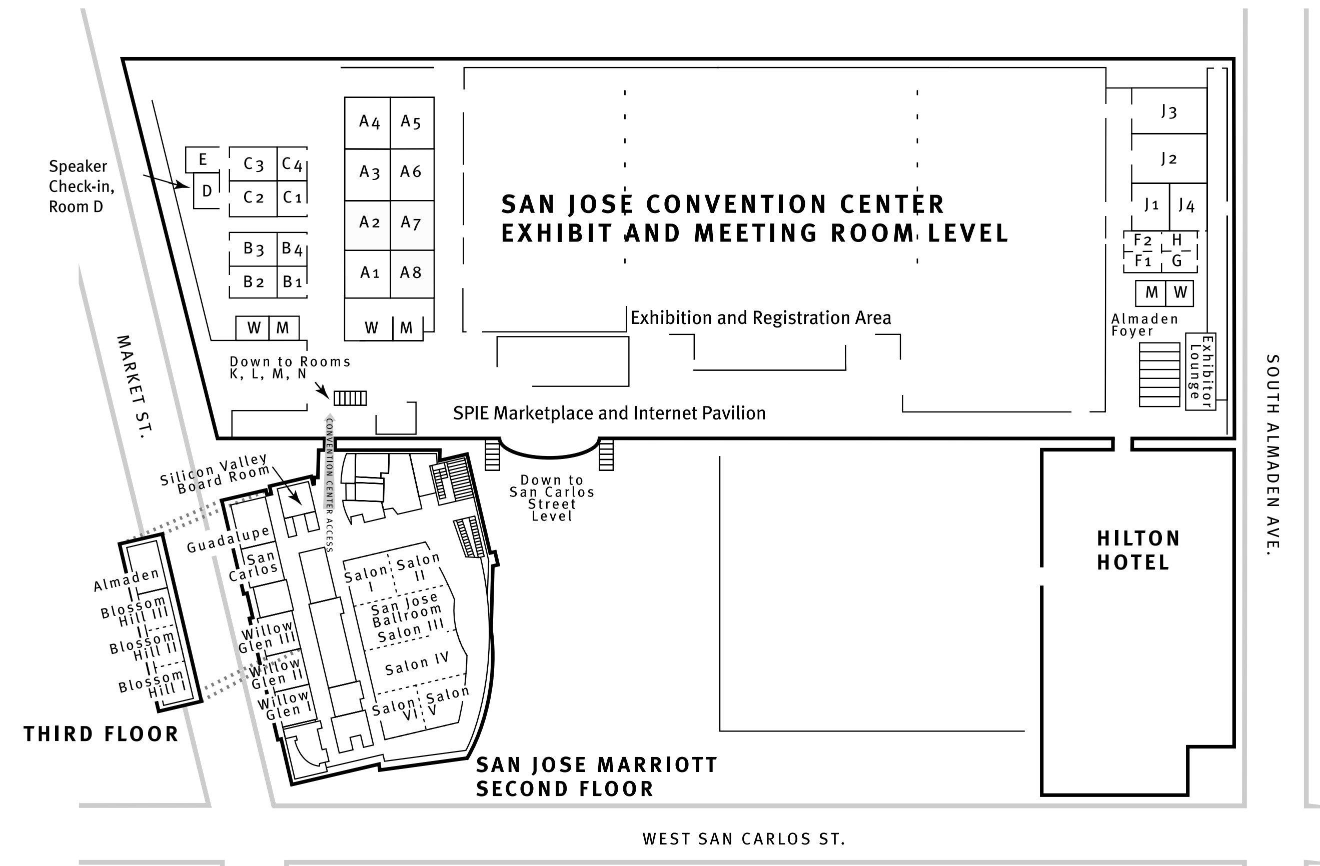
Mitsui Chemicals
Booth #603

Poster Reception

Booth #407 • www.semiconductor.net

San Jose Convention Center and Marriott Hotel





Special Events and Conference Daily Schedule

Monday	Tuesday	Wednesday	Thursday	Friday

Special Events

Monday

Welcome Announcements, 8:00 to 8:30 am, p. 6

Plenary: **Embedded Electronics and the Semiconductor Industry,** *(L. Su),* 8:30 to 9:10 am, p.6

Plenary: **'Moore's Law' Extension: From Integrated Circuits to Flat Panel Displays and Photovoltaic Solar Power,** *(G. Almogy),* 9:10 to 9:50 am, p. 6

Plenary: **Semiconductor Technology: A Convergence of Technology and Business Models,** *(B. Meyerson),* 9:50 to 10:30 am, p. 7

2008 Best Paper Announcement, *(Conf. 7272),* 11:00 to 11:10 am, p. 20

2008 C. Grant Willson Best Paper Announcement *(Conf.7273),* 11:00 to 11:10 am, p. 20

Fellows Lunch, 12:00 to 1:00 pm, p. 9

BACUS Panel Discussion: **The Future—Where will Reticles be by the end of 2013 ?,** 7:30 to 9:00 pm, p. 8

Poster Reception, *(Conferences 7272, 7273),* 5:30 to 8:00 pm, p. 8

Tuesday

Nanotechnology in Microlithography Panel Discussion: **Is the end of CMOS is near? Nanotechnology alternatives to CMOS scaling,** 7:00 to 8:30 pm, p. 9

SPIE Women in Optics Lunch, 12:00 to 1:00 pm, p. 9

Wednesday

Lunch with the Experts—A Student Networking Event, 12:30 to 1:30 pm, p. 9

Panel Discussion: **DFM,** *(Conf. 7275),* 6:30 to 8:30 pm, p. 9

Tuesday–Wednesday

EXHIBITION, p. 12

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

Thursday

Poster Reception, *(Conferences 7271, 7274, 7275),* 5:30 to 8:00 pm, p. 8

Panel Discussion: **Global Collaboration in Reference Metrology,** *(Conf. 7272),* 3:30 to 5:00 pm, p. 9

National Institute for Standards and Technology Panel Discussion: Shaping Up—Frontiers and Challenges in Contour Metrology, 7:00 to 9:00 pm, p. 9

Friday

Optical Microlithography Best Student Paper Award Announcement *(Conf 7274),* 10:00 to 10:10 am, p. 9

See Daily Course Schedule on pages 10-11. Register for Courses onsite!

Conferences

Conference	Days
7271 **Alternative Lithographic Technologies** *(Schellenberg)* p. 18-48	Tuesday–Thursday
7272 **Metrology, Inspection, and Process Control for Microlithography XXIII** *(Allgair)* p. 18-48	Monday–Friday
7273 **Advances in Resist Materials and Processing Technology XXVI** *(Henderson)* p. 19-43	Monday–Wednesday
7274 **Optical Microlithography XXII** *(Levinson)* p. 19-57	Tuesday–Friday
7275 **Design for Manufacturability through Design-Process Integration III** *(Singh)* p. 19-57	Thursday–Friday

Welcome and Announcements

Convention Center Hall 3

Monday 23 February . . . . .8:00 to 8:30 am

Symposium Chair: **Christopher J. Progler,** Photronics, Inc.

- **Introduction of New SPIE Fellows**
- **6th Frits Zernike Award for the Advances in Optical Microlithography Award**

Frits Zernike Award is sponsored by

Plenary Presentations

Plenary Presentations are sponsored by

SOKUDO

Embedded Electronics and the Semiconductor Industry

Convention Center Hall 3

Monday 23 February . . . . .8:30 to 9:10 am

Lisa T. Su, Senior Vice President and Chief Technology Officer for Freescale Semiconductor, Inc.

Embedded electronics is increasingly driving growth in the semiconductor industry. In addition to the traditional wireless and computing markets, there are an increasing number of new applications that use electronics to change the way we live in the consumer, automotive, and industrial markets. These applications will provide new growth opportunities for semiconductors and also require new innovation to provide value in the equation. This talk will discuss the trends and opportunities for innovation in embedded electronics.

Biography: **Lisa Su** is the senior vice president and chief technology officer for Freescale Semiconductor, the global leader in embedded processing solutions. In this role, Lisa is responsible for Freescale's technology roadmap and global research and development (R&D) operations. Lisa joined Freescale in June 2007 from International Business Machines Corporation (IBM), where she was vice president of the Semiconductor Research and Development Center and was responsible for the strategic direction of IBM's silicon technologies, joint development alliances and semiconductor R&D operations. Lisa joined IBM in 1995 and held various engineering and business management positions including vice president of technology development and alliances in the IBM Systems and Technology Group and director of the PowerPC Product Line. Prior to IBM, Lisa was a Member of Technical Staff at Texas Instruments. She has extensive experience in the semiconductor industry leading technology innovation, global strategic alliances, and the launch of new products. Lisa has authored or co-authored more than 40 technical publications and co-authored a book chapter on next-generation consumer electronics. She was named in MIT Technology Review's Top 100 Young Innovators in 2002. Lisa received bachelor's, master's and doctorate degrees in electrical engineering from the Massachusetts Institute of Technology.

'Moore's Law' Extension: From Integrated Circuits to Flat Panel Displays and Photovoltaic Solar Power

Convention Center Hall 3

Monday 23 February . . . . 9:10 to 9:50 am

Gilad Almogy, Senior Vice President and General Manager for the Display and Thin Film Solar Products Business Group, Applied Materials, Inc.

While 'Moore's Law' is well known as the underlying principle enabling semiconductor industry growth, its less-well-known parallels are presently shaping the growth of the TFT-LCD and solar photovoltaic industries as well.

Just as the continuous reduction in cost per transistor has enabled ever more integrated circuit applications, the reduction in the cost per area has had the same impact on displays. Over the last fifteen years the display analogy to 'Moore's law' has been the ability to produce 25% more TFT-LCD area at a given cost every year, enabling the rapid proliferation of laptop computers in the mid-1990s, later followed by flat panel desktop monitors, and currently flat panel TVs. These new markets drove the industry's unprecedented growth: from barely $1B of revenue in 1991, to over $10B in 1999 and crossing the $100B mark last year. For TFT-LCD displays, the ability to stay on the exponential cost-reduction curve has been enabled not by smaller feature design rules but by rapidly increasing substrate sizes, as well as bigger and more efficient factories. While the first monitors designed for laptops were made on 370mm by 470mm pieces of glass using technologies developed for the semiconductor industry, modern TVs are made on glass panels as big as 2.2 by 2.5 meters and factories using glass substrates of nearly 10 square meters are in the pipeline.

In the last couple of years a 'Moore's Law' dynamic has started to drive the explosive growth of yet another industry - solar photovoltaic electricity generation. Just as the semiconductor industry was the stepping stone for a rapid growth of flat panel displays in the early 90s; currently the display industry is serving as the stepping stone for the even more rapid emergence of commercially-viable thin-film solar panels. The use of panel sizes as large as 5.7m^2 (Gen 8.5) as an entry point enables an electricity cost per watt which can begin to gradually replace carbon-emitting sources.

Just as the IC 'Moore's law' brings with it a host of challenges associated with the ever shrinking design rules, the Display and Solar 'Moore's laws' in turn bring their own set of challenges associated with ever growing substrate sizes. While semiconductor lithography pushes short wavelength optics and accurate motion control to the limits, accurate large area deposition of nano-scale films continues to challenge the limits of vacuum technology, plasma physics and even large area machining capabilities. This talk will cover some of the similarities and differences between the IC, Display and Solar industries as they attempt to stay on their respective 'Moore's law' treadmill.

Biography: **Dr. Gilad Almogy** is senior vice president and general manager for the Display and Thin Film Solar Products Business Group since July 2008, which provides products to the flat panel display market as well as tools for Applied's SunFabTM Thin Film Solar production lines. Previously, Dr. Almogy served as general manager for the Display and Thin Film Solar Products Business Group.

Prior to the Display and Thin Film Solar Products Business Groups, Dr. Almogy was general manager of the Process Diagnostics and Control (PDC) business group, where he was responsible for the growth of the Company's metrology and inspection business from 2002 to 2007. Before that, he served as vice president and co-general manager of the PDC business group from 2000 to 2002. During his tenure with PDC, Dr. Almogy focused his team on the expansion of the Company's metrology and inspection offerings to address the challenges of advanced customer requirements.

Prior to Applied Materials, Dr. Almogy served as the Physics Group Manager for the Wafer Inspection Group at Orbot Instruments, which was subsequently acquired by Applied Materials in 1995.

Dr. Almogy holds a doctorate in applied physics from the California Institute of Technology and received a bachelor of science degree in mathematics and physics from the Hebrew University in Jerusalem and holds over 28 US patents.

Semiconductor Technology: A Convergence of Technology and Business Models

Convention Center Hall 3

Monday 23 February . . . . 9:50 to 10:30 am

Bernard S. Meyerson, Vice President for Strategic Alliances and Chief Technology Officer (CTO), IBM Systems and Technology Group (STG)

Silicon technology and its attendant business model are both in the process of making dramatic changes in trajectory. Silicon's trajectory has been driven by the ongoing scaling of semiconductors, enabling decades of successive improvements in cost and performance. As technology reaches the physical limits of its underlying materials, dramatic changes are coming in what constitutes ongoing progress in the field. Similarly, the business model around semiconductors is undergoing a parallel revolution. This talk will explore the ongoing and parallel revolutions in both trajectories. Extraordinary measures will be required to sustain both, and this talk will explore the progress in both.

Biography: **Dr. Meyerson** is Vice President for Strategic Alliances and Chief Technology Officer (CTO) of IBM's Systems and Technology Group (STG). Dr. Meyerson was appointed to this position in December 2005.

In 1980, Dr. Meyerson joined IBM Research as a Staff member, leading the development of silicon:germanium and other high performance technologies over a period of 10 years.

In 1992, Dr. Meyerson was appointed an IBM Fellow - IBM's highest technical honor. In 2001 he was appointed Chief Technologist of IBM's Technology Group, and in 2003 he assumed operational responsibility for IBM's global semiconductor R&D efforts. In that role Dr. Meyerson led the world's largest semiconductor development consortium - members being IBM, Sony, Toshiba, AMD, Samsung, Chartered Semiconductor, and Infineon.

Innovation at Work

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Monterey, California, USA

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2008 Best Paper Announcement

Convention Center J 1-4

Monday 23 February . . . . .11:00 to 11:10 am

The Diana Nyyssonen Memorial Award for the Best Paper in Metrology, Inspection, and Process Control for Microlithograpy
(Conf. 7272)

2008 C. Grant Willson Best Paper Announcement (Conf. 7273)

Convention Center Hall 3

Monday 23 February . . . . .11:00 to 11:10 am

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BACUS Technical Group Panel Discussion: The Future—Where Will Reticles Be by the End of 2013 ???

Convention Center C 1-4

Monday 23 February . . . . .7:30 to 9:00 pm

Moderators: **Larry S. Zurbrick,** Agilent Technologies, Inc. and **Paul F. Luehrmann,** ASML Netherlands (Netherlands)

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Five years from now: Dateline—Friday the 13th, December 2013...

Where will the reticle industry be? Will we continue to use our current glass plates? How will EUV and it's reflective masks have changed things? Maybe 1x Imprint Masks will be in vogue? Maybe none at all (Maskless)...

Our panel of master prognosticators will set to creatively solve the problems of the Universe and determine the answers to these questions.

Our Prognosticating Panelists are:

Customer view: **Paul W. Ackmann,** Advanced Micro Devices, Inc.

EDA view: **J. Tracy Weed,** Synopsys, Inc.

Maskmaker view: **Christopher J. Progler,** Photronics, Inc.

Maskmaker view: **Franklin D. Kalk,** Toppan Photomasks, Inc.

EUV view: **Christian Wagner,** ASML Netherlands B.V. (Netherlands)

Imprint view: **Benjamin G. Eynon,** Molecular Imprints, Inc.

Maskless view: **Bert Jan Kamperbeek,** MAPPER Lithography (Netherlands)

Poster Reception

Convention Center Hall 3

Monday 23 February . . . . 5:30 to 8:00 pm
(Conferences 7272, 7273)

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ShinEtsuMicroSi

Convention Center Hall 3

Thursday 26 February . . . . 5:30 to 8:00 pm
(Conferences 7271, 7274, 7275)

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Luminescent

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

For the poster session on Monday 23 February, poster authors can set up their posters after 10:30 am. For the Thursday poster session, the authors can set-up after 9:00 am. Poster supplies (Push-pins) will be available. Poster can be previewed during the day before the formal poster sessions begin at 5:30 pm.

Authors must remove their posters at the conclusion of the poster reception for that day. It is the authors' responsibility to remove their posters. Posters 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.

Panel Discussion: Lithography for 22nm: How Many Patterning Steps?

Convention Center Hall A

Tuesday 24 February. . . . . 5:30 to 7:00 pm

Moderators: **Mircea V. Dusa,** ASML MaskTools, Inc. and **Nigel R. Farrar,** Cymer Inc.

It is difficult to define what 22 nm is, given that each circuit design has a different idea of what it means. What we know is that device scaling could slow down which will keep optical lithography as the most likely option until CMOS scaling runs out of steam, and it will require a fundamental change in design flow. At this moment, for 22nm process node, there are two accepted options, with one option having multiple variants.

The first option is double patterning. There have been claims that double patterning with water based exposure systems can meet the 22nm process node resolution requirements. "Double" patterning with 193 nm lithography will probably do the job, with one of its flavors, self-aligned spacer, litho-etch-litho-etch and litho- process- litho-etch. The second option is single exposure EUV. EUV has the potential to be less expensive than double patterning even with the expected high cost of EUV systems and has a fairly good chance of being ready in the 2011-2012 time frame. Options like direct-write e-beam should also be considered, although it lags behind the first two options in maturity and industry acceptance.

On the other side, one cannot ignore the recent developments showing capability of integrated source mask optimization (SMO) technology which could be employed as single, double or perhaps more than exposures or patterning steps to support 22nm manufacturing . This panel will explore 22nm lithography options, looking into both development and introduction into manufacturing and trying to find initial answers to the basic question: how many patterning steps are needed to achieve 22nm requirements.

Participants include experts from the semiconductor industry and universities.

Nanotechnology in Microlithography Panel Discussion: Is the end of CMOS near? Nanotechnology alternatives to CMOS scaling

Marriott Salon III-IV

Tuesday 24 February . . . . .7:00 to 8:30 pm

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

Sponsored by: Molecular Imprints

There is wide spread consensus that Moore's law cannot continue indefinitely. At some point the laws of physics will intervene and scaling will become impossible with CMOS as we know it today. However, there is no agreement within the industry as to how or when this change will occur. At what point will the roadblocks to continued scaling become insurmountable and force the industry down a different path? What will the critical roadblock(s) be that forces a radical departure from evolutionary design and manufacturing advances? With several potential game changing solutions, what will this new path be? We have assembled a panel of experts to address these questions and discuss the future and limitations of CMOS-based devices for information processing. The panelists will discuss alternatives such as quantum computing and optical computation methods as well as fundamental new directions in computational state variables, alternative interconnect or device structures, creative circuit and architecture designs. The experts will evaluate the importance of thermal and energy management issues at the nanoscale, novel materials and fabrication methods, and the measurement technologies needed to pave this new path. The goal for this forum is to provide a realistic snapshot of what the future holds for CMOS and to identify and evaluate the pathways forward.

The panel will be composed of university and industry experts in advanced CMOS circuit design and wafer fabrication processes as well as leading researchers working in fundamental new computational architectures.

Panel Discussion: DFM

Marriott Salon III-IV

Wednesday 25 February . . . . .6:30 to 8:30 pm

Conference 7275: Design for Manufacturability through Design-Process Integration

Sponsored by:

Panel Discussion: Global Collaboration in Reference Metrology

Convention Center J 1-4

Thursday 26 February . . . . .3:30 to 5:00 pm

Moderator: **Vladimir A. Ukraintser,** Nanometrology International, Inc.

Conference 7272: Metrology, Inspection, and Process Control for Microlithography

Semiconductor manufacturers around the globe are becoming increasingly concerned about the current state and the future of reference metrology. Nanotechnology is another growing area where an accurate reference metrology is a vital element of the business. A Reference Metrology working group has been formed in April 2008 with the goal to coordinate and promote pre-competitive research in the field. This is the first workshop organized by the group and SPIE Metrology, Inspection, and Process Control for Microlithography organizing committee. The workshop will rectify goals of the group, scope of activities and operational umbrella. We encourage a diversity of opinions. Please contact the organizers if you would like to contribute to the discussion.

National Institute for Standards and Technology Panel Discussion: Shaping Up—Frontiers and Challenges in Contour Metrology

Convention Center B 1-4

Thursday 26 February . . . . .7:00 to 9:00 pm

Moderators: **George Orji, Ronald G. Dixson,** National Institute of Standards and Technology

Sponsored by NIST

The era of the classical, single-metric critical dimension (CD) metrology is rapidly giving way to the extraction of multi-parameter information - both from individual CD-SEM scan lines (e.g. modeling to extract edge shape) and from the SEM image as a whole - as features of interest migrate away from traditional line/space SEM targets to patterns of more complex shape.

Metrology of contacts was one of the early application drivers for measurements that extended beyond extraction of a single CD value. The increasing importance of OPC is widening the need for feature shape measurements in the plane of wafer.

The panel discussion will cover the status and directions of contour metrology in manufacturing metrology. Participants will include experts from the semiconductor industry and government labs.

Optical Microlithography Best Student Paper Award Announcement (Conf 7274)

Convention Center A 1-8

Friday 27 February . . . . .10:30 to 10:40 am

Sponsored by

The Cymer Scientific Leadership Award for Best Student Paper, a monetary award to help support students engaged in research activities in optical microlithography, will be awarded again this year at the Optical Lithography conference. Student authors and student co-authors are eligible only. A panel of experts will be invited by the chair of the conference to serve as judges. The paper (oral or poster) demonstrating scientific excellence in presentation, quality and importance to the lithography community will be selected as the winner of this award.

SPIE Fellows Lunch

Monday 23 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. Brentj@spie.org

SPIE Women in Optics Lunch

SPIE Women in Optics

Tuesday 24 February . . . . 12:00 to 1:00 pm

Join us for an opportunity to network with other professionals at this lunch hosted by SPIE. Register at the SPIE Cashier on-site by 3:00 pm Monday; location information provided upon sign-up.

Lunch with the Experts—A Student Networking Event

Wednesday 25 February 12:30 to 1:30 pm

Seating is limited. See ticket for location.

Enjoy a casual meal and lively discussion with optics/lithography experts at this complimentary event. Hosted by SPIE Student Services, this event features experts willing to share their accumulated wisdom on career paths in optics and photonics. Take advantage of this opportunity to network with some of the best and brightest in the field!

Students receive one complimentary ticket with registration.

Daily Course Schedule

Sunday · Monday · Tuesday · Wednesday · Thursday

Advances in Resist Materials and Processing Technology

Sunday

SC101 **Introduction to Microlithography: Theory, Materials, and Processing** *(Bowden, Thompson, Willson)* 8:30 am to 5:30 pm, $605 / $705

SC780 **Tracks 101: Microlithography Coat and Develop Basics** *(Daggett, Williams),* 8:30 am to 5:30 pm, $525 / $625

Thursday

SC103 **Chemically Amplified Resists** *(Willson)* 8:30 am to 5:30 pm, $525 / $625

SC616 **Practical Photoresist Processing** *(Dammel),* 1:30 to 5:30 pm, $320 / $370

Alternative Lithographic Technologies

Sunday

SC888 **EUV Lithography** *(Bakshi, Ahn, Naulleau)* 8:30 am to 5:30 pm, $740 / $840

SC101 **Introduction to Microlithography: Theory, Materials, and Processing** *(Bowden, Thompson, Willson)* 8:30 am to 5:30 pm, $605 / $705

SC622 **Nano-Scale Patterning with Imprint Lithography** *(Sreenivasan, Willson, Resnick)* 6:00 to 10:00 pm, $320 / $370

Design for Manufacturability through Design-Process Integration

Sunday

SC116 **Lithographic Optimization: A Theoretical Approach** *(Mack)* 8:30 am to 5:30 pm, $580 / $580

SC887 **Modeling Exposure Tools for OPC and Tooling Analysis** *(Lai)* 8:30 am to 5:30 pm, $525 / $625

SC833 **Lithography Integration for Semiconductor Back-End-Of-The-Line (BEOL)** *(Lin)* 1:30 to 5:30 pm, $320 / $370

Monday

SC885 **Principles and Practical Implementation of Double Patterning** *(Dusa)* 8:30 am to 5:30 pm, $475 / $575

Tuesday

NEW SC942 **Design-Technology CoOptimization to Combat Escalating Manufacturability and Design Challenges** *(Liebmann, Pileggi)* 1:30 to 5:30 pm, $320 / $370

Wednesday

SC889 **Layout-Aware Circuit Analysis** *(Singh, Heng, Bansal)* 8:30 am to 12:30 pm, $320 / $370

Metrology, Inspection, and Process Control for Microlithography

Sunday

NEW SC943 **Basics of In-Line Critical Dimension Metrology** *(Ukraintsev)* 8:30 am to 12:30 pm, $320 / $370

SC705 **Instruments and Methodologies for Accurate Metrology and Fleet Matching** *(Archie, Banke)* 1:30 to 5:30 pm, $320 / $370

SC886 **Line Edge Roughness** *(Gallatin)* 1:30 to 5:30 pm, $320 / $370

SC101 **Introduction to Microlithography: Theory, Materials, and Processing** *(Bowden, Thompson, Willson)* 8:30 am to 5:30 pm, $605 / $705

Advertisers Index

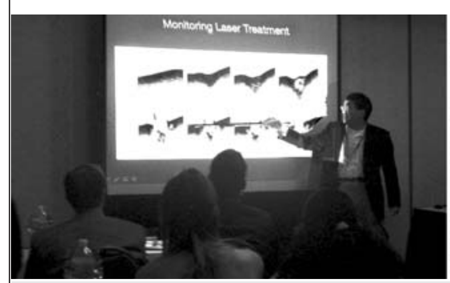
Rohm and Haas Electronic Materials - inside front cover

SOKUDO Co., Ltd. - back cover

Optical Microlithography

Sunday	Monday	Tuesday	Wednesday	Thursday
SC120 **193-nm Photoresist Materials** *(Dammel)* 8:30 am to 12:30 pm, $320 / $370	SC885 **Principles and Practical Implementation of Double Patterning** *(Dusa)* 8:30 am to 5:30 pm, $475 / $575		SC889 **Layout-Aware Circuit Analysis** *(Singh, Heng, Bansal)* 8:30 am to 12:30 pm, $320 / $370	SC118 **Anti-Reflective Coatings: Theory and Practice** *(Dammel)* 8:30 am to 12:30 pm, $320 / $370
SC707 **Basics of Optical Imaging in Microlithography: A Hands-on Approach** *(Milster, Brooker, Socha)* 8:30 am to 12:30 pm, $320 / $370				
SC101 **Introduction to Microlithography: Theory, Materials, and Processing** *(Bowden, Thompson, Willson)* 8:30 am to 5:30 pm, $605 / $705				
SC116 **Lithographic Optimization: A Theoretical Approach** *(Mack)* 8:30 am to 5:30 pm, $580 / $580				
SC887 **Modeling Exposure Tools for OPC and Tooling Analysis** *(Lai)* 8:30 am to 5:30 pm, $525 / $625				
SC117 **The Fundamental Limits of Optical Lithography** *(Smith)* 8:30 am to 12:30 pm, $430 / $480				
SC706 **Imaging and Optics Fundamentals in Advanced Lithography** *(Flagello)* 1:30 to 5:30 pm, $320 / $370				
SC886 **Line Edge Roughness** *(Gallatin)* 1:30 to 5:30 pm, $320 / $370				
SC833 **Lithography Integration for Semiconductor Back-End-Of-The-Line (BEOL)** *(Lin)* 1:30 to 5:30 pm, $320 / $370				
SC124 **Pushing the Limits: Hyper-NA, Immersion, Polarization, and Pitch Division (Double Patterning) in Optical Lithography** *(Smith)* 1:30 to 5:30 pm, $320 / $370				
SC102 **Optical Lithography Modeling** *(Neureuther, Smith)* 6:00 to 10:00 pm, $320 / $370				

SPIE Courses



KNOWLEDGE — NETWORKING — ADVANCEMENT

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We are confident that once you experience an SPIE course for yourself you will look to SPIE for your future education needs. However, if for any reason you are dissatisfied, SPIE will gladly refund your money. We just ask that you tell us what you did not like; suggestions for improvement are always welcome.

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SPIE has been approved as an authorized provider of CEUs by IACET, The International Association for Continuing Education and Training (Provider #1002092). In obtaining this approval, SPIE has demonstrated that it complies with the ANSI/IACET Standards which are widely recognized as standards of good practice.

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Courses and Workshops at SPIE events offer all-inclusive experiences for those who prefer live instruction, where teacher and student interaction is important.

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spie.org/education

Attend the number one exhibit for IC design, fabrication, processing, and manufacturing

Advanced Lithography

Exhibition Hours

Tuesday 24 February . . . . . 10:00 am to 5:00 pm
Wednesday 25 February . . 10:00 am to 4:00 pm

Don't miss the exhibition. This event brings together all aspects of IC design, fabrication, processing, and manufacturing. See the latest products and services on display, meet the people shaping your industry, and generate sales by connecting with qualified buyers.

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

Registration Hours

San Jose Convention Center, Exhibit Hall 2

Sunday . . . . .7:00 am to 6:00 pm
Monday . . . . .7:00 am to 4:00 pm
Tuesday . . . . .7:30 am to 5:00 pm
Wednesday . . . . .7:30 am to 5:00 pm
Thursday . . . . .7:30 am to 5:00 pm
Friday . . . . .7:30 am to 11:00 am

Multiple facilities in downtown San Jose are used for conferences and courses, so please allow yourself enough time to register, pick up your materials and possibly walk to a nearby facility before your meeting or course begins.

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 near the SPIE registration area.

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-ROM, and to discover the opportunities of customized In-company courses.

Coffee Breaks

Sponsored by

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

Sponsored by

Breakfast breads and coffee will be served from 7:30 am to 8:30 am Monday through Friday for Symposium attendees in the Convention Center, Concourse 2 Lobby.

Lunch

Sponsored by

Full conference registrants will receive a lunch coupon redeemable towards a luncheon purchased Tuesday and Wednesday at designated areas of the Exhibit Hall 3. Coupons will be accepted from 11:30am to 1:30 pm both days. Some restrictions apply; please refer to the coupons in your registration packet.

Cash Lunches and Exhibition Concessions

Exhibition Halls 2-3

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.

Desserts

Sponsored by

Served in the Advanced Lithography exhibition halls.

Tuesday and Wednesday

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.

Internet Pavilion

Sponsored by

SPIE will have a complimentary Internet Pavilion at the Convention Center on Sunday through Friday 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

Sponsored by

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 Friday 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.

Poster Setup Information

Convention Center Hall 3

Monday 23 February and Thursday 26 February

- For the poster session on Monday 23 February, poster authors can set up their posters after 10:30 am.
- For the Thursday poster session, the authors can set-up after 9:00 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.
- Posters can be previewed during the day before the formal poster sessions begin at 6:00 pm.
- A poster author or coauthor is required to stand by the 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.

General Information

Speaker Check In Desk

San Jose Convention Center, Ballroom Concourse

Sunday . . . . .2:00 am to 6:00 pm
Monday through Thursday . . . . .7:30 am to 5:00 pm
Friday . . . . .7:30 am to 12:00 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.

SPIE Copy Center

Sunday through Thursday during registration hours San Diego Copy will provide a copy service during the week for symposium attendees. The rates are 5 cents per copy. The Copy Center will be located near registration.

SPIE Message Center

The SPIE Message Center telephone number is 408-271-6200 Messages will be taken during registration hours Sunday through Thursday. Please check the message board at the message center near SPIE registration daily to receive your messages.

SPIE Marketplace & Membership Services

Convention Center Concourse 1
Open during Registration hours

The SPIE Marketplace 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.

Industry Resources Booth

Convention Center Exhibition Floor, Booth # 104

The SPIE Industry Resources Booth provides the tools you need to move ideas and technology to the market. Visit the booth for information on events, marketing opportunities, education, and training that SPIE can provide you to make your venture a success.

Press & 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. Registration and exhibition fees are waived for working journalists and editors. Preregister by e-mailing name, organization, title, address, e-mail, and phone number to media@spie.org.

Child Care Services

Two 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, ext. 109. Fax: (650) 493-6598, Email: oncall@2ndmom.com or parentcounselor@2ndmom.com, Website: www.2ndmom.com

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

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 short 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 you 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.

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.

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# 029B0012. Call 1-800-654-2240.

Parking

For the city: http://www.sjdowntownparking.com/

At the Convention Center, 150 W. San Carlos St.
Max $18 per day. ($1 for each 20 min to max $16.)
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 10pm 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.
Visitors - $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
Guests - $25 per day with in/out privileges
Non-guests - $6.00 per hour with a maximum of $25/day.

Hilton San Jose & Towers
Guests: Self - $18 max. with in/out privileges. Valet $23 max. with in/out privileges and complimentary with validation at the City Bar & Grille.
Non Guests: Self - $18 max., Valet $20 max. and $8 for up to 5 hours with validation from the City Bar & Grille.

Crowne Plaza
Guests self parking $18 with in/out privileges (no valet). Covered parking garage parallel to hotel.
Non-guest parking is $20 daily max. ($6 for 1st hour, then $1 every 1/2 hour to $20 max)

Sainte Claire
For Guests only Valet Parking Only, $21 for overnight.
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.

Park & Ride

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 & 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 & Ride parking is limited to 72 hours.

Hotel Information

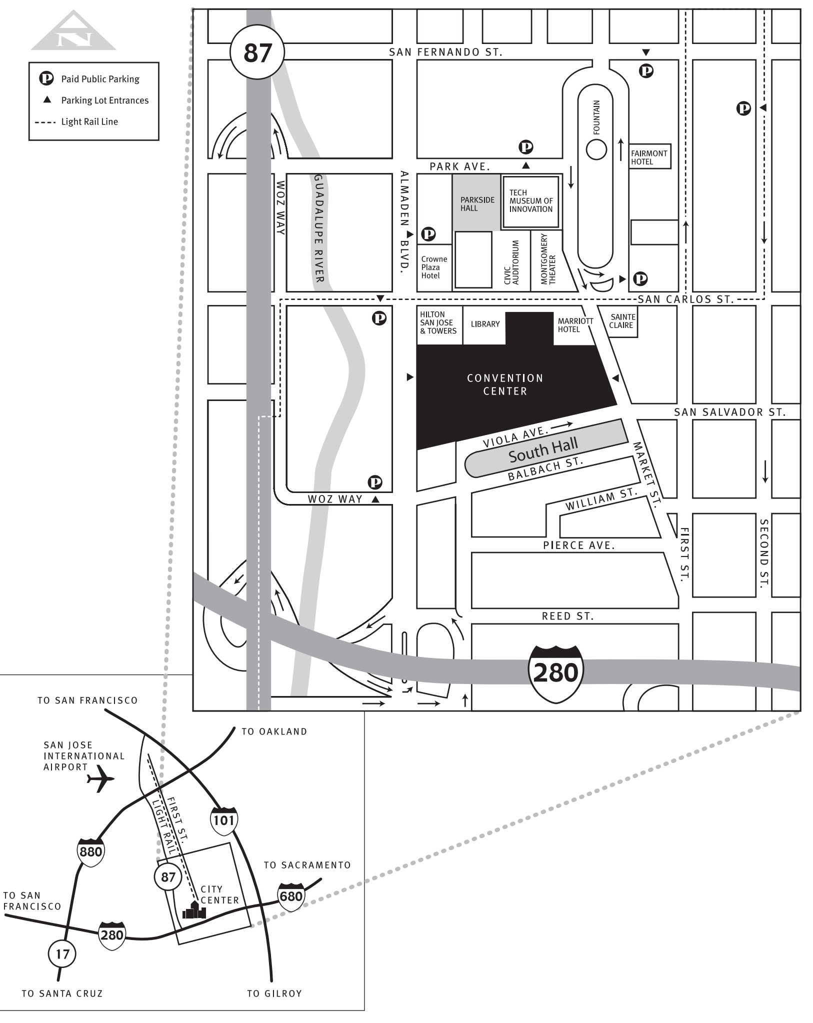
San Jose Marriott, Headquarters Hotel
301 South Market St., Tel: 408 280 1300; Fax: 408 278 4444.

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.

Crowne Plaza San Jose Hotel
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.



	Conference 7271 **Alternative Lithographic Technologies**		Conference 7272 **Metrology, Inspection, and Process Control for Microlithography XXIII**
Monday 23 February			**SESSION 1** 11:10 am to 12:30 pm **Keynote Session** **SESSION 2** 1:40 to 3:40 pm **Methods for Today** **SESSION 3** 4:10 to 6:10 pm **Solutions for Tomorrow**
Tuesday 24 February	**SESSION 1** 8:00 to 10:00 am **Keynotes: EUV** **SESSION 2** 10:30 am to 12:30 pm **Keynotes: Alternative Litho Technologies** **SESSION 3** 1:40 to 3:20 pm **EUV Source** **SESSION 4** 3:50 to 6:10 pm **EUV Mask**	**SESSION 5** 1:40 to 3:20 pm **EBDW** **SESSION 6** 3:50 to 6:10 pm **Multibeam and Tools Patterning**	**SESSION 4** 8:10 to 10:40 am **Overlay** **SESSION 5** 11:00 am to 12:20 pm **Line Edge/Width Roughness** **SESSION 6** 1:50 to 3:10 pm **SEM I** **SESSION 7** 3:40 to 5:20 pm **Scatterometry I**
Wednesday 25 February	**SESSION 7** 8:00 to 10:00 am **EUV Printing** **SESSION 8** 10:30 am to 12:10 pm **EUV Lifetime** **SESSION 9** 1:40 to 3:20 pm **EUV Applications** **SESSION 10** 3:50 to 6:10 pm **EUV OPC**	**SESSION 11** 10:30 am to 12:10 pm **Maskless** **SESSION 12** 1:40 to 3:20 pm **Nanoimprint I** **SESSION 13** 3:50 to 6:10 pm **Nanoimprint II**	**SESSION 8** 8:30 to 10:10 am **SEM II** **SESSION 9** 10:40 am to 12:00 pm **Diffraction-Based Overlay** **SESSION 10** 1:30 to 3:10 pm **Mask Metrology** **SESSION 11** 3:40 to 6:00 pm **Inspection**
Thursday 26 February	**SESSION 14** 8:00 to 10:00 am **EUV Tools** **SESSION 15** 10:30 am to 12:10 pm **EUV Resist** **SESSION 16** 1:40 to 3:20 pm **Nanoimprint Materials** **SESSION 17** 3:50 to 6:10 pm **Directed Self Assembly**		**SESSION 12** 8:00 to 10:20 am **Process Control** **SESSION 13** 10:50 am to 12:10 pm **Scatterometry II** **SESSION 14** 1:40 to 3:00 pm **Reference Metrology** **Workshop** 3:30 to 5:00 pm **Global Collaboration in Reference Metrology**
Friday 27 February			

Technical Conference Session Schedule

Conference 7273 **Advances in Resist Materials and Processing Technology XXVI**	Conference 7274 **Optical Microlithography XXII**	Conference 7275 **Design for Manufacturability through Design-Process Integration III**
SESSION 1 11:10 am to 12:30 pm **Keynote Session** **SESSION 2** 2:00 to 3:40 pm **Double Patterning and Double Exposure I** **SESSION 3** 4:10 to 5:50 pm **Double Patterning and Double Exposure II**		
SESSION 4 8:00 to 9:20 am **Immersion Lithography Materials and Processes** **SESSION 5** 9:20 to 10:40 am **Molecular Resists** **SESSION 6** 11:10 am to 12:30 pm **Novel Materials, Processes, and Applications I** **SESSION 7** 2:00 to 3:20 pm **ARCs and Multi-Layer Processes** **SESSION 8** 3:50 to 6:10 pm **EUV Resist Materials and Processes**	**SESSION 1** 8:40 to 10:00 am **Invited Session** **SESSION 2** 10:30 to 11:50 am **Resolution Enhancement** **SESSION 3** 1:20 to 3:00 pm **Source and Mask Optimization** **SESSION 4** 3:30 to 4:50 pm **Spacer-based Processes**	
SESSION 9 8:00 to 10:00 am **Resist Fundamentals** **SESSION 10** 10:30 am to 12:30 pm **Simulation of Resist Processes** **SESSION 11** 2:00 to 3:40 pm **LER/LWR Behavior in Resists** **SESSION 12** 4:10 to 6:10 pm **Novel Materials, Processes, and Applications II**	**SESSION 5** 8:20 to 10:00 am **Double Patterning I** **SESSION 6** 10:30 to 11:50 am **Double Patterning II** **SESSION 7** 1:20 to 3:00 pm **Tools Related Process Control I** **SESSION 8** 3:30 to 4:50 pm **Tools Related Process Control II**	
	SESSION 9 8:00 to 10:00 am **Optical Proximity Corrections I** **SESSION 10** 10:30 to 11:50 am **Optical Proximity Corrections II** **SESSION 11** 1:20 to 2:00 pm **Optical Proximity Corrections III** **SESSION 12** 2:00 to 4:30 pm **Resolution Enhancement** **SESSION 13** 4:30 to 5:10 pm **Process**	**SESSION 1** 8:00 to 10:00 am **Keynote Session on DFM for Scalability** **SESSION 2** 10:30 am to 12:30 pm **Variability** **SESSION 3** 2:00 to 3:20 pm **Design Rules for Manufacturability** **SESSION 4** 3:50 to 5:30 pm **Variation Aware Design I**
	SESSION 14 8:00 to 10:00 am **Tools I** **SESSION 15** 10:30 am to 12:10 pm **Tools II**	**SESSION 5** 8:20 to 10:00 am **Variation Aware Design II** **SESSION 6** 10:30 to 11:50 am **DFM for Future Nodes**

Conference 7271

Tuesday-Thursday
24-26 February 2009
Proceedings of SPIE Vol. 7271

Alternative Lithographic Technologies

Conference Chair: **Frank M. Schellenberg,** Mentor Graphics Corp.

Conference Co-Chair: **Bruno M. La Fontaine,** Advanced Micro Devices, Inc.

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Conference 7271 continues on page 28.

Conference 7272

Monday-Thursday
23-26 February 2009
Proceedings of SPIE Vol. 7272

Metrology, Inspection, and Process Control for Microlithography XXIII

Conference Chair: **John A. Allgair,** SEMATECH, Inc. and Advanced Micro Devices, Inc.

Conference Co-Chair: **Christopher J. Raymond,** Nanometrics Inc.

Program Committee: **Ofer Adan,** Applied Materials (Israel); **Michael E. Adel,** KLA-Tencor Corp. (Israel); **Chas N. Archie,** IBM Microelectronics Div.; **Jason P. Cain,** Advanced Micro Devices, Inc.; **Alain G. Deleporte,** STMicroelectronics (France); **Daniel J. C. Herr,** Semiconductor Research Corp.; **David C. Joy,** The Univ. of Tennessee; **Chih-Ming Ke,** Taiwan Semiconductor Manufacturing Co. Ltd. (Taiwan); **Byoung-Ho Lee,** SAMSUNG Electronics Co., Ltd. (South Korea); **Martha I. Sanchez,** IBM Almaden Research Ctr.; **Richard M. Silver,** National Institute of Standards and Technology; **Alexander Starikov,** Intel Corp.; **Neal T. Sullivan,** Arradiance, Inc.; **Vladimir A. Ukraintsev,** Nanometrology International, Inc.

Conference 7272 continues on page 20.

Conference 7273

Monday-Wednesday
23-25 February 2009
Proceedings of SPIE Vol. 7273

Advances in Resist Materials and Processing Technology XXVI

Conference Chair: **Clifford L. Henderson,** Georgia Institute of Technology

Conference Co-Chair: **Robert D. Allen,** IBM Almaden Research Ctr.

Program Committee: **George G. Barclay,** Rohm and Haas Electronic Materials; **Sean D. Burns,** IBM Thomas J. Watson Research Ctr.; **Ralph R. Dammel,** AZ Electronic Materials USA Corp.; **Douglas J. Guerrero,** Brewer Science, Inc.; **Christoph K. Hohle,** Qimonda Dresden GmbH & Co. OHG (Germany); **Qinghuang Lin,** IBM Thomas J. Watson Research Ctr.; **Nobuyuki N. Matsuzawa,** Sony Atsugi Technology Ctr. (Japan); **Dah-Chung Owe-Yang,** Shin-Etsu MicroSi, Inc.; **Adam R. Pawloski,** Affymetrix, Inc.; **Vivek M. Prabhu,** National Institute of Standards and Technology; **Ernisse S. Putna,** Intel Corp.; **Mark H. Somervell,** Tokyo Electron America, Inc.; **Gregory M. Wallraff,** IBM Almaden Research Ctr.

Conference 7273 continues on page 20.

Conference 7274

Tuesday-Friday
24-27 February 2009
Proceedings of SPIE Vol. 7274

Optical Microlithography XXII

Conference Chair: **Harry J. Levinson,** Advanced Micro Devices, Inc.

Conference Co-Chair: **Mircea V. Dusa,** ASML MaskTools Inc.

Program Committee: **Pary Baluswamy,** Micron Technology, Inc.; **Willard E. Conley,** Freescale Semiconductor, Inc.; **Nigel R. Farrar,** Cymer, Inc.; **Roger H. French,** DuPont Co.; **Tatsuhiko Higashiki,** Toshiba Corp. (Japan); **Kurt R. Kimmel,** Advanced Mask Technology Ctr. GmbH & Co. KG (Germany); **Tsai-Sheng Gau,** Taiwan Semiconductor Manufacturing Co. Ltd. (Taiwan); **Kafai Lai,** IBM Microelectronics Div.; **SukJoo Lee,** SAMSUNG Electronics Co., Ltd. (South Korea); **Wilhelm Maurer,** Infineon Technologies AG (Germany); **Soichi Owa,** Nikon Corp. (Japan); **Ken Ozawa,** Sony Atsugi Technology Ctr. (Japan); **Sam Sivakumar,** Intel Corp.; **Bruce W. Smith,** Rochester Institute of Technology; **Kazuhiro Takahashi,** Canon Inc. (Japan); **Geert Vandenberghe,** IMEC (Belgium)

Conference 7274 continues on page 29.

Conference 7275

Thursday-Friday
26-27 February 2009
Proceedings of SPIE Vol. 7275

Design for Manufacturability through Design-Process Integration III

Conference Chair: **Vivek Singh,** Intel Corp.

Conference Co-Chair: **Michael L. Rieger,** Synopsys, Inc.

Program Committee: **Juan Antonio Carballo,** IBM Venture Capital Group; **Lars W. Liebmann,** IBM Microelectronics Div.; **Mark E. Mason,** Texas Instruments Inc.; **John L. Sturtevant,** Mentor Graphics Corp.; **Joerg Thiele,** Qimonda AG (Germany); **Alfred K. Wong,** Magma Design Automation

Conference 7275 continues on page 45.

Monday 23 February

Conference 7272

Metrology, Inspection, and Process Control for Microlithography XXIII

Room: Conv. Ctr. J 1-4 . . . . .Mon. 11:00 to 11:10 am

Announcements and Award Presentation

Session Chairs: **John A. Allgair,** SEMATECH, Inc.; **Christopher J. Raymond,** Nanometrics Inc.

The Diana Nyyssonen Memorial Award presented for Best Paper for Metrology 2008

SESSION 1

Room: Conv. Ctr. J 1-4 . . . . Mon. 11:10 am to 12:30 pm

Keynote Session

Session Chairs: **John A. Allgair,** SEMATECH, Inc. and Advanced Micro Devices, Inc.; **Christopher J. Raymond,** Nanometrics Inc.

11:10 am: **Improving optical measurement accuracy using multi-technique nested uncertainties** *(Keynote Presentation)***,** Richard M. Silver, Nien-Fan Zhang, Bryan M. Barnes, Hui Zhou, Ronald G. Dixson, Ravikiran Attota, Thomas A. Germer, National Institute of Standards and Technology (United States); Benjamin D. Bunday, SEMATECH, Inc. (United States) . . . . [7272-01]

11:50 am: **The measurement uncertainty challenge of advanced patterning development** *(Keynote Presentation)***,** Narender Rana, Chas N. Archie, Wei Lu, IBM Microelectronics Div. (United States); G. William Banke, Jr., IBM Corp. (United States) . . . . [7272-02]

Lunch Break . . . . 12:30 to 1:40 pm

SESSION 2

Room: Conv. Ctr. J 1-4 . . . . Mon. 1:40 to 3:40 pm

Session Chairs: **Chas Archie,** IBM Corp.; **Alexander Starikov,** Intel Corp.

Methods for Today

1:40 pm: **CD-SEM parameter influence on image resolution and measurement accuracy**, Benjamin D. Bunday, SEMATECH, Inc. (United States); Uwe Kramer, Qimonda Dresden GmbH & Co. OHG (Germany) . . . . [7272-03]

2:00 pm: **Role of CDAFM in achieving accurate OPC modeling**, Vladimir A. Ukraintsev, Nanometrology International, Inc. (United States) . . . . [7272-04]

2:20 pm: **Optimized overlay sampling for new process development**, John C. Robinson, KLA-Tencor Texas (United States); Cindy Kato, Hiroyuki Kurita, KLA-Tencor Japan (Japan); James R. Manka, KLA-Tencor Corp. (United States); Pavel Izikson, KLA-Tencor Israel (Israel) . . . . [7272-05]

2:40 pm: **Simultaneous CD and Overlay Measurement for Double Patterning: Scatterometry and RCWA Approach**, Jie Li, Zhuan Liu, Silvio Rabello, Prasad Dasari, Nanometrics Inc. (United States); Oleg Kritsun, Advanced Micro Devices, Inc. (United States); Jung-Chul Park, Lovejeet Singh, Spansion Inc. (United States) . . . . . [7272-06]

3:00 pm: **Overlay control scenario for volume production**, Jens Busch, Rolf Seltmann, Uwe Schulze, AMD Saxony LLC & Co. KG (Germany) . . . . [7272-07]

3:20 pm: **Reference metrology in a research fab: the NIST Clean Calibrations Program**, Ronald G. Dixson, Ndubuisi G. Orji, Joseph Fu, Thomas B. Renegar, Alan Zheng, Theodore V. Vorburger, Marc Cangemi, Lei Chen, Mike Hernandez, Russell E. Hajdaj, Al Hilton, National Institute of Standards and Technology (United States) . . . . [7272-08]

Coffee Break. . . . . 3:40 to 4:10 pm

Conference 7272 continues on page 21.

Conference 7273

Advances in Resist Materials and Processing Technology XXVI

Room: Conv. Ctr. Hall 3 . . Mon. 11:00 to 11:10 am

Welcome and Announcements

Session Chairs: **Clifford L. Henderson,** Georgia Institute of Technology; **Robert D. Allen,** IBM Almaden Research Ctr.

Presentation of the C. Grant Willson 2008 Best Paper Award

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SESSION 1

Room: Conv. Ctr. Hall 3 Conv. Ctr. Hall 3 . . . . Mon. 11:10 am to 12:30 pm

Keynote Session

Session Chair: **Robert D. Allen,** IBM Almaden Research Ctr.

11:10 am: **EUV photoresists: exploring resolution, sensitivity, and LWR tradeoffs** *(Keynote Presentation)***,** Gilroy J. Vandentop, Intel Corp. (United States) . . . . [7273-01]

11:50 am: **Keynote Presentation**, Clifford L. Henderson, Georgia Institute of Technology. . . . . [7273-02]

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

SESSION 2

Room: Conv. Ctr. Hall 3 . . . . .Mon. 2:00 to 3:40 pm

Double Patterning and Double Exposure I

Session Chairs: **Robert D. Allen,** IBM Almaden Research Ctr.; **Christoph K. Hohle,** Qimonda Dresden GmbH & Co. OHG (Germany)

2:00 pm: **Newly developed positive-tone resists for Posi/Posi double patterning**, Tsuyoshi Nakamura, Masaru Takeshita, Satoshi Maemori, Tokyo Ohka Kogyo Co., Ltd. (Japan); Ryusuke Uchida, Tokyo Ohka Kogyo America, Inc. (United States); Ryoichi Takasu, IMEC (Belgium); Katsumi Ohmori, Tokyo Ohka Kogyo Co., Ltd. (Japan) . . . . [7273-03]

2:20 pm: **Resist-on-resist for double-patterning simplicity: a novel material approach to nested 32-nm lines**, Michael M. Crouse, ASML US, Inc. (United States); Ryusuke Uchida, Tokyo Ohka Kogyo America, Inc. (United States); Brian N. Martinick, Univ. at Albany (United States); Youri van Dommelen, ASML US, Inc. (United States); Tomoyuki Ando, Masaru Takeshita, Tokyo Ohka Kogyo Co., Ltd. (Japan); Robert M. Routh, ASML US, Inc. (United States) . . [7273-04]

2:40 pm: **Development of a thermally activated image lock resist for double patterning**, Charlotte A. Cutler, Young Bae, Thomas Cardolaccia, Charles R. Szmanda, Damien Perret, Amandine Pikon, Rohm and Haas Electronic Materials (United States); Stephanie Gaurigan, Julia Simon, Commissariat à l'Energie Atomique (France) . . . . [7273-05]

3:00 pm: **Double-exposure materials for pitch division with 193-nm lithography: requirements and results**, Robert L. Bristol, Evan Schwartz, Courtney Turner, David Shykind, Yan A. Borodovsky, Intel Corp. (United States); Georgeta Masson, Ke Min, Katherine Esswein, Clarion Tung, James M. Blackwell, Lawrence Berkeley National Lab. (United States); Nikolay V. Suetin, Intel Technologies, Inc. (United States); Valery A. Barachevsky, Anton Ait, Ctr. of Photochemistry (Russian Federation). . . . . [7273-06]

3:20 pm: **Development and evaluation of topcoat-free ArF negative tone resist**, Tomoyuki Ando, Jun Iwashita, Shogo Matsumaru, Sho Abe, Takeshi Iwai, Tokyo Ohka Kogyo Co., Ltd. (Japan) . . . . [7273-07]

Coffee Break. . . . . 3:40 to 4:10 pm

Monday 23 February

Conference 7272

Metrology, Inspection, and Process Control for Microlithography XXIII

SESSION 3

Room: Conv. Ctr. J 1-4 . . . . Mon. 4:10 to 6:10 pm

Solutions for Tomorrow

Session Chairs: **Christopher J. Raymond,** Nanometrics Inc.; **Daniel J. Herr,** Semiconductor Research Corp.

4:10 pm: **Evaluation of a new metrology technique to support the needs of accuracy, precision, speed, and sophistication in near-future lithography**, Jimmy Hu, Chih-Ming Ke, Willie Y. H. Wang, Jacky Huang, Joyce Chung, C. R. Liang, L. G. Terng, Taiwan Semiconductor Manufacturing Co. Ltd. (Taiwan); Kaustuve Bhattacharyya, Maurits van der Schaar, Mark A. van de Kerkhof, Kiwi Yuan, Vivien Wang, Karel D. Van der Mast, ASML Netherlands B.V. (Netherlands). . . . . [7272-09]

4:30 pm: **MOSAIC: a new wavefront metrology**, Christopher N. Anderson, Univ. of California, Berkeley (United States); Patrick P. Naulleau, Lawrence Berkeley National Lab. (United States)[7272-10]

4:50 pm: **Study of after-development-inspection with an advanced e-beam inspection system**, Byoung-Ho Lee, SAMSUNG Electronics Co., Ltd. (Korea, Republic of); Hong Xiao, Hermes Microvision, Inc. (United States) . . . . [7272-11]

5:10 pm: **A method to determine dose to target without metrology ambiguity using model-based data analysis**, Koen D'havé, Anne-Laure Charley, David Laidler, Shaunee Cheng, IMEC (Belgium). . . . . [7272-12]

5:30 pm: **Overlay similarity: a new overlay index for metrology tool and scanner overlay fingerprint**, Chih-Ming Ke, Tsai-Sheng Gau, Taiwan Semiconductor Manufacturing Co. Ltd. (Taiwan) . . . . [7272-13]

5:50 pm: Tabletop coherent diffractive microscopy with extreme-ultraviolet light from high-harmonic generation, Daisy A. Raymondson, Richard L. Sandberg, Univ. of Colorado at Boulder (United States); William Schlotter, Univ. Hamburg (Germany); Kevin Raines, Univ. of California, Los Angeles (United States); Chan La-o-Vorakiat, Ethan Townsend, Ariel Paul, Margaret M. Murnane, Henry C. Kapteyn, Univ. of Colorado at Boulder (United States); Jianwei Miao, Univ. of California, Los Angeles (United States). . . . [7272-14]

Conference 7272 continues on page 28.

Conference 7273

Advances in Resist Materials and Processing Technology XXVI

SESSION 3

Room: Conv. Ctr. Hall 3 . . . . Mon. 4:10 to 5:50 pm

Double Patterning and Double Exposure II

Session Chairs: **George G. Barclay,** Rohm and Haas Electronic Materials; **Sean D. Burns,** IBM Thomas J. Watson Research Ctr.

4:10 pm: **Correlation of experimental and simulated cure-induced photoresist distortions in double patterning**, Thomas I. Wallow, Mahidhar Rayasam, Kenji Yoshimoto, Advanced Micro Devices, Inc. (United States); Masanori Yamaguchi, Yohei Yamada, Ushio Inc. (Japan); Ryoung-Han Kim, Jong-Wook Kye, Harry J. Levinson, Advanced Micro Devices, Inc. (United States). . [7273-08]

4:30 pm: **Fine trench patterns with double patterning and etching shrink technology**, Satoru Shimura, Tokyo Electron Kyushu Ltd. (Japan); Masato Kushibiki, Tokyo Electron AT Ltd. (Japan); Tetsu Kawasaki, Tokyo Electron Kyushu Ltd. (Japan); Ryo Tanaka, Akira Tokui, Yuuki Ishii, Nikon Corp. (Japan) . . . . [7273-09]

4:50 pm: **Double-patterning process with freezing technique**, Gouji Wakamatsu, Yuusuke Anno, Masafumi Hori, Tomohiro Kakizawa, Michihiro Mita, Kenji Hoshiko, Takeo Shioya, Koichi Fujiwara, Shiro Kusumoto, Yoshikazu Yamaguchi, Tsutomu Shimokawa, JSR Corp. (Japan) . . . . [7273-10]

5:10 pm: **Development of materials and processes for negative tone development toward 32-nm node 193-nm immersion double-patterning process**, Shinji Tarutani, Hideaki Tsubaki, Sou Kamimura, FUJIFILM Corp. (Japan). . . . . [7273-11]

5:30 pm: Photoresist stabilization for double-patterning using 172-nm photoresist curing, Thomas I. Wallow, Advanced Micro Devices, Inc. (United States); Junyan Dai, SOKUDO USA, LLC (United States); Charles R. Szmanda, Rohm and Haas Electronic Materials (United States); Nikolaos Bekiaris, Hiram Cervera, SOKUDO USA, LLC (United States); Ryoung-Han Kim, Jong-Wook Kye, Harry J. Levinson, Advanced Micro Devices, Inc. (United States); Glen Mori, SOKUDO USA, LLC (United States); Chi Truong, Rohm and Haas Electronic Materials (United States) . . . . [7273-12]

Conference 7273 continues on page 29.

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Monday 23 February – Poster Sessions – 5:30 to 8:00 pm

The following posters will be displayed all day Monday. Authors will be present during the formal poster session Monday evening between 5:30 and 8:00 pm for discussion. Authors may set-up their posters after 10:30 am on Monday.

Conference 7272 Metrology, Inspection, and Process Control for Microlithography XXIII

Alignment method of self-aligned double patterning process, Meng-Feng Tsai, Jun-Cheng N. Lai, Yi-Shiang S. Chang, Chia-Chi Lin, Powerchip Semiconductor Corp. (Taiwan). . . . . [7272-16]

Application results of lot-to-lot high-order overlay correction for sub-60-nm memory device fabrication, Jang Ho Shin, Sangmo Nam, Taekyu Kim, Yong-Kug Bae, Junghyeon Lee, SAMSUNG Electronics Co., Ltd. (Korea, Republic of) . . [7272-19]

Fast mask CD uniformity measurement using zero-order diffraction from memory array pattern, Jinseok Heo, Jinhong Park, Jeong-Ho Yeo, Seong-Woon Choi, Woo-Sung Han, SAMSUNG Electronics Co., Ltd. (Korea, Republic of). . . . . [7272-45]

Requirements of the inspection for double patterning technology reticles, Wonil Cho, Won-Sun Kim, Sung-Joon Sohn, Sunpyo Lee, Ji-Hyeon Choi, Yong-Hoon Kim, Han-Ku Cho, SAMSUNG Electronics Co., Ltd. (Korea, Republic of). . . . . [7272-51]

Sensitivity improvement and noise reduction of array CD mapping on memory device using inspection tool, Jeong-Ho Yeo, Jinhong Park, Jin-Seok Her, Byoung-Ho Lee, Byeong-Ok Cho, SAMSUNG Electronics Co., Ltd. (Korea, Republic of) . . . . [7272-52]

Analysis of systematic errors in lateral shearing interferometry for in-situ EUV optical testing, Ryan H. Miyakawa, Patrick P. Naulleau, Kenneth A. Goldberg, Lawrence Berkeley National Lab. (United States) . . . . [7272-71]

A probe characterizer for atomic force microscope fabricated from GaAs/InGaP superlattice and Si/SiO_2 multilayer, Hiroshi Itoh, National Institute of Advanced Industrial Science and Technology (Japan) . . . . [7272-72]

Haze-generation model for sulfate-free cleaning and prevention techniques, Manish J. Patil, PKL Co., Ltd. (Korea, Republic of). . . . . [7272-74]

Investigation on the effect of wafer surface charging during photolithography DI-rinse pocess, Changyeop Shin, Dongbu HiTek Co., Ltd. (Korea, Republic of); Shady A. Abdelwahed, Mohamed Al-Imam, Mentor Graphics Corp. (Egypt) . . . . . [7272-75]

Resist-based polarization monitoring with phase-shift masks at 1.35 numerical aperture, Gregory R. McIntyre, IBM Corp. (United States); Richard Y. Tu, Benchmark Technologies (United States) . . [7272-76]

An Investigation of Perfluoroalkylamine Contamination Control, Andrew J. Dallas, Dustin Zastera, Donaldson Co., Inc. (United States)[7272-79]

Sub-nanometer broadband measurement of elastic displacements in optical metrology frames and other critical elements, Baruch Pletner, Grace Kesenich, Wesley Horth, IPTRADE Inc. (United States); Todd W. Murray, Boston Univ. (United States) and IPTRADE Inc. (United States); Shweta Bhola, IPTRADE Inc. (United States). [7272-80]

Monitoring low molecular weight silicon AMC to protect UV optics, Jürgen M. Lobert, Jr., Entegris, Inc. (United States). . . . . [7272-81]

Positive identification of lithographic photoresists using real-time index of refraction monitoring for reduced cost of ownership, Susanne Pepper, Ronald Jee, David Stedman, Swagelok Co. (United States) . . . . [7272-82]

Sub-50-nm pitch size grating reference for CD-SEM magnification calibration, Yoshinori Nakayama, Jiro Yamamoto, Hitachi, Ltd. (Japan); Hiroki Kawada, Hitachi High-Technologies Corp. (Japan) . . . . [7272-84]

Optical properties of pellicle studied by vacuum UV spectroscopic ellipsometry, Jaewook Jung, Seungmin Won, Jaisun Kyoung, Songyi Park, Sangyouk Lee, Chulgi Song, Hye-Keun Oh, Ilsin An, Hanyang Univ. (Korea, Republic of) . . . . . . [7272-85]

Effective purging solution to reticle haze formation, Wei-Jui Tseng, Rexchip Electronics Corp. (Taiwan); Ming-Chien Chiu, Poshin Lee, Gudeng Precision Industrial Co., Ltd. (Taiwan) . . . . . [7272-86]

Measurement of dimensions of resist mask elements below 100 nm with help of a scanning electron microscope, Valeriy P. Gavrilenko, A.M. Prokhorov General Physics Institute (Russian Federation); Vladimir Kalnov, Institute of Physics and Technology (Russian Federation); Yury A. Novikov, A.M. Prokhorov General Physics Institute (Russian Federation); Alexander A. Orlikovsky, Institute of Physics and Technology (Russian Federation); Alexander Rakov, Pavel A. Todua, A.M. Prokhorov General Physics Institute (Russian Federation); Kamil Valiev, Evgeniy Zhikharev, Institute of Physics and Technology (Russian Federation) . . . . [7272-87]

Aerial imaging for FABs: productivity and yield aspects, Ilan Englard, Applied Materials BV (Netherlands); Lior Shoval, Michael Ben-Yishai, Shmoolik Mangan, Applied Materials (Israel)[7272-88]

Mapping mask-induced CD variation of a two-dimensional mask aerial image pattern, Netanel Polonsky, Amir M. Sagiv, Shmoolik Mangan, Applied Materials (Israel) . . . . [7272-89]

Study of advanced mask inspection optics with superresolution method for next-generation mask fabrication, Ryoichi Hirano, Masatoshi Hirono, Riki Ogawa, Nobutaka Kikuiri, Advanced Mask Inspection Technology, Inc. (Japan); Kenichi Takahara, Hideaki Hashimoto, NuFlare Technology, Inc. (Japan); Hiroyuki Shigemura, Semiconductor Leading Edge Technologies, Inc. (Japan) . . . . [7272-90]

Novel lithography approach to mask CDU feed-forward corrections increases FAB productivity and yield, Ilan Englard, Applied Materials BV (Netherlands); Erik R. Byers, Merri Carlson, Craig Hickman, Micron Technology, Inc. (United States); Daniel L. Rost, MP Mask Technology Ctr., LLC (United States); Jo M. Finders, Paul F. Luehrmann, Jr., Frank Duray, Ingrid Minnaert-Janssen, Robert Kazinczi, ASML Netherlands B.V. (Netherlands); Michael Ben-Yishai, Lior Shoval, Shmoolik Mangan, Ryan Gibson, Racel Ren, Applied Materials, Inc. (United States) . . . . [7272-91]

CD-bias reduction in CD-SEM line-width measurement for the 32-nm node and beyond using the model-based library method, Chie Shishido, Mayuka Osaki, Hitachi, Ltd. (Japan); Maki Tanaka, Hitachi High-Technologies Corp. (Japan) . . . . [7272-93]

Design-based metrology integration system for MASK and wafer CD-SEM, Tatsuya Maeda, Hitachi High-Technologies Corp. (Japan); Katsuya Hayano, Dai Nippon Printing Co., Ltd. (Japan); Hideo Sakai, Hiodetoshi Sato, Ryoichi Matsuoka, Hitachi High-Technologies Corp. (Japan) . . . . [7272-94]

A practical application of Multiple Prameters Profile Characterization (MPPC) using CD-SEM on production wafers using Hyper-NA Lithography, Toru Ishimoto, Hitachi High-Technologies Corp. (Belgium); Kohei Sekiguchi, Hitachi High-Technologies Europe GmbH (Germany); Norio Hasegawa, Kenji Watanabe, Hitachi High-Technologies Corp. (Japan); David Laidler, Shaunee Cheng, IMEC (Belgium) . . . . [7272-95]

Improving recipe automation of CD-SEM using recipe diagnostic function, Kyoungmo Yang, Junichi Kakuta, Shunsuke Koshihara, Hitachi High-Technologies Corp. (Japan) . . . . [7272-96]

Three-dimensional profile extraction from CD-SEM top-view image, Atsuko Yamaguchi, Yoshinori Momonoi, Hitachi, Ltd. (Japan); Ken Murayama, Hitachi Kenki FineTech Co., Ltd. (Japan); Junichi Tanaka, Hitachi, Ltd. (Japan); Hiroki Kawada, Hitachi High-Technologies Corp. (Japan). . . . . [7272-97]

Using CD SEM to identify the unique wavelength of LER for the SADP flow, James J. Yu, Applied Materials, Inc. (United States) . . . . [7272-98]

OPC modeling cycle-time improvement through the implementation of automatic wafer-less CDSEM recipe generation for 45-nm technology node, Yun Tao Jiang, Chartered Semiconductor Manufacturing Ltd. (Singapore); Sern Loong Ng, Applied Materials South East Asia Pte. Ltd. (Singapore) . . . . [7272-100]

Using the 3D-AFM technique as a means to accelerate the introduction of the NanoImprint lithography in production, Anne-Lise Foucher, Johann Foucher, Stefan Landis, CEA-LETI (France). . . . . [7272-101]

The LER/LWR metrology challenge for advance process control through 3D-AFM and CD-SEM, Pascal Faurie, Johann Foucher, CEA-LETI (France). . . . . [7272-102]

Simulation of secondary-electron emission in helium ion microscope for overcut and undercut line-edge patterns, Kaoru Ohya, Takuya Yamanaka, Kensuke Inai, Univ. of Tokushima (Japan); Tohru Ishitani, Hitachi High-Technologies Corp. (Japan) . . . . [7272-103]

Nonplanar high-k dielectrics thickness measurement using CD-SAXS, Chengqing Wang, National Institute of Standards and Technology (United States); Kwang-Woo Choi, Intel Corp. (United States); Yi-Ching Chen, Wen-Li Wu, National Institute of Standards and Technology (United States); Jimmy M. Price, SEMATECH, Inc. (United States); Benjamin D. Bunday, International SEMATECH Manufacturing Initiative (United States) . . . . [7272-104]

High-precision CD matching monitoring technology using profile gradient method for the 32-nm technology generation, Toru Ikegami, Akemi Kono, Tatsuya Maeda, Hitachi High-Technologies Corp. (Japan) . . . . [7272-105]

Monday 23 February – Poster Sessions – 5:30 to 8:00 pm

The following posters will be displayed all day Monday. Authors will be present during the formal poster session Monday evening between 5:30 and 8:00 pm for discussion. Authors may set-up their posters after 10:30 am on Monday.

CD budget analysis on sub-50-nm DRAM device: global CD variation to local CD variation, Chan Hwang, Joon-Soo Park, Jeong-Ho Yeo, Seong-Woon Choi, Woo-Sung Han, SAMSUNG Electronics Co., Ltd. (Korea, Republic of). . . . . [7272-106]

Intrafield CD improvement for 45-nm CMOS logic patterning, Bertrand Le Gratiet, Jean Massin, STMicroelectronics (France). . . . . [7272-107]

Contour-quality assessment for OPC model calibration, Paul S. Filitchkin, John L. Sturtevant, Ir Kusnadi, Thuy Do, Mentor Graphics Corp. (United States); Peter De Bisschop, Jeroen Van de Kerkhove, IMEC (Belgium). . . . . [7272-108]

Modern AFM applications in semiconductor R&D and manufacturing at 45-nm node and beyond, Moonk-Keun Lee, Veeco Metrology Inc. (United States); Min-Jung Shin, SAMSUNG Electronics Co., Ltd. (Korea, Republic of); Tianming Bao, Veeco Metrology Inc. (United States); Chul-Gi Song, SAMSUNG Electronics Co., Ltd. (Korea, Republic of); Dean J. Dawson, Veeco Metrology Inc. (United States); Dongchul Ihm, SAMSUNG Electronics Co., Ltd. (Korea, Republic of); Vladimir A. Ukraintsev, Nanometrology International, Inc. (United States) . . . . [7272-109]

Metrology to optimize contact hole in weak configurations, Juhyoung Moon, Dongbu HiTek Co., Ltd. (Korea, Republic of). . . . . [7272-110]

A new system for wafer level CD metrology, Holger Seitz, Sven Martin, Rigo Richter, Thomas Scherübl, Carl Zeiss SMS GmbH (Germany) . . . . [7272-111]

A 3D CMM probe based on fiber Bragg gratings, Bangzhou Ding, Yetai Fei, Zheguang Fan, Hefei Univ. of Technology (China). . . . . [7272-112]

Overlay enhancements through optimization of alignment processes on ASML systems, Augustin Jeyakumar, Intel Corp. (United States); Vilay Fortner, ASML Hillsboro (United States) . . . . [7272-113]

In-die registration metrology on future-generation reticles, Frank Laske, Vistec Semiconductor Systems GmbH (Germany) and Hoya Corp. (Japan) and Dai Nippon Screen Manufacturing Co. Ltd. (Japan); Hiroshi Kinoshita, Daisuke Kenmochi, HOYA Corp. (Japan); Klaus-Dieter Röth, Vistec Semiconductor Systems GmbH (Germany); Hitoshi Ota, Dai Nippon Screen Manufacturing Co. Ltd. (Japan) . . . . [7272-114]

Advanced modeling strategies to improve overlay control for 32-nm lithography process's, Brad J. Eichelberger, Kelly O'Brien, David C. Tien, James R. Manka, John C. Robinson, KLA-Tencor Corp. (United States); Jeff A. Schefske, Spansion Inc. (United States) . . . . [7272-115]

Overlay mark optimization using the KTD signal simulation system, Anat Marchelli, KLA-Tencor Corp. (Israel) and Qimonda Dresden GmbH & Co. OHG (Germany); Karsten Gutjahr, Michael Kubis, Qimonda Dresden GmbH & Co. OHG (Germany); Christian Sparka, KLA-Tencor Corp. (Germany); Mark Ghinovker, KLA-Tencor Corp. (Israel); Amir Widmann, KLA-Tencor Corp. (United States) . . . . [7272-117]

Fast analysis and diagnostics for improving overlay control: moving beyond the Black Box approach, Yi-An Liou, Wei-Ming Wu, Hsiao-Chiang Lin, Jun-Cheng N. Lai, Powerchip Semiconductor Corp. (Taiwan); Chin-Chou K. Huang, Hsing-Chien R. Wu, Chao-Tien Huang, David C. Tien, KLA-Tencor Corp. (United States) . . . . [7272-119]

The study and simulation of high-order overlay control including field-by-field methodologies, DongSub Choi, KLA-Tencor Korea (Korea, Republic of); Chulseung Lee, Changjin Bang, Hynix Semiconductor Inc. (Korea, Republic of); James R. Manka, KLA-Tencor Corp. (United States); Dohwa Lee, SeungHoon Yoon, KLA-Tencor Korea (Korea, Republic of); John C. Robinson, KLA-Tencor Texas (United States) . . . . [7272-120]

Sampling strategy: optimization and correction for high-order overlay control for 45-nm process node, Bo-Yun Hsueh II, George K. C. Huang, Chun-Chi Yu, United Microelectronics Corp. (Taiwan); Chin-Chou K. Huang, Chien-Jen Huang, James R. Manka, David C. Tien, KLA-Tencor Corp. (United States) . . . . [7272-121]

Automated overlay recipe setup in high-volume manufacturing: improving performance, efficiency, and robustness, Christian Sparka, KLA-Tencor Germany (Germany); Anna Golotsvan, Yosef Avrahamov, KLA-Tencor Israel (Israel); Wolfgang Sitzmann, KLA-Tencor Germany (Germany); David C. Tien, KLA-Tencor Corp. (United States). . . [7272-122]

Optimization of alignment strategy for metal layer in local interconnect integration, Jun-Kyu Ahn, Ji-Hyun Ha, Hong-Ik Kim, Jeong-Lyeol Park, Jae-Sung Choi, Tae-Jong Lee, MagnaChip Semiconductor, Ltd. (Korea, Republic of) . . . . [7272-123]

Challenges of long-term process stability and solutions for better control, Jin-Phil Choi, SAMSUNG Electronics Co., Ltd. (Korea, Republic of); Nakgeuon Seong, Cymer, Inc. (United States); Sang-Ho Lee, Young-Seog Kang, Young-Kyou Park, SAMSUNG Electronics Co., Ltd. (Korea, Republic of) . . . . [7272-126]

Use of 3D metrology for process control, Bart Rijpers, Jo M. Finders, ASML Netherlands B.V. (Netherlands); Tatsuya Asahata, Toshiaki Fujii, SII NanoTechnology Inc. (Japan); Yuichiro Yamazaki, Masafumi Asano, Toshiba Corp. (Japan); Michael Rauscher, Carl Zeiss NTS GmbH (Germany). . . . . [7272-127]

Track optimization and control for 32-nm node double patterning and beyond, David Laidler, Philippe Foubert, Philippe J. Leray, Koen D'havé, IMEC (Belgium); Craig A. Rosslee, Len Tedeschi, Glen Mori, SOKUDO USA, LLC (United States) . . . . [7272-128]

Contact area as the intuitive definition of contact CD based on aerial image analysis, Netanel Polonsky, Amir M. Sagiv, Shmoolik Mangan, Applied Materials (Israel) . . . . [7272-129]

Focus and dose control for high-volume manufacturing of semiconductor, Koichi Sentoku, Hideki Ina, Takeaki Ebihara, Canon Inc. (Japan) . . . . [7272-130]

Efficient use of design-based binning for DRAM process monitoring, Arno Wehner, Andreas Fischer, Uwe Seifert, Jens Goeckeritz, Qimonda Dresden GmbH & Co. OHG (Germany); Laurent Karsenti, Mark Geshel, Applied Materials (Israel); Dieter Gscheidlen, Applied Materials GmbH (Germany); ofer lindman, Avishai Bartov, Applied Materials (Israel) . . [7272-131]

Proximity matching for ArF and KrF scanners, Jerome Depre, ASML Netherlands B.V. (Netherlands); Jongkyun Hong, ASML Taiwan Ltd. (Taiwan); Alexander Serebriakov, ASML Netherlands B.V. (Netherlands); YoungKi Kim, Lua Pohling, Jeong Soo Kim, Teng H. Ng, Chartered Semiconductor Manufacturing Ltd. (Singapore) . . . . [7272-132]

Scanner matching optimization, Michiel Kupers, Patrick Klingbeil, Joerg Tschischgale, Stefan Buhl, Qimonda Dresden GmbH & Co. OHG (Germany). . . . . [7272-133]

Multivariable predictive temperature control for photoresist processing, Arthur E. Tay, Yit Sung Ngo, National Univ. of Singapore (Singapore) . . . . [7272-134]

Comparative study of process window identification methods for 45-nm device and beyond, HoSung Kang, SooChul Lee, Ki-Ho Kim, YongTeak Jeong, SAMSUNG Electronics Co., Ltd. (Korea, Republic of); YeonHo Pae, ChangHo Lee, KLA-Tencor Corp. (United States) . . . . . . [7272-135]

Improve scanner matching using automated real-time feedback control via scanner match maker (SMM), Sheng-Hsiung Yu, Min-Hin Tung, Lei-Ken Wu, Ya-Tsz Yeh, Rexchip Electronics Corp. (Taiwan); James R. Manka, Chao-Tien Huang, KLA-Tencor Corp. (United States); John C. Robinson, KLA-Tencor Texas (United States); Chin-Chou K. Huang, David C. Tien, KLA-Tencor Corp. (United States); Yuyu Chen, Nikon Precision Tawian Ltd. (Taiwan) . . . . [7272-136]

In-line wafer double-check method, Arnold C. Chen, United Microelectronics Corp. (Taiwan) . . . . [7272-137]

Low-energy microcolumn for large field view inspection, Dae-Wook Kim, Young-Chul Kim, Seung-Joon Ahn, Tae-Sik Oh, Sun Moon Univ. (Korea, Republic of); Sang-Won Jin, Nam-Woo Hwang, CEBT Co. (Korea, Republic of); Ho-Seob Kim, Sun Moon Univ. (Korea, Republic of) [7272-139]

Hole inspection technology using Fourier imaging method, Yoshino Kiminori, Toshiba Corp. (Japan) . . . . [7272-140]

Experiment and simulation of voltage contrast of contacts and vias in SEM, Motoki Kadowaki, Akira Hamaguchi, Hideaki Abe, Yuichiro Yamazaki, Toshiba Corp. (Japan); Sergey Borisov, Sergey V. Babin, Abeam Technologies (United States) . . . . [7272-143]

Development and implementation of PWQ on patterned wafer darkfield inspection systems, Uwe Streller, Andreas Fischer, Arno Wehner, Jens Goeckeritz, Qimonda Dresden GmbH & Co. OHG (Germany); Markus Gahr, Martin Tuckermann, KLA-Tencor Germany (Germany); Jennifer Kopp, Monica Hellerqvist, KLA-Tencor Corp. (United States) . . . . [7272-145]

Monday 23 February – Poster Sessions – 5:30 to 8:00 pm

The following posters will be displayed all day Monday. Authors will be present during the formal poster session Monday evening between 5:30 and 8:00 pm for discussion. Authors may set-up their posters after 10:30 am on Monday.

Development of a novel methodology for effective partial die inspection and monitoring, Byoung-Ho Lee, Tae-Yong Lee, SAMSUNG Electronics Co., Ltd. (Korea, Republic of); Andrew Cross, Masami Aoki, HeungSoo Choi, Yeonho Pae, KLA-Tencor Corp. (United States) . . . .[7272-147]

Evaluation of a new photoresist dispense system to detect coating variation, Florent Gapin, Altis Semiconductor (France); Laurent STOCK, Marc Hanotte, Entegris S.A.S. (France). . . . .[7272-148]

A study on effect of point-of-use filters on defect reduction for advanced 193-nm processes, Nelson Vitorino, Elizabeth Wolfer, Yi Cao, Dongkwan Lee, AZ Electronic Materials USA Corp. (United States); Aiwen Wu, Entegris, Inc. (United States). . . . .[7272-149]

Automated defect review of the wafer bevel with a defect review scanning electron microscope, Tim Derouin, Lam Research Corp. (United States); Steve A. McGarvey, Hitachi High Technologies America, Inc. (United States). . . . .[7272-150]

Results from a new die-to-database reticle inspection system, William H. Broadbent, KLA-Tencor Corp. (United States) . . . .[7272-151]

Automated reticle inspection data analysis for wafer fabs, Bryan W. Reese, KLA-Tencor Corp. (United States) . . . .[7272-152]

Inspection and metrology tools benefit from free-form refractive micro-lens and micro-lens arrays, Tanja Bizjak, Lutz Aschke, Thomas Mitra, LIMO Lissotschenko Mikrooptik GmbH (Germany). . . . .[7272-153]

A scatterometry based CD metrology solution for advanced nodes, including capability of handling birefringent layers with uniaxial anisotropy, Chih-Ming Ke, Jimmy Hu, Willie Y. H. Wang, Jacky Huang, Tsai-Sheng Gau, Taiwan Semiconductor Manufacturing Co. Ltd. (Taiwan); Noelle Wright, Ruben Alvarez-Sanchez, Wim M. J. Coene, Marc Noot, Kiwi Yuan, Vivien Wang, Kaustuve Bhattacharyya, Karel D. van der Mast, ASML Netherlands B.V. (Netherlands) . . . .[7272-155]

An inverse ellipsometric problem for thin film characterization: comparison of different optimization methods, Ayse Akbalik, Sébastien Soulan, Jean-Hervé Tortai, David Fuard, Issiaka Kone, Jerome Hazart, Ctr. National de la Recherche Scientifique (France); Patrick Schiavone, Georgia Institute of Technology (United States) . . .[7272-156]

Analysis of Köhler illumination for 193-nm scatterfield microscope, Yeungjoon Sohn, Richard Quintanilha, Lowell P. Howard, Richard M. Silver, National Institute of Standards and Technology (United States) . . . .[7272-157]

A new illumination technique for grating-based nanometer measurement applications, Li Jiang, Tuskegee Univ. (United States) . . . .[7272-158]

Optical scatterometry simulation of FinFET using FDTD, Wenda Han, Xunya Jiang, Shanghai Institute of Microsystem and Information Technology (China) . . . .[7272-159]

3D semiconductor grooves measurement simulations (scatterometry) using MRTD method, Hirokimi Shirasaki, Tamagawa Univ. (Japan). . . . .[7272-160]

SCAT: software to model scatterometry using the rigorous electromagnetic theory, Sergey V. Babin, Leonid L. Doskolovich, Andrey Ivanchikov, Nikolay L. Kazanskiy, Ivan Kadomin, Abeam Technologies (United States); Yasuhiko Ishibashi, Toru Mikami, Yuuichiro Yamazaki, Toshiba Corp. (Japan). . . . .[7272-161]

Improved diffraction computation by a combination of RCWA and C-Method, Jörg Bischoff, Tokyo Electron Deutshcland GmbH (Germany). . . . .[7272-162]

Multipurpose optical profiler for characterization of materials and film stacks and absolute topography measurement, Xavier Colonna de Lega, Peter J. de Groot, Martin F. Fay, Mitch Haller, Zygo Corp. (United States); Mark P. Davidson, Spectel Research Corp. (United States) . . . .[7272-163]

Immersion scanner proximity matching using angle resolving scatterometry metrology, Reiner M. Jungblut, Shih-En Tseng, Jason J. S. Shieh, Jim Chen, Alek C. Chen, Jay Kou, Jan Hauschild, ASML Taiwan Ltd. (Taiwan); Koen Schreel, ASML The Netherlands B.V. (Netherlands) . . . .[7272-164]

Integrated ODP metrology with floating n&k's for lithography process control, Patrick Kearney, Tokyo Electron Europe Ltd. (Germany); Goeran Fleischer, Qimonda Dresden GmbH & Co. OHG (Germany); Dmitriy Likhachev, Tokyo Electron America, Inc. (United States); Junichi Uchida, Tokyo Electron Europe Ltd. (Germany). . . . .[7272-165]

Scatterometry software simulator development using RCWA, CG and GA methods, Hirokimi Shirasaki, Tamagawa Univ. (Japan) . . . . . .[7272-167]

Restoring pattern crossections using scatterometry: various approaches, Sergey V. Babin, Leonid L. Doskolovich, Elena Kadomina, Sergey Volotovskiy, Abeam Technologies (United States) . . . .[7272-168]

Process optimization for optical CD correlation improvement of ADI and AEI 3D structure by using iODP, Anice Lee, Chung-Yi Lin, Feng-Yi Chen, Wen-Hao Chang, Nanya Technology Corp. (Taiwan) . . . .[7272-169]

Using scatterometry to improve process control during the spacer pitch splitting process, Scott Corboy, Craig W. MacNaughton, Thomas Gubiotti, KLA-Tencor Corp. (United States) . . . .[7272-171]

Optimization of process segmented metrology markers: simulation and experimental results, Joerg Tschischgale, Sven Trogisch, Qimonda Dresden GmbH & Co. OHG (Germany) . . .[7272-172]

Improved OPC measurement of advanced 32-nm technology node on FEM for OPC model calibration logic fab environment, Costa Adi, Applied Materials (Israel) . . . .[7272-173]

Time dependence of charging in CD-SEM: measurement and simulation using Monte Carlo software, Sergey V. Babin, Sergey Borisov, Andrey Ivanchikov, Abeam Technologies (United States); Motoki Kadowaki, Akira Hamaguchi, Hideaki Abe, Yuuichiro Yamazaki, Toshiba Corp. (Japan) . . . .[7272-174]

Arbitrary precision value overlay and alignment system by using double positioning of mask and wafer and electronics parallel datum and nano-array sensor, Wynn Bear, Consulting (United States) . . . .[7272-175]

Strategic shifts in airborne molecular contamination (AMC) monitoring of 193-nm photolithography environments, Steven Rowley, Particle Measuring Systems, Inc. (United States) . . . .[7272-176]

Noise-free estimation of spatial line edge roughness parameters: modeling and experimental results, Vassilios Constantoudis, Evangelos Gogolides, Institute of Microelectronics (Greece) . . . .[7272-177]

Comparison of physical gate-CD with in-die at-speed non-contact measurements for bin-yield and process optimization, James S. Vickers, Tau-Metrix Inc. (United States); Jean Galvier, Wim Doedel, Crolles II Alliance (France); Gary Steinbrueck, Tau-Metrix Inc. (United States); Bertrand Borot, Maxime Gatefait, Pascal Gouraud, Philippe Gros, Crolles II Alliance (France); Gloria Johnson, Majid Babazadeh, Mario M. Pelella, Nader Pakdaman, Tau-Metrix Inc. (United States) . . . .[7272-178]

Implementation of multiple ROI with single FOV for advanced mask metrology, Kyu-hwa Jeong, Hatsey Frezghi, Malahat Tavassoli, Intel Corp.; Stephen Kim, Ray Morgan, Synopsys Inc. [7272-179]

Conference 7273 Advances in Resist Materials and Processing Technology XXVI

Novel Materials, Processes, and Applications

DUV-assisted e-beam resist process, Wei-Su G. Chen, Industrial Technology Research Institute (Taiwan) . . . .[7273-59]

Improved CD uniformity for shrink-assisted patterning, Lu Chen, Nikolaos Bekiaris, Glen Mori, SOKUDO USA, LLC (United States). . . . . . .[7273-60]

Fabrication of 22-nm polysilicon gate using resist shrink technology, Fumiko Iwao, Satoru Shimura, Tetsu Kawasaki, Tokyo Electron Kyushu Ltd. (Japan); Masato Kushibiki, Eiichi Nishimura, Tokyo Electron AT Ltd. (Japan). . . . .[7273-61]

Properties of the novel deprotecting unit for next-generation ArF resist polymer, Akinori Shibuya, Shuhei Yamaguchi, Yuko Yoshida, Michihiro Shirakawa, FUJIFILM Corp. (Japan). . . . . . .[7273-63]

Spin-on overcoats for self-aligned double patterning, Ralph R. Dammel, AZ Electronic Materials USA Corp. (United States); Yusuke Takano, Jin Li, Tomonori Ishikawa, AZ Electronic Materials (Japan) K.K. (Japan); John P. Sagan, AZ Electronic Materials USA Corp. (United States) . . . . . .[7273-64]

Chemically amplified hybrid resist platform for i-line applications, Medhat A. Toukhy, Margareta Paunescu, Zachary Bogusz, Georg Pawlowski, AZ Electronic Materials USA Corp. (United States) . . . .[7273-65]

Criteria for success in e-beam photoresists, Amy E. Zweber, IBM Corp. (United States) and Toppan Photomasks, Inc. (United States); Toru Komizo, Toppan Photomasks, Inc. (United States); James P. Levin, IBM Microelectronics Div. (United States); Zdenek Benes, IBM Corp. (United States) . .[7273-66]

Monday 23 February – Poster Sessions – 5:30 to 8:00 pm

The following posters will be displayed all day Monday. Authors will be present during the formal poster session Monday evening between 5:30 and 8:00 pm for discussion. Authors may set-up their posters after 10:30 am on Monday.

0.30k1 CH delineation with novel image reversal materials, Jun Hatakeyama, Kazuhiro Katayama, Takao Yoshihara, Yoshio Kawai, Toshinobu Ishihara, Shin-Etsu Chemical Co., Ltd. (Japan) . . . . .[7273-67]

KrF resists and process for implant layers at advanced nodes, Hung-Chin Huang, United Microelectronics Corp. (Taiwan); Yoshihiro Yamamoto, Rohm & Haas Electronic Materials K.K. (Japan) . . . .[7273-68]

Process-induced bias: a study of resist design, device node, illumination conditions, and process implications, Michael A. Carcasi, Steven A. Scheer, Tokyo Electron America, Inc. (United States); Carlos Fonseca, TEL Technology Ctr., America, LLC (United States); Tsuyoshi Shibata, Hitoshi Kosugi, Takahisa Otsuka, Tokyo Electron Kyushu Ltd. (Japan)[7273-69]

Microbridge and e-test opens defectivity reduction via improved filtration of photolithography fluids, Michael Mesawich, Michael S. Sevegney, Barry Gotlinsky, Pall Corp. (United States); Santos Reyes, Patrick R. Abbott, Jeremy Marzani, Freescale Semiconductor, Inc. (United States) . . . .[7273-70]

Post-develop blob defect reduction, Masahiko Harumoto, Sei Negoro, Akihiro Hisai, Tanaka Michio, SOKUDO Co., Ltd. (Japan); Glen Mori, SOKUDO USA, LLC (United States); Mark Slezak, JSR Micro, Inc. (United States). . . . .[7273-71]

Thin NIL films characterization (viscosity, adhesion) with rheological nanoprobe, Sergey I. Zaitsev, Alexander A. Svintsov, O. Trofimov, Institute of Microelectronics Technology and High Purity Materials (Russian Federation) . . . .[7273-72]

Embedded micro/nano channels formation for three-dimensional negative-tone photoresist microstructuring, Sang-Kon Kim, Hye-Keun Oh, Hanyang Univ. (Korea, Republic of) . . . .[7273-73]

Analysis of the effect of point-of-use filtration on microbridging defectivity, Jennifer Braggin, Entegris, Inc. (United States); Roel Gronheid, Shaunee Y. Cheng, Dieter Van Den Heuvel, Sophie Bernard, Philippe Foubert, IMEC (Belgium); Craig A. Rosslee, SOKUDO USA, LLC (United States) . . . .[7273-75]

In-wafer CD uniformity improvement by controlling inter-zone coupling effects in multi-zone post-expose bake processes, Jin-Phil Choi, Jung-Ik Ha, Ha-Soo Kim, Sang-Ho Lee, Young-Seog Kang, Young-Kyou Park, SAMSUNG Electronics Co., Ltd. (Korea, Republic of). . . . .[7273-76]

Novel resist for replica preparation of mold for imprint lithography, Daisaku Matsukawa, Hiroyuki Wakayama, Kazuyuki Mitsukura, Haruyuki Okamura, Yoshihiko Hirai, Masamitsu Shirai, Osaka Prefecture Univ. (Japan). . . . .[7273-77]

Pressure control for reduced microbubble formation, Jennifer Braggin, Entegris, Inc. (United States) . . . .[7273-78]

Productivity improvement in the wafer backside washing before exposure, Shuuichi Nishikido, Tokyo Electron Kyushu Ltd. (Japan) . . . . . .[7273-79]

Development of novel UV cross-linkable materials for enhancing planarity in gap-filling applications via the correlation of simulated and experimental analyses, Satoshi Takei, Nissan Chemical Industries, Ltd. (Japan); Michael W. Lin, The Univ. of Texas at Austin (United States); Sangwoong Yoon, Tomoya Ohashi, Yusuke Horiguchi, Yasuyuki Nakajima, Nissan Chemical Industries, Ltd. (Japan); C. Grant Willson, The Univ. of Texas at Austin (United States) . . . .[7273-80]

Method for forming patterned-photoresist layer, Chien-Chih Fang, Te-shao Hsu, Chih-Jung Chen, United Microelectronics Corp. (Taiwan). . . .[7273-81]

Comparison of thermal and chemical shrink processes for 193-nm contact-hole patterning, Takanori Kudo, Charito Antonio, John P. Sagan, Srinivasan Chakrapani, Deepa Parthasarathy, Sungeun Hong, Muthiah Thiyagarajan, Yi Cao, Munirathna Padmanaban, AZ Electronic Materials USA Corp. (United States) . . . .[7273-82]

ARCs and Multi-Layer Processes

Ultra-low k1 process window optimization in hyper-NA immersion lithography when using thin antireflective coating, Danilo De Simone, Enrico Tenaglia, Gina Cotti, Paolo Canestrari, Numonyx Srl (Italy); Jonathan Jeauneau, Darron Jurajda, Zhimin Zhu, Brewer Science, Inc. (United States) . .[7273-84]

Organic underlayer materials with exceptionally high-thermal stability, Hwan-Sung Cheon, Kyong-Ho Yoon, Min-Soo Kim, Sung Bae Oh, Jee-Yun Song, Nataliya Tokareva, Jong-Seob Kim, Tuwon Chang, Cheil Industries Inc. (Korea, Republic of) . . . .[7273-85]

Effects of carbon/hardmask interactions on hardmask performance, Charles J. Neef, Christopher R. James, Brewer Science, Inc. (United States) . . . .[7273-86]

Improving performance of light-sensitive developer-soluble antireflective coatings by using adamantyl polymers, Jim D. Meador, Joyce A. Lowes, Charlyn Stroud, Sherilyn Thomas, Yilin Qiu, Ramil-Marcelo L. Mercado, Brewer Science, Inc. (United States) . . . .[7273-87]

Controlling etch properties of silicon-based antireflective spin-on hardmask materials, Sang Kyun Kim, Hyeon Mo Cho, Changsoo Woo, Sang Ran Koh, Mi-Young Kim, Hui Chan Yoon, Woojin Lee, Seung-Wook Shin, Jong-Seob Kim, Tuwon Chang, Cheil Industries Inc. (Korea, Republic of) . . . .[7273-88]

Modified trilayer resist approach for ArF immersion lithography, Tae-Hwan Oh, Yunsuk Nam, Suhyun Kim, Minkeun Kwak, Hyungsam Choi, Chansam Chang, Yongchul Kim, Hong-Jae Shin, Nae-In Lee, SAMSUNG Electronics Co., Ltd. (Korea, Republic of) . . . .[7273-89]

The sequence of set-up lithography process with inorganic hardmask on non-flatten topology substrate, Sang-Uk Lee, Hong-Ik Kim, Meng-An Jung, Hyunhee Nam, Ji-Hyun Ha, Jae-Sung Choi, Tae-Jong Lee, MagnaChip Semiconductor, Ltd. (Korea, Republic of) . . . .[7273-90]

Radiation sensitive developable bottom anti-reflective coatings (DBARC): recent results, Francis M. Houlihan, Alberto Dioses, Meng Li, Lin Zhang, Takanori Kudo, Charito Antonio, Sumathy Vasanthan, Srinivasan Chakrapani, Deepa Parthasarathy, Edward Ng, Yayi Wei, Ping-Hung Lu, Mark Neisser, Munirathna Padmanaban, AZ Electronic Materials USA Corp. (United States) . . . .[7273-91]

Immersion BARC for Hyper NA Applications, Wan-Ju Tseng, United Microelectronics Corp. (Taiwan) and Rohm and Haas Electronic Materials LLC (United States); Hung-Chin Huang, Bill Lin, Steven Wu, E. T. Liu, Chun Chi Yu, United Microelectronics Corp. (Taiwan); Sue Ryeon Kim, United Microelectronics Corp. (Taiwan) and Rohm and Haas Electronic Materials LLC (United States); Jeong Yun Yu, Gerald Wayton, Sook Lee, Sabrina Wong, Maurizio Ciambra, Suzanne Coley, David Praseuth, Kathleen M. O'Connell, United Microelectronics Corp. (Taiwan) . . . .[7273-92]

Reflection control for immersion lithography: a single organic antireflectant over high-reflective substrates for double patterning, Jeong Yun Yu, Sabrina Wong, Sue Ryeon Kim, Mike Mori, Amy Kwok, Kathleen M. O'Connell, Rohm and Haas Electronic Materials LLC (United States); Ki Lyoung Lee, Rohm and Haas Electronic Materials LLC (United States) and Hynix Semiconductor Inc. (Korea, Republic of); Sungkoo Lee, Dong-Heok Park, Rohm and Haas Electronic Materials LLC (United States) . . . .[7273-93]

Via filling material development for dual-Damascene application, Walter W. Liu, AZ Electronic Materials USA Corp. (United States). . . . . [7273-94]

Double Patterning and Double Exposure

Utilization of spin-on and reactive ion-etch critical dimension shrink with double patterning for 32 nm and beyond contact level interconnects, Andrew W. Metz, Shannon Dunn, Vaidyanathan Balasubramaniam, TEL Technology Ctr., America, LLC (United States); Jason R. Cantone, Kenichi Ueda, Thomas E. Winter, Tokyo Electron America, Inc. (United States); Karen E. Petrillo, Matthew E. Colburn, IBM Thomas J. Watson Research Ctr. (United States); Cherry Tang, Mark Slezak, JSR Micro, Inc. (United States) . . . .[7273-96]

Optical threshold layer and intermediate-state two-photon photoacid generator approaches to double-exposure lithography, Adam J. Berro, The Univ. of Texas at Austin (United States). . . .[7273-97]

Optical threshold layer for double-exposure lithography, Xinyu Gu, The Univ. of Texas at Austin (United States) . . . .[7273-98]

CD budget analysis in double-patterning lithography (Litho-Litho-Etch) using 'freezing' process, Hisanori Sugimachi, Tokyo Electron Kyushu Ltd. (Japan); Koichi Fujiwara, JSR Corp. (Japan) . . . .[7273-101]

Contact formation with extremely low proximity effect by double-patterning technology, C. W. Yeh, S. S. Yu, Chih-Hao Huang, Chin-Cheng Yang, Elvis Yang, H. J. Lee, Ta-Hung Yang, Kuang-Chao Chen, Chih-Yuan Lu, Macronix International Co., Ltd. (Taiwan) . . . .[7273-102]

Monday 23 February – Poster Sessions – 5:30 to 8:00 pm

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Double imaging with a vapor reaction chamber, Ralph R. Dammel, David J. Abdallah, AZ Electronic Materials USA Corp. (United States) . . . . .[7273-104]

Study of the simulation parameter for EUVL, Atsushi Sekiguchi, Litho Tech Japan Co., Ltd. (Japan) . . . .[7273-105]

Process latitude simulation of positive-tone litho-litho-etch freeze double patterning, Wallace P. Printz, Steven A. Scheer, Tokyo Electron America, Inc. (United States). . . . .[7273-106]

Performance of an ArF siloxane BARC exposed to a 172-nm UV cure for double patterning applications, Kyle Y. Flanigan, Joseph T. Kennedy, Benjamin Z. Y. Wu, Ron Katsanes, Honeywell Electronic Materials (United States); Thomas I. Wallow, Advanced Micro Devices, Inc. (United States); Junyan Dai, SOKUDO USA, LLC (United States); Nikolaos Bekiaris, Applied Materials, Inc. (United States); Hiram Cervera, Glen Mori, SOKUDO USA, LLC (United States) [7273-107]

EUV Resist Materials and Processes

Resolution and LWR improvements by acid diffusion control in EUV lithography, Tooru Tsuchihashi, Katsuhiro Yamashita, Tomotaka Tsuchimura, Hidenori Takahashi, Naoyuki Nishikawa, FUJIFILM Corp. (Japan) . . . .[7273-108]

Underlayer designs to enhance the performance of EUV resists, Hao Xu, Brewer Science, Inc. (United States); Todd R. Younkin, James M. Blackwell, Intel Corp. (United States) . . . .[7273-109]

EUV lithography for 30-nm HP and beyond: exploring resolution, sensitivity, and LWR tradeoffs, Ernisse S. Putna, Intel Corp. (United States) . . . .[7273-110]

Development of EUV resists at Selete, Hiroaki Oizumi, Daisuke Kawamura, Koji Kaneyama, Shinji Kobayashi, Toshiro Itani, Semiconductor Leading Edge Technologies, Inc. (Japan) . . . .[7273-111]

Non-chemically amplified negative resist for EUV lithography, Masamitsu Shirai, Koichi Maki, Haruyuki Okamura, Osaka Prefecture Univ. (Japan); Kanayama Koji, Toshiro Itani, Semiconductor Leading Edge Technologies, Inc. (Japan) . . . .[7273-112]

Pattern-transfer process development for EUVL, Daisuke Kawamura, Toshiro Itani, Semiconductor Leading Edge Technologies, Inc. (Japan) .[7273-113]

EUV-resist outgassing quantification methods and application, Shinji Kobayashi, Julius Joseph S. Santillan, Hiroaki Oizumi, Toshiro Itani, Semiconductor Leading Edge Technologies, Inc. (Japan) . . . .[7273-114]

EUV-resist processing in vacuum, Koji Kaneyama, Shinji Kobayashi, Toshiro Itani, Semiconductor Leading Edge Technologies, Inc. (Japan) .[7273-115]

Non-ionic PAG photoacid generator behavior ender high-energy exposure sources, Richard A. Lawson, David Noga, Clifford L. Henderson, Georgia Institute of Technology (United States) . . .[7273-116]

Super photoacid generators (SPAGs)-based chemical amplified resists for EUV lithography, Mingxing Wang, Kenneth E. Gonsalves, The Univ. of North Carolina at Charlotte (United States)[7273-117]

Development of partially fluorinated resist polymers for EUV and EB lithography, Takashi Sasaki, Osamu Yokokoji, Asahi Glass Co., Ltd. (Japan) . . . .[7273-118]

Fluorinated anionic photoacid generators(PAGs)-bound polymer resists for EUV lithography, Mingxing Wang, The Univ. of North Carolina at Charlotte (United States); Tapia-Tapia Melina, Nikola Batina, Univ. Autónoma Metropolitana-Iztapalapa (Mexico); Kenneth E. Gonsalves, The Univ. of North Carolina at Charlotte (United States) . . . . .[7273-119]

Influences of polymer disposition on EUV resist performances, Jung Youl Lee, Jeong-Woo Kim, Hyun-Jin Kim, Jae-Woo Lee, Deog-Bae Kim, Jae-Hyun Kim, Dongjin Semichem Co. Ltd. (Korea, Republic of) and Seoul National Univ. (Korea, Republic of) . . . .[7273-120]

Sensitivity of EUV resists to out-of-band radiation, Jeanette M. Roberts, Robert L. Bristol, Intel Corp. (United States); Theodore H. Fedynyshyn, David K. Astolfi, Alberto Cabral, MIT Lincoln Lab. (United States) . . . .[7273-121]

Dissolution Kinetics and deprotection reaction in chemically amplified resists, Hiroki Yamamoto, Takahiro Kozawa, Seiichi Tagawa, Osaka Univ. (Japan); Takeyoshi Mimura, Takeshi Iwai, Junichi Onodera, Tokyo Ohka Kogyo Co., Ltd. (Japan) . . . .[7273-122]

Evaluation of alcoholic hydroxyl derivatives for chemically amplified extreme-ultraviolet resist, Kikuo Furukawa, Mitsubishi Gas Chemical Co., Inc. (Japan); Takahiro Kozawa, Seiichi Tagawa, Osaka Univ. (Japan). . . . .[7273-123]

Evaluation of novel resist materials for EUV lithography, Ichihiro Aratani, Shuji Matsunaga, Tsuyoshi Kajiyashiki, Kuraray Co., Ltd. (Japan) . . . .[7273-124]

Evaluation of track performance for EUV lithography, Keiichi Tanaka, Tokyo Electron Kyushu Ltd. (Japan) and Semiconductor Leading Edge Technologies, Inc. (Japan); Junji Nakamura, Yamada Yoshiaki, Tokyo Electron Kyushu Ltd. (Japan); Toshiro Itani, Semiconductor Leading Edge Technologies, Inc. (Japan) . . . .[7273-125]

Development of novel polymers for non-CAR resists for EUV lithography, Andrew K. Whittaker, Idriss Blakey, James Blinco, Kevin Jack, Heping Liu, Anguang Yu, The Univ. of Queensland (Australia); Michael Leeson, Yeuh Wang, Todd R. YounKin, Intel Corp. (United States) . . . .[7273-175]

Immersion Lithography Materials and Processes

CD and defect improvement challenges for immersion processes, Seiji Nakagawa, Toshiba Corp. (Japan); Timothy B. Michaelson, SOKUDO USA, LLC (United States); Seiji Shitani, Toshinari Yamasaki, Keisuke Ehara, Toshiba Corp. (Japan); Akihiko Morita, Jeonghun Kim, Masashi Kanaoka, Shuichi Yasuda, Masaya Asai, SOKUDO Co., Ltd. (Japan) . . . .[7273-126]

Toward the design and development of 193-nm generation three immersion fluid candidates, Shu Li, Louis E. Brus, Michael Steigerwald, Nicholas J. Turro, Xue-Gong Lei, Steffen Jockusch, Columbia Univ. (United States); Paul A. Zimmerman, SEMATECH, Inc. (United States) . . . .[7273-127]

Defect reduction of topcoatless resist by selective segregation removal step in development, Takuya Hagiwara, Takeo Ishibashi, Tomofumi Miyauchi, Tetsuro Hanawa, Renesas Technology Corp. (Japan); Mamoru Terai, Teruhiko Kumada, Mitsubishi Electric Corp. (Japan) . . . .[7273-129]

Characterization of film cut position at wafer bevel for effective immersion-lithography process, Kazuyuki Matsumaro, Miyoshi Seki, Takeshi Kato, Semiconductor Leading Edge Technologies, Inc. (Japan) . . . .[7273-131]

High-index nanocomposite photoresist for 193-nm lithography, Woo Jin Bae, Markos Trikeriolis, Robert Rodriguez, Michael F. Zettel, Christopher K. Ober, Emmanuel P. Giannelis, Cornell Univ. (United States); Paul A. Zimmerman, SEMATECH, Inc. (United States) . . . .[7273-132]

Integration of improved develop process for topcoat-less immersion resists, Craig A. Rosslee, SOKUDO USA, LLC (United States); Philippe J. Leray, David Laidler, IMEC (Belgium); Masahiko Harumoto, Akihiro Hisai, Michio Tanaka, SOKUDO Co., Ltd. (Japan); Glen Mori, SOKUDO USA, LLC (United States) . . . .[7273-133]

Non-topcoat process development for ArF immersion lithography, Takehiko Naruoka, Nobuji Matsumura, Akimasa Soyano, Shiro Kusumoto, Yoshikazu Yamaguchi, JSR Corp. (Japan); Hiroshi Arima, Yuichi Yoshida, Kousuke Yoshihara, Tsuyoshi Shibata, Tokyo Electron Kyushu Ltd. (Japan). . . . .[7273-134]

Backside EBR process performance with various wafer properties, Tomohiro Goto, Kazuhito Shigemori, Masakazu Sanada, SOKUDO Co., Ltd. (Japan) . . . .[7273-135]

High-refractive index nanoparticles for 193-nm immersion lithography, Robert Rodriguez, Michael F. Zettel, Markos Trikeriotis, Aristeidis Bakandritsos, Woo Jin Bae, Christopher K. Ober, Emmanuel P. Giannelis, Cornell Univ. (United States); Paul A. Zimmerman, SEMATECH, Inc. (United States) . . . .[7273-137]

Defectivity process optimization on immersion topcoat less resist stacks, Len Tedeschi, SOKUDO USA, LLC (United States); Kazuhito Shigemori, Akihiro Hisai, Masahiko Harumoto, SOKUDO Co., Ltd. (Japan); Suping Wang, Coen Verspaget, Orhangazi Tanriseven, Raymond Maas, Joerg Mallmann, ASML Netherlands B.V. (Netherlands) . . . .[7273-138]

LER/LWR Behavior in Resists

Reduction of line width and edge roughness by resist reflow process for extreme-ultraviolet lithography, In Wook Cho, Joon-Min Park, Hyunsu Kim, Jaisun Kyoung, Hanyang Univ. (Korea, Republic of); Seong-Sue Kim, Han-Ku Cho, SAMSUNG Electronics Co., Ltd. (Korea, Republic of); Hye-Keun Oh, Hanyang Univ. (Korea, Republic of). . .[7273-140]

Line edge and width-roughness dependency on each ingredient of the extreme-ultraviolet molecular resist, Hyunsu Kim, In Wook Cho, Hanyang Univ. (Korea, Republic of); Seong-Sue Kim, Han-Ku Cho, SAMSUNG Electronics Co., Ltd. (Korea, Republic of); Hye-Keun Oh, Hanyang Univ. (Korea, Republic of) . . . .[7273-141]

Monday 23 February – Poster Sessions – 5:30 to 8:00 pm

The following posters will be displayed all day Monday. Authors will be present during the formal poster session Monday evening between 5:30 and 8:00 pm for discussion. Authors may set-up their posters after 10:30 am on Monday.

A study on the PAG material design for chemically amplified photoresists, Yoshiyuki Utsumi, Takehiro Seshimo, Akiya Kawaue, Yoshitaka Komuro, Keita Ishiduka, Kensuke Matsuzawa, Hideo Hada, Junichi Onodera, Tokyo Ohka Kogyo Co., Ltd. (Japan) . . . .[7273-143]

Stochastic approach to modeling line-edge roughness in photolithography, Chris A. Mack, Consultant (United States) . . . .[7273-145]

Important challenges for line-width-roughness reduction, Eiichi Nishimura, Masato Kushibiki, Tokyo Electron AT Ltd. (Japan); Yuichiro Inatomi, Fumiko Iwao, Satoru Shimura, Tetsu Kawasaki, Tokyo Electron Kyushu Ltd. (Japan); Kazuhide Hasebe, Tokyo Electron Tohoku Ltd. (Japan); Hiroki Murakami, Tokyo Electron Kyushu Ltd. (Japan); Arisa Hara, Kazuo Yabe, Hidetami Yaegashi, Tokyo Electron AT Ltd. (Japan). . . . .[7273-146]

Stochastic approach to modeling photoresist development, Chris A. Mack, lithoguru.com (United States) . . . .[7273-147]

Line-edge roughness transfer during plasma etching: modeling approaches and comparison with experimental results, George Kokkoris, Vassilios Constantoudis, George P. Patsis, Evangelos Gogolides, Institute of Microelectronics (Greece); Erwine Pargon, Commissariat à l'Energie Atomique (France). . . . .[7273-177]

Molecular Resists

Reverse tone trilayer processing, David J. Abdallah, Ralph R. Dammel, AZ Electronic Materials USA Corp. (United States) . . . .[7273-148]

Quantitative measurement of the molecular-mass distribution in Calix[4]resorcinarene molecular glass resists by mass spectrometry, William E. Wallace, Charles M. Guttman, Kathleen M. Flynn, David L. VanderHart, Vivek M. Prabhu, National Institute of Standards and Technology (United States); Anuja De Silva, Nelson Felix, Christopher K. Ober, Cornell Univ. (United States) . . . . . .[7273-149]

Adamantane-based molecular glass resists and novel monomers for 193 nm, Shinji Tanaka, Miki Murakami, Kazuya Fukushima, Naoya Kawano, Yohitaka Uenoyama, Katsuki Ito, Hidetoshi Ohno, Nobuaki Matsumoto, Idemitsu Kosan Co., Ltd. (Japan) . . . .[7273-151]

High-resolution molecular glass resists for next-generation lithography, Marie E. Krysak, Anuja De Silva, Jing Sha, Christopher K. Ober, Cornell Univ. (United States) . . . .[7273-152]

Reworkable spin-on trilayer materials: optimization of rework process and solutions for manufacturability, Ruzhi Zhang, Allen G. Timko, Yayi Wei, John R. Zook, Lyudmila Pylneva, Yi Yi, Chenghong Li, Hengpeng Wu, M. Dalil Rahman, Douglas S. McKenzie, Clement T. Anyadiegwu, Ping-Hung Lu, Mark Neisser, Ron Bradbury, Timothy Lee, AZ Electronic Materials USA Corp. (United States) . . . .[7273-153]

Novel chemically amplified molecular glass photoresist materials derived from dimeric abietic acid, Liyuan Wang, Jinxing Yu, Beijing Normal Univ. (China) . . . .[7273-154]

Development of new phenyl-Calix[4]resorcinarene including bromine atom, carboxy group, and phenolic-hydroxy group: its application to positive-tone molecular resists for EB and EUV lithography, Masatoshi Echigo, Dai Oguro, Mitsubishi Gas Chemical Co., Inc. (Japan) [7273-155]

Development of novel positive-tone resists for EUVL, Takanori Owada, Idemitsu Kosan Co., Ltd. (Japan) . . . .[7273-156]

Integrating photo-patternable low- materials into advanced semiconductor Cu BEOL, Qinghuang Lin, IBM Thomas J. Watson Research Ctr. (United States); A. Nelson, Phillip J. Brock, IBM Almaden Research Ctr. (United States); S. Cohen, IBM Thomas J. Watson Research Ctr. (United States); Blake W. Davis, IBM Almaden Research Ctr. (United States); J. Gambino, IBM Corp. (United States); Martin Glodde, E. Liniger, D. Neumayer, Y. Ostrovski, Jyotica Patel, Eva Simonyi, IBM Thomas J. Watson Research Ctr. (United States); Ratnam Sooriyakumaran, IBM Almaden Research Ctr. (United States); Sampath Purushothaman, IBM Thomas J. Watson Research Ctr. (United States); Robert D. Miller, IBM Almaden Research Ctr. (United States); R. Wisnieff, IBM Thomas J. Watson Research Ctr. (United States) . . . .[7273-157]

Molecular glass resists developable in supercritical carbon dioxide for 193-nm lithography, Jing Sha, Jin-Kyun Lee, Christopher K. Ober, Cornell Univ. (United States) . . . . . .[7273-158]

Molecular resist based on Calix[4]resorcinarene derivatives for EB lithography, Ken-ichi Okuyama, Dai Nippon Printing Co., Ltd. (Japan). . . . .[7273-159]

Practical implementation of immersion resist materials, Hamid R. Khorram, Nikon Precision Inc. (United States); Katsushi Nakano, Natsuko Sagawa, Yuuki Ishii, Tomoharu Fujiwara, Yasuhiro Iriuchijima, Tadamasa Kawakubo, Nikon Corp. (Japan) . . . .[7273-160]

Molecular glass resist film stability by x-ray diffraction, Jeong-Sik Kim, Dongjin Semichem Co. Ltd. (Korea, Republic of) and Pohang Univ. of Science and Technology (Korea, Republic of); Jae-Woo Lee, Deog-Bae Kim, Jae-Hyun Kim, Dongjin Semichem Co. Ltd. (Korea, Republic of); Sung-Il Ahn, Wang-Cheol Zin, Pohang Univ. of Science and Technology (Korea, Republic of) . . . .[7273-161]

Resist Fundamentals

Theoretical analysis of energy degradation of electron in the resists, Minoru Toriumi, Lab. for Interdisciplinary Science and Technology (Japan). . . . .[7273-162]

Theoretical analysis of development behavior of resist measured by QCM, Minoru Toriumi, Lab. for Interdisciplinary Science and Technology (Japan) . . . .[7273-163]

Temperature and critical-dimension variation in a single wafer on hot plate due to non-uniform heat source, Bobae Kim, Joon-Min Park, Hyunsu Kim, Do Wan Kim, Ilsin An, Seung-Wook Park, Hye-Keun Oh, Hanyang Univ. (Korea, Republic of) . . . . . .[7273-164]

Decomposition analysis of molecular resists to further CD control, Daiju Shiono, Tokyo Ohka Kogyo Co., Ltd. (Japan) and Univ. of Hyogo (Japan); Takeo Watanabe, Hiroo Kinoshita, Univ. of Hyogo (Japan) . . . .[7273-165]

Diffusion of acid and amine at resist/BARC interface, Masamitsu Shirai, Noriaki Majima, Haruyuki Okamura, Osaka Prefecture Univ. (Japan); Yoshiomi Hiroi, Yasuyuki Nakajima, Nissan Chemical Industries, Ltd. (Japan). . . . .[7273-166]

EUV resist requirements: absorbance and acid yield, Roel Gronheid, IMEC (Belgium); Carlos Fonseca, Tokyo Electron America, Inc. (United States); Michael J. Leeson, Intel Corp. (United States); Jacob R. Adams, Jeffrey R. Strahan, C. Grant Willson, The Univ. of Texas at Austin (United States); Bruce W. Smith, Rochester Institute of Technology (United States) . . . .[7273-167]

Study of residue-type defect formation mechanism and effect of advanced defect reduction (ADR) rinse process, Hiroshi Arima, Tokyo Electron Kyushu Ltd. (Japan); Yuki Kushida, JSR Corp. (Japan) . . . .[7273-168]

The dissolution behavior of hexafluoroalchol containing 2-fluoroacrylate polymers for resist materials, Yamashita Tsuneo, Kishikawa Yosuke, Morita Masamichi, Tanaka Yoshito, Kanemura Takashi, Daikin Industries, Ltd. (Japan) . . .[7273-169]

Simulation of Resist Processes

Characteristic three-dimensional structure of resist's distribution after drying a resist solution coated on a flat substrate: analysis using the extended dynamical model of the drying process, Hiroyuki Kagami, Nagoya College (Japan) [7273-170]

Resist reflow modeling for complex patterns, Jinho Park, Seung-Ryong Park II, Hye-Sung Lee, Young-Je Yun, Kwang-Seon Choi, Jae-Won Han, Dongbu HiTek Co., Ltd. (Korea, Republic of) . . . .[7273-171]

Dynamical interpretation of critical ionization model for photoresist dissolution, Siddharth Chauhan, The Univ. of Texas at Austin (United States); Chris A. Mack, lithoguru.com (United States); C. Grant Willson, The Univ. of Texas at Austin (United States) . . . .[7273-172]

Meso-scale simulation of the polymer dynamics in the formation process of line-edge roughness, Hiroshi Morita, National Institute of Advanced Industrial Science and Technology (Japan); Masao Doi, The Univ. of Tokyo (Japan) . . . .[7273-173]

Advantages of a calibrated physical-resist model for contact patterns prediction of sub-50-nm node, Yung Long Hung, Nanya Technology Corp. (Taiwan) . . . .[7273-174]

Tuesday 24 February

Conference 7271

Alternative Lithographic Technologies

Room: Conv. Ctr. B 1-4 . . . . Tues. 7:55 to 8:00 am

Welcome and Introduction

Session Chair: **Frank M. Schellenberg,** Mentor Graphics Corp.

SESSION 1

Room: Conv. Ctr. B 1-4 . . . . Tues. 8:00 to 10:00 am

Keynotes: EUV

Session Chairs: **Bruno M. La Fontaine,** Advanced Micro Devices, Inc.; **James A. Liddle,** National Institute of Standards and Technology

8:00 am: **EUV system: moving toward production** *(Keynote Presentation)***,** Hans Meiling, Noreen Harned, Christian Wagner, ASML Netherlands B.V. (Netherlands); Martin Lowisch, Carl Zeiss SMT AG (Germany) . . . . [7271-01]

8:40 am: **LPP source system development for HVM** *(Keynote Presentation)***,** David C. Brandt, Igor V. Fomenkov, Alex I. Ershov, William N. Partlo, Dave W. Myers, Norbert R. Bowering, Alexander N. Bykanov, Oleh V. Khodykin, Georgiy O. Vaschenko, Cymer, Inc. (United States) . . . . [7271-02]

9:20 am: **Integration of EUV lithography in the fabrication of 22-nm node devices** *(Keynote Presentation)***,** Obert Wood II, Yunfei Deng, Uzodinma Okoroanyanwu, Sudhar Raghunathan, Advanced Micro Devices, Inc. (United States); Anna Tchikoulaeva, AMD Saxony LLC & Co. KG (Germany); Thomas I. Wallow, Bruno M. La Fontaine, Advanced Micro Devices, Inc. (United States); Chiew-seng Koay, IBM Corp. (United States); Karen E. Petrillo, IBM Thomas J. Watson Research Ctr. (United States); Martin Burkhardt, Gregory R. McIntyre, John Arnold, David V. Horak, IBM Corp. (United States); Hiroyuki Mizuno, Toshiba America Electronic Components, Inc. (United States); Kevin D. Cummings, Sang-In Han, Robert M. Routh, Bill Pierson, Anita Fumar-Pici, Robert Watso, ASML US, Inc. (United States) . . . . [7271-03]

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

Conference 7271 continues on page 30.

Conference 7272

Metrology, Inspection, and Process Control for Microlithography XXIII

SESSION 4

Room: Conv. Ctr. J 1-4 . . . . Tues. 8:30 to 10:10 am

Overlay

Session Chairs: **Michael E. Adel,** KLA-Tencor Israel (Israel); **Chas N. Archie,** IBM Corp.

8:30 am: **Overlay metrology for double patterning processes**, Philippe J. Leray, David Laidler, Shaunee Cheng, IMEC (Belgium); Daniel Kandel, Michael E. Adel, Anat Marchelli, Anna Golotsvan, KLA-Tencor Israel (Israel); Mauro Vasconi, Numonyx Srl (Italy); Bartlomiej W. Salski, QWED (Poland); Berta A. Dinu, KLA-Tencor Israel (Israel) . . . . [7272-15]

8:50 am: **Implementation of the high-order overlay control for mass production of 40-nm node logic devices**, Daisuke Umeda, Mami Miyasaka, Takayuki Uchiyama, NEC Electronics Corp. (Japan) . . . . [7272-18]

9:10 am: **Using intrafield high-order correction by reticle registration to achieve overlay requirement for sub-40-nm node**, Chun-Yen Huang, Chia-Tsung Hung, Nanya Technology Corp. (Taiwan) . . . . [7272-20]

9:30 am: **Development of a new overlay control method 'Polar Correction' of higher order intrafield error which depends on the wafer coordinates**, Manabu Takakuwa, Keigo Toriumi, Nobuhiro Komine, Kazutaka Ishigo, Takuya Kono, Tetsuro Nakasugi, Tatsuhiko Higashiki, Toshiba Corp. (Japan) . . . [7272-21]

9:50 am: **Optimization of multiple and colliding laser-produced plasmas for EUV lithography**, Ahmed Hassanein, Purdue Univ. (United States) . . . . [7272-73]

Coffee Break. . . . . 10:10 to 11:00 am

Conference 7272 continues on page 30.

Tuesday 24 February

Conference 7273

Advances in Resist Materials and Processing Technology XXVI

SESSION 4

Room: Marriott Salon III-IV . . . . Tues. 8:00 to 9:20 am

Immersion Lithography Materials and Processes

Session Chairs: **George G. Barclay,** Rohm and Haas Electronic Materials; **Dah-Chung Owe-Yang,** Shin-Etsu MicroSi, Inc.

8:00 am: **Improvements in process performance for immersion technology high-volume manufacturing**, Kathleen R. Nafus, Takeshi Shimoaoki, Masashi Enomoto, Hideo Shite, Takahisa Otsuka, Hitoshi Kosugi, Tsuyoshi Shibata, Tokyo Electron Kyushu Ltd. (Japan); Raymond Maas, Coen Verspaget, Carmen Zoldesi, Nicolas Boudou, Joerg Mallmann, Eddy van der Heijden, Eelco van Setten, Jo M. Finders, ASML Netherlands B.V. (Netherlands) . . . .[7273-13]

8:20 am: **Advanced immersion contact hole patterning for sub-40-nm memory applications**, Yun Kyeong Jang, SAMSUNG Electronics Co., Ltd. (Korea, Republic of) and Rohm and Haas Electronic Materials (United States); Jinyoung Yoon, Shiyong Lee, Kwang-Sub Yoon, Seok-Hwan Oh, Seong-Woon Choi, Woo-Sung Han, SAMSUNG Electronics Co., Ltd. (Korea, Republic of); Seokho Kang, Rohm and Haas Electronic Materials (United States) and SAMSUNG Electronics Co., Ltd. (Korea, Republic of); Dong Won Chung, Sung-seo Cho, Cheng Bai Xu, George G. Barclay, Rohm and Haas Electronic Materials (United States)[7273-14]

8:40 am: **Resist process control for 32-nm logic node and beyond with NA ≥1.30 immersion exposure tool**, Seiji Nagahara, Takashi Murakami, Kazuhiro Takeda, Makoto Ueki, NEC Electronics Corp. (Japan); Kazuhiro Takahata, Masaki Satake, Tatsuhiko Ema, Hiroharu Fujise, Hiroki Yonemitsu, Yuriko Seino, Shinichiro Nakagawa, Masafumi Asano, Yosuke Kitamura, Toshiba Corp. (Japan); Takayuki Uchiyama, NEC Electronics Corp. (Japan); Shoji Mimotogi, Toshiba Corp. (Japan); Makoto Tominaga, NEC Electronics Corp. (Japan) . . . .[7273-15]

9:00 am: **Feasibility study of non-topcoat resist for 22-nm node devices**, Koutaro Sho, Hirokazu Kato, Katsutoshi Kobayashi, Kazunori Iida, Tomoya Ori, Daizo Muto, Tsukasa Azuma, Shinichi Ito, Toshiba Corp. (Japan); Tomoharu Fujiwara, Yuuki Ishii, Nikon Corp. (Japan). . . [7273-16]

SESSION 5

Room: Marriott Salon III-IV . . . . Tues. 9:20 to 10:40 am

Molecular Resists

Session Chairs: **Clifford L. Henderson,** Georgia Institute of Technology; **Mark H. Somervell,** Tokyo Electron America, Inc.

9:20 am: **Single-component molecular resists containing bound-photoacid generators: a progress report**, Richard A. Lawson, David Noga, Georgia Institute of Technology (United States); Todd R. Younkin, Intel Corp. (United States); Laren M. Tolbert, Clifford L. Henderson, Georgia Institute of Technology (United States) . . . . [7273-17]

9:40 am: **Low-activation energy fullerene molecular resist**, Alex P. G. Robinson, Jedsada Manayam, Mayandithevar Manickam, Jon A. Preece, Richard E. Palmer, The Univ. of Birmingham (United Kingdom) [7273-18]

10:00 am: **Negative-tone molecular resists based on cationic polymerization**, Richard A. Lawson, Georgia Institute of Technology (United States); Todd R. Younkin, Intel Corp. (United States); Laren M. Tolbert, Clifford L. Henderson, Georgia Institute of Technology (United States) . . . . [7273-19]

10:20 am: **Synthesis of polymers and molecular glasses containing neutral arylsulfonate photoacid generators**, James M. Blackwell, Todd R. YounKin, Intel Corp. (United States); Ke Min, Lawrence Berkeley National Lab. (United States) . . . . [7273-20]

Coffee Break. . . . . 10:40 to 11:10 am

Conference 7273 continues on page 31.

Conference 7274

Optical Microlithography XXII

Room: Conv. Ctr. A 1-8 . . . . Tues. 8:20 to 8:40 am

Welcome and Introduction

Session Chairs: **Harry J. Levinson,** Advanced Micro Devices, Inc.; **Mircea V. Dusa,** ASML MaskTools Inc.

SESSION 1

Room: Conv. Ctr. A 1-8 . . . . Tues. 8:40 to 10:00 am

Invited Session

Session Chairs: **Harry J. Levinson,** Advanced Micro Devices, Inc.; **Mircea V. Dusa,** ASML MaskTools Inc.

8:40 am: **Alternative optical technologies: more than curiosities?** *(Keynote Presentation)*, Bruce W. Smith, Rochester Institute of Technology (United States) . . . . [7274-01]

9:20 am: **Extreme scaling of optical lithography: overview of process integration issues** *(Keynote Presentation)***,** Kurt G. Ronse, IMEC (Belgium). . . . . [7274-02]

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

Conference 7274 continues on page 31.

Tuesday 24 February

Conference 7271

Alternative Lithographic Technologies

SESSION 2

Room: Conv. Ctr. B 1-4 . . . . . . Tues. 10:30 am to 12:30 pm

Keynotes: Alternative Litho Technologies

Session Chairs: **Frank M. Schellenberg,** Mentor Graphics Corp.; **James A. Liddle,** National Institute of Standards and Technology

10:30 am: **Patterning single atom architectures** *(Keynote Presentation),* Michelle Y. Simmons, Univ. of New South Wales (Australia) . . . . [7271-04]

11:10 am: **Nanoimprint lithography for memristor/CMOS hybrid circuits** *(Keynote Presentation),* Qiangfei Xia, William M. Tong, Wei Wu, Jianhua Yang, Xuema Li, Warren Robinett, Hewlett-Packard Labs. (United States); Michael Cumbie, Jim E. Ellenson, Hewlett-Packard Co. (United States); Philip J. Kuekes, R. Stanley Williams, Hewlett-Packard Labs. (United States) . . . . [7271-05]

11:50 am: **Reflective electron-beam lithography (REBL)** *(Keynote Presentation),* Paul F. Petric, KLA-Tencor Corp. (United States) . . . . [7271-06]

Lunch/Exhibition Break . . . . 12:30 to 1:40 pm

Conference 7271 continues on page 32.

Conference 7272

Metrology, Inspection, and Process Control for Microlithography XXIII

SESSION 5

Room: Conv. Ctr. J 1-4
Tues. 11:00 am to 12:20 pm

Line Edge/Width Roughness

Session Chairs: **Martha I. Sanchez,** IBM Almaden Research Ctr.; **Vladimir A. Ukraintsev,** Veeco Instruments Inc.

11:00 am: **Dark-field optical scatterometry for line-width-roughness metrology**, Vera Zhuang, KLA-Tencor Corp. (United States) . . . .[7272-22]

11:20 am: **A CD AFM study of the plasma impact on 193nm Photoresist LWR :**, Erwine Pargon, Commissariat à l'Energie Atomique (France); Mickael Martin, Kevin Menguelti, Arnaud F. Bazin, Johann Foucher, Olivier P. Joubert, Ctr. National de la Recherche Scientifique (France) . . . .[7272-23]

11:40 am: **SEM metrology damage in polysilicon line and its impact on LWR evaluation**, Shiang Bau Wang, W. Y. Lee, Yuan-Hun Chiu, Hun-Yuan Tao, Y. J. Mii, Taiwan Semiconductor Manufacturing Co. Ltd. (Taiwan) . . . .[7272-24]

12:00 pm: **Process variation monitoring by wafer inspection tool as a complementary to CD-SEM method to map LER & defect density on production wafers**, Yuval Blumberg, Shimon Levi, Gadi Greenberg, Daniel Harel, Amiad Conley, Doron Meshulach, Kobi Kan, Saar Shabty, Ido Dolev, Surender Kumar, Applied Materials (Israel); Naoaki Yamaguchi, Applied Materials Japan, Inc. (Japan); Yasuhiro Iriuchijimac, Shinichi Nakamura, Shirou Nagaoka, Toshiyuki Sekito, Nikon Corp. (Japan) . . . .[7272-25]

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

Conference 7272 continues on page 32.

Tuesday 24 February

Conference 7273

Advances in Resist Materials and Processing Technology XXVI

SESSION 6

Room: Marriott Salon III-IV . . . Tues. 11:10 am to 12:30 pm

Novel Materials, Processes, and Applications I

Session Chairs: **Adam R. Pawloski,** Affymetrix, Inc.; **Vivek M. Prabhu,** National Institute of Standards and Technology

11:10 am: **Fluorinated polymethacrylates as highly sensitive non-chemically amplified e-beam resists**, Jeffrey R. Strahan, The Univ. of Texas at Austin (United States); Jacob R. Adams, The Univ. of Texas at Austin (United States) and IMEC (Belgium); Wei-Lun Jen, The Univ. of Texas at Austin (United States); Anja Vanlennhove, NXP Semiconductors (Belgium); Colin C. Neikirk, Timothy Rochelle, The Univ. of Texas at Austin (United States); Roel Gronheid, IMEC (Belgium); C. Grant Willson, The Univ. of Texas at Austin (United States) . . . . [7273-21]

11:30 am: **Resist systems based on alpha-substituted acrlate copolymers**, Hiroshi Ito, Linda K. Sundberg, Luisa D. Bozano, Kazuhiro Yamanaka, Masaki Fujiwara, IBM Almaden Research Ctr. (United States) . . . . [7273-22]

11:50 am: **20-nm trench patterning using a hybrid chemical shrink and SAFIER process with 193-nm dry lithography**, Xumou Xu, Yijian Chen, Hao Chen, Liyan Miao, Applied Materials, Inc. (United States) . . . . [7273-23]

12:10 pm: **Advanced pattern shrink technology for sub-40-nm size contact hole patterning using ArF immersion lithography**, Junggun Heo, Sungkoo Lee, Changil Oh, Keundo Ban, Eunkyung Shin, Heeyoul Lim, Cheolkyu Bok, Seung-Chan Moon, Hynix Semiconductor Inc. (Korea, Republic of) . . . . [7273-24]

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

Conference 7273 continues on page 33.

Conference 7274

Optical Microlithography XXII

SESSION 2

Room: Conv. Ctr. A 1-8 . . . . Tues. 10:30 to 11:50 am

Resolution Enhancement

Session Chairs: **Kafai Lai,** IBM Microelectronics Div.; **Willard E. Conley,** Freescale Semiconductor, Inc.

10:30 am: **Overcoming the challenges of 22-nm node patterning through litho-design co-optimization**, Matthew E. Colburn, IBM Thomas J. Watson Research Ctr. (United States); Zachary Baum, IBM Microelectronics Div. (United States); Martin Burkhardt, IBM Corp. (United States); Sean D. Burns, Josephine Chang, IBM Thomas J. Watson Research Ctr. (United States); Jin H. Cho, Vito Dai, Yunfei Deng, Advanced Micro Devices, Inc. (United States); Scott D. Halle, IBM Microelectronics Div. (United States); Steven J. Holmes, Geng Han, IBM Corp. (United States); Ryoung-Han Kim, Advanced Micro Devices, Inc. (United States); Asher Klatchko, Freescale Semiconductor Corp. (United States); Chiew-seng Koay, IBM Corp. (United States); Azalia Krasnoperova, IBM Microelectronics Div. (United States); Yuangsheng Ma, Advanced Micro Devices, Inc. (United States); Erin McLellan Martin, Karen E. Petrillo, IBM Corp. (United States); Cyrus E. Tabery, Advanced Micro Devices, Inc. (United States); Lei L. Zhuang, IBM Corp. (United States); Yi Zou, Jongwook Kye, Advanced Micro Devices, Inc. (United States); Scott M. Mansfield, IBM Microelectronics Div. (United States); Christopher A. Spence, Advanced Micro Devices, Inc. (United States). . . . . [7274-03]

10:50 am: **Improving model predictability through scanner-specific data and models in computational lithography**, Stefan Hunsche, Xu Xie, Qian Zhao, Hua-Yu Liu, Brion Technologies, Inc. (United States); Peter Nikolsky, Anthony Ngai, Paul J. M. van Adrichem, ASML Netherlands B.V. (Netherlands) . . . . [7274-04]

11:10 am: **Predictive OPC models for advanced computational lithography**, Jason E. Meiring, Geng Han, Scott M. Mansfield, IBM Microelectronics Div. (United States) . . . . [7274-05]

11:30 am: **Contact mask optimization and SRAF design**, Uwe P. Schroeder, Infineon Technologies North America Corp. (United States); Cyrus E. Tabery, Advanced Micro Devices, Inc. (United States); Bradley J. Morgenfeld, IBM Corp. (United States) [7274-06]

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

Conference 7274 continues on page 33.

Tuesday 24 February

Conference 7271

Alternative Lithographic Technologies

Sessions 3 and 5 run concurrently.

SESSION 3

Room: Conv. Ctr. B 1-4 . Tues. 1:40 to 3:20 pm

EUV Source

Session Chairs: **Francis Goodwin,** SEMATECH, Inc.; **Michael Goldstein,** SEMATECH, Inc.

1:40 pm: **Laser-produced plasma source development for EUV lithography**, Akira Endo, EUVA/Gigaphoton (Japan); Hiroshi Komori, Yoshifumi Ueno, Krzysztof M. Nowak, Yabu Takayuki, Yanagida Tatsuya, Takashi Suganuma, Takeshi Asayama, Hiroshi Someya, Hideo Hoshino, Masaki Nakano, Masato Moriya, Toshihiro Nishisaka, Tamotsu Abe, Akira Sumitani, EUVA/Komatsu (Japan); Hitoshi Nagano, Youichi Sasaki, Shinji Nagai, Yukio Watanabe, Georg Soumagne, Takanobu Ishihara, Osamu Wakabayashi, Kouji Kakizaki, Hakaru Mizoguchi, EUVA/Gigaphoton (Japan) [7271-07]

2:00 pm: **DPP source technologies for EUVL exposure tools**, Masaki Yoshioka, Denis Bolshukhin, XTREME technologies GmbH (Germany); Marc Corthout, Philips Extreme UV GmbH (Germany); Günther H. Derra, Philips Research (Germany); Sven Götze, XTREME technologies GmbH (Germany); Jeroen Jonkers, Philips Extreme UV GmbH (Germany); Jürgen Kleinschmidt, Rainer Müller, Max C. Schürmann, Guido Schriever, XTREME technologies GmbH (Germany); Rob Snijkers, Peter Zink, Philips Extreme UV GmbH (Germany) . . . . [7271-08]

2:20 pm: **Sn DPP source-collector modules: status of Alpha sources, Beta developments, and HVM experiments**, Marc Corthout, Rolf Apetz, Philips Extreme UV GmbH (Germany); Jesko Bruedermann, XTREME technologies GmbH (Germany); Marcel Damen, Philips Extreme UV GmbH (Germany); Günther H. Derra, Philips Research (Germany); Oliver Franken, Fraunhofer-Institut für Lasertechnik (Germany); Jeroen Jonkers, Philips Extreme UV GmbH (Germany); Juergen Klein, Felix Kuepper, Fraunhofer-Institut für Lasertechnik (Germany); Arnaud Mader, Philips Extreme UV GmbH (Germany); Willi Neff, Fraunhofer-Institut für Lasertechnik (Germany); Hans Scheuermann, Philips Extreme UV GmbH (Germany); Guido Schriever, XTREME technologies GmbH (Germany); Guido Siemons, Rob Snijkers, Dominik Vaudrevange, Pieter van der Wel, Philips Extreme UV GmbH (Germany); Masaki Yoshioka, XTREME technologies GmbH (Germany); Peter Zink, Oliver Zitzen, Philips Extreme UV GmbH (Germany). . . . . [7271-09]

2:40 pm: **5 sr high-temperature collector mirror**, Torsten Feigl, Marco Perske, Hagen Pauer, Sergiy A. Yulin, Mark Schürmann, Norbert Kaiser, Fraunhofer-Institut für Angewandte Optik und Feinmechanik (Germany); Norbert R. Bowering, Oleh V. Khodykin, Igor V. Fomenkov, David C. Brandt, Cymer, Inc. (United States) . . . . [7271-10]

3:00 pm: **Design and fabrication considerations of EUVL collectors for HVM**, Giovanni Bianucci, Gian Luca Cassol, Jacques Kools, Marco Prea, Guido Salmaso, Giuseppe Valsecchi, Fabio E. Zocchi, Media Lario Technologies (Italy); Denis Bolshukhin, XTREME technologies GmbH (Germany); Arnaud Mader, Philips Extreme UV GmbH (Germany); Max C. Schürmann, Guido Schriever, XTREME technologies GmbH (Germany); Peter Zink, Philips Extreme UV GmbH (Germany). . . . . [7271-11]

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

SESSION 5

Room: Conv. Ctr. C 1-4 . Tues. 1:40 to 3:20 pm

EBDW

Session Chairs: **Hans Loeschner,** IMS Nanofabrication AG (Austria); **Cynthia Hanson,** Space and Naval Warfare Systems Command

1:40 pm: **Experimental evaluation of 3rd-order imaging beam** *(Invited Paper)*, Takashi Fuse, Hidetoshi Kinoshita, Koji Takeya, Tadashi Kotsugi, Tokyo Electron AT Ltd. (Japan); N. William Parker, Multibeam Systems Inc. (United States) . . . [7271-19]

2:20 pm: **Cell projection use in maskless lithography for 45-nm and 32-nm logic nodes**, Serdar Manakli, STMicroelectronics (France); Hideaki Komami, Masahiro Takizawa, Advantest Corp. (Japan); Takashi Mitsuhashi, Direct2Silicon (Japan); Laurent Pain, CEA-LETI (France) . . . . [7271-20]

2:40 pm: **Optimal character-size exploration for increasing throughput of MCC lithographic systems**, Makoto Sugihara, Toyohashi Univ. of Technology (Japan) . . . . [7271-21]

3:00 pm: **Selection of Gaussian-beam and raster-scan parameters in electron-beam direct-write lithography considering device patterning and performance variability**, Hoi Tou Ng, National Taiwan Univ. (Taiwan). . . . . [7271-22]

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

Conference 7271 continues on page 34.

Conference 7272

Metrology, Inspection, and Process Control for Microlithography XXIII

SESSION 6

Room: Conv. Ctr. J 1-4 . . Tues. 1:50 to 3:10 pm

SEM I

Session Chairs: **John A. Allgair,** SEMATECH, Inc.; **Alexander Starikov,** Intel Corp.

1:50 pm: **Simulation of SEM images and charging of an insulator/metal bilayer in trench/hole patterns**, Kaoru Ohya, Kensuke Inai, Ryosuke Kawasaki, Hideaki Kuwada, Univ. of Tokushima (Japan); Misako Saito, Tokyo Electron AT Ltd. (Japan); Hiroyuki Hayashi, Tokyo Electron Technology Development Institute, Inc. (Japan); Jack Y. Jau, Kenichi Kanai, Hermes Microvision, Inc. (United States) . . . . [7272-26]

2:10 pm: **Validation of CD-SEM etching residue evaluation technique for MuGFET structures**, Miki Isawa, Maki Tanaka, Tatsuya Maeda, Kenji Watanabe, Hitachi High-Technologies Corp. (Japan); Tom Vandeweyer, Nadine Collarert, Rita Rooyackers, IMEC (Belgium). . . . . [7272-27]

2:30 pm: **Sensitivity of model-based SEM dimensional measurements to model assumptions**, John S. Villarrubia, National Institute of Standards and Technology (United States); Zejun Ding, Univ. of Science and Technology of China (China) . . . . [7272-28]

2:50 pm: **Accurate electrical prediction of memory array through SEM-based edge-contour extraction using SPICE simulation**, Ovadya Menadeva, Applied Materials (Israel); Eitan N. Shauly, Tower Semiconductor Ltd. (Israel) . . . . [7272-29]

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

Conference 7272 continues on page 34.

Tuesday 24 February

Conference 7273

Advances in Resist Materials and Processing Technology XXVI

SESSION 7

Room: Marriott Salon III-IV . . . . Tues. 2:00 to 3:20 pm

ARCs and Multi-Layer Processes

Session Chairs: **Ralph R. Dammel,** AZ Electronic Materials USA Corp.; **Douglas J. Guerrero,** Brewer Science, Inc.

2:00 pm: **Message to the undecided: using DUV dBARC for 32-nm node implants**, Hyung-Rae Lee, SAMSUNG Electronics Co., Ltd. (Korea, Republic of); Irene Y. Popova, JoAnn Rolick, IBM Microelectronics Div. (United States); Juan-Manuel M. Gomez, Freescale Semiconductor, Inc. (United States); Todd C. Bailey, IBM Microelectronics Div. (United States). . . . . [7273-25]

2:20 pm: **Lithographic and etching performance of trilayer of different Si contents for 32-nm and 22-nm technologies**, Itty Matthew, Advanced Micro Devices, Inc. (United States) . . [7273-26]

2:40 pm: **Developable BARCs (DBARCs) for KrF implant lithography**, James F. Cameron, Rohm and Haas Electronic Materials (United States) and IBM Corp. (United States); John Amara, Gregory P. Prokopowicz, Jin Wuk Sung, David Valeri, Adam Ware, Jason DeSisto, Rohm and Haas Electronic Materials (United States); Yoshihiro Yamamoto, Tomoki Kurihara, Rohm & Haas Electronic Materials K.K. (Japan); Libor Vyklicky, IBM Thomas J. Watson Research Ctr. (United States); Wu-Song Huang, Irene Popove, Pushkara R. Varanasi, IBM Microelectronics Div. (United States) . . . . [7273-27]

3:00 pm: **High-Si content BARC for dual-BARC systems such as trilayer patterning**, Joseph T. Kennedy, Benjamin Wu, SongYuan Xie, Ron Katsanes, Kyle Y. Flanigan, Honeywell Electronic Materials (United States) . . . . [7273-28]

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

Conference 7273 continues on page 35.

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Conference 7274

Optical Microlithography XXII

SESSION 3

Room: Conv. Ctr. A 1-8 . . . . Tues. 1:20 to 3:00 pm

Source and Mask Optimization

Session Chairs: **Tatsuhiko Higashiki,** Toshiba Corp. (Japan); **Sam Sivakumar,** Intel Corp.

1:20 pm: **A study of source and mask optimization for ArF scanners**, Tomoyuki Matsuyama, Toshiharu Nakashima, Tomoya Noda, Nikon Corp. (Japan). . . . . [7274-07]

1:40 pm: **Intensive optimization of masks and sources for 22-nm lithography**, Alan E. Rosenbluth, David O. Melville, IBM Thomas J. Watson Research Ctr. (United States); Kehan Tian, IBM Microelectronics Div. (United States); Saeed Bagheri, IBM Corp. (United States); Jaione Tirapu-Azpiroz, Kafai Lai, IBM Microelectronics Div. (United States); Andreas Waechter, IBM Thomas J. Watson Research Ctr. (United States); Tadanobu Inoue, Tokyo Research Lab. (Japan); Laszlo Ladanyi, Francisco Barahona, Katya Scheinberg, IBM Thomas J. Watson Research Ctr. (United States); Masaharu Sakamoto, Hidemasa Muta, Tokyo Research Lab. (Japan); Michael S. Hibbs, IBM Corp. (United States) [7274-08]

2:00 pm: **Experimental result and simulation analysis for the use of pixelated illumination from source mask optimization for 22-nm logic lithography process**, Kafai Lai, IBM Microelectronics Div. (United States); Alan E. Rosenbluth, IBM Thomas J. Watson Research Ctr. (United States); Saeed Bagheri, IBM Corp. (United States); John A. Hoffnagle, IBM Almaden Research Ctr. (United States); Kehan Tian, IBM Microelectronics Div. (United States); David O. Melville, IBM Thomas J. Watson Research Ctr. (United States); Jaione Tirapu-Azpiroz, Moutaz Fakhry, IBM Microelectronics Div. (United States); Young Kim, IBM Almaden Research Ctr. (United States); Scott D. Halle, IBM Microelectronics Div. (United States); Greg McIntyre, IBM Corp. (United States); Geoffrey W. Burr, IBM Almaden Research Ctr. (United States); Martin Burkhardt, IBM Corp. (United States); Daniel A. Corliss, IBM Microelectronics Div. (United States); Donis G. Flagello, Nikon Corp. of America (United States); Joerg Zimmermann, Bernhard Kneer, Frank Rohmund, Frank Hartung, Carsten Russ, Manfred Maul, Carl Zeiss SMT AG (Germany); Robert Kazinczi, Andre Engelen, Melchoir Mulder, ASML Netherlands B.V. (Netherlands) . . . . [7274-09]

2:20 pm: **Enabling process window improvement at 45 nm and 32 nm with free-form DOE illumination**, Tamer H. Coskun, Apo Sezginer, Vishnu G. Kamat, Cadence Design Systems, Inc. (United States); James T. Carriere, Jared D. Stack, Marc D. Himel, Tessera North America (United States) . . . . [7274-10]

2:40 pm: **Benefits and trade-offs of global source optimization in optical lithography**, Kehan Tian, Azalia Krasnoperova, IBM Microelectronics Div. (United States); David O. Melville, Alan E. Rosenbluth, IBM Thomas J. Watson Research Ctr. (United States); Jaione Tirapu-Azpiroz, Kafai Lai, IBM Microelectronics Div. (United States); Saeed Bagheri, IBM Corp. (United States); Chia-chen Chen, Bradley J. Morgenfeld, IBM Microelectronics Div. (United States) . . . . [7274-11]

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

Conference 7274 continues on page 35.

Tuesday 24 February

Conference 7271

Alternative Lithographic Technologies

Sessions 4 and 6 run concurrently.

SESSION 4

Room: Conv. Ctr. B 1-4 . Tues. 3:50 to 5:50 pm

EUV Mask

Session Chairs: **Kurt R. Kimmel,** Advanced Mask Technology Ctr. (Germany); **R. Scott Mackay,** Mackay and Associated, Inc.

3:50 pm: **An EUVL mask applying phase-shifting thinner absorber for device fabrication in a full-field scanner**, Hwan-Seok Seo, Dong-Gun Lee, Byungsup Ahn, Hakseung Han M.D., In-Yong Kang, Chang-Hyun Jeong, Hoon Kim, Dongwan Kim, Seong-Sue Kim, Han-Ku Cho, SAMSUNG Electronics Co., Ltd. (Korea, Republic of). . . . .[7271-12]

4:10 pm: **EUVL mask inspection and repair technology development at MIRAI-Selete**, Osamu Suga, Tsuneo Terasawa, Hiroyuki Shigemura, Tsuyoshi Amano, Yasushi Nishiyama, Ichiro Mori, Semiconductor Leading Edge Technologies, Inc. (Japan) . . . .[7271-13]

4:30 pm: **Nanopit smoothing by cleaning**, Abbas Rastegar, Sean K. Eichenlaub, Arun Johnkadaksham, Matthieu House, SEMATECH, Inc. (United States) . . . .[7271-14]

4:50 pm: **Compensation of overlay errors due to mask bending and non-flatness for EUV masks**, Manish Chandhok, Sanjay Goyal, Seh-Jin Park, Emily Y. Shu, Guojing Zhang, Marilyn Kamna, Fabian C. Martinez, Intel Corp. (United States); Alan M. Myers, Intel Corp. (Belgium); Gian F. Lorusso, Jan Hermans, Eric Hendrickx, IMEC (Belgium) . . . .[7271-15]

5:10 pm: **Analysis of Coulomb and Johnsen-Rahbek electrostatic chuck performance in the presence of particles for EUV lithography**, Michael R. Sogard, Nikon Research Corp. of America (United States); Andrew R. Mikkelson, Vasu Ramaswamy, Roxann L. Engelstad, Univ. of Wisconsin, Madison (United States) . . . .[7271-17]

5:30 pm: **Protection efficiency and commercial availability of a standards-compliant EUV reticle handling solution**, Long He, SEMATECH, Inc. (United States); John Lystad, Entegris, Inc. (United States); Stefan Wurm, Kevin Orvek, Jaewoong Sohn, SEMATECH, Inc. (United States); Patrick A. Kearney, SEMATECH North (United States); Steven P. Kolbow, David Halbmaier, Entegris, Inc. (United States) . . . .[7271-18]

SESSION 6

Room: Conv. Ctr. C 1-4 . Tues. 3:50 to 6:10 pm

Multibeam and Tools Patterning

Session Chairs: **Timothy R. Groves,** SUNY/Univ. at Albany; **Laurent Pain,** STMicroelectronics (France)

3:50 pm: **PML2: the maskless multibeam solution for the 22-nm node and beyond** *(Invited Paper)*, Christof Klein, Elmar Platzgummer, Jan Klikovits, Hans Loeschner, Gerhard Gross, IMS Nanofabrication AG (Austria); Thomas Bejdak, Pavel Dolezel, Vladimir Kolarik, Delong Instruments a.s. (Czech Republic); Wolfram Klingler, Florian Letzkus, Jörg Butschke, Mathias Irmscher, Institut für Mikroelektronik Stuttgart (Germany); Martin Witt, Wolfgang Pilz, Fraunhofer-Institut für Siliziumtechnologie (Germany); Philipp Jaschinsky, Fraunhofer-Ctr. Nanoelektronische Technologien (Germany); Frank Thrum, Christoph K. Hohle, Johannes Kretz, Qimonda Dresden GmbH & Co. OHG (Germany); John T. Nogatch, Ray E. Morgan, Sr., Synopsys, Inc. (United States). . . . .[7271-23]

4:30 pm: **MAPPER: high-throughput maskless lithography**, Marco J. Wieland, MAPPER Lithography (Netherlands) . . . .[7271-24]

4:50 pm: **Development of 10-beams EBDW system using 3rd-order imaging technique**, N. William Parker, John C. Wiesner, Dan Miller, Multibeam Systems Inc. (United States); Hidetoshi Kinoshita, Kyo Tsuboi, Satoshi Morita, Takashi Fuse, Kohei Noguchi, Koji Takeya, Tokyo Electron AT Ltd. (Japan) . . . .[7271-25]

5:10 pm: **Coulomb blur advantage of a multishaped beam lithography approach**, Ines A. Stolberg, Hans-Joachim Doering, Thomas Elster, Matthias Slodowski, Vistec Electron Beam GmbH (Germany). . . . .[7271-26]

5:30 pm: **Development of resist process for 5-KV multibeam technology**, Beatrice Icard, Laurent Pain, Jonathan Pradelles, David Rio, Christophe Constancias, CEA-LETI (France); Serdar Manakli, STMicroelectronics (France); Bert J. Kampherbeek, Erwin Slot, Peter Veltman, MAPPER Lithography (Netherlands) . . . .[7271-27]

5:50 pm: **Advances in zone-plate-array lithography: photons versus electrons in next-generation maskless lithography,** Michael E. Walsh, Feng Zhang, LumArray Inc. (United States); Rajesh Menon, Henry I. Smith, LumArray Inc. (United States) and Massachusetts Institute of Technology (United States) . . . .[7271-28]

Conference 7271 continues on page 36.

Conference 7272

Metrology, Inspection, and Process Control for Microlithography XXIII

SESSION 7

Room: Conv. Ctr. J 1-4 . . . Tues. 3:40 to 5:20 pm

Scatterometry I

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

3:40 pm: **Development of independent traceability for optical scatterometry**, Thomas A. Germer, National Institute of Standards and Technology (United States); Heather J. Patrick, National Institute of Standards and Technology (United States) and KT Consulting, Inc. (United States); Richard M. Silver, National Institute of Standards and Technology (United States); Benjamin D. Bunday, International SEMATECH Manufacturing Initiative (United States) . . . .[7272-30]

4:00 pm: **Effect of line-width roughness (LWR) on optical scatterometry measurements**, Brent C. Bergner, K.T. Consulting (United States) and National Institute of Standards and Technology (United States) and The Univ. of North Carolina at Charlotte (United States); Thomas A. Germer, National Institute of Standards and Technology (United States); Thomas J. Suleski, The Univ. of North Carolina at Charlotte (United States) . . . .[7272-31]

4:20 pm: **Product-driven material characterization for improved scatterometry time-to-solution**, Alok Vaid, Advanced Micro Devices, Inc. (United States); Carsten Hartig, AMD Saxony Manufacturing GmbH (Germany); Matthew Sendelbach, IBM Microelectronics Div. (United States); Cornel Bozdog, Helen H. K. Kim, Michael Sendler, Nova Measuring Instruments Inc. (United States); Yoel Cohen, Boaz Brill, Victor Kucherov, Nova Measuring Instruments Ltd. (Israel). . . . .[7272-32]

4:40 pm: **Manufacturing implementation of scatterometry and other techniques for 300-mm lithography tool controls**, Timothy J. Wiltshire, Daniel A. Corliss, Timothy A. Brunner, IBM Microelectronics Div. (United States); Christopher P. Ausschnitt, Roger M. Young, Ryan R. Nielson, IBM Corp. (United States) . . . .[7272-33]

5:00 pm: **Development of fast pattern-quality monitoring technique using spectral imaging method,** Younghoon Sohn, ChungSam Jun, Taesung Kim, SAMSUNG Electronics Co., Ltd. (Korea, Republic of) . . . .[7272-34]

Conference 7272 continues on page 36.

Tuesday 24 February

Conference 7273

Advances in Resist Materials and Processing Technology XXVI

SESSION 8

Room: Marriott Salon III-IV . . . . .Tues. 3:50 to 6:10 pm

EUV Resist Materials and Processes

Session Chairs: **Ernisse Steve Putna,** Intel Corp.; **Nobuyuki N. Matsuzawa,** Sony Atsugi Technology Ctr. (Japan)

3:50 pm: **Incorporating organosilane functionality into EUV photoresists: new PAGs, PhLAGs, polymers, and sensitizers**, James M. Blackwell, Todd R. Younkin, Intel Corp. (United States); Ke Min, Clarion Tung, Lawrence Berkeley National Lab. (United States); Shalini Sharma, Yoichi Ogata, Yoshi Hishiro, JSR Micro, Inc. (United States) . . . . [7273-29]

4:10 pm: **Main chain decomposible star shaped polymer for EUV resist**, Jun Iwashita, Takeshi Iwai, Takeyoshi Mimura, Taku Hirayama, Tokyo Ohka Kogyo Co., Ltd. (Japan) . . . . [7273-30]

4:30 pm: **Resist materials design to improve sensitivity in EUV lithography**, Hideaki Tsubaki, Katsuhiro Yamashita, Tomotaka Tsuchimura, Naoyuki Nishikawa, FUJIFILM Corp. (Japan) [7273-31]

4:50 pm: **Design and lithographic evaluation of EUV photoresists containing acid amplifiers**, Robert L. Brainard, Seth Kruger, Craig D. Higgins, Srividya Revuru, Hasti Amiri, Univ. at Albany (United States); Sarah Gibbons, Dan Freedman, Preeti Dhar, State Univ. of New York at New Paltz (United States); Vaida Auzelyte, Pratap Sahoo, Harun H. Solak, Paul Scherrer Institut (Switzerland); Wang Yueh, Todd R. Younkin, Intel Corp. (United States). . . . . . [7273-32]

5:10 pm: **Aryl sulfonates as neutral photoacid generators (PAGs) for EUV lithography**, Todd R. YounKin, Intel Corp. (United States); James M. Blackwell, Lawrence Berkeley National Lab. (United States); Ernisse S. Putna, Intel Corp. (United States); Ryan Callahan, FUJIFILM Electronic Materials U.S.A., Inc. (United States); Hideaki Tsubaki, Tooru Tsuchihashi, FUJIFILM Corp. (Japan) . . . . [7273-33]

5:30 pm: **Effect of resist polymer molecular weight on EUV lithography**, Katsuhiro Yamashita, Hideaki Tsubaki, Hidenori Takahashi, Naoyuki Nishikawa, FUJIFILM Corp. (Japan); Daisuke Kawamura, Toshiro Itani, Semiconductor Leading Edge Technologies, Inc. (Japan) . . . . [7273-34]

5:50 pm: **Correlation of EUV resist performance metrics in micro-exposure and full-field EUV projection tools,** Thomas I. Wallow, Yunfei Deng, Obert Wood, Bruno M. La Fontaine, Advanced Micro Devices, Inc. (United States); Bill Pierson, ASML US, Inc. (United States); Anita Fumar-Pici, ASML Special Applications (United States); Sang-In Han, Robert Watso, Robert M. Routh, Kevin D. Cummings, ASML US, Inc. (United States); Sudharshanan Raghunathan, Univ. at Albany (United States); Lior Huli, Albany NanoTech (United States); Karen E. Petrillo, IBM Thomas J. Watson Research Ctr. (United States); Chiew-Seng Koay, IBM Corp. (United States); Hiroyuki Mizuno, Toshiba America Electronic Components, Inc. (United States); Christopher N. Anderson, Univ. of California, Berkeley (United States); Patrick P. Naulleau, Lawrence Berkeley National Lab. (United States) . . . . [7273-35]

Conference 7273 continues on page 37.

Conference 7274

Optical Microlithography XXII

SESSION 4

Room: Conv. Ctr. A 1-8 . . . . Tues. 3:30 to 4:50 pm

Spacer-based Processes

Session Chairs: **Kazuhiro Takahashi,** Canon, Inc. (Japan); **Geert Vandenberghe,** IMEC (Belgium)

3:30 pm: **Advanced self-aligned double-patterning development for sub-30-nm DRAM manufacturing**, Weicheng Shiu, Candice Ni, Vincent Wu, Hung Jen Liu, Nick Tseng, Chun-Yen Huang, Klesko Chang, Jan-Shiun Wu, Hong Wen Lee, Tsu-Li Tseng, Chao-Wen Lay, Chun Te Liao, Chih-Huang Wu, Wendy Chang, Chester Nieh, Chien Ming Lien, Chien Mao Liao, Hsiao Ting Wu, Jerry Liu, Barry Kuan, Troy Wang, Wen Bin Wu, Chiang Lin Shih, Nanya Technology Corp. (Taiwan) . . . . [7274-12]

3:50 pm: **Process step reduction at negative-tone spacer-patterning technique using developer-soluble bottom ARC**, Woo Yung Jung, Hynix Semiconductor Inc. (Korea, Republic of)[7274-13]

4:10 pm: **Gridded design rule scaling: taking the CPU toward the 16-nm node**, Chris Bencher, Huixiong Dai, Yongmei Chen, Applied Materials, Inc. (United States) . . . . [7274-14]

4:30 pm: **Demonstration of 32-nm half pitch electrical testable NAND FLASH patterns using self-aligned double patterning,** Shiyu Sun, Chris Bencher, Yongmei Chen, Huixiong Dai, Man-Ping Cai, Jaklyn Jin, Pokhui Blanco, Liyan Miao, Ping Xu, Xumou Xu, James J. Yu, Raymond Hung, Shiany Oemardani, Osbert Chan, Chorng-Ping Chang, Chris Ngai, Applied Materials, Inc. (United States) . . . .[7274-149]

Room: Conv. Ctr. A 1-8 . . . . .Tues. 6:30 to 8:00 pm

Panel Discussion: Lithography for 22nm: How many patterning steps?

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

Conference 7274 continues on page 37.

Wednesday 25 February

Conference 7271

Alternative Lithographic Technologies

SESSION 7

Room: Conv. Ctr. B 1-4 Wed. 8:00 to 10:00 am

EUV Printing

Session Chairs: **Shinji Okazaki,** Hitachi, Ltd. (Japan); **Hans Meiling,** ASML Netherlands B.V. (Netherlands)

8:00 am: **Stability and imaging of the ASML EUV alpha demo tool**, Jan Hermans, Bart Baudemprez, Gian F. Lorusso, Eric Hendrickx, IMEC (Belgium); Andre Van Dijk, ASML Netherlands B.V. (Netherlands); David Laidler, Rik M. Jonckheere, Mieke Goethals, IMEC (Belgium) . . . .[7271-29]

8:20 am: **Flare evaluation of ASML Alpha Demo Tool**, Hiroyuki Mizuno, Toshiba America Electronic Components, Inc. (United States); Gregory R. McIntyre, Chiew-seng Koay, Martin Burkhardt, IBM Corp. (United States); Bruno M. La Fontaine, Obert Wood, Advanced Micro Devices, Inc. (United States) . . . .[7271-30]

8:40 am: **SEMATECH research activities on EUV full-field exposure tool**, Liping Ren, Frank Goodwin, Stefan Wurm, Chawon Koh, Long He, Cecilia Montgomery, Sungmin Huh, SEMATECH, Inc. (United States); Sudharshanan Raghunathan, John G. Hartley, Univ. at Albany (United States); Brian Lee, Brian Niekrewicz, Kevin D. Cummings, ASML US, Inc. (United States). . . . .[7271-31]

9:00 am: **The SEMATECH Berkeley microfield exposure tool: learning at the 22-nm node and beyond**, Patrick P. Naulleau, Christopher N. Anderson, Paul E. Denham, Simi A. George, Kenneth A. Goldberg, Brian Hoef, Lawrence Berkeley National Lab. (United States); Chawon Koh, SEMATECH, Inc. (United States); Bruno M. La Fontaine, Advanced Micro Devices, Inc. (United States); Warren M. Montgomery, SEMATECH, Inc. (United States); John Roller, Lawrence Berkeley National Lab. (United States); Thomas I. Wallow, Advanced Micro Devices, Inc. (United States); Stefan Wurm, SEMATECH, Inc. (United States) . . . .[7271-32]

9:20 am: **Out-of-band exposure characterization with the SEMATECH Berkeley 0.3-NA microfield exposure tool**, Simi A. George, Patrick P. Naulleau, Senajith B. Rekawa, Charles Kemp, Lawrence Berkeley National Lab. (United States). . . . .[7271-33]

9:40 am: **Estimation of cost comparison of lithography technologies at the 22-nm half-pitch node**, Andrea F. Wuest, SEMATECH, Inc. (United States); Andrew J. Hazelton, Nikon Corp. (Japan); Lloyd C. Litt, Gregory P. Hughes, SEMATECH, Inc. (United States) . . . .[7271-34]

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

Conference 7271 continues on page 38.

Conference 7272

Metrology, Inspection, and Process Control for Microlithography XXIII

SESSION 8

Room: Conv. Ctr. J 1-4 . . Wed. 8:50 to 10:10 am

SEM II

Session Chairs: **Ofer Adan,** Applied Materials (Israel); **John A. Allgair,** SEMATECH, Inc. and Advanced Micro Devices, Inc.

8:50 am: **Methodologies for evaluating CD-matching of CD-SEM**, Hiroki Kawada, Hitachi High-Technologies Corp. (Japan); Chih-Ming Ke, Taiwan Semiconductor Manufacturing Co. Ltd. (Taiwan) . . . .[7272-36]

9:10 am: **Calibration of a scanning electron microscope in the wide range of magnifications for the microscope operation in the line of integrated circuits production**, Valeriy P. Gavrilenko, A.M. Prokhorov General Physics Institute (Russian Federation); Michael Filippov, N.S. Kurnakov Institute of General and Inorganic Chemistry (Russian Federation); Yury A. Novikov, A.M. Prokhorov General Physics Institute (Russian Federation); Yury Ozerin, JSC Mikron (Russian Federation); Alexander Rakov, Pavel A. Todua, A.M. Prokhorov General Physics Institute (Russian Federation); Cheslav Volk, JSC Mikron (Russian Federation). . . . .[7272-37]

9:30 am: **CD-SEM tool stability and tool-to-tool matching management using image sharpness monitor**, Hideaki Abe, Yasuhiko Ishibashi, Yuichiro Yamazaki, Toshiba Corp. (Japan); Akemi Kono, Tatsuya Maeda, Akihiro Miura, Shunsuke Koshihara, Daisuke Hibino, Hitachi High-Technologies Corp. (Japan) . . . .[7272-38]

9:50 am: **Improvement of resist loss measurement method using top-down CD-SEM images for hyper-NA lithography**, Mayuka Osaki, Chie Shishido, Hitachi, Ltd. (Japan); Maki Tanaka, Hitachi High-Technologies Corp. (Japan) . . . .[7272-39]

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

Conference 7272 continues on page 38.

Wednesday 25 February

Conference 7273

Advances in Resist Materials and Processing Technology XXVI

SESSION 9

Room: Marriott Salon III-IV
Wed. 8:00 to 10:00 am

Resist Fundamentals

Session Chairs: **Gregory M. Wallraff,** IBM Almaden Research Ctr.; **Ralph R. Dammel,** AZ Electronic Materials USA Corp.

8:00 am: **Characterization of the photoacid diffusion length**, Shuhui Kang, National Institute of Standards and Technology (United States); Kwang-Woo Choi, Intel Corp. (United States); Vivek M. Prabhu, Wen-li Wu, Eric K. Lin, National Institute of Standards and Technology (United States); Manish Chandhok, Todd R. Younkin, Wang Yueh, Intel Corp. (United States) . . . .[7273-36]

8:20 am: **Elucidating the physiochemical and lithographic behavior of photoresist ultra-thin films**, Annapoorani Sundaramoorthi, Georgia Institute of Technology (United States) and Intel Corp. (United States); Clifford L. Henderson, Georgia Institute of Technology (United States); Todd R. Younkin, Intel Corp. (United States) . . . .[7273-37]

8:40 am: **Topcoat free resists: are they ready for prime time???,** Peggy C. Lawson, Irene Y. Popova, IBM Microelectronics Div. (United States); Daniel P. Sanders, Linda K. Sundberg, IBM Almaden Research Ctr. (United States); Alfred Wagner, IBM Thomas J. Watson Research Ctr. (United States); Christopher F. Robinson, Kourosh Nafisi, IBM Microelectronics Div. (United States); Dario L. Goldfarb, IBM Thomas J. Watson Research Ctr. (United States); Robin Thomas, IBM Microelectronics Div. (United States); Karen E. Petrillo, IBM Thomas J. Watson Research Ctr. (United States); Willard E. Conley, Freescale Semiconductor, Inc. (United States); Richard Johnson, IBM Corp. (United States); Daniel A. Corliss, Pushkara R. Varanasi, IBM Microelectronics Div. (United States) . . . .[7273-139]

9:00 am: **Non-CA resists for 193-nm immersion lithography: effects of chemical structure on sensitivity**, Idriss Blakey, Lan Chen, Yong Keng Goh, The Univ. of Queensland (Australia); Paul A. Zimmerman, Emil C. Piscani, SEMATECH, Inc. (United States); Andrew K. Whittaker, The Univ. of Queensland (Australia) . . . .[7273-39]

9:20 am: **Understanding and predicting the dissolution behavior of molecular resists**, Richard A. Lawson, Clifford L. Henderson, Georgia Institute of Technology (United States) . . . .[7273-40]

9:40 am: **Quantitative measurement of resist outgassing during exposure**, Nicolae Maxim, Jeroen Huijbregtse, ASML Netherlands B.V. (Netherlands); Frances A. Houle, Vaughn R. Deline, Hoa D. Truong, IBM Almaden Research Ctr. (United States) [7273-41]

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

Conference 7273 continues on page 39.

Conference 7274

Optical Microlithography XXII

SESSION 5

Room: Conv. Ctr. A 1-8 Wed. 8:20 to 10:00 am

Double Patterning I

Session Chairs: **Soichi Owa,** Nikon Corp. (Japan); **Ken Ozawa,** Sony Corp. (Japan)

8:20 am: **Split, overlap/stitching and process design for double patterning considering local reflectivity variation by using rigorous 3D wafer-topography/lithography simulation**, Itaru Kamohara, Nihon Synopsys Co., Ltd. (Japan); Thomas Schmoeller, Synopsys GmbH (Germany) . . . .[7274-16]

8:40 am: **Advances and challenges in dual-tone development process optimization**, Carlos Fonseca, Mark H. Somervell, Tokyo Electron America, Inc. (United States); Sophie Bernard, Roel Gronheid, IMEC (Belgium); Steven A. Scheer, Tokyo Electron America, Inc. (United States); Shinichi Hatakeyama, Kathleen R. Nafus, Tokyo Electron Kyushu Ltd. (Japan) . . . .[7274-17]

9:00 am: **New process proximity correct methodology using neural network in spacer patterning technology**, Fumiharu Nakajima, Toshiya Kotani, Masafumi Asano, Satoshi Tanaka, Soichi Inoue, Toshiba Semiconductor Co. (Japan) [7274-18]

9:20 am: **32-nm and below logic patterning using optimized illumination and double patterning**, Michael C. Smayling, Tela Innovations, Inc. (United States); Valery Axelrad, Sequoia Design Systems, Inc. (United States). . . . .[7274-19]

9:40 am: **Contact-hole double patterning for the 22-nm node**, Willard E. Conley, Massud Aminpur, Cesar M. Garza, Sr., Freescale Semiconductor, Inc. (United States); Doug LaTulipe, David V. Horak, Susan Fan, Richard Johnson, Karen E. Petrillo, IBM Corp. (United States) . . . .[7274-20]

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

Conference 7274 continues on page 39.

Conference 7275

Design for Manufacturability through Design-Process Integration III

Room: Marriott Salon III-IV
Wed. 6:30 to 8:00 pm

Panel Discussion: A DFM Debate

Moderator: **Lars W. Liebmann,** IBM Corp.

DfM meets MfD - is CMOS scaling enabled through better design or tighter process control?

Conference 7275 continues on page 45.

Wednesday 25 February

Conference 7271

Alternative Lithographic Technologies

Sessions 8 runs concurrently with session 11.

SESSION 8

Room: Conv. Ctr. B 1-4
Wed. 10:30 am to 12:10 pm

EUV Lifetime

Session Chairs: **Andrea F. Wüest,** SEMATECH, Inc.; **Kazuaki Suzuki,** Nikon Corp. (Japan)

10:30 am: **Debris detection, mitigation, and cleaning methods for life-time improvement of integrated-EUVL-scanner stepper systems**, David N. Ruzic, Ramasamy Raju, John Sporre, Hyungjoo Shin, Bob Lofgren, Vijay Surla, Univ. of Illinois at Urbana-Champaign (United States) . . . .[7271-35]

10:50 am: **Carbon film growth on model electron-irradiated MLM cap layer: interaction of benzene and MMA vapor with TiO_2 surface**, Boris V. Yakshinskiy, Shimon Zalkind, Theodore E. Madey, Rutgers Univ. (United States) . . . .[7271-36]

11:10 am: **Protective capping layers for EUVL optics**, Sergiy A. Yulin, Viatcheslav Nesterenko, Mark Schürmann, Marco Perske, Torsten Feigl, Norbert Kaiser, Fraunhofer-Institut für Angewandte Optik und Feinmechanik (Germany); Max C. Schürmann, XTREME technologies GmbH (Germany); James S. Clarke, Gilroy J. Vandentop, Intel Corp. (United States) . . . .[7271-37]

11:30 am: **Tracking down sources of carbon contamination in EUVL exposure tools**, Charles Tarrio, Robert E. Vest, Steven E. Grantham, Thomas B. Lucatorto, National Institute of Standards and Technology (United States); Roman Caudillo, Intel Corp. (United States) . . . .[7271-38]

11:50 am: **Measuring the EUV-induced contamination rates of TiO_2-capped multilayer optics by anticipated production-environment hydrocarbons**, Shannon B. Hill, National Institute of Standards and Technology (United States); Nadir Faradzhev, Rutgers Univ. (United States); Charles Tarrio, Thomas B. Lucatorto, National Institute of Standards and Technology (United States); Theodore E. Madey, Rutgers Univ. (United States) . . .[7271-39]

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

SESSION 11

Room: Conv. Ctr. C 1-4
Wed. 10:30 am to 12:10 pm

Maskless

Session Chairs: **Daniel J. C. Herr,** Semiconductor Research Corp.; **Tatsuhiko Higashiki,** Toshiba Corp. (Japan)

10:30 am: **Full-chip characterization of compression algorithms for direct-write lithography systems** *(Invited Paper)*, Avideh Zakhor, Vito Dai, Univ. of California, Berkeley (United States) . . . .[7271-52]

11:10 am: **Scalable (24-140 Gbps) optical data link, well adapted for future maskless lithography applications**, Anagnostis Paraskevopoulos, Sven-Hedrik Voss, Maati Talmi, Godehard Walf, Fraunhofer-Institut für Nachrichtentechnik Heinrich-Hertz-Institut (Germany) . . . .[7271-53]

11:30 am: **Proximity effect correction for multiple-electron-beam direct-write lithography**, Shy-Jay Lin, Taiwan Semiconductor Manufacturing Co. Ltd. (Taiwan) . . . .[7271-54]

11:50 am: **Evaluation and mitigation of proximity effects for 5kV multi-beam technology: application for 32-nm node and beyond**, Serdar Manakli, STMicroelectronics (France); Peter Veltman, Erwin Slot, V. Kuiper, Bert J. Kampherbeek, MAPPER Lithography (Netherlands); Ray E. Morgan, Sr., John T. Nogatch, Synopsys, Inc. (United States); Lars H. Bomholt, Synopsys Switzerland, LLC (Switzerland); Laurent Pain, CEA-LETI (France) . . . .[7271-55]

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

Conference 7271 continues on page 40.

Conference 7272

Metrology, Inspection, and Process Control for Microlithography XXIII

SESSION 9

Room: Conv. Ctr. J 1-4
Wed. 10:40 to 11:40 am

Diffraction-Based Overlay

Session Chairs: **Christopher J. Raymond,** Nanometrics Inc.; **Vladimir A. Ukraintsev,** Veeco Instruments Inc.

10:40 am: **Diffraction-based overlay metrology for spacer double patterning**, Prasad Dasari, Rahul Korlahalli, Jie Li, Nigel P. Smith, Nanometrics Inc. (United States); Oleg Kritsun, Advanced Micro Devices, Inc. (United States) . . . .[7272-41]

11:00 am: **Investigation of the capabilities of normal incidence polarized reflectometry using full-modeling scatterometry overlay measurement and special target designs**, Yoel Cohen, Limor Issaschrof, Roy Koret, Igor Turovets, Nova Measuring Instruments Ltd. (Israel) . . . .[7272-42]

11:20 am: **Through-focus scanning and scatterfield optical methods for advanced overlay target analysis**, Ravikiran Attota, Richard M. Silver, Michael D. Stocker, Hui Zhou, National Institute of Standards and Technology (United States); William P. Lipscomb III, International SEMATECH Manufacturing Initiative (United States) . . . .[7272-43]

Lunch/Exhibition Break . . . . . . 11:40 am to 1:30 pm

Conference 7272 continues on page 40.

Wednesday 25 February

Conference 7273

Advances in Resist Materials and Processing Technology XXVI

SESSION 10

Room: Marriott Salon III-IV
Wed. 10:30 am to 12:10 pm

Simulation of Resist Processes

Session Chairs: **Adam R. Pawloski,** Affymetrix, Inc.; **Vivek M. Prabhu,** National Institute of Standards and Technology

10:30 am: **Simulation of optical lithography in the presence of topography and spin coated films**, Stewart A. Robertson, KLA-Tencor Texas (United States); Michael T. Reilly, Rohm and Haas Electronic Materials (United States); John J. Biafore, Mark D. Smith, Trey Graves, KLA-Tencor Texas (United States) . . . .[7273-42]

10:50 am: **Mesoscale Kinetic Monte Carlo simulations of molecular resists**, Richard A. Lawson, Clifford L. Henderson, Georgia Institute of Technology (United States) . . . .[7273-44]

11:10 am: **Calibration of physical resist models: methods, usability, and predictive power**, Ulrich K. Klostermann, Thomas Mülders, Denis Ponomarenco, Thomas Schmoeller, Synopsys GmbH (Germany); Jeroen Van de Kerkhove, Peter De Bisschop, IMEC (Belgium). . . . .[7273-45]

11:30 am: **Statistical simulation of photoresists at EUV and ArF**, John J. Biafore, Mark D. Smith, KLA-Tencor Texas (United States); Jim W. Thackeray, Rohm and Haas Electronic Materials (United States); Stewart A. Robertson, KLA-Tencor Texas (United States); Roel Gronheid, IMEC (Belgium) . . .[7273-46]

11:50 pm: **Position shift analysis in resist reflow process for sub-50-nm contact hole**, Jee-Hye You, Joonwoo Park, Joon-Min Park, HeeJun Jeong, Hye-Keun Oh, Hanyang Univ. (Korea, Republic of) . . . .[7273-47]

Lunch/Exhibition Break . . . . 12:10 to 2:00 pm

Conference 7273 continues on page 41.

Conference 7274

Optical Microlithography XXII

SESSION 6

Room: Conv. Ctr. A 1-8 Wed. 10:30 to 11:50 am

Double Patterning II

Session Chairs: **Geert Vandenberghe,** IMEC (Belgium); **Pary Baluswamy,** Micron Technology, Inc.

10:30 am: **Analysis of topography effects on lithographic performance in double-patterning applications**, Joachim Siebert, Synopsys GmbH (Germany); Peter D. Brooker, Synopsys, Inc. (United States); Thomas Schmoeller, Thomas Klimpel, Synopsys GmbH (Germany). . . . .[7274-21]

10:50 am: **Ultimate contact-hole resolution using immersion lithography with line/space imaging**, Vincent P. Truffert, Joost P. M. Bekaert, Andy Miller, Mireille Maenhoudt, Alexey Milenin, IMEC (Belgium). . . . .[7274-23]

11:10 am: **Efficient simulation and optimization of wafer topographies in double patterning and double exposure**, Feng Shao, Peter Evanschitzky, Tim Fühner, Andreas Erdmann, Fraunhofer-Institut für Integrierte System und Bauelem (Germany) [7274-24]

11:30 am: **Investigating the effect of topography on stitching strategies for pitch-splitting double patterning using rigorous physical simulation**, Stewart A. Robertson, John J. Biafore, Trey Graves, Mark D. Smith, KLA-Tencor Texas (United States) . . . .[7274-22]

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

Conference 7274 continues on page 41.

Wednesday 25 February

Conference 7271

Alternative Lithographic Technologies

Sessions 8 runs concurrently with session 11.

SESSION 9

Room: Conv. Ctr. B 1-4 . Wed. 1:40 to 3:20 pm

EUV Applications

Session Chairs: **Michael J. Lercel,** IBM Corp.; **Obert Wood II,** Advanced Micro Devices, Inc.

1:40 pm: **The application of EUV lithography for 40-nm node DRAM device and beyond**, Joo-On Park, DooHoon Goo, Insung Kim, Chang Min Park, Jeonghoon Lee, JinHong Park, Jeong-Ho Yeo, Seong-Woon Choi, Woo-Sung Han, SAMSUNG Electronics Co., Ltd. (Korea, Republic of) . .[7271-40]

2:00 pm: **Comparative study of DRAM cell patterning between ArF immersion and EUV lithography**, Tae-Seung Eom, Jun-Taek Park, Sarohan Park, Sunyoung Koo, Yoon-Suk Hyun, Chang-Moon Lim, HyeongSoo Kim, Seung-Chan Moon, Sungki Park, Hynix Semiconductor Inc. (Korea, Republic of) . . . .[7271-41]

2:20 pm: **Demonstration of full-field patterning of 32-nm test chips using EUVL**, Gilroy J. Vandentop, Manish Chandhok, Ernisse S. Putna, Todd R. Younkin, Intel Corp. (United States); Alan M. Myers, Michael J. Leeson, Intel Corp. (Belgium); Guojing Zhang, Ted Liang, Intel Corp. (United States) . . . .[7271-42]

2:40 pm: **Defectivity of wafers processed using a 0.25NA full-field EUV lithography exposure tool**, Anna Tchikoulaeva, AMD Saxony LLC & Co. KG (Germany); Uzodinma Okoroanyanwu, Obert Wood II, Bruno M. La Fontaine, Advanced Micro Devices, Inc. (United States); Kevin D. Cummings, Robert M. Routh, Thomas Laursen, Bill Pierson, Sang-In Han, Youri van Dommelen, ASML US, Inc. (United States); Christian Holfeld, Advanced Mask Technology Ctr. (Germany); Chiew-seng Koay, Karen E. Petrillo, IBM Corp. (United States); Sumanth Kini, KLA-Tencor New York (United States); Hiroyuki Mizuno, Toshiba America Electronic Components, Inc. (United States) . . . .[7271-43]

3:00 pm: **Recent progress of EUV full-field exposure tool in Selete**, Kazuo Tawarayama, Shunko Magoshi, Yuusuke Tanaka, Seiichiro Shirai, Hiroyuki Tanaka, Semiconductor Leading Edge Technologies, Inc. (Japan) . . . .[7271-44]

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

SESSION 12

Room: Conv. Ctr. C 1-4 . Wed. 1:40 to 3:20 pm

Nanoimprint I

Session Chairs: **Douglas J. Resnick,** Molecular Imprints, Inc.; **Lloyd C. Litt,** Advanced Micro Devices, Inc.

1:40 pm: **Patterned media using step-and-flash imprint lithography** *(Invited Paper)*, Cynthia B. Brooks, Michael L. Miller, Gerard M. Schmid, Dwayne L. LaBrake, Paul Hofemann, Douglas J. Resnick, S. V. Sreenivasan, Molecular Imprints, Inc. (United States) . . . .[7271-56]

2:20 pm: **Design and fabrication of Si-based photonic crystal stamps with electron-beam lithography (EBL)**, Reyhaneh Jannesary, Saeid Zamiri Hossein Zahdeh, Kurt Hingerl, Johannes Kepler Univ. Linz (Austria); Graham Hubbard, Steven Abbott, MacDermid Autotype Ltd. (United Kingdom); Qin Chen, Duncan Allsopp, Univ. of Bath (United Kingdom) . . . .[7271-57]

2:40 pm: **Soft stamp UV-nanoimprint lithography for fabrication of laser diodes**, Jukka Viheriälä, Milla-Riina Viljanen, Juha Kontio, Tomi Leinonen, Juha Tommila, Michail Dumitrescu, Tapio Niemi, Markus Pessa, Optoelectronics Research Ctr. (Finland) . . . .[7271-58]

3:00 pm: **Nanoimprint lithography for sub-10-nm complex patterns**, Wei Wu, Qiangfei Xia, Hewlett-Packard Labs. (United States); Deborah Morecroft, Joel Yang, Karl K. Berggren, Massachusetts Institute of Technology (United States); Xuema Li, Shih-Yuan Wang, R. Stanley Williams, Hewlett-Packard Labs. (United States) . . . .[7271-59]

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

Conference 7271 continues on page 42.

Conference 7272

Metrology, Inspection, and Process Control for Microlithography XXIII

SESSION 10

Room: Conv. Ctr. J 1-4 . . . Wed. 1:30 to 2:50 pm

Mask Metrology

Session Chairs: **Martha I. Sanchez,** IBM Almaden Research Ctr.; **Daniel J. Herr,** Semiconductor Research Corp.

1:30 pm: **Cr migration on 193-nm binary photomasks**, John Bruley, IBM Thomas J. Watson Research Ctr. (United States); Geoffrey W. Burr, IBM Almaden Research Ctr. (United States); Robert E. Davis, Philip Flaitz, IBM Corp. (United States); William D. Hinsberg, Frances A. Houle, Dolores C. Miller, IBM Almaden Research Ctr. (United States); Michael Pike, Jed H. Rankin, IBM Corp. (United States); Alfred Wagner, IBM Thomas J. Watson Research Ctr. (United States); Andrew J. Watts, IBM Corp. (United States) . . . .[7272-44]

1:50 pm: **Compute resource management and tat control in mask data preparation**, Ahmed Nouh, Minyoung Park, Mentor Graphics Corp. (United States) . . . .[7272-46]

2:10 pm: **Study of mask process signatures using PhameÎ in-die phase measurements**, Ute Buttgereit, Sascha Perlitz, Carl Zeiss SMS GmbH (Germany). . . . .[7272-47]

2:30 pm: **Image library approach to evaluating parametric uncertainty in metrology of isolated feature width**, James E. Potzick, National Institute of Standards and Technology (United States) [7272-48]

Coffee Break. . . . . 2:50 to 3:30 pm

Conference 7272 continues on page 42.

Wednesday 25 February

Conference 7273

Advances in Resist Materials and Processing Technology XXVI

SESSION 11

Room: Marriott Salon III-IV
Wed. 2:00 to 3:40 pm

LER/LWR Behavior in Resists

Session Chairs: **Qinghuang Lin,** IBM Thomas J. Watson Research Ctr.; **Christoph K. Hohle,** Qimonda Dresden GmbH & Co. OHG (Germany)

2:00 pm: **Resist roughness bi-modality as revealed by two-dimensional FFT 2D analysis**, Yehiel Gotkis, Leonid Baranov, KLA-Tencor Corp. (United States); Theodore H. Fedynyshyn, Susan G. Cann, MIT Lincoln Lab. (United States) . . . . [7273-48]

2:20 pm: **Reducing LER using a grazing incidence ion beam**, Corey R. Struck, David N. Ruzic, Univ. of Illinois at Urbana-Champaign (United States); Robert L. Bristol, Intel Corp. (United States) . . . . . . [7273-49]

2:40 pm: **Resist fundamentals for resolution, LER, and sensitivity (RLS) performance tradeoffs and the relation to microbridging defects**, Benjamin M. Rathsack, Mark H. Somervell, Tokyo Electron America, Inc. (United States); Kathleen R. Nafus, Shinichi Hatakeyama, Tokyo Electron Kyushu Ltd. (Japan); Roel Gronheid, Sophie Bernard, IMEC (Belgium). . . . . [7273-50]

3:00 pm: **PAG, shot noise, and LER in EUV photoresists**, Christopher N. Anderson, Univ. of California, Berkeley (United States); Patrick P. Naulleau, Lawrence Berkeley National Lab. (United States) . . . . [7273-51]

3:20 pm: **PAG segregation during exposure affecting innate material roughness**, Theodore H. Fedynyshyn, David K. Astolfi, Alberto Cabral, Susan G. Cann, Indira Pottebaum, MIT Lincoln Lab. (United States); Jeanette M. Roberts, Intel Corp. (United States) . . . . [7273-52]

Coffee Break. . . . . 3:40 to 4:10 pm

Conference 7273 continues on page 43.

Conference 7274

Optical Microlithography XXII

SESSION 7

Room: Conv. Ctr. A 1-8 . . Wed. 1:20 to 3:00 pm

Tools Related Process Control I

Session Chairs: **Kazuhiro Takahashi,** Canon Inc. (Japan); **Tsai-Sheng Gau,** Taiwan Semiconductor Manufacturing Co. Ltd. (Taiwan)

1:20 pm: **Scanner OPC signatures: automatic vendor-to-vendor OPE matching**, Stephen P. Renwick, Nikon Precision Inc. (United States) . . . . [7274-86]

1:40 pm: **Dense lines created by double patterning schemes: process control by local dose and placement adjustment using advanced scanner control**, Jo M. Finders, ASML Netherlands B.V. (Netherlands) . . . . [7274-26]

2:00 pm: **Focus and dose characterization of immersion photoclusters**, Timothy A. Brunner, Daniel A. Corliss, Timothy J. Wiltshire, Christopher P. Ausschnitt, IBM Microelectronics Div. (United States) . . . . [7274-27]

2:20 pm: **Model-based scanner tuning in a manufacturing environment**, Chi-Yuan Shih, Ray-Chen Peng, Yao-Wen Guo, Jia-Yun Lee, Heng-Hsin Liu, Heng-Jen Lee, Chin-Hsiang Lin, Taiwan Semiconductor Manufacturing Co. Ltd. (Taiwan); Wenjin Shao, Hua Cao, Antoine Bruguier, Xu Xie, Chung-Hsing Chang, Cao Yu, Ronald Goossens, Brion Technologies, Inc. (United States); Simon Hsieh, ASML Netherlands B.V. (Netherlands) . . . . [7274-114]

2:40 pm: **Scanner-dependent optical proximity effects**, Jacek K. Tyminski, Nikon Precision Inc. (United States) . . . . [7274-29]

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

Conference 7274 continues on page 43.

Wednesday 25 February

Conference 7271

Alternative Lithographic Technologies

Sessions 10 runs concurrently with session 13.

SESSION 10

Room: Conv. Ctr. B 1-4 . Wed. 3:50 to 6:10 pm

EUV OPC

Session Chairs: **Sung-Woo Lee,** SAMSUNG Electronics Co., Ltd. (Korea, Republic of); **Patrick P. Naulleau,** Lawrence Berkeley National Lab.

3:50 pm: **Exposure tool settings and OPC strategies for EUV lithography at the 16-nm node**, Yunfei Deng, Jongwook Kye, Harry J. Levinson, Thomas I. Wallow, Obert Wood II, Bruno M. La Fontaine, Advanced Micro Devices, Inc. (United States); Anita Fumar-Pici, ASML Mask Tools Inc. (United States); Hiroyuki Mizuno, Toshiba America Electronic Components, Inc. (United States); Chiew-seng Koay, Greg McIntyre, IBM Corp. (United States) . . . .[7271-45]

4:10 pm: **Requirements and results for a full-field EUV OPC flow**, Stephen Jang, Lena Zavyalova, Synopsys, Inc. (United States); Brian S. Ward, Synopsys, Inc. (Belgium); Jonathan L. Cobb, Kevin Lucas, Synopsys, Inc. (United States) . . . . .[7271-46]

4:30 pm: **Imaging budgets for EUV optics: ready for 22-nm node and beyond**, Marc Bienert, Aksel Göhnemeier, Martin Lowisch, Paul Gräupner, Tilmann Heil, Carl Zeiss SMT AG (Germany); Koen van Ingen Schenau, ASML Netherlands B.V. (Netherlands); Steven G. Hansen, ASML US, Inc. (United States) . . . .[7271-47]

4:50 pm: **Modeling and experiments of non-telecentric thick mask effects for EUV lithography**, Gregory R. McIntyre, Chiew-seng Koay, IBM Corp. (United States); Hiroyuki Mizuno, Toshiba America Electronic Components, Inc. (United States); Martin Burkhardt, IBM Corp. (United States) . . . . .[7271-48]

5:10 pm: **Full-layout correction of a clear-field EUV mask**, Jérôme Belledent, NXP Semiconductors (Belgium); Timothy Y. Wu, Boren Luo, Wei-Long Wang, Wen-Chun Huang, Jieh-Jang Chen, Anthony Yen, Taiwan Semiconductor Manufacturing Co. Ltd. (Taiwan); Axel Nackaerts, NXP Semiconductors (Belgium). . . . .[7271-49]

5:30 pm: **Comparison of fast 3D simulation and actinic inspection for EUV masks with buried defects**, Chris H. Clifford, Sandy Wiraatmadja, Tina T. Chan, Andrew R. Neureuther, Univ. of California, Berkeley (United States); Kenneth A. Goldberg, Iacopo Mochi, Lawrence Berkeley National Lab. (United States); Ted Liang, Intel Corp. (United States) . . . .[7271-50]

5:50 pm: **EUV-patterning characterization using a 3D mask simulation and field EUV scanner**, Jun-Taek Park, Sarohan Park, Sunyoung Koo, Yoon-Suk Hyun, Tae-Seung Eom, Chang-Moon Lim, HyeongSoo Kim, Seung-Chan Moon, Hynix Semiconductor Inc. (Korea, Republic of) . . .[7271-51]

SESSION 13

Room: Conv. Ctr. C 1-4 . Wed. 3:50 to 6:10 pm

Nanoimprint II

Session Chairs: **Benjamin G. Eynon, Jr.,** Molecular Imprints, Inc.; **William M. Tong,** Hewlett-Packard

3:50 pm: **SEMATECH's NanoImprint Program: a key enabler for nanoimprint introduction**, Lloyd C. Litt, Advanced Micro Devices, Inc. (United States) and SEMATECH, Inc. (United States); Matt Malloy, SEMATECH, Inc. (United States); Michael J. Lercel, IBM Corp. (United States) . . . .[7271-60]

4:10 pm: **Recent developments in UV nanoimprint stepper technology for sub-30-nm half-pitch lithography**, S. V. Sreenivasan, Phil Schumaker, Babak Mokaberi-Nezhad, Jin Choi, Joseph Perez, Van Truskett, Frank Y. Xu, Xiaoming Lu, Molecular Imprints, Inc. (United States) . . . .[7271-61]

4:30 pm: **Direct laser write (DLW) as a versatile tool in manufacturing templates for imprint lithography on flexible substrates**, Marius G. Ivan, Jochem Deen, Jean-Baptiste Vaney, TNO Science and Industry (Netherlands); Gerardous J. Verhaart, Singulus Mastering B.V. (Netherlands); Erwin Meinders, TNO Science and Industry (Netherlands) . . . .[7271-62]

4:50 pm: **Polyhedral Oligomeric Silsesquioxane (POSS) functional-patterns directly fabricated by nanoimprint lithography**, Hyun Wook Ro, Yifu Ding, Kyle J. Alvine, Christopher L. Soles, National Institute of Standards and Technology (United States); Vera Popova, Dave J. Krug, Mayaterials, Inc. (United States); Richard M. Laine, Univ. of Michigan (United States) . . . .[7271-63]

5:10 pm: **Evaluation of the CD-SEM Vistec LWM90xx for line-width measurement of nanoimprint templates**, Marcus Pritschow, Jörg Butschke, Mathias Irmscher, Institut für Mikroelektronik Stuttgart (Germany); Lidia Parisoli, Vistec Semiconductor Systems GmbH (Germany); Toshihide Oba, Toshimichi Iwai, Takayuki Nakamura, Advantest Corp. (Japan). . . . .[7271-64]

5:30 pm: **Physical properties of thin nanoimprint polymer films measured by photo-acoustic metrology**, Timothy Kehoe, Tyndall National Institute (Ireland) and Catalan Institute of Nanotechnology (ICN) (Spain); Jurg Bryner, ETH Zürich (Switzerland); Vincent Reboud, Catalan Institute of Nanotechnology (ICN) (Spain); Jurg Dual, ETH Zürich (Switzerland); Clivia M. Sotomayor Torres, Catalan Institute of Nanotechnology (ICN) (Spain) . . . .[7271-65]

5:50 pm: **High-resolution defect inspection of step-and-flash imprint lithography for 32-nm half-pitch patterning,** Douglas J. Resnick, Kosta S. Selinidis, Ian McMackin, S. V. Sreenivasan, Molecular Imprints, Inc. (United States) . . . .[7271-66]

Conference 7271 continues on page 44.

Conference 7272

Metrology, Inspection, and Process Control for Microlithography XXIII

SESSION 11

Room: Conv. Ctr. J 1-4 . . . Wed. 3:30 to 5:30 pm

Inspection

Session Chairs: **Chas N. Archie,** IBM Corp.; **Alexander Starikov,** Intel Corp.

3:30 pm: **New inspection technology for hole pattern by Fourier space on hp 4X-nm generation**, Akitoshi Kawai, Kazumasa Endo, Fuminori Hayano, Nikon Corp. (Japan); Kiminori Yoshino, Yuichiro Yamazaki, Toshiba Corp. (Japan) . . . .[7272-49]

3:50 pm: **Development of optical simulation tool for defect inspection**, Takayoshi Fujii, Yusaku Konno, Naotada Okada, Kiminori Yoshino, Yuuichiro Yamazaki, Toshiba Corp. (Japan) . . . .[7272-50]

4:10 pm: **Phenomenology of electron-beam-induced photoresist shrinkage trends**, Benjamin D. Bunday, John A. Allgair, Aaron M. Cordes, International SEMATECH Manufacturing Initiative (United States); Ofer Adan, Applied Materials (Israel). . . . .[7272-138]

4:30 pm: **Systematic defect filtering and data analysis methodology**, Hyunjo Yang, Jungchan Kim, Taehyeong Lee, Areum Jung, Gyun Yoo, Dong-Gyu Yim, Sungki Park, Hynix Semiconductor Inc. (Korea, Republic of) . . . .[7272-53]

4:50 pm: **Quantitative measurement of voltage contrast in SEM images for in-line resistance inspection of wafers manufactured for SRAM**, Miyako Matsui, Takahiro Odaka, Hitachi, Ltd. (Japan); Hiroshi Nagaishi, Koichi Sakurai, Renesas Technology Corp. (Japan) . . . .[7272-54]

5:10 pm: **Study of 45-nm node device leakage with different SRAM layout using an advanced e-beam inspection system,** Hong Xiao, Hermes Microvision, Inc. (United States). . . . .[7272-55]

Conference 7272 continues on page 44.

Wednesday 25 February

Conference 7273

Advances in Resist Materials and Processing Technology XXVI

SESSION 12

Room: Marriott Salon III-IV
Wed. 4:10 to 6:10 pm

Novel Materials, Processes, and Applications II

Session Chairs: **Ernisse Steve Putna,** Intel Corp.; **Mark H. Somervell,** Tokyo Electron America, Inc.

4:10 pm: **Chalcogenide glass thin film resists for grayscale photolithography**, Andriy Kovalskyy, Jiri Cech, Lehigh Univ. (United States); Christopher M. Waits, Madan Dubey, Army Research Lab. (United States); Elizabeth Miller, Lehigh Univ. (United States); Miroslav Vlcek, Univ. Pardubice (Czech Republic); Himanshu Jain, Lehigh Univ. (United States)[7273-53]

4:30 pm: **Defect reduction by using point-of-use filtration in a new coater/developer**, Toru Umeda, Shuichi Tsuzuki, Toru Numaguchi, Nihon Pall Ltd. (Japan) . . . .[7273-54]

4:50 pm: **CDU improvement with wafer warpage control oven for high-volume manufacturing**, Tadatoshi Tomita, Heiko Weichert, Tokyo Electron Europe Ltd. (Germany); Hideo Shite, Ryoichi Uemura, Junichi Kitano, Hisanori Sugimachi, Hitoshi Kosugi, Tokyo Electron Kyushu Ltd. (Japan) . . . . . .[7273-55]

5:10 pm: **Gap-fill type HSQ/ZEP520A bilayer resist process, part III: optimal process window for HSQ air-tip formation**, Wei-Su G. Chen, Industrial Technology Research Institute (Taiwan) . . .[7273-56]

5:30 pm: **Feasibility studies of coating method for planarization process**, Kentaro Matsunaga, Tomoya Oori, Hirokazu Kato, Eishi Shiobara, Toshiba Corp. (Japan); Makoto Muramatsu, Mitsuaki Iwashita, Takahiro Kitano, Tokyo Electron Kyushu Ltd. (Japan); Yusuke Horiguchi, Satoshi Takei, Nissan Chemical Industries, Ltd. (Japan); Shinichi Ito, Toshiba Corp. (Japan) . . . .[7273-57]

5:50 pm: **Environmentally benign development of photoresists in supercritical carbon dioxide using CO_2 compatible additives**, Abhinav Rastogi, Manabu Tanaka, Cornell Univ. (United States); Gregory N. Toepperwein, Robert A. Riggleman, Juan J. de Pablo, Univ. of Wisconsin, Madison (United States); Christopher K. Ober, Cornell Univ. (United States) . . . .[7273-58]

Conference 7273 end.

Conference 7274

Optical Microlithography XXII

SESSION 8

Room: Conv. Ctr. A 1-8 . . Wed. 3:30 to 4:50 pm

Tools Related Process Control II

Session Chairs: **Nigel R. Farrar,** Cymer, Inc.; **Kurt R. Kimmel,** Advanced Mask Technology Ctr. GmbH & Co. KG (Germany)

3:30 pm: **Challenges and solutions in the calibration of projection lens pupil-image metrology tools**, Steven D. Slonaker, Nikon Precision Inc. (United States); Hisashi Nishinaga, Nikon Corp. (Japan); Bryan D. Riffel, Nikon Precision Inc. (United States) . . . .[7274-30]

3:50 pm: **Impact of CD and overlay errors on double-patterning processes**, Céline Lapeyre, Sébastien Barnola, Isabelle Servin, Commissariat à l'Energie Atomique (France); Vincent Salvetat, Nikon Precision Europe GmbH (France); Nobutaka Magome, Andrew J. Hazelton, Nikon Corp. (Japan); Martin McCallum, Nikon Precision Europe GmbH (United Kingdom) . . . .[7274-31]

4:10 pm: **Achieving overlay budgets for double patterning**, Andrew J. Hazelton, Nobutaka Magome, Shinji Wakamoto, Akira Tokui, Nikon Corp. (Japan) . . . .[7274-32]

4:30 pm: **Innovative pattern-matching method considering process margin and scanner-design information,** Koichiro Tsujita, Koji Mikami, Hiroyuki Ishii, Kazuhiro Takahashi, Akiyoshi Suzuki, Canon Inc. (Japan) . . . .[7274-33]

Conference 7274 continues on page 45.

Thursday 26 February

Conference 7271

Alternative Lithographic Technologies

SESSION 14

Room: Conv. Ctr. B 1-4 . . . . .Thurs. 8:00 to 10:20 am

EUV Tools

Session Chairs: **Shinji Okazaki,** Hitachi, Ltd. (Japan); **David T. Attwood, Jr.,** Lawrence Berkeley National Lab.

8:00 am: **Nikon EUVL development progress update**, Takaharu Miura, Katsuhiko Murakami, Hidemi Kawai, Yoshiaki Kohama, Kenji Morita, Kazunari Hada, Yukiharu Okubo, Nikon Corp. (Japan) . . . . [7271-67]

8:20 am: **Development status of Canon's full-field EUVL tool**, Takayuki Hasegawa, Shigeyuki Uzawa, Tokuyuki Honda, Hideki Morishima, Canon Inc. (Japan). . . . . [7271-68]

8:40 am: **Development progress of optics for EUVL at Nikon**, Katsuhiko Murakami, Tetsuya Oshino, Hiroyuki Kondo, Masayuki Shiraishi, Hiroshi Chiba, Hideki Komatsuda, Kazushi Nomura, Jin Nishikawa, Nikon Corp. (Japan) . . . . [7271-69]

9:00 am: **Process liability evaluation with EUVL**, Hajime Aoyama, Kazuo Tawarayama, Yuusuke Tanaka, Daisuke Kawamura, Yukiyasu Arisawa, Takashi Kamo, Toshiro Itani, Toshihiko Tanaka, Hiroyuki Tanaka, Ichiro Mori, Semiconductor Leading Edge Technologies, Inc. (Japan); Yumi Nakajima, Ryouichi Inanami, Takeshi Koshiba, Kohji Hashimoto, Toshiba Corp. (Japan) [7271-74]

9:20 am: **Characterization of a 0.25 NA full-field EUV exposure tool**, Oleg Kritsun, Advanced Micro Devices, Inc. (United States) . . . . [7271-70]

9:40 am: **Development of actinic full-field EUV mask blank inspection tool at MIRAI-Selete**, Tsuneo Terasawa, Takeshi Yamane, Toshuhiko Tanaka, Teruo Iwasaki, Osamu Suga, Semiconductor Leading Edge Technologies, Inc. (Japan); Toshihisa Tomie, National Institute of Advanced Industrial Science and Technology (Japan) . . . . [7271-71]

10:00 am: **Improving the performances of the AIT with an optimized alignment procedure**, Iacopo Mochi, Kenneth A. Goldberg, Patrick P. Naulleau, Lawrence Berkeley National Lab. (United States); Sungmin Huh, SEMATECH, Inc. (United States) . . . . [7271-72]

Coffee Break. . . . . 10:20 to 10:50 am

Conference 7271 continues on page 46.

Conference 7272

Metrology, Inspection, and Process Control for Microlithography XXIII

SESSION 12

Room: Conv. Ctr. J 1-4 . . . . .Thurs. 8:00 to 10:20 am

Process Control

Session Chairs: **John A. Allgair,** SEMATECH, Inc. and Advanced Micro Devices, Inc.; **Christopher J. Raymond,** Nanometrics Inc.

8:00 am: **Hotspot monitoring system with contour-based die-to-die metrology**, Akiko Fujii, Yukako Tanaka, Shigeko Tsuda, Koichiro Shibayama, Shinichi Furukawa, Hideaki Abe, Tadashi Mitsui, Yuuichiro Yamazaki, Toshiba Corp. (Japan) . . . . [7272-56]

8:20 am: **Outliers detection by fuzzy classification method for model building**, Mame-Kouna Top, Yorick Trouiller, Vincent Farys, STMicroelectronics (France); Patrick Schiavone, David Fuard, Ctr. National de la Recherche Scientifique (France); Emek Yesilada, Catherine Martinelli, Mazen Said, Franck Foussadier, STMicroelectronics (France). . . . . [7272-57]

8:40 am: **Assessing, monitoring, and driving continuous improvements in fleet measurement uncertainty**, Eric P. Solecky, Chas N. Archie, Matthew Sendelbach, Ronald Fiege, Mary Ann Zaitz, Dmitriy Shneyder, Carlos Strocchia-rivera, Andres Munoz, Srinivasan Rangarajan, IBM Microelectronics Div. (United States); G. William Banke, Jr., IBM Corp. (United States); Alok Vaid, IBM Microelectronics Div. (United States); Mark Kelling, Advanced Micro Devices, Inc. (United States); Bernd Schulz, AMD Saxony LLC & Co. KG (Germany); Carsten Hartig, AMD Saxony Manufacturing GmbH (Germany); Jon-Tobias Hoeft, AMD Saxony LLC & Co. KG (Germany); Benjamin D. Bunday, John A. Allgair, SEMATECH, Inc. (United States) . . . . [7272-58]

9:00 am: **Two-dimensional dose and focus-error measurement technology for exposure tool management in half-pitch 3x generation**, Kazuhiko Fukazawa, Yuji Kudo, Yoshihiko Fujimori, Nikon Corp. (Japan); Kiminori Yoshino, Yuichiro Yamazaki, Toshiba Corp. (Japan) . . . . [7272-59]

9:20 am: **Increased uniformity control in a 45-nm poly gate etch process**, Blake Parkinson, Daniel Prager, Merritt L. Funk, Radha Sundararajan, Tokyo Electron America, Inc. (United States); Asao Yamashita, TEL Technology Ctr., America, LLC (United States); Kenneth A. Bandy, Eric Meyette, Elizabeth Hampton, IBM Microelectronics Div. (United States) . . . . [7272-124]

9:40 am: **The measurement uncertainty challenge for the future technological nodes production and development**, Johann Foucher, CEA-LETI (France). . . . . [7272-125]

10:00 am: **A characterization of several pre-etch feature profile parameters and thier impacts on post-etch profiles**, Michael J. Cicoria, Kenichi Ueda, Thomas E. Winter, Tokyo Electron America, Inc. (United States); Shannon Dunn, TEL Technology Ctr., America, LLC (United States); Tsuyoshi Shibata, Tokyo Electron Kyushu Ltd. (Japan); Xiaoping Lui, Youxian Wen, Timbre Technologies, Inc. (United States) . . . . [7272-62]

Coffee Break. . . . . 10:20 to 10:50 am

Conference 7272 continues on page 46.

Thursday 26 February

Conference 7274

Optical Microlithography XXII

SESSION 9

Room: Conv. Ctr. A 1-8 . . . . Thurs. 8:00 to 10:00 am

Optical Proximity Corrections I

Session Chairs: **Willard E. Conley,** Freescale Semiconductor, Inc.; **Geert Vandenberghe,** IMEC (Belgium)

8:00 am: **A new method for post-etch OPC modeling to compensate for underlayer effects from integrated wafers**, Chandrasekhar Sarma, Infineon Technologies North America Corp. (United States); Amr Abdo, Daniel S. Fischer, Derren Dunn, IBM Microelectronics Div. (United States); Klaus Herold, Infineon Technologies North America Corp. (United States); Scott M. Mansfield, Len Y. Tsou, IBM Microelectronics Div. (United States) . . . . [7274-34]

8:20 am: **Optimal setting strategy for kernel-based OPC simulation engines**, Katsuyoshi Kodera, Satoshi Tanaka, Toshiya Kotani, Soichi Inoue, Toshiba Corp. (Japan) . . . . [7274-35]

8:40 am: **Improving yield through the application of process window OPC**, Jaione Tirapu-Azpiroz, Azalia Krasnoperova, Shahab Siddiqui, Kenneth Settlemyer, Ian P. Stobert, Ioana C. Graur, James M. Oberschmidt, IBM Microelectronics Div. (United States) . . . . [7274-36]

9:00 am: **Etch-aware optical proximity correction: a first step toward integrated pattern engineering**, Derren Dunn, Scott M. Mansfield, IBM Microelectronics Div. (United States); Klaus Herold, Infineon Technologies North America Corp. (United States) . . . . [7274-37]

9:20 am: **Integrating assist feature printing with OPC**, Benjamin D. Painter, Levi D. Barnes, Amyn A. Poonawala, Andrew M. Jost, Yong Li, Synopsys, Inc. (United States). . . . . [7274-38]

9:40 am: **Double-patterning friendly OPC**, Xiaohai Li, Gerry Luk-Pat, Synopsys, Inc. (United States); Christopher M. Cork, Synopsys SARL (France); Levi D. Barnes, Kevin Lucas, Synopsys, Inc. (United States) . . . . [7274-39]

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

Conference 7274 continues on page 47.

Conference 7275

Design for Manufacturability through Design-Process Integration III

SESSION 1

Room: Conv. Ctr. C 1-4 . . . . .Thurs. 8:00 to 10:00 am

Keynote Session on DFM for Scalability

Session Chair: **Vivek Singh,** Intel Corp.

8:00 am: **Computational scaling: an integrated solution for today's semiconductor challenges** *(Keynote Presentation),* Timothy Farrell, IBM Corp. (United States) . . . . [7275-01]

8:40 am: **Co-optimization: the new DFM (***Keynote Presentation)*, Sunit Rikhi, Intel Corp. (United States). . . . . [7275-02]

9:20 am: **DFM 5 years from now: research in the IMPACT Program at UC Berkeley** *(Keynote Presentation)*, Kameshwar Poolla, Univ. of California, Berkeley (United States) . . . . . [7275-03]

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

Conference 7275 continues on page 47.

Thursday 26 February

Conference 7271

Alternative Lithographic Technologies

SESSION 15

Room: Conv. Ctr. B 1-4 . . . . .Thurs. 10:50 to 11:50 am

EUV Resist

Session Chairs: **Patrick P. Naulleau,** Lawrence Berkeley National Lab.; **Thomas I. Wallow,** Advanced Micro Devices, Inc.

10:50 am: **Assessment of EUV resist readiness for 32-nm hp manufacturing and extendibility study of EUV ADT using state-of-the-art resists**, Chawon Koh, Liping Ren, Jacque Georger, Stefan Wurm, SEMATECH, Inc. (United States); Bill Pierson, ASML US, Inc. (United States); Joo-On Park, SAMSUNG Electronics Co., Ltd. (Korea, Republic of); Thomas I. Wallow, Advanced Micro Devices, Inc. (United States); Todd R. Younkin, Intel Corp. (United States); Patrick P. Naulleau, Lawrence Berkeley National Lab. (United States) . . . . [7271-73]

11:10 am: **Synthesis and kinetics of novel acid amplifiers for use in EUV photoresists**, Seth Kruger, Srividya Revuru, Craig D. Higgins, Hasti Amiri, Univ. at Albany (United States); Wang Yueh, Todd R. Younkin, Intel Corp. (United States); Robert L. Brainard, Univ. at Albany (United States). . . . . [7271-75]

11:30 am: **EUVL-resist outgassing measurements and calibrations for high-volume manufacturing (HVM)**, Gregory P. Denbeaux, Alin O. Antohe, Rashi Garg, Chimaobi Mbanaso, Leonid Yankulin, Yu-Jen Fan, Univ. at Albany (United States); Kevin Orvek, Andrea F. Wuest, SEMATECH, Inc. (United States). . . . . . [7271-76]

Lunch Break . . . . 11:50 am to 1:40 pm

SESSION 16

Room: Conv. Ctr. B 1-4 . . . . .Thurs. 1:40 to 3:20 pm

Nanoimprint Materials

Session Chairs: **Frances A. Houle,** IBM Almaden Research Ctr.; **Elizabeth A. Dobisz,** Hitachi Global Storage Technologies, Inc.

1:40 pm: **Debonding of UV-cured nanoimprint resist-release layer systems** *(Invited Paper)*, Deborah L. Casher, Frances A. Houle, Dolores C. Miller, IBM Almaden Research Ctr. (United States) . . . . [7271-78]

2:20 pm: **Time-resolved measurement of line-shape decay in nanoimprinted polymer films using ellipsometric scatterometry**, Heather J. Patrick, Yifu Ding, Hyun Wook Ro, Lee J. Richter, Thomas A. Germer, Christopher L. Soles, National Institute of Standards and Technology (United States) . . . . [7271-79]

2:40 pm: **Characterization of vinyl ether UV-cure nanoimprint resists**, Taiichi Furukawa, JSR Micro, Inc. (United States); Frances A. Houle, Deborah L. Casher, Dolores C. Miller, IBM Almaden Research Ctr. (United States). . . . . [7271-80]

3:00 pm: **A study of filling process for UV-nanoimprint lithography using a fluid simulation**, Ikuo Yoneda, Yasutada Nakagawa, Shinji Mikami, Hiroshi Tokue, Takumi Ota, Takeshi Koshiba, Masamitsu Ito, Kohji Hashimoto, Tetsuro Nakasugi, Tatsuhiko Higashiki, Toshiba Corp. (Japan). . . . . [7271-81]

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

Conference 7271 continues on page 48.

Conference 7272

Metrology, Inspection, and Process Control for Microlithography XXIII

SESSION 13

Room: Conv. Ctr. J 1-4 . . . . Thurs. 10:50 to 11:50 am

Scatterometry II

Session Chairs: **Martha I. Sanchez,** IBM Almaden Research Ctr.; **Alexander Starikov,** Intel Corp.

10:50 am: **Angle-resolved scatterfield microscope for linewidth measurement**, Deh-Ming Shyu, Yi-Sha Ku, Wei-Te Hsu, Industrial Technology Research Institute (Taiwan) . . . . [7272-63]

11:10 am: **Optical CD metrology model evaluation and refining for manufacturing**, Shiang Bau Wang, C. L. Huang, Yuan-Hun Chiu, Hun-Yuan Tao, Y. J. Mii, Taiwan Semiconductor Manufacturing Co. Ltd. (Taiwan). . . . . [7272-64]

11:30 am: **Uncertainty and sensitivity analysis and its applications in OCD measurements**, Pedro P. T. Vagos, Jiangtao Hu, Zhuan Liu, Silvio Rabello, Nanometrics Inc. (United States) . . . . [7272-65]

Lunch Break . . . . 11:50 am to 1:40 pm

SESSION 14

Room: Conv. Ctr. J 1-4 . . . . Thurs. 1:40 to 2:20 pm

Reference Metrology

Session Chairs: **Chas N. Archie,** IBM Corp.; **Vladimir A. Ukraintsev,** Veeco Instruments Inc.

1:40 pm: **Using the 3D-AFM technique as a mean to decrease OPC model error**, Vincent Farys, STMicroelectronics (France); Johann Foucher, CEA-LETI (France); Gurwan Kerrien, Catherine Martinelli, Emek Yesilada, Alexandre Villaret, STMicroelectronics (France). . . . . [7272-67]

2:00 pm: **AFM method for sidewall measurement through CNT probe deformation correction and its accuracy evaluation,** Masahiro Watanabe, Shuichi Baba, Toshihiko Nakata, Hitachi, Ltd. (Japan); Takafumi Morimoto, Satoshi Sekino, Hitach Kenki FineTech Co., Ltd. (Japan); Hiroshi Itoh, National Institute of Advanced Industrial Science and Technology (Japan) . . . . [7272-70]

Conference 7272 continues on page 48.

Thursday 26 February

Conference 7274

Optical Microlithography XXII

SESSION 10

Room: Conv. Ctr. A 1-8 . . . . Thurs. 10:30 to 11:50 am

Optical Proximity Corrections II

Session Chairs: **Sam Sivakumar,** Intel Corp.; **Kafai Lai,** IBM Corp.

10:30 am: **Calibrating OPC model with full CD profile data for 2D and 3D patterns using scatterometry**, Aasutosh Dave, Mentor Graphics Corp. (United States); Oleg Kritsun, Advanced Micro Devices, Inc. (United States); Christian D. Zuniga, Mentor Graphics Corp. (United States); Jie Li, Jiangtao Hu, Nanometrics Inc. (United States); Yunfei Deng, Advanced Micro Devices, Inc. (United States) . . . . [7274-40]

10:50 am: **Impact of modelization pixel size on OPC consistency**, Franck Foussadier, Emek Yesilada, Jean-Christophe Le Denmat, STMicroelectronics (France); Yorick Trouiller, Commissariat à l'Energie Atomique (France); Vincent Farys, Frederic Robert, Gurwan Kerrien, Christian Gardin, STMicroelectronics (France); Loic Perraud, Commissariat à l'Energie Atomique (France); Florent Vautrin, Alexandre Villaret, Catherine Martinelli, Jonathan Planchot, STMicroelectronics (France); Jean-Luc Di Maria, Commissariat à l'Energie Atomique (France); Mazen Saied, Mame-Kouna Top, STMicroelectronics (France). . . . . [7274-41]

11:10 am: **OPC simplification and mask cost reduction using regular design fabrics**, Tejas K. Jhaveri, Andrzej J. Strojwas, Larry Pileggi, Vyacheslav Rovner, Carnegie Mellon Univ. (United States) . . . . [7274-42]

11:30 am: **Resist development modeling for OPC accuracy improvement**, Yongfa Fan, Charlie Q. Zhang, Bradley J. Falch, Kevin Lucas, Ebo H. Croffie, Jianliang Li, Synopsys, Inc. (United States) . . . . [7274-43]

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

SESSION 11

Room: Conv. Ctr. A 1-8 . . . . Thurs. 1:20 to 2:00 pm

Optical Proximity Corrections III

Session Chairs: **Ken Ozawa,** Sony Atsugi Technology Ctr. (Japan); **Kurt R. Kimmel,** Advanced Mask Technology Ctr. GmbH & Co. KG (Germany)

1:20 pm: **OPC for reduced process sensitivity in the double-patterning flow**, Mohamed Gheith, James C. Word, Mentor Graphics Corp. (United States) . . . . [7274-44]

1:40 pm: **Through-focus pattern matching applied to double patterning**, Juliet A. Rubinstein, Andrew R. Neureuther, Univ. of California, Berkeley (United States) . . . . [7274-45]

Conference 7274 continues on page 49.

Conference 7275

Design for Manufacturability through Design-Process Integration III

SESSION 2

Room: Conv. Ctr. C 1-4 . . . . . . Thurs. 10:30 am to 12:10 pm

Variability

Session Chair: **Alfred K. Wong,** Magma Design Automation, Inc.

10:30 am: **Hierarchical modeling of spatial variability of a 45-nm test chip**, Kun Qian, Costas J. Spanos, Univ. of California, Berkeley (United States) . . . . [7275-04]

10:50 am: **DFM physical-electrical co-optimization of standard cells for C45/32-nm nodes**, Lionel Riviere Cazaux, Freescale Semiconductor, Inc. (United States); Philippe Hurat, Bala Kasthuri, Larry Layton, Nishath Verghese, Cadence Design Systems, Inc. (United States) . . . . [7275-37]

11:10 am: **Tiny footprint programmable electrical defocus monitors**, Wojtek J. Poppe, Andrew R. Neureuther, Patrick Au, Darshana Jayasuriya, Juliet A. Rubinstein, Univ. of California, Berkeley (United States). . . . . [7275-06]

11:30 am: **Tracking systematic defects hidden by random defectivity in mature technology yield**, Jean-Christophe Le Denmat, STMicroelectronics (France) and Applied Materials, Inc. (Israel); Laurent Karsenti, Applied Materials, Inc. (Israel); Laurent Couturier, Applied Materials, Inc. (France). . . . . [7275-07]

11:50 am: **The nebulous hotspot**, Alfred K. Wong, Magma Design Automation (United States) . . . . [7275-09]

Lunch Break . . . . 12:10 to 2:00 pm

Conference 7275 continues on page 49.

Thursday 26 February

Conference 7271

Alternative Lithographic Technologies

SESSION 17

Room: Conv. Ctr. B 1-4 . . . . Thurs. 3:50 to 6:10 pm

Directed Self Assembly

Session Chairs: **Kevin T. Turner,** Univ. of Wisconsin, Madison; **James W. Blatchford,** Texas Instruments Inc.

3:50 pm: **Self assembly of DNA nanostructures on lithographically patterned surfaces** *(Invited Paper)*, Gregory M. Wallraff, Ryan J. Kershner, Luisa D. Bozano, Christine Micheel, Ann Fornof, Albert Hung, Charles T. Rettner, Marco Bersani, Jennifer Cha, Jane E. Frommer, IBM Almaden Research Ctr. (United States); Paul W. K. Rothemund, California Institute of Technology (United States) . . . . [7271-82]

4:30 pm: **Resolution enhancement based on directed polymer self assembly**, Joy Y. Cheng, Daniel P. Sanders, Charles T. Rettner, Young-Hye Na, Ho-Cheol Kim, William D. Hinsberg, IBM Almaden Research Ctr. (United States) . . . . [7271-83]

4:50 pm: **Lithographically directed material assembly**, Richard P. Kingsborough, Russell B. Goodman, Theodore H. Fedynyshyn, MIT Lincoln Lab. (United States) . . . . [7271-84]

5:10 pm: **Control of placement of self-assembled patterns from block copolymers**, Ho-Cheol Kim, Sang-Min Park, Charles T. Rettner, IBM Almaden Research Ctr. (United States) . . . . [7271-85]

5:30 pm: **Assembly of block copolymers on chemically nanopatterned substrates: a platform for nanoscale lithography**, Paul F. Nealey, Univ. of Wisconsin, Madison (United States) and Hitachi Global Storage Technologies (United States) . . . . [7271-86]

5:50 pm: **From nanoimprint lithography to self-assembly: pattern generation for bit-patterned media beyond 1 Tbit/in2,** XiaoMin Yang, Shuaigang Xiao, Yuan Xu, Seagate Technology (United States) . . . . [7271-87]

Conference 7271 end.

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Conference 7272

Metrology, Inspection, and Process Control for Microlithography XXIII

Room: Conv. Ctr. J 1-4 . . . . Thurs. 3:30 to 5:00 pm

Global Collaboration in Reference Metrology

Workshop Chair: **Vladimir A. Ukraintsev,** Veeco Instruments Inc.

Semiconductor manufacturers around the globe are becoming increasingly concerned about the current state and the future of reference metrology. Nanotechnology is another growing area where an accurate reference metrology is a vital element of the business. A Reference Metrology working group has been formed in April 2008 with the goal to coordinate and promote pre-competitive research in the field. This is the first workshop organized by the group and SPIE Metrology, Inspection, and Process Control for Microlithography organizing committee. The workshop will rectify goals of the group, scope of activities and operational umbrella. We encourage a diversity of opinions. Please contact the organizers if you would like to contribute to the discussion.

Conference 7272 end.

Thursday 26 February

Conference 7274

Optical Microlithography XXII

SESSION 12

Room: Conv. Ctr. A 1-8 . . . . Thurs. 2:00 to 4:10 pm

Resolution Enhancement

Session Chairs: **Bruce W. Smith,** Rochester Institute of Technology; **Tsai-Sheng Gau,** Taiwan Semiconductor Manufacturing Co. Ltd. (Taiwan)

2:00 pm: **A novel methodology for hybrid mask assist features generation for 22- and 15-nm technology nodes**, Yi Zou, Luigi Capodieci, Cyrus E. Tabery, Advanced Micro Devices, Inc. (United States) . . . .[7274-46]

2:20 pm: **Pushing the limits of RET with different illumination methods,** Aasutosh Dave, Mentor Graphics Corp. (United States); Ryoung-Han Kim, Advanced Micro Devices, Inc. (United States). . . . .[7274-129]

2:40 pm: **How to win control and influence line-width: assessing gate line-width tolerance for the 22-nm node**, Scott D. Halle, Jason E. Meiring, Allen H. Gabor, IBM Microelectronics Div. (United States) . . . .[7274-48]

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

3:30 pm: **A computational technique to optimally design in-situ diffractive elements: applications to projection lithography at the resist resolution limit**, Gonzalo R. Feijoo, Woods Hole Oceanographic Institution (United States); Assad A. Oberai, Jayanth J. Mohan, Rensselaer Polytechnic Institute (United States); Jaione Tirapu-Azpiroz, IBM Microelectronics Div. (United States); Alan E. Rosenbluth, IBM Thomas J. Watson Research Ctr. (United States); Kehan Tian, IBM Microelectronics Div. (United States); David O. Melville, IBM Thomas J. Watson Research Ctr. (United States); Dario Gil, Kafai Lai, IBM Microelectronics Div. (United States) . . . .[7274-50]

3:50 pm: **Feasibility of ultra-low k1 lithography for 32-nm CMOS node and half node**, Shoji Mimotogi, Kazuhiro Takahata, Toshiba Corp. (Japan); Takashi Murakami, Seiji Nagahara, Kazuhiro Takeda, NEC Electronics Corp. (Japan); Masaki Satake, Yosuke Kitamura, Tomoko Ojima, Hiroharu Fujise, Yuriko Seino, Tatsuhiko Ema, Hiroki Yonemitsu, Manabu Takakuwa, Shinichiro Nakagawa, Takuya Kono, Masafumi Asano, Suigen Kyoh, Hideaki Harakawa, Akiko Nomachi, Tatsuya Ishida, Shunsuke Hasegawa, Katsura Miyashita, Toshiba Corp. (Japan); Makoto Tominaga, NEC Electronics Corp. (Japan); Soichi Inoue, Toshiba Corp. (Japan) . . . .[7274-51]

SESSION 13

Room: Conv. Ctr. A 1-8 . . . . Thurs. 4:10 to 4:50 pm

Process

Session Chairs: **Ken Ozawa,** Sony Atsugi Technology Ctr. (Japan); **Kurt R. Kimmel,** Advanced Mask Technology Ctr. GmbH & Co. KG (Germany)

4:10 pm: **Patterning 32-nm SOI high-k metal gate with double exposure and double etch (DE2) process**, ChangAn Wang, Advanced Micro Devices, Inc. (United States); Wendy Yan, Rajiv Ranade, Ryan L. Burns, IBM Microelectronics Div. (United States); Amy Child, Klaus Gebauer, Advanced Micro Devices, Inc. (United States); Peggy C. Lawson, Chung-hsi J. Wu, Allen H. Gabor, Timothy A. Brunner, IBM Microelectronics Div. (United States); Chidam Kallingal, Norman S. Chen, Sarah N. McGowan, Advanced Micro Devices, Inc. (United States); Henning Haffner, Infineon Technologies North America Corp. (United States); Zheng G. Chen, IBM Microelectronics Div. (United States); Mark Kelling, Advanced Micro Devices, Inc. (United States); Colin J. E. Brodsky, IBM Microelectronics Div. (United States) . . . .[7274-52]

4:30 pm: **Design of resist stacks with antireflection coatings from a viewpoint of focus budget,** Satoshi Nagai, Kazuya Sato, Toshiba Corp. (Japan) . . . .[7274-53]

Conference 7274 continues on page 56.

Conference 7275

Design for Manufacturability through Design-Process Integration III

SESSION 3

Room: Conv. Ctr. C 1-4 . . . . Thurs. 2:00 to 3:20 pm

Design Rules for Manufacturability

Session Chair: **Lars W. Liebmann,** IBM Corp.

2:00 pm: **Simplify to survive: prescriptive layouts ensure profitable scaling to 32 nm and beyond**, Lars W. Liebmann, IBM Microelectronics Div. (United States); Larry Pileggi, PDF Solutions, Inc. (United States); Jason Hibbeler, IBM Corp. (United States); Vyacheslav Rovner, Tejas K. Jhaveri, PDF Solutions, Inc. (United States); Gregory A. Northrop, IBM Corp. (United States) . [7275-10]

2:20 pm: **Illustration of illumination effects on proximity and focus spillover and design rules**, Lynn T. N. Wang, Anthony Yeh, Lilly Kem, Andrew R. Neureuther, Univ. of California, Berkeley (United States) . . . . [7275-11]

2:40 pm: **Two-dimensional design rule and layout analysis using novel large-area first-principles-based simulation flow incorporating lithographic, stress, and interconnect parasitic effects**, Steven L. Prins, James W. Blatchford, Oluwamuyiwa O. Olubuyide, Deborah Riley, Simon Chang, Qi-Zhong Hong, T. S. Kim, Texas Instruments Inc. (United States); Ricardo Borges, Li Lin, Synopsys, Inc. (United States) . . . . [7275-12]

3:00 pm: **Exploration of complex metal 2D design rules using inverse lithography**, Simon Chang, Texas Instruments Inc. (United States) . . . . [7275-13]

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

SESSION 4

Room: Conv. Ctr. C 1-4 . . . . Thurs. 3:50 to 5:10 pm

Variation Aware Design I

Session Chair: **Juan Antonio Carballo,** Argon Venture Partners

3:50 pm: **Compensating non-optical effects using electrically driven optical proximity correction**, Shayak Banerjee, The Univ. of Texas at Austin (United States); Kanak Agarwal, IBM Austin Research Lab. (United States); James A. Culp, Praveen Elakkumanan, Lars W. Liebmann, IBM Microelectronics Div. (United States); Michael Orshansky, The Univ. of Texas at Austin (United States). . [7275-15]

4:10 pm: **Lithography and variability at the system level**, Axel Nackaerts, Jérôme Belledent, NXP Semiconductors (Belgium); Harold Benten, Andrei S. Terechko, Harry Veendrick, NXP Semiconductors (Netherlands); Phillip Christie, NXP Semiconductors (Belgium). . . . . [7275-16]

4:30 pm: **Impact of lithography variability on analog circuit behavior**, Christopher J. Progler, Photronics Inc. (United States); Bhaskar Banerjee, The Univ. of Texas at Dallas (United States) . . . . [7275-17]

4:50 pm: **Design specific variation in pattern transfer by via/contact etch process: full-chip analysis,** Valeriy Sukharev, Ara Markosian, Levon Manukyan, Armen Kteyan, Hasmik Lazaryan, Mentor Graphics Corp. (United States); Nikolay Khachatryan, Henrik Hovsepyan, Mentor Graphics Corp. (Armenia); Seiji Onoue, Takuo Kikuchi, Tetsuya Kamigaki, Toshiba Corp. (Japan) . . . . . . [7275-18]

Conference 7275 continues on page 56.

Thursday 26 February - Poster Sessions • 5:30 to 8:00 pm

The following posters will be displayed all day Thursday. Authors will be present during the formal poster session Thursday evening between 5:30 and 8:00 pm for discussion. Authors may set-up their posters after 9:00 am on Thursday.

Conference 7271 Alternative Lithographic Technologies

Nanoimprint

Automated mask cleaning for step-and-flash imprint lithography (S-FIL), Sherjang Singh, Ssuwei Chen, Kader Mekias, Hamatech USA Inc. (United States); Brian Fletcher, Ian McMackin, Molecular Imprints, Inc. (United States); Uwe U. Dietze, Hamatech USA Inc. (United States); Peter Dress, HamaTech AG (Germany). . . . .[7271-88]

Optimization of droplets for UV-NIL using coarse-grain simulation of resist flow, Vadim Sirotkin, Alexander A. Svintsov, Sergey I. Zaitsev, Institute of Microelectronics Technology and High Purity Materials (Russian Federation) . . . .[7271-89]

Industrial applications demanding low- and high-resolution features realized by using soft UV NIL, Thomas Glinsner, Gerald Kreindl, Alois Malzer, Rainer Födisch, Paul Lindner, Markus Wimplinger, EV Group (Austria); Ron Miller, EV Group Inc. (United States) . . . .[7271-90]

Characterization of crosslinking density of UV-nanoimprint resist confined inside mold, Hae-Jeong Lee, Joseph M. Antonucci, Sangcheol Kim, Christopher L. Soles, Lei Chen, National Institute of Standards and Technology (United States) [7271-92]

Step-and-flash imprint lithography: design and synthesis of directly patternable dielectric materials, Michael B. Jacobsson, Wei-Lun Jen, Daniel J. Hellebusch, Tsuyoshi Ogawa, Sungyong Bae, Frank L. Palmieri, Brook H. Chao, C. Grant Willson, The Univ. of Texas at Austin (United States) . . . .[7271-93]

UV-NIL template making and imprint evaluation, Shiho Sasaki, Takaaki Hiraka, Jun Mizuochi, Yuko Sakai, Takanori Sutou, Satoshi Yusa, Koki Kuriyama, Masashi Sakaki, Yasutaka Morikawa, Hiroshi Mohri, Naoya Hayashi, Dai Nippon Printing Co., Ltd. (Japan) . . . .[7271-94]

E-Beam and Maskless

Fabrication of metrology test structures for future technology nodes using high-resolution variable-shaped e-beam direct-write lithography, Philipp Jaschinsky, László Szikszai, Katja Keil, Marc Hauptmann, Fraunhofer-Ctr. Nanoelektronische Technologien (Germany); Manfred Moert, Christoph K. Hohle, Kang-Hoon Choi, Frank Thrum, Johannes Kretz, Qimonda Dresden GmbH & Co. OHG (Germany); Vaeriano Ferreras Paz, Univ. of Stuttgart (Germany); Arie J. den Boef, ASML Netherlands B.V. (Netherlands) . . . .[7271-95]

Sub-30-nm resolution parallel EB lithography based on a planar type Si nanowire array ballistic electron source, Akira Kojima, Crestec Corp. (Japan) and Tokyo Univ. of Agriculture and Technology (Japan); Hideyuki Ohyi, Crestec Corp. (Japan); Nobuyoshi Koshida, Tokyo Univ. of Agriculture and Technology (Japan) . . . .[7271-96]

Optimization of BSE-detector for e-beam direct-write lithography, Helder Alves, Peter Hahmann, Hans-Joachim Doering, Vistec Electron Beam GmbH (Germany); Carl G. Frase, Dominic J. Gnieser, Harald Bosse, Physikalisch-Technische Bundesanstalt (Germany). . . . .[7271-97]

3D ion multibeam processing with the CHARPAN PMLP tool and with the single ion-beam FIB tool, optimized with the 'IonRevSim' software, Sergey I. Zaitsev, Institute of Microelectronics Technology and High Purity Materials (Russian Federation); C. Ebm, S. Eder-Kapl, Hans Loeschner, Elmar Platzgummer, IMS Nanofabrication AG (Austria); Alexander A. Svintsov, Institute of Microelectronics Technology and High Purity Materials (Russian Federation); Stefan S. Dimov, G. Lalev, Cardiff Univ. (United Kingdom); B. Basnar, Vienna Univ. of Technology (Austria) . . . .[7271-98]

Registration marks for the characterization and tuning of individual beamlets of a PML2 Tool in the sub-10-nm range, Sergey I. Zaitsev, Eugeny E. Yakimov, S. Borisov, Alexander A. Svintsov, Institute of Microelectronics Technology and High Purity Materials (Russian Federation); Grazyna Mozdzen, Austrian Research Ctrs. GmbH (Austria) . . .[7271-99]

Monitor and self-diagnostic technology for mask e-beam writing system, Norihiko Samoto, Hironobu Manabe, Osamu Wakimoto, Satoshi Iida, Hiromichi Hoshi, Masaki Yamabe, Association of Super-Advanced Electronics Technologies (Japan). . . . .[7271-100]

Proximity effect correction for 20-nm dimension patterning, Dai Tsunoda, Nippon Control System Corp. (Japan); Piotr Jedrasik, Chalmers Tekniska Högskola (Sweden) . . . .[7271-101]

Novel Technologies

Fabrication of sub-10-nm pattern using diblock copolymer, Naoko Kihara, Kazutaka Takizawa, Hiroyuki Hieda, Toshiba Corp. (Japan). . . .[7271-102]

Interference assisted lithography for patterning of 1D gridded design, Rudolf H. Hendel, Zhilong Rao, Applied Materials, Inc. (United States); John S. Petersen, Petersen Advanced Lithography, Inc. (United States); Andrew B. Kahng, Univ. of California, San Diego (United States); Michael C. Smayling, Tela Innovations, Inc. (United States); Kwangok Jeong, Univ. of California, San Diego (United States); Robert T. Greenway, R. Scott Mackay, Petersen Advanced Lithography, Inc. (United States) . . . .[7271-103]

Plasmonic nanolithography for sub-100-nm patterning using array ridge apertures, Yongwoo Kim, Seok Kim, Howon Jung, Sinjeung Park, Eungman Lee, Jae W. Hahn, Yonsei Univ. (Korea, Republic of) . . . .[7271-104]

EUV Source

Kinetic simulation of high-conversion efficiency, low-debris EUV LPP source, Bob Rollinger, Andrea Giovannini, Martin Haag, Davide R. Bleiner, Ndaona Chokani, Reza S. Abhari, ETH Zürich (Switzerland) . . . .[7271-105]

High-performance next-generation EUV lithography light source, Peter Choi, NANO-UV SAS (France); Sergey V. Zakharov, Raul Aliaga-Rossel, Ouassima Sarroukh, Otman Benali, EPPRA SAS (France); Grainne Duffy, NANO-UV SAS (France); Gerry D. O'Sullivan, John K. White, Univ. College Dublin (Ireland); Edmund Wyndham, Pontificia Univ. Catolica de Chile (Chile); Vasily S. Zakharov, EPPRA SAS (France). . . . .[7271-106]

Grid spectral purity for suppression of infrared radiation on LLP EUV sources, Wouter A. Soer, Philips Research (Netherlands); Martin J. Jak, Philips Research (Netherlands); Andrei Yakunin, ASML Netherlands B.V. (Netherlands); Maarten M. van Herpen, Philips Research (Netherlands); Vadim Y. Banine, ASML Netherlands B.V. (Netherlands) . . . .[7271-108]

Ablation depth in planar Sn targets during the interaction with a pulsed laser for extreme-ultraviolet lithography, Russell A. Burdt, Yezheng Tao, Sam Yuspeh, Mark S. Tillack, Kevin L. Sequoia, Farrokh Najmabadi, Univ. of California, San Diego (United States) . . . .[7271-109]

Atomic processes in the LPP and LA-DPP EUV sources, Akira Sasaki, Japan Atomic Energy Agency (Japan); Katsunobu Nishihara, Atsushi Sunahara, Hiroyuki Furukawa, Osaka Univ. (Japan); Takeshi Nishikawa, Okayama Univ. (Japan); Fumihiro Koike, Kitasato Univ. (Japan) . . . .[7271-110]

Remote plasma cleaning of Sn from an EUV collector mirror, Hyungjoo Shin, Ramasamy Raju, David N. Ruzic, Univ. of Illinois at Urbana-Champaign (United States) . . . .[7271-112]

Debris characteristics and mitigation of a laser plasma tin-contained liquid jet/droplet targets, Masanori Kaku, Shunsuke Touge, Masahito Katto, Shoichi Kubodera, Univ. of Miyazaki (Japan). . . . .[7271-113]

Evaluation at the intermediate focus for EUV light source, Takashi Suganuma, Georg Soumagne, Masato Moriya, Tamotsu Abe, Akira Endo, Akira Sumitani, EUVA (Japan) . . . .[7271-114]

Laser diagnostics of laser-ablated tin particles from droplet targets, Tatsuya Yanagida, EUVA (Japan); Youichi Sasaki, Gigaphoton Inc. (Japan); Takashi Suganuma, Yoshifumi Ueno, Masaki Nakano, Hiroshi Komori, Akira Endo, Akira Sumitani, EUVA (Japan); Daisuke Nakamura, Tomoya Akiyama, Kota Okazaki, Tatsuo Okada, Kyushu Univ. (Japan). . . . .[7271-115]

Performance evaluation of EUV-SFET source collector module, Shunko Magoshi, Seiichiro Shirai, Hideto Mori, Kazuo Tawarayama, Yuusuke Tanaka, Hiroyuki Tanaka, Semiconductor Leading Edge Technologies, Inc. (Japan) . . . .[7271-116]

Dependence of in-band EUV conversion efficiency on sphere diameter to laser focal spot size ratio, Sam Yuspeh, Kevin L. Sequioa, Yezheng Tao, Mark S. Tillack, Russell A. Burdt, Farrokh Najmabadi, Univ. of California, San Diego (United States). . .[7271-117]

Measurement of particle flux at the intermediate focus of a DPP source, John Sporre, Ramasamy Raju, Vijay Surla, David N. Ruzic, Univ. of Illinois at Urbana-Champaign (United States); Frank Goodwin, SEMATECH, Inc. (United States) . . . .[7271-118]

Laser-produced plasma lightsource for EUVL, Igor V. Fomenkov, Alex I. Ershov, William N. Partlo, Dave W. Myers, Norbert R. Bowering, Oleh V. Khodykin, Georgiy O. Vaschenko, Alexander N. Bykanov, Christopher P. Chrobak, Shailendra N. Srivastava, David C. Brandt, Cymer, Inc. (United States) . . . .[7271-119]

Thursday 26 February - Poster Sessions • 5:30 to 8:00 pm

The following posters will be displayed all day Thursday. Authors will be present during the formal poster session Thursday evening between 5:30 and 8:00 pm for discussion. Authors may set-up their posters after 9:00 am on Thursday.

Dependence of laser parameter on conversion efficiency in high-repetition-rate laser-ablation-discharge EUV source, Yusuke Teramoto, Takuma Yokoyama, Hiroshi Mizokoshi, Hiroto Sato, Kazuaki Hotta, EUVA (Japan). . . . .[7271-120]

Development of a high-pulse-rate EUV source, Fred M. Niell, Matthew J. Partlow, Stephen F. Horne, Matthew M. Besen, Donald K. Smith, Paul A. Blackborow, Deborah S. Gustafson, Energetiq Technology, Inc. (United States) . . . .[7271-121]

EUV Mask

Removal of contamination by plasma-assisted cleaning by metastable atom neutralization (PACMAN), Wayne M. Lytle, Ramasamy Raju, Martin J. Neumann, David N. Ruzic, Univ. of Illinois at Urbana-Champaign (United States) . . . . . .[7271-122]

Precise evaluation of zero-CTE temperature of EUVL-grade TiO_2-SiO_2 ultra-low-expansion glass using the line-focus-beam ultrasonic material characterization system, Jun-ichi Kushibiki, Mototaka Arakawa, Tohoku Univ. (Japan) [7271-123]

Defect mitigation and reduction in EUVL mask blanks, Patrick A. Kearney, SEMATECH, Inc. (United States); Paul B. Mirkarimi, Veeco Instruments Inc. (United States); C. C. Lin, Henry K. Yun, SEMATECH, Inc. (United States); Rajul V. Randive, Ira Reiss, Alan V. Hayes, Veeco Instruments Inc. (United States); Takashi Sugiyama, SEMATECH, Inc. (United States) . . . .[7271-124]

13.2-nm table-top full-field inspection microscope, Fernando Brizuela, Yong Wang, Francesco Pedaci, Courtney A. Brewer, Przemyslaw W. Wachulak, Colorado State Univ. (United States); Weilun Chao, Yanwei Liu, Kenneth A. Goldberg, Patrick P. Naulleau, Erik H. Anderson, David T. Attwood, Jr., Lawrence Berkeley National Lab. (United States); Mario C. Marconi, Jorge J. Rocca, Carmen S. Menoni, Colorado State Univ. (United States) . . . . .[7271-125]

Experimental study of particle-free mask handling, Mitsuaki Amemiya, Kazuya Ota, Takao Taguchi, Osamu Suga, Semiconductor Leading Edge Technologies, Inc. (Japan) . . . .[7271-126]

The performance of an actinic full-field EUVL mask blank inspection system, Takeshi Yamane, Teruo Iwasaki, Toshihiko Tanaka, Tsuneo Terasawa, Osamu Suga, Semiconductor Leading Edge Technologies, Inc. (Japan); Toshihisa Tomie, National Institute of Advanced Industrial Science and Technology (Japan) . . . .[7271-127]

Defect printability of thin absorber mask in EUV lithography, Takashi Kamo, Hajime Aoyama, Yukiyasu Arisawa, Toshihiko Tanaka, Osamu Suga, Semiconductor Leading Edge Technologies, Inc. (Japan) . . . .[7271-128]

Mask defect verification using actinic inspection and wafer inspection tools, Sungmin Huh, Chawon Koh, Liping Ren, Stefan Wurm, SEMATECH, Inc. (United States); Kenneth A. Goldberg, Iacopo Mochi, Lawrence Berkeley National Lab. (United States) . . . .[7271-129]

Analysis of a relation between the spatial frequency of electrostatic chuck roughness and induced mask inplane distortion (IPD), Takeshi Yamamoto, The Univ. of Tokyo (Japan); Kazuya Ota, Naosuke Nishimura, Semiconductor Leading Edge Technologies, Inc. (Japan); Shin'ichi Warisawa, Sunao Ishihara, The Univ. of Tokyo (Japan) . . . . .[7271-130]

Characterization of electrostatic chucks for extreme-ultraviolet lithography, Tom C. Mulholland, Jacob R. Zeuske, Roxann L. Engelstad, Univ. of Wisconsin, Madison (United States) . . . . .[7271-131]

Experimental evaluation of particulate contamination on backside of EUV reticle, Kazuya Ota, Takao Taguchi, Mitsuaki Amemiya, Naosuke Nishimura, Osamu Suga, Semiconductor Leading Edge Technologies, Inc. (Japan) . . . .[7271-132]

Collecting EUV mask images through focus by wavelength tuning, Kenneth A. Goldberg, Iacopo Mochi, Lawrence Berkeley National Lab. (United States); Sungmin Huh, SEMATECH Inc. (United States) . . . .[7271-155]

EUV Performance

Extreme-ultraviolet holographic lithography with a table-top laser source, Artak Isoyan, Fan Jiang, Yang-Chun Cheng, Univ. of Wisconsin, Madison (United States); Przemyslaw W. Wachulak, Lukasz Urban'ski, Jorge J. Rocca, Mario C. Marconi, Colorado State Univ. (United States); Franco Cerrina, Univ. of Wisconsin, Madison (United States) . . . .[7271-133]

Analysis of carbon deposition on multilayer mirrors by using two different beam lines, Takahiro Nakayama, Hiromitsu Takase, Shigeru Terashima, Takashi Sudo, Yutaka Watanabe, Yasuaki Fukuda, Akira Miyake, Canon Inc. (Japan); Katsuhiko Murakami, Shintaro Kawata, Takashi Aoki, Shuichi Matsunari, Yukinobu Kakutani, Nikon Corp. (Japan); Masahito Niibe, Keigo Koida, Univ. of Hyogo (Japan) . . . .[7271-134]

Assumptions and trade-offs of extreme-ultraviolet optics contamination modeling, Andrea F. Wuest, SEMATECH, Inc. (United States); Vibhu Jindal, Gregory P. Denbeaux, Univ. at Albany (United States) . . . .[7271-135]

Durability of capped multilayer mirrors for high-volume manufacturing extreme-ultraviolet lithography tool, Shuichi Matsunari, Yukinobu Kakutani, Takashi Aoki, Katsuhiko Murakami, Shintaro Kawata, Nikon Corp. (Japan); Takahiro Nakayama, Shigeru Terashima, Hiromitsu Takase, Yutaka Watanabe, Yoshio Gomei, Yasuaki Fukuda, Canon Inc. (Japan); Masahito Niibe, Univ. of Hyogo (Japan) . . . .[7271-136]

Fabrication of half-pitch 32 45-nm SRAM patterns with EUVL, Yuusuke Tanaka, Hajime Aoyama, Shunko Magoshi, Kazuo Tawarayama, Seiichiro Shirai, Hiroyuki Tanaka, Semiconductor Leading Edge Technologies, Inc. (Japan) . . . .[7271-137]

The influence of out-of-band radiation on EUV optics contamination, Gregory P. Denbeaux, Leonid Yankulin, Yu-Jen Fan, Rashi Garg, Univ. at Albany (United States); Andrea F. Wuest, SEMATECH, Inc. (United States) . . . .[7271-138]

Effect of carbon contamination of EUV masks on imaging, Yu-Jen Fan, Leonid Yankulin, Gregory P. Denbeaux, Univ. at Albany (United States); Frank Goodwin, Andrea F. Wuest, Sungmin Huh, SEMATECH, Inc. (United States) . . . .[7271-139]

Nitridated La/B4C multilayer optics with improved reflectivity for next-generation EUV lithography, T. Tsarfati, E. Zoethout, E. Louis, R. W. E. van de Kruijs, A. E. Yakshin, FOM-Instituut voor Plasmafysica Rijnhuizen (Netherlands); S. Muellender, Carl Zeiss SMT AG (Germany); F. Bijkerk, FOM-Instituut voor Plasmafysica Rijnhuizen and Univ. Twente (Netherlands) . . . .[7271-156]

Development of evaluation technologies of contaminating materials from Sn-DPP SoCoMo, Hironoba Yabuta, Shinsuke Mouri, Uta Taniguchi, Takahiro Inoue, Yuki Joshima, Kazunori Bessho, Hiroto Sato, Kazuaki Hotta, EUVA (Japan) . . . .[7271-158]

EUV Metrology

EUV radiometric capabilities at NIST, Steven E. Grantham, Robert E. Vest, Charles Tarrio, Thomas B. Lucatorto, National Institute of Standards and Technology (United States) . . . .[7271-140]

High-accuracy EUV reflectometry at large optical components and oblique incidence, Christian Laubis, Frank Scholze, Christian Buchholz, Andreas Fischer, Steven Hesse, Annett Kampe, Jana Puls, Christian Stadelhoff, Gerhard Ulm, Physikalisch-Technische Bundesanstalt (Germany) . . . .[7271-141]

Gratings development for standalone EUV interferometer, Philippe Michallon, Constancias Christophe, Dalzotto Bernard, Lappras Valerie, Commissariat à l'Energie Atomique (France). . . . .[7271-142]

Ellipsometric and surface acoustic wave sensing of carbon contamination on EUV optics, Juequan Chen, Eric Louis, FOM-Instituut voor Plasmafysica Rijnhuizen (Netherlands); Chris J. Lee II, Herbert Wormeester, Univ. Twente (Netherlands); Reinhard Kunze, Hagen Schmidt, Leibniz-Institut für Festkörper- und Werkstoffforschung Dresden (Germany); Dieter Schneider, Fraunhofer-Institut für Werkstoff- und Strahltechnik (Germany); Fred Bijkerk, FOM-Instituut voor Plasmafysica Rijnhuizen and Univ. Twente (Netherlands) . . . . [7271-157]

EUV OPC

Mask diffraction analysis and optimization for EUV masks, Andreas Erdmann, Tim Fühner, Peter Evanschitzky, Fraunhofer-Institut für Integrierte System und Bauelem (Germany) . . . .[7271-144]

Analysis of EUVL mask effects under partially coherent illumination, Vitaly M. Domnenko, Synopsys, Inc. (Russian Federation); Thomas Schmoeller, Thomas Klimpel, Synopsys GmbH (Germany) . . . .[7271-145]

Assessment of full-chip level EUV optical correction for sub-40-memory device, Jeonghoon Lee, Insung Kim, Doohoon Goo, Joo-On Park, Chang Min Park, Jinhong Park, Jeong-Ho Yeo, Seong-Woon Choi, Woo-Sung Han, SAMSUNG Electronics Co., Ltd. (Korea, Republic of). . . . .[7271-146]

Incident angle change caused by different off-axis illumination in extreme-ultraviolet lithography, Eun-Jin Kim, Jee-Hye You, Hanyang Univ. (Korea, Republic of); Seong-Sue Kim, Han-Ku Cho, SAMSUNG Electronics Co., Ltd. (Korea, Republic of); Ilsin An, Hye-Keun Oh, Hanyang Univ. (Korea, Republic of) . . . .[7271-147]

Thursday 26 February - Poster Sessions • 5:30 to 8:00 pm

The following posters will be displayed all day Thursday. Authors will be present during the formal poster session Thursday evening between 5:30 and 8:00 pm for discussion. Authors may set-up their posters after 9:00 am on Thursday.

Evaluation of shadowing and flare effect for EUV tool, Jae-In Moon, Cheol-Kyun Kim, Byoung-Sub Nam, Byung-Ho M. Nam, Yoon-Suk Hyun, Chang-Moon Lim, Donggyu Yim, Hynix Semiconductor Inc. (Korea, Republic of) . . . .[7271-149]

Flare compensation for EUVL, Yukiyasu Arisawa, Hajime Aoyama, Toshihiko Tanaka, Semiconductor Leading Edge Technologies, Inc. (Japan) .[7271-150]

EUV Resist

RLS tradeoff versus quantum yield of high PAG EUV resists, Craig D. Higgins, Alin O. Antohe, Gregory P. Denbeaux, Richard J. Matyi, Univ. at Albany (United States); Andrea F. Wuest, Jacque Georger, SEMATECH North (United States); Robert L. Brainard, Univ. at Albany (United States)[7271-153]

Investigation of EUV-process sensitivities for wafer-track processing, Neil G. Bradon, Heiko Weichert, Tokyo Electron Europe Ltd. (United Kingdom) . . . .[7271-154]

Conference 7274 Optical Microlithography XXII

Double Patterning

A second look at double printing through the use of ion implantation, Nandasiri Samarakone, ASML Special Applications (United States) . . . . . .[7274-65]

Comparison of double-patterning methods using Monte Carlo simulation, Joshua S. Hooge, Tokyo Electron America, Inc. (United States); Kathleen R. Nafus, Shinichi Hatakeyama, Tokyo Electron Kyushu Ltd. (Japan); Shaunee Cheng, Philippe Foubert, Philippe J. Leray, IMEC (Belgium) . . . .[7274-66]

Exploration of linear and nonlinear double-exposure techniques by simulation, John S. Petersen, Robert T. Greenway, Petersen Advanced Lithography, Inc. (United States); Tim Führer, Peter Evanschitzky, Feng Shao, Andreas Erdmann, Fraunhofer-Institut für Integrierte System und Bauelem (Germany) . . . .[7274-67]

Predictive model-based pitch splitting, Aasutosh Dave, Pat J. LaCour, Alexander V. Tritchkov, Mentor Graphics Corp. (United States) . . . .[7274-68]

Integration of dry etching steps for double patterning and spacer patterning processes, Sébastien Barnola, Céline Lapeyre, Isabelle Servin, Christian Arvet, Patrick Maury, Lucile Mage, Commissariat à l'Energie Atomique (France)[7274-69]

Polarization-induced double patterning through four-beam interference, Peng Xie, Rochester Institute of Technology (United States) . . . .[7274-70]

High Index Lithography

32-nm half-pitch formation with high-NA single exposure, Minhee Jung, Joon-Min Park, Hanyang Univ. (Korea, Republic of); Moonseok Kim, Sukjoon Hong, Jaisoon Kim, Seoul National Univ. (Korea, Republic of); In-Ho Park, Univ. of Incheon (Korea, Republic of); Hye-Keun Oh, Hanyang Univ. (Korea, Republic of) . . . .[7274-71]

High-index 193-nm immersion lithography: the beginning or the end of the road, Paul A. Zimmerman, Bryan J. Rice, SEMATECH, Inc. (United States) . . . .[7274-72]

Spatial dispersion-induced index anisotropy in sapphire, John H. Burnett, Eric C. Benck, Simon G. Kaplan, National Institute of Standards and Technology (United States) . . . .[7274-73]

Evaluation of LuAG and high-index fluids for next-generation immersion lithography, Vladimir Liberman, Steven T. Palmacci, Mordechai Rothschild, MIT Lincoln Lab. (United States); Paul A. Zimmerman, SEMATECH, Inc. (United States) . . . . [7274-74

Masks

Multiple-layer CD control treatment, Anka Birnstein, Christoph Röpke, Martin Sczyrba, Advanced Mask Technology Ctr. GmbH & Co. KG (Germany); Guy Ben-Zvi, Erez Graitzer, Avi Cohen, Pixer Technology Ltd. (Israel) . . . .[7274-76]

Smart data filtering for enhancement of model accuracy, Shady A. Abdelwahed, Mentor Graphics Corp. (Egypt); Jae-Hyun Kang, Jaeyoung Choi, Jong-Doo Kim, Hye-Sung Lee, Sungho Jun, Youngmi Kim, Dongbu HiTek Co., Ltd. (Korea, Republic of)[7274-77]

Analysis and modeling of photomask edge effects for 3D geometries and the effect on process window, Marshal A. Miller, Andrew R. Neureuther, Univ. of California, Berkeley (United States) [7274-78]

Optical Proximity Corrections

Transformation procedure from sparse OPC model to grid-based model, Ching-Heng Wang, Qingwei Liu, Semiconductor Manufacturing International Corp. (China); Liguo Zhang, Mentor Graphics Shanghai Electronic Technology Co. (China) . . . .[7274-79]

Image-based OPC model calibration on 65-nm node contact layer, Yi-Yien Tsai, Shih-Lung Tsai, Fred Lo, Elvis Yang, Ta-Hung Yang, Kuang-Chao Chen, Chih-Yuan Lu, Macronix International Co., Ltd. (Taiwan) . . . .[7274-80]

Design-driven test patterns for calibration of OPC models, Mohamed Al-Imam, Mentor Graphics Corp. (Egypt) . . . .[7274-82]

Model-based retarget for 45-nm node and beyond, Ellyn Yang, Cheng He Li, Semiconductor Manufacturing International Corp. (China); Xiao Hui Kang, Mentor Graphics Shanghai Electronic Technology Co. (China) . . . .[7274-85]

Pattern-matching assisted-modeling test-pattern generation, Le Hong, Qiao Li, Jian Rao, Mentor Graphics Corp. (United States) . . . .[7274-87]

Model-based mask process correction and verification for advanced process nodes, Steffen F. Schulze, Thomas M. Donnelly, Emile Sahouria, Michael Pomerantsev, Yuri Granik, Mentor Graphics Corp. (United States) . . . .[7274-89]

Double-exposure OPC model calibration and verification for removable assistant features, Xima Zhang, Todd Lukanc, Makoto Takahashi, Hung-Eil Kim, Brandon L. Ward, Spansion Inc. (United States) . . . .[7274-90]

Novel OPC method to create sub-45-nm contact holes using design-based metrology, Dongjin Lee, Seyoung Oh, Jongcheon Park, Jinyoung Choi, Jungchan Kim, Cheol-Kyun Kim, Donggyu Yim, Hynix Semiconductor Inc. (Korea, Republic of) . . .[7274-91]

Abbe-PCA: microlithography aerial image analytical compact kernel generation based on principle component analysis, Charlie C. Chen, National Taiwan Univ. (Taiwan); Lawerence S. Melvin III, Synopsys, Inc. (United States) . . . .[7274-92]

Analysis of etch model accuracy and prediction of full-chip etch verification, Tae-Hoon Park, Jung-Hoon Ser, Seong-Bo Shim, Min-Jung Hong, Young-Chang Kim, SukJoo Lee, Seong-Woon Choi, Woo-Sung Han, Joo-Tae Moon, SAMSUNG Electronics Co., Ltd. (Korea, Republic of) . .[7274-94]

Automatic SRAF size optimization during OPC, Srividya Jayaram, James C. Word, Mentor Graphics Corp. (United States) . . . .[7274-98]

OPC segmentation: dilemma between degree-of-freedom and stability, Yu-Po Tang, Jui-Hsuan Feng, Ming-Hui Chih, Cheng-Kun Tsai, Wen-Chun Huang, Cheng-Cheng Kuo, Ru-Gun Liu, Hua-Tai Lin, Yao-Ching Ku, Taiwan Semiconductor Manufacturing Co. Ltd. (Taiwan) . . . .[7274-99]

Efficient hardware usage in the mask tapeout flow, Mathias Boman, Travis E. Brist, Synopsys, Inc. (United States); Scott Hafeman, Synopsys, Inc. (Canada); Yong-Dong Wang, Synopsys, Inc. (United States) . . . .[7274-100]

Advanced pre-OPC layout decomposition for image fidelity improvement, Shady A. Abdelwahed, Rami Fathy, Mentor Graphics Corp. (Egypt); Jae-Hyun Kang, Jong-Doo Kim, Youngmi Kim, Dongbu HiTek Co., Ltd. (Korea, Republic of). . . . . .[7274-101]

Process

Next-generation siloxane-based bottom anti-reflective coating (BARC) formulations with selective strip rates and required optical properties, Sudip Mukhopadhyay, Joseph T. Kennedy, Yamini Pandey, Preeti Amin, Jaswinder Gil, Honeywell Electronic Materials (United States) . . . .[7274-102]

Defectivity improvement by modified wafer edge treatment in immersion lithography, Masafumi Fujita, Takao Tamura, Takayuki Uchiyama, Naka Onoda, NEC Electronics Corp. (Japan) . . .[7274-103]

Optimizing material interactions in hard-mask patterning stacks, Zhimin Zhu, Brewer Science, Inc. (United States); Emil C. Piscani, SEMATECH, Inc. (United States); Yubao Wang, Jody C. Neef, Brian A. Smith, Brewer Science, Inc. (United States) . . . .[7274-104]

Arbitrary three-dimensional microfabrication by polymer grayscale lithography, Li Jiang, Pranay Nath, Tuskegee Univ. (United States); Naga S. Korivi, Louisiana State Univ. (United States). . . . .[7274-105]

0.13µm BiCMOS emitter window lithography with KrF scanners, Li-Heng Chou, Neil S. Patel, Patrick M. McCarthy, National Semiconductor Corp. (United States) . . . .[7274-107]

SU-8 patterning with digital micromirror device (DMD) maskless lithography, Tao Wang, Univ. of Wisconsin, Madison (United States); Marzia Quaglio, Fabrizio Pirri, Politecnico di Torino (Italy); Yang-Chun Cheng, David Busacker, Franco Cerrina, Univ. of Wisconsin, Madison (United States) . . . . .[7274-109]

Thursday 26 February - Poster Sessions • 5:30 to 8:00 pm

The following posters will be displayed all day Thursday. Authors will be present during the formal poster session Thursday evening between 5:30 and 8:00 pm for discussion. Authors may set-up their posters after 9:00 am on Thursday.

Process Control

Process transfer strategies between ASML immersion scanners, Yuan He, Jianming Zhou, Anton J. Devilliers, Erik R. Byers, Micron Technology, Inc. (United States); Peter Engblom, Eric A. Janda, Bernd Geh, ASML US, Inc. (United States); Jasper Menger, ASML Netherlands B.V. (United States) . . . .[7274-113]

32-nm node device laser-bandwidth OPE sensitivity and process matching, Kazuyuki Yoshimochi, Takao Tamura, Takaaki Kuribayashi, Takayuki Uchiyama, NEC Electronics Corp. (Japan); Nigel R. Farrar, Toshihiro Oga, Cymer, Inc. (United States); James F. Bonafede, Cymer Japan, Inc. (Japan) . . . .[7274-115]

The overlay measurement by CDSEM images for double-patterning process, Fu-Jye Liang, Taiwan Semiconductor Manufacturing Co. Ltd. (Taiwan) . . . .[7274-116]

New approach to determine best beam focus, Tamer M. Tawfik, Mentor Graphics Corp. (Egypt); Edita Tejnil, Mentor Graphics Corp. (United States) . . . .[7274-117]

High-order distortion effects induced by extreme off-axis illuminations at hyper-NA lithography, Umberto Iessi, Numonyx Srl (Italy); Leonardo Amato, STMicroelectronics (Italy); Gianfranco Capetti, Paolo Canestrari, Elio G. De Chiara, Pierluigi Rigolli, Numonyx Srl (Italy) . . . .[7274-118]

Resolution Enhancement

Cost-effective SRAF insertion and optimization flow for 70-nm node rectangular contacts, Dyiann Chou, Srividya Jayaram, Mentor Graphics Corp. (United States); Ryan Chou, Jochen Schacht, Mentor Graphics Taiwan, Ltd. (Taiwan); Kunyuan Chen, Chun-Cheng Liao, Nanya Technology Corp. (Taiwan) . . . .[7274-123]

Line-end shortening and corner-rounding effects for a novel double-annular illumination, Moh-Lung Ling, National Univ. of Singapore (Singapore); Gek Soon Chua, Chartered Semiconductor Manufacturing Ltd. (Singapore); Cho Jui Tay, Chenggen Quan, National Univ. of Singapore (Singapore); Qunying Lin, Chartered Semiconductor Manufacturing Ltd. (Singapore) . . . .[7274-124]

The analysis of polarization characteristics on 40-nm memory devices, Chan-Ha Park, Minae Yoo, Taejun You, Hyunjo Yang, Hynix Semiconductor Inc. (Korea, Republic of); Young-Hong Min, Ki-Yeop Park, ASML Korea Co., Ltd. (Korea, Republic of); Donggyu Yim, Sungki Park, Hynix Semiconductor Inc. (Korea, Republic of) . . . .[7274-125]

22-nm technology node active-layer patterning for planar transistor devices, Ryoung-Han Kim, Advanced Micro Devices, Inc. (United States) . . . .[7274-126]

C-quad polarized illumination for back-end thin wire: moving beyond annular illumination regime, Sohan S. Mehta, Chartered Semiconductor Manufacturing Ltd. (United States); Hyung-Rae Lee, IBM Microelectronics Div. (United States); Bassem Hamieh, STMicroelectronics (United States); Itty Matthew, Advanced Micro Devices, Inc. (United States); Ramya Viswanathan, IBM Microelectronics Div. (United States); Chidam Kallingal, Advanced Micro Devices, Inc. (United States); Derren Dunn, IBM Microelectronics Div. (United States) . . . . .[7274-128]

Simulation

A proposal image intensity expressing local irradiance, Shuji Nakao, Akira Imai, Junjiro Sakai, Tetsuro Hanawa, Kazuyuki Suko, Renesas Technology Corp. (Japan) . . . .[7274-131]

The divergence of the aerial image threshold and the critical dimension printed in resist, Stewart A. Robertson, Sanjay H. Kapasi, John J. Biafore, Mark D. Smith, Christopher A. Sallee, KLA-Tencor Texas (United States) . . . .[7274-132]

Advanced model and fast algorithm for computing of aerial image with well controlling accuracy, Vadim V. Manuylov, BindKey Technologies, Inc. (United States) . . . .[7274-133]

A novel fast 3D resist-simulation method using Chebyshev expansion, Masanori Takahashi, Satoshi Tanaka, Shoji Mimotogi, Soichi Inoue, Toshiba Corp. (Japan) . . . .[7274-134]

Modeling mask scattered field at oblique incidence, Tamer M. Tawfik, Mentor Graphics Corp. (Egypt); Ahmed H. Morshed, Diaa A. Khalil, Ain Shams Univ. (Egypt). . . . .[7274-135]

Partially coherent image computation using elementary functions, Arlene Smith, Anna Burvall, Christopher J. Dainty, National Univ. of Ireland, Galway (Ireland) . . . .[7274-136]

Chemically amplified resist modeling in OPC, Xin Zheng, Jason H. Huang, Yongfa Fan, Synopsys, Inc. (United States) . . . .[7274-137]

High-speed microlithography aerial image contour generation without images, Charlie C. Chen, National Taiwan Univ. (Taiwan); Lawerence S. Melvin III, Synopsys, Inc. (United States) . .[7274-138]

Source and Mask Optimization

PSM design for inverse lithography using illumination with small partial coherence factor, Xu Ma, Gonzalo R. Arce, Univ. of Delaware (United States) . . . .[7274-139]

Study of mask pixelization for inverse lithography technology, Shuo-Yen Chou, Chun-Kuang Chen, Tsai-Sheng Gau, Burn J. Lin, Taiwan Semiconductor Manufacturing Co. Ltd. (Taiwan) . . . .[7274-140]

Manufacturability of ICT patterns in low-NA 193nm environment, Chin-Teong Lim, Vlad Temchenko, Ingo Meusel, Infineon Technologies AG (Germany). . . . .[7274-141]

Extreme versus traditional OPC for the 22-nm node, James C. Word, Yuri Granik, Marina G. Medvedeva, Mentor Graphics Corp. (United States); Yi Zou, Cyrus E. Tabery, Luigi Capodieci, Kenji Yoshimoto, Jongwook Kye, Yunfei Deng, Advanced Micro Devices, Inc. (United States); Mohamed Gheith, Cynthia Zhu, Mentor Graphics Corp. (United States); Hesham A. Diab, Mentor Graphics Corp. (Egypt) . . . .[7274-142]

Innovative pixel-inversion calculation for model-based subresolution assist features and optical proximity correction, Jue-Chin Yu, Peichen Yu, Hsueh-Yung Chao, National Chiao Tung Univ. (Taiwan) . . . .[7274-143]

Implementation of model-based assist features technology for sub-50-nm contact layers, Sungwoo Ko, Dongjin Lee, Byung-Ug Cho, Jae-Seung Choi, Cheol-Kyun Kim, Dong-Gyu Yim, Sungki Park, Hynix Semiconductor Inc. (Korea, Republic of) . . . .[7274-144]

Source optimization for 3D image designs through film stacks, David O. Melville, Alan E. Rosenbluth, IBM Thomas J. Watson Research Ctr. (United States); Kehan Tian, IBM Semiconductor Research and Development Ctr. (United States); Dario L. Goldfarb, Matthew E. Colburn, IBM Thomas J. Watson Research Ctr. (United States) . . . .[7274-145]

Spacer-based Processes

A manufacturing lithographic approach for 16M MRAM device using KrF double-mask patterning technique, Daniel H. Liu, Tom X. Zhong, Terry Torng, Magic Technologies Group, Inc. (United States) . . . .[7274-146]

Pattern decomposition and process integration of self-aligned double patterning for 30-nm node NAND FLASH process and beyond, Yi-Shiang S. Chang, Jun-Cheng N. Lai, Chia-Chi Lin, Meng-Feng Tsai, Powerchip Semiconductor Corp. (Taiwan) . . . . [7274-147]

Alignment and overlay improvements for 3X nm and beyond process with CVD spacer self-aligned double patterning, Huixiong Dai, Chris Bencher, Yongmei Chen, Shiyu Sun, Chris Ngai, Xumou Xu, Applied Materials, Inc. (United States) . . . .[7274-148]

Tools

Birefringence simulations of annealing ingot of calcium fluoride single crystal, Noriyuki Miyazaki, Hirotaka Ogino, Yuya Kitamura, Kyoto Univ. (Japan); Toshiro Mabuchi, Teruhiko Nawata, Tokuyama Corp. (Japan) . . . .[7274-151]

Enhanced KrF imaging performance of the TWINSCAN XT:1000 NA 0.93 scanner, Frank Bornebroek, Harm-Jan Voorma, Rene Toussaint, Marteijn de Jong, Wim P. de Boeij, Hans Onvlee, ASML Netherlands B.V. (Netherlands) . . . .[7274-152]

Optical performances of laser light source for ArF immersion double-patterning lithography tool, Katsuhiko Wakana, Satoshi Tanaka, Toru Suzuki, Hiroaki Nakarai, Masaya Yoshino, Takahito Kumazaki, Shinichi Matsumoto, Takashi Matsunaga, Junichi Fujimoto, Hakaru Mizoguchi, Gigaphoton Inc. (Japan) . . . .[7274-153]

True polarization characteristics of high-index optics excluding impact of measurement system, Toru Fujii, Ken-ichi Muramatsu, Nikon Corp. (Japan); Masayasu Sawada, Nikon Systems Inc. (Japan). . . . .[7274-155]

Reliability report of high-power injection lock laser light source for double exposure and double-patterning ArF immersion lithography, Hiroaki Tsushima, Masaya Yoshino, Hiroaki Nakarai, Takeshi Ohta, Hitoshi Nagano, Hiroshi Umeda, Yasufumi Kawasuji, Toru Abe, Toru Suzuki, Satoshi Tanaka, Taku Yamazaki, Akihiko Kurosu, Shinji Nagai, Osamu Wakabayashi, Takashi Matsunaga, Kouji Kakizaki, Junichi Fujimoto, Hakaru Mizoguchi, Gigaphoton Inc. (Japan). . . . .[7274-156]

Thursday 26 February - Poster Sessions • 5:30 to 8:00 pm

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Immersion-cluster uptime enhancement technology toward high-volume manufacturing, Ryo Tanaka, Tomoharu Fujiwara, Hirokazu Tanizaki, Nikon Corp. (Japan); Shinya Wakamizu, Hideharu Kyouda, Tokyo Electron Kyushu Ltd. (Japan) . . . .[7274-157]

Lithography line productivity impact using Cymer GLX technology, Wayne J. Dunstan, Kevin O'Brien, Robert N. Jacques, Daniel J. Brown, Cymer, Inc. (United States) . . . .[7274-158]

Enabling high-volume manufacturing of double-patterning immersion lithography with the XLR 600i ArF light source, Daniel J. Brown, Slava Rokitski, Vladimir B. Fleurov, Robert Bergstedt, Hong Ye, Robert J. Rafac, Robert N. Jacques, Fedor Trintchouk, Toshihiko Ishihara, Rajasekhar Rao, Theodore Cacouris, William N. Partlo, Cymer, Inc. (United States) . . . .[7274-159]

Lithography impact of sapphire as a last optical element in hyper-NA immersion lithography tool, Chris A. Mack, lithoguru.com (United States); Gabriel Y. Sirat, Crystalith Ltd. (Israel) . . . .[7274-160]

Conference 7275 Design for Manufacturability through Design-Process Integration III

Score-based fixing guidance generation with accurate hotspot detection method, Yong Hee Park, SAMSUNG Electronics Co., Ltd. (Korea, Republic of); Jung Hoe Choi, Synopsys Korea Inc. (Korea, Republic of); Jun Dong Cho, Sungkyunkwan Univ. (Korea, Republic of). . . . .[7275-26]

Verification of extraction repeating pattern efficiency from many actual device data, Masahiro Shoji, Nippon Control System Corp. (Japan); Tadao Inoue, SII NanoTechnology Inc. (Japan); Masaki Yamabe, Association of Super-Advanced Electronics Technologies (Japan) . . . .[7275-28]

Design ranking and analysis methodology for standard cells and full-chip physical optimization, Yosi Vaserman, Eitan Shauly, Tower Semiconductor Ltd. (Israel) . . . .[7275-29]

Practical implementation of via and wire optimization at SoC level, Chi-Min Yuan, Guy Assad, Bob Jarvis, Marc Olivares, Lionel Riviere Cazaux, Puneet Sharma, Jayathi Subramanian, Matthew A. Thompson, Kevin Wu, Freescale Semiconductor, Inc. (United States) . . . . . .[7275-30]

Test structures for 45-nm design rule evaluation, Jonathan Ho, Yan Wang, Xilinx, Inc. (United States) . . . .[7275-31]

Computational requirements for OPC, Christopher A. Spence, Scott Goad, Advanced Micro Devices, Inc. (United States). . . . .[7275-32]

Hotspot management for spacer patterning technology with die-to-database wafer inspection system, Yoshinori Hagio, Ichirota Nagahama, Yasuo Matsuoka, Hidefumi Mukai, Kohji Hashimoto, Toshiba Corp. (Japan) . . . .[7275-33]

Source-mask selection using computational lithography incorporating rigorous physical resist models, Sanjay H. Kapasi, Stewart A. Robertson, Trey Graves, Mark D. Smith, Christopher A. Sallee, KLA-Tencor Texas (United States) . . . .[7275-34]

Application of pixel-based mask optimization technique for high-transmission attenuated PSM, Kyohei Sakajiri, Alexander Trichkov, Yuri Granik, Mentor Graphics Corp. (United States); Eric Hendrickx, Geert Vandenberghe, IMEC (Belgium). . . . .[7275-35]

Transistor layout configuration effect on actual gate LER, Guy Ayal, Eitan N. Shauly, Israel Rotshtein, Tower Semiconductor Ltd. (Israel); Ovadya Menadeva, Amit Siany, Ram Peltinov, Applied Materials, Inc. (Israel); Yosi Y. Shacham-Diamand, Tel-Aviv Univ. (Israel) . . . .[7275-36]

The PIXBAR OPC for contact-hole pattern in sub-70-nm generation, Kunyuan Chen, Nanya Technology Corp. (Taiwan). . . . .[7275-38]

Adaptive library based performance-based OPC for VLSI circuit, Siew Hong Teh, Chun Huat Heng, Arthur E. Tay, National Univ. of Singapore (Singapore) . . . .[7275-43]

Computational technology scaling from 32- to 22-nm through systematic layout printability verification, Jason P. Cain, Luigi Capodieci, Advanced Micro Devices, Inc. (United States) . . . .[7275-44]

TCAD-based analysis/estimation of gate/active region nonrectangularity in FETs, Rama N. Singh, Aditya Bansal, Fook-luen Heng, Niladri N. Mojumder, IBM Thomas J. Watson Research Ctr. (United States) . . . .[7275-45]

Variability aware device and interconnect timing models for double patterning, Eric Chin, Andrew R. Neureuther, Univ. of California, Berkeley (United States) . . . .[7275-46]

Design-overlay interactions in metal double patterning, Rani S. Ghaida, Puneet Gupta, Univ. of California, Los Angeles (United States) . . . .[7275-47]

Manufacturability aware placement sensitivity analysis, Jen-Yi Wuu, Univ. of California, Santa Barbara (United States); Fedor G. Pikus, J. Andres Torres, Mentor Graphics Corp. (United States); Malgorzata Marek-Sadowska, Univ. of California, Santa Barbara (United States) . . . .[7275-49]

Clustering and pattern matching for an automatic hotspot classification and detection system, Justin Ghan, Ning Ma, Sandipan Mishra, Costas J. Spanos, Kameshwar Poolla, Univ. of California, Berkeley (United States); Norma P. Rodriguez, Luigi Capodieci, Advanced Micro Devices, Inc. (United States) . . . .[7275-50]

Developing DRC-plus rules through 2D pattern extraction and clustering techniques, Vito Dai, Jie Yang, Luigi Capodieci, Norma P. Rodriguez, Advanced Micro Devices, Inc. (United States) . . . .[7275-52]

Electrical impact of line-edge roughness on sub-45-nm node standard cell, Yong-Chan Ban, David Z. Pan, The Univ. of Texas at Austin (United States); Savithri Sundareswaran, Rajendran Panda, Freescale Semiconductor, Inc. (United States) . . . . . .[7275-53]

Full-flow for transistors simulation based on edge-contour extraction and advanced SPICE simulation, Eitan N. Shauly, Tower Semiconductor Ltd. (Israel); J. Andres Torres, Mentor Graphics Corp. (United States); Moran Cohen-Yasour, Tower Semiconductor Ltd. (Israel); Fedor G. Pikus, Mentor Graphics Corp. (United States); Olivier R. Toublan, Mentor Graphics Corp. (France); Ovadya Menadeva, Applied Materials, Inc. (Israel) . . . .[7275-54]

Circuit-topology driven OPC for increased performance/yield ratio, Edmund Pierzchala, J. Andres Torres, Cynthia Zhu, Fedor G. Pikus, Mentor Graphics Corp. (United States) . . . .[7275-55]

Systematic study of the impact of curved active and poly contours on transistor performance, Victor Moroz, Munkang Choi, Xi-Wei Lin, Synopsys, Inc. (United States). . . . .[7275-56]

Lithography aware characterization of a 40-nm logic cell library, Mark E. Rubin, Synopsys, Inc. (United States); Naohiro Kobayashi, Toshiaki Yanagihara, NEC Electronics Corp. (Japan) [7275-57]

Application of PROLITH simulation for OPC model calibration of sub-50-nm DRAM node, Yung Long Hung, Nanya Technology Corp. (Taiwan); Sanjay H. Kapasi, Stewart A. Robertson, KLA-Tencor Texas (United States); Chun-Cheng Liao, Nanya Technology Corp. (Taiwan) . . . .[7275-58]

Implementing self-aligned double patterning on non-gridded layouts, Huixiong Dai, Applied Materials, Inc. (United States); Judith A. Huckabay, Jason Sweis, Cadence Design Systems, Inc. (United States); Chris Bencher, Xumou Xu, Chris Ngai, Jen Shu, Applied Materials, Inc. (United States); Milind Weling, Cadence Design Systems, Inc. (United States) . . . .[7275-59]

High-precision contouring from SEM image in 32-nm lithography and beyond, John L. Sturtevant, Thuy Do, Ir Kusnadi, Mentor Graphics Corp. (United States); Hiroyuki Shindo, Akiyuki Sugiyama, Hitoshi Komuro, Yutaka Hojo, Ryoichi Matsuoka, Hitachi High-Technologies Corp. (Japan); Peter De Bisschop, Jeroen Van de Kerkhove, IMEC (Belgium) . .[7275-60]

Uniformity aware standard cell design with accurate shape control, Hongbo Zhang, Univ. of Illinois at Urbana-Champaign (United States) . . . .[7275-62]

Thursday 26 February - Poster Sessions • 5:30 to 8:00 pm

The following posters will be displayed all day Thursday. Authors will be present during the formal poster session Thursday evening between 5:30 and 8:00 pm for discussion. Authors may set-up their posters after 9:00 am on Thursday.

Contour-based optical proximity correction, Brian Zhou, Liang Zhu, Yingchun Zhang, Qingqing Wenren, Yili Gu, Grace Semiconductor Manufacturing Corp. (China); Xiao Hui Kang, Mentor Graphics Shanghai Electronic Technology Co. (China); Cynthia Zhu, Mentor Graphics Corp. (United States) . . . .[7275-66]

Model-based adaptive fragmentation, Daisy Liu, Cheng He Li, Semiconductor Manufacturing International Corp. (China); Xiao Hui Kang, Mentor Graphics Corp. (China). . . . .[7275-67]

Process variation aware OPC modeling for leading edge technology nodes, Charlie Q. Zhang, Ebo H. Croffie, Yongfa Fan, Jianliang Li, Kevin Lucas, Bradley J. Falch, Lawerence S. Melvin III, Synopsys, Inc. (United States). . . . .[7275-68]

Large-scale double-patterning compliant layouts for DP engine and design rule development, Christopher M. Cork, Synopsys SARL (France); Kevin Lucas, Synopsys, Inc. (United States); John Hapli, Synopsys, Inc. (Canada); Herve Raffard, Synopsys SARL (France); Levi D. Barnes, Synopsys, Inc. (United States) . . . .[7275-69]

Statistical approach to design DRAM bitcell considering overlay errors, Yu-Jin Pyo, Dae-Wook Kim, Jai-Kyun Park, Ji-Seong Doh, Hyun-Jae Kang, SAMSUNG Electronics Co., Ltd. (Korea, Republic of); Jae-Hoon Song, SAMSUNG Electronics Co., Ltd. (United States); Ji-Suk Hong, Sang-Hoon Lee, Joon-Ho Choi, Moon-Hyun Yoo, SAMSUNG Electronics Co., Ltd. (Korea, Republic of). . . . .[7275-70]

Enhanced Layout Optimization of Sub-45nm Standard, Memory Cells and Its Effects, Seung Weon Paek, SAMSUNG Electronics Co., Ltd. (Korea, Republic of) . . . .[7275-71]

Integration of mask and silicon metrology in DFM, Ryoichi Matsuoka, Hitachi High-Technologies Corp. (Japan) . . . .[7275-72]

Implementing a framework to generate a unified OPC from different EDA vendors for 45-nm node and beyond, Chia Wei Huang, Pei Ru Tsai, Calvin Wu, Chuen-Huei Yang, United Microelectronics Corp. (Taiwan); Shady A. Abdelwahed, Nader M. Hindawy, Mohamed Al-Iman, Rami Fathy, Mentor Graphics Corp. (Egypt); Regina Shen, Jochen Schacht, Mentor Graphics Taiwan, Ltd. (Taiwan) . . . .[7275-73]

Timing-aware metal fill for optimized timing impact and uniformity, Ushasree Katakamsetty, Colin C. W. Hui, Chartered Semiconductor Manufacturing Ltd. (Singapore); Li-Da Huang, Magma Design Automation (United States); Lannie Weng, Peter Wu, Magma Design Automation (Taiwan) . . . .[7275-74]

Process variability band analysis for quantitative optimization of exposure conditions, John L. Sturtevant, Le Hong, Srividya Jayaram, Mentor Graphics Corp. (United States) . . . .[7275-75]

Hotspot detection and design recommendation using silicon-calibrated CMP model, Colin C. W. Hui, Xian Bin Wang, Haigou Huang, Ushasree Katakamsetty, Chartered Semiconductor Manufacturing Ltd. (Singapore); Laertis Economikos, Mohammed Fayaz, Stephen Greco, IBM Microelectronics Div. (United States); Xiang Hua, IBM Thomas J. Watson Research Ctr. (United States); Subramanian Jayathi, Chi-Min Yuan, Freescale Semiconductor, Inc. (United States); Song Li, Vikas Mehrotra, Kuang Han Chen, Taber Smith, Tamba Gbondo-Tugbawa, Cadence Design Systems, Inc. (United States) . . . .[7275-76]

Convergent automated chip-level lithography checking and fixing at 45 nm, Valerio Perez, Shyue Fong Quek, Sky Yeo, Colin C. W. Hui, Chartered Semiconductor Manufacturing Ltd. (Singapore); Kuang Kuo Lin, Walter Ng, Chartered Semiconductor Manufacturing, Inc. (United States); Michel L. Cote, Bala Kasthuri, Philippe Hurat, Cadence Design Systems, Inc. (United States); Matthew A. Thompson, Chi-Min Yuan, Puneet Sharma, Freescale Semiconductor, Inc. (United States) . . . . . .[7275-77]

Modeling and simulation of transistor performance shift under pattern-dependent RTA process, Yun Ye, Arizona State Univ. (United States); Frank Liu, IBM Austin Research Lab. (United States); Yu Cao, Arizona State Univ. (United States) [7275-78]

Amorphous carbon bevel film management for defect reduction during immersion lithography, Martin Seamons, Ganesh Balasubramanian, Chiu Chan, Daemian Raj, Cindy Pagdanganan, Applied Materials, Inc. (United States); Sven Kuo, Applied Materials Taiwan, Ltd. (Taiwan); Wendy Yeh, Applied Materials, Inc. (United States); Chun-Sheng Wu, Steve Tang, Chun-Hung Lu, Ding-I Liu, Wen-Lung Lee, Yi-Yu Liu, Rondy Huang, Taiwan Semiconductor Manufacturing Co. Ltd. (Taiwan) . . . .[7275-79]

Friday 27 February

Conference 7274

Optical Microlithography XXII

SESSION 14

Room: Conv. Ctr. A 1-8 . . . . Fri. 8:00 to 10:00 am

Tools I

Session Chairs: **Nigel R. Farrar,** Cymer, Inc.; **Tatsuhiko Higashiki,** Toshiba Corp. (Japan)

8:00 am: **An innovative platform for high-throughput, high-accuracy lithography using a single wafer stage**, Yuichi Shibazaki, Hirotaka Kohno, Masato Hamatani, Nikon Corp. (Japan) . . . . [7274-54]

8:20 am: **Latest development of Canon's immersion exposure tool and introduction of the new system and functions for the double patterning era**, Takeaki Ebihara, Toshiyuki Yoshihara, Ken-ichiro Mori, Hiroshi Morohoshi, Tadamasa Makiyama, Yoshio Kawanobe, Koichiro Tsujita, Takehiko Iwanaga, Toshiyuki Kojima, Kazuhiro Takahashi, Canon Inc. (Japan) . . . . [7274-55]

8:40 am: **Extending single-exposure patterning with 1.35 NA immersion**, Igor Bouchoms, Andre Engelen, Jan C. H. Mulkens, Herman Boom, Martijn Leenders, ASML Netherlands B.V. (Netherlands) . . . . [7274-56]

9:00 am: **Advanced aberration control in projection optics for double patterning**, Toshiyuki Yoshihara, Takashi Sukegawa, Nobuhiko Yabu, Masatoshi Kobayashi, Tadashi Arai, Yasuo Hasegawa, Kazuhiro Takahashi, Canon Inc. (Japan) . . . . . [7274-57]

9:20 am: **Polarization aberration control for ArF projection lenses**, Tomoyuki Matsuyama, Naonori Kita, Nikon Corp. (Japan) . . . . [7274-58]

9:40 am: Development of high-index lens material LuAG: status and prospect, Lutz Parthier, Gunther Wehrhan, Frank Seifert, Markus Ansorg, Tilo Aichele, Christoph Seitz, SCHOTT Lithotec AG (Germany) . . . . [7274-59]

Conference 7274 continues on page 57.

Conference 7275

Design for Manufacturability through Design-Process Integration III

SESSION 5

Room: Marriott Salon II-IV . . . . Fri. 8:20 to 10:00 am

Variation Aware Design II

Session Chair: **Mark E. Mason,** Texas Instruments Inc.

8:20 am: **Modeling of process variations for use in more accurate statistical timing analysis in advanced common platform process nodes**, Lance D. Pickup, IBM Corp. (United States); Sky Yeo, Chartered Semiconductor Manufacturing Ltd. (Singapore); Sachin Idgunji, ARM Inc. (United States); Prashanth Sagar, Chartered Semiconductor Manufacturing Ltd. (Singapore); Byoung-Hyun Lee, SAMSUNG Electronics Co., Ltd. (Korea, Republic of); Jae-eun Park, IBM Corp. (United States) . . . . [7275-19]

8:40 am: **Interval-value-based circuit simulation for statistical circuit design**, Qian-Ying Tang, Costas J. Spanos, Univ. of California, Berkeley (United States) . . . . [7275-20]

9:00 am: **Variations in timing and leakage power of 45-nm library cells due to lithography and stress effects**, Mark Terry, Arjun Rajagopal, Robert A. Soper, Brian Hornung, Rajesh Khamankar, Texas Instruments Inc. (United States); Philippe Hurat, Nishath Verghese, Bala Kasthuri, Cadence Design Systems, Inc. (United States) . . . . [7275-21]

9:20 am: **Parameter-specific ring oscillators for quantifying sources of electronic variability**, Lynn T. N. Wang, Liang-Teck Pang, Andrew R. Neureuther, Borivoje Nikolic, Univ. of California, Berkeley (United States). . . . . [7275-22]

9:40 am: **Manufacturing system based on tolerance deduced from design intention**, Suigen Kyoh, Shimon Maeda, Soichi Inoue, Toshiba Corp. (Japan) . . . . [7275-23]

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

Conference 7275 continues on page 57.

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Friday 27 February

Conference 7274

Optical Microlithography XXII

Room: Conv. Ctr. A 1-8 . . . . Fri. 10:00 to 10:10 am

Best Student Paper Award

Sponsored by

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

SESSION 15

Room: Conv. Ctr. A 1-8 . . . . Fri. 10:30 am to 12:10 pm

Tools II

Session Chairs: **Bruce W. Smith,** Rochester Institute of Technology; **Pary Baluswamy,** Micron Technology, Inc.

10:30 am: **Modeling laser bandwidth for OPC applications**, Christian D. Zuniga, Kostas Adam, Michael Lam, Thuy Do, Mentor Graphics Corp. (United States); Ivan Lalovic, Cymer, Inc. (United States); Peter De Bisschop, IMEC (Belgium) . . . . [7274-60]

10:50 am: **Control and reduction of immersion defectivity for yield enhancement at high-volume production**, Katsushi Nakano, Rei Seki, Masato Yoshida, Tomoharu Fujiwara, Toshiyuki Sekito, Yasuhiro Iriuchijima, Soichi Owa, Nikon Corp. (Japan). . . . . [7274-61]

11:10 am: **Photolithography using freeform sources on high-NA immersion systems**, Andre Engelen, Melchior Mulder, ASML Netherlands B.V. (Netherlands); Steven G. Hansen, ASML US, Inc. (United States); Oscar Noordman, Jos W. de Klerk, Robert Kazinczi, Gert Streutker, ASML Netherlands B.V. (Netherlands); Markus Deguenther, Bernhard Kneer, Michael Patra, Frank Rohmund, Joerg Zimmermann, Carl Zeiss SMT AG (Germany) . . . . [7274-62]

11:30 am: **Speckle in optical lithography and the influence on line-width roughness**, Oscar Noordman, Andrey Tychkov, Jan Baselmans, ASML Netherlands B.V. (Netherlands); James G. Tsacoyeanes, Gary Politi, ASML Wilton (United States); Michael Patra, Vladan Blahnik, Manfred Maul, Carl Zeiss SMT AG (Germany) . . . . [7274-63]

11:50 am: **Enabling the lithography roadmap: an immersion tool based on a novel stage-positioning system,** Fred de Jong, Bert van der Pasch, Tom Castenmiller, Bert Vleeming, Richard Droste, Frank van de Mast, ASML Netherlands B.V. (Netherlands) [7274-64]

Room: Conv. Ctr. A 1-8 . . . . Fri. 12:10 to 12:30 pm

Closing Remarks

Session Chairs: **Harry J. Levinson,** Advanced Micro Devices, Inc.; **Mircea V. Dusa,** ASML MaskTools Inc.

Conference 7275 end.

Conference 7275

Design for Manufacturability through Design-Process Integration III

SESSION 6

Room: Marriott Salon III-IV . . . . Fri. 10:30 to 11:10 am

DFM for Future Nodes

Session Chair: **Michael L. Rieger,** Synopsys, Inc.

10:30 am: **Directional kernels as models for fast layout's pattern transfer verification**, J. Andres Torres, Mentor Graphics Corp. (United States) . . . . [7275-24]

10:50 am: **Algorithm for determining printability and coloring of a target layout for double patterning**, Justin Ghan, Apo Sezginer, Cadence Design Systems, Inc. (United States) . . . . [7275-27]

Conference 7275 end.

Index of Authors, Chairs, and Committee Members

Bold = SPIE Member

A

Abbott, Patrick R. [7273-70] SPS1
Abbott, Steven [7271-57]S12
Abdallah, David J. [7273-104] SPS3, [7273-148]SPS7
Abdelwahed, Shady A. [7272-75]SPS1, [7274-77]SPS3, [7274-101]SPS4, [7275-73] SPS1
Abdo, Amr [7274-34]S9
Abe, Hideaki [7272-38]S8, [7272-56]S12, [7272-143] SPS1, [7272-174]SPS1
Abe, Sho [7273-07]S2
Abe, Tamotsu [7271-07]S3, [7271-114]SPS4
Abe, Toru [7274-156]SPS11
Abhari, Reza S. [7271-105] SPS4, [7271-107]SPS4
Adam, Kostas [7274-60]S15
Adams, Jacob R. [7273-21]S6, [7273-167]SPS8
Adan, Ofer 7272 ProgComm, [7272-138]SPS1
Adel, Michael E. 7272 ProgComm, [7272-15]S4, [7272-40]S9
Adi, Costa [7272-173]SPS1
Agarwal, Kanak [7275-15]S4
Ahn, Byungsup [7271-12]S4
Ahn, Jinho SC888 Inst
Ahn, Jun-Kyu [7272-123]SPS1
Ahn, Seung-Joon [7272-139] SPS1
Ahn, Sung-Il [7273-161]SPS7
Aichele, Tilo [7274-59]S14
Ait, Anton [7273-06]S2
Akbalik, Ayse [7272-156]SPS1
Akiyama, Tomoya [7271-115] SPS4
Aksenov, German [7271-152] SPS9
Aliaga-Rossel, Raul [7271-106] SPS4
Al-Imam, Mohamed [7272-75] SPS1, [7274-82]SPS4, [7275-73]SPS1
Allen, Robert D. 7273 CoChr, 7273 S SessChr, 7273 S1 SessChr, 7273 S2 SessChr
Allgair, John A. 7272 Chr, 7272 S SessChr, [7272-58] S12, [7272-138]SPS1
Allsopp, Duncan [7271-57]S12
Almogy, Gilad [AL09PL-02] SPL2
Alvarez-Sanchez, Ruben [7272-155]SPS1
Alves, Helder [7271-97]SPS2
Alvine, Kyle J. [7271-63]S13
Amano, Tsuyoshi [7271-13]S4
Amara, John [7273-27]S7
Amato, Leonardo [7274-118] SPS6
Amemiya, Mitsuaki [7271-126] SPS5, [7271-132]SPS5
Amin, Preeti [7274-102]SPS5
Aminpur, Massud [7274-20]S5
Amiri, Hasti [7271-75]S15, [7273-32]S8
An, Ilsin [7271-147]SPS8, [7272-85]SPS1, [7273-164] SPS8
Anderson, Christopher N. [7271-32]S7, [7272-10]S3, [7273-35]S8, [7273-51]S11
Anderson, Erik H. [7271-125] SPS5
Ando, Tomoyuki [7273-04]S2, [7273-07]S2
Anno, Yuusuke [7273-10]S3
Ansorg, Markus [7274-59]S14
Antohe, Alin O. [7271-76]S15, [7271-153]SPS9
Antonio, Charito [7273-82] SPS1, [7273-91]SPS2
Antonucci, Joseph M. [7271-92] SPS1
Anyadiegwu, Clement T. [7273-153]SPS7
Aoki, Masami [7272-147]SPS1
Aoki, Takashi [7271-134]SPS6, [7271-136]SPS6
Aoyama, Hajime [7271-74]S14, [7271-128]SPS5, [7271-137] SPS6, [7271-150]SPS8
Apetz, Rolf [7271-09]S3
Arai, Tadashi [7274-57]S14
Arakawa, Mototaka [7271-123] SPS5
Aratani, Ichihiro [7273-124]SPS4
Arce, Gonzalo R. [7274-139] SPS9
Archie, Chas SC705 Inst, 7272 ProgComm, [7272-02]S1, [7272-58]S12, [7272-69]S14, [7274-97]SPS4
Arima, Hiroshi [7273-134]SPS5, [7273-168]SPS8
Arisawa, Yukiyasu [7271-74] S14, [7271-128]SPS5, [7271-150]SPS8
Arnold, John [7271-03]S1
Artem, Shamsuarov [7274-83] SPS4
Arvet, Christian [7274-69]SPS1
Asahata, Tatsuya [7272-127] SPS1
Asai, Masaya [7273-126]SPS5
Asai, Satoru [7274-49]S12
Asano, Masafumi [7272-127] SPS1, [7273-15]S4, [7274-18] S5, [7274-51]S12
Asayama, Takeshi [7271-07]S3
Aschke, Lutz [7272-153]SPS1
Assad, Guy [7275-30]SPS1
Astolfi, David K. [7273-52]S11, [7273-121]SPS4
Attota, Ravikiran [7272-01]S1, [7272-43]S9
Attwood, David T. 7271 ProgComm, 7271 S14 SessChr, [7271-125]SPS5
Au, Patrick [7275-06]S2
Ausschnitt, Christopher P. [7272-33]S7, [7274-27]S7
Auzelyte, Vaida [7273-32]S8
Avrahamov, Yosef [7272-122] SPS1
Axelrad, Valery [7274-19]S5
Ayal, Guy [7275-36]SPS1
Azuma, Tsukasa [7273-16]S4

B

Baba, Shuichi [7272-70]S14
Babazadeh, Majid [7272-178] SPS1
Babin, Sergey V. [7272-143] SPS1, [7272-161]SPS1, [7272-168]SPS1, [7272-174]SPS1
Bae, Sungyong [7271-93]SPS1
Bae, Woo Jin [7273-132]SPS5, [7273-137]SPS5
Bae, Yong-Kug [7272-19]SPS1
Bagheri, Saeed [7274-08]S3, [7274-09]S3, [7274-11]S3
Bailey, Todd C. [7273-25]S7, [7274-106]SPS5
Bakandritsos, Aristeidis [7273-137]SPS5
Bakshi, Vivek SC888 Inst
Balasubramaniam, Vaidyanathan [7273-96]SPS3
Balasubramanian, Ganesh [7275-79]SPS1
Bald, Holger [7274-111]SPS6
Baluswamy, Pary 7274 ProgComm, 7274 S6 SessChr, 7274 S15 SessChr
Ban, Keundo [7273-24]S6
Ban, Yong-Chan [7275-53] SPS1
Bandy, Kenneth A. [7272-124] SPS1
Banerjee, Bhaskar [7275-17]S4
Banerjee, Shayak [7275-15]S4
Bang, Changjin [7272-120]SPS1
Banine, Vadim Y. [7271-108] SPS4, [7271-111]SPS4
Banke, Bill SC705 Inst, [7272-02]S1, [7272-58]S12
Bansal, Aditya SC889 Inst, [7275-45]SPS1
Bao, Tianming [7272-109]SPS1
Barachevsky, Valery A. [7273-06]S2
Barahona, Francisco [7274-08] S3
Baranov, Leonid [7273-48]S11
Barclay, George G. 7273 ProgComm, 7273 S3 SessChr, 7273 S4 SessChr, [7273-14]S4
Barnes, Bryan M. [7272-01]S1
Barnes, Levi D. [7274-38]S9, [7274-39]S9, [7275-69]SPS1
Barnola, Sébastien [7274-31]S8, [7274-69]SPS1
Bartov, Avishai [7272-131] SPS1
Baselmans, Jan [7274-63]S15
Basnar, B. [7271-98]SPS2
Batina, Nikola [7273-119]SPS4
Baudemprez, Bart [7271-29]S7
Baum, Zachary [7274-03]S2
Bazin, Arnaud F. [7272-23]S5
Bear, Wynn [7272-175]SPS1
Bejdak, Thomas [7271-23]S6
Bekaert, Joost P. M. [7274-23] S6
Bekiaris, Nikolaos [7273-12]S3, [7273-60]SPS1, [7273-107] SPS3
Belledent, Jérôme [7271-49] S10, [7275-16]S4
Benali, Otman [7271-106]SPS4
Bencher, Chris [7274-14]S4, [7274-148]SPS10, [7274-149] SPS10, [7275-59]SPS1
Benck, Eric C. [7274-73]SPS2
Benes, Zdenek [7273-66]SPS1
Benten, Harold [7275-16]S4
Ben-Yishai, Michael [7272-88] SPS1, [7272-91]SPS1
Ben-Zvi, Guy [7274-76]SPS3
Berggren, Karl K. [7271-59]S12
Bergner, Brent C. [7272-31]S7
Bergstedt, Robert [7274-159] SPS11
Bernard, Dalzotto [7271-142] SPS7
Bernard, Sophie [7273-50]S11, [7273-75]SPS1, [7274-17]S5
Berro, Adam J. [7273-97]SPS3
Bersani, Marco [7271-82]S17
Besen, Matthew M. [7271-121] SPS4
Bhattacharyya, Kaustuve [7272-09]S3, [7272-155]SPS1
Bhola, Shweta [7272-80]SPS1
Biafore, John J. [7273-42]S10, [7273-46]S10, [7274-22]S6, [7274-132]SPS8
Bianucci, Giovanni [7271-11]S3
Bienert, Marc [7271-47]S10
Birnstein, Anka [7274-76]SPS3
Bischoff, Jörg [7272-162]SPS1
Bizjak, Tanja [7272-153]SPS1
Blackborow, Paul A. [7271-121]SPS4
Blackwell, James M. [7273-06] S2, [7273-20]S5, [7273-29]S8, [7273-33]S8, [7273-109]SPS4
Blahnik, Vladan [7274-63]S15
Blakey, Idriss [7273-39]S9, [7273-175]SPS4
Blanco, Pokhui [7274-149] SPS10
Blatchford, James W. 7271 ProgComm, 7271 S17 SessChr, [7275-12]S3
Blavier, Guillaume [7272-118] SPS1
Bleiner, Davide R. [7271-105] SPS4, [7271-107]SPS4
Blinco, James [7273-175]SPS4
Blumberg, Yuval [7272-25]S5
Bogusz, Zachary [7273-65] SPS1
Bok, Cheolkyu [7273-24]S6
Bolshukhin, Denis [7271-08]S3, [7271-11]S3
Boman, Mathias [7274-100] SPS4
Bomholt, Lars H. [7271-55]S11
Bonafede, James F. [7274-115] SPS6
Boom, Herman [7274-56]S14
Borges, Ricardo [7275-12]S3
Borisov, S. [7271-99]SPS2
Borisov, Sergey [7272-143] SPS1, [7272-174]SPS1
Bornebroek, Frank [7274-152] SPS11
Borodovsky, Yan A. [7273-06] S2
Borot, Bertrand [7272-178]SPS1
Bosse, Harald [7271-97]SPS2
Bouchoms, Igor [7274-56]S14
Boudou, Nicolas [7273-13]S4
Bowden, Murrae J. SC101 Inst
Bowering, Norbert R. [7271-02] S1, [7271-10]S3, [7271-119] SPS4
Bozano, Luisa D. [7271-82]S17, [7273-22]S6
Bozdog, Cornel [7272-32]S7
Bradbury, Ron [7273-153]SPS7
Bradon, Neil G. [7271-154]SPS9
Braggin, Jennifer [7273-75] SPS1, [7273-78]SPS1
Brainard, Robert L. [7271-75] S15, [7271-153]SPS9, [7273-32]S8
Brandt, David C. [7271-02]S1, [7271-10]S3, [7271-119]SPS4
Bremmer, Jeff [7273-176]SPS8
Brewer, Courtney A. [7271-125]SPS5
Brick, Chad M. [7273-176] SPS8
Brill, Boaz [7272-32]S7
Brist, Travis E. [7274-100]SPS4
Bristol, Robert L. [7273-06] S2, [7273-49]S11, [7273-121] SPS4
Brizuela, Fernando [7271-125] SPS5
Broadbent, William H. [7272-151]SPS1
Brock, Phillip J. [7273-157]SPS7
Brodsky, Colin J. E. [7274-52] S13
Brooker, Peter D. SC707 Inst, [7274-21]S6
Brooks, Cynthia B. [7271-56] S12
Brown, Daniel J. [7274-158] SPS11, [7274-159]SPS11
Bruce, James A. [7275-08]S2
Bruedermann, Jesko [7271-09] S3
Bruguier, Antoine [7274-114] SPS6
Bruley, John [7272-44]S10
Brunner, Timothy A. [7272-33] S7, [7274-27]S7, [7274-52]S13
Brus, Louis E. [7273-127]SPS5
Bryner, Jurg [7271-65]S13
Buchholz, Christian [7271-141] SPS7
Buhl, Stefan [7272-133]SPS1
Bunday, Benjamin D. [7272-01] S1, [7272-03]S2, [7272-30] S7, [7272-58]S12, [7272-104] SPS1, [7272-138]SPS1
Burdt, Russell A. [7271-109] SPS4, [7271-117]SPS4
Burkhardt, Martin [7271-03]S1, [7271-30]S7, [7271-48]S10, [7274-03]S2, [7274-09]S3
Burnett, John H. [7274-73] SPS2
Burns, Ryan L. [7274-52]S13, [7275-08]S2
Burns, Sean D. 7273 ProgComm, 7273 S3 SessChr, [7274-03]S2
Burr, Geoffrey W. [7272-44] S10, [7274-09]S3
Burvall, Anna [7274-136]SPS8
Busacker, David [7274-109] SPS5
Busch, Jens [7272-07]S2, [7272-17]S4, [7274-111]SPS6
Butschke, Jörg [7271-23]S6, [7271-64]S13
Buttgereit, Ute [7272-47]S10
Byers, Erik R. [7272-91]SPS1, [7274-113]SPS6
Bykanov, Alexander N. [7271-02]S1, [7271-119]SPS4

C

Cabral, Alberto [7273-52]S11, [7273-121]SPS4
Cacouris, Theodore [7274-159] SPS11
Cai, Man-Ping [7274-149]SPS10
Cain, Jason P. 7272 ProgComm, [7275-44]SPS1
Callahan, Ryan [7273-33]S8
Cameron, James F. [7273-27] S7
Canestrari, Paolo [7273-84] SPS2, [7274-118]SPS6
Cangemi, Marc [7272-08]S2
Cann, Susan G. [7273-48]S11, [7273-52]S11
Cantone, Jason R. [7273-96] SPS3
Cao, Hua [7274-114]SPS6
Cao, Yi [7272-149]SPS1, [7273-82]SPS1

Bold = SPIE Member

Cao, Yu [7275-78]SPS1
Capetti, Gianfranco [7274-118] SPS6
Capodieci, Luigi [7274-46]S12, [7274-142]SPS9, [7275-44] SPS1, [7275-50]SPS1, [7275-52]SPS1
Carballo, Juan Antonio 7275 ProgComm, 7275 S4 SessChr
Carcasi, Michael A. [7273-69] SPS1
Cardolaccia, Thomas [7273-05] S2
Carlson, Merri [7272-91]SPS1
Carrera, Samuele [7272-40]S9
Carriere, James T. [7274-10]S3
Casher, Deborah L. [7271-78] S16, [7271-80]S16
Cassol, Gian Luca [7271-11]S3
Castenmiller, Tom [7274-64]S15
Caudillo, Roman [7271-38]S8
Cech, Jiri [7273-53]S12
Cerrina, Franco [7271-133] SPS6, [7274-109]SPS5
Cervera, Hiram [7273-12]S3, [7273-107]SPS3
Cha, Jennifer [7271-82]S17
Chakrapani, Srinivasan [7273-82]SPS1, [7273-91]SPS2
Chan, Chiu [7275-79]SPS1
Chan, Osbert [7274-149]SPS10
Chan, Tina T. [7271-50]S10
Chandhok, Manish [7271-15]S4, [7271-42]S9, [7273-36]S9
Chang, Chansam [7273-89] SPS2
Chang, Chorng-Ping [7274-149] SPS10
Chang, Chung-Hsing [7274-114] SPS6
Chang, Josephine [7274-03]S2
Chang, Klesko [7274-12]S4
Chang, Simon [7275-12]S3, [7275-13]S3
Chang, Tuwon [7273-85]SPS2, [7273-88]SPS2
Chang, Wendy [7274-12]S4
Chang, Wen-Hao [7272-169] SPS1
Chang, Yi-Shiang S. [7272-16] S4, [7274-147]S4
Chao, Brook H. [7271-93]SPS1
Chao, Hsueh-Yung [7274-143] SPS9
Chao, Weilun [7271-125]SPS5
Charley, Anne-Laure [7272-12] S3
Chauhan, Siddharth [7273-172] SPS9
Chen, Alek C. [7272-164]SPS1
Chen, Arnold C. [7272-137] SPS1
Chen, Charlie C. [7274-92] SPS4, [7274-138]SPS8
Chen, Chia-chen [7274-11]S3
Chen, Chih-Jung [7273-81] SPS1
Chen, Chun-Kuang [7274-140] SPS9
Chen, Feng-Yi [7272-169]SPS1
Chen, Hao [7273-23]S6
Chen, Hong [7273-103]SPS3
Chen, Jieh-Jang [7271-49]S10
Chen, Jim [7272-164]SPS1
Chen, Kuang Han [7275-76] SPS1
Chen, Kuang-Chao [7273-102] SPS3, [7274-80]SPS4
Chen, Kunyuan [7274-123] SPS7, [7275-38]SPS1
Chen, Lan [7273-39]S9
Chen, Lei [7271-92]SPS1, [7272-08]S2
Chen, Lu [7273-60]SPS1
Chen, Norman S. [7274-52]S13
Chen, Qin [7271-57]S12
Chen, Ssuwei [7271-88]SPS1
Chen, Wei-Su G. [7273-56]S12, [7273-59]SPS1
Chen, Yi-Ching [7272-104]SPS1
Chen, Yijian [7273-23]S6
Chen, Yongmei [7274-14]S4, [7274-148]SPS10, [7274-149] SPS10
Chen, Yuyu [7272-136]SPS1
Chen, Zheng G. [7274-52]S13
Cheng, Joy Y. [7271-83]S17
Cheng, Shaunee [7272-12] S3, [7272-15]S4, [7272-40] S9, [7272-95]SPS1, [7273-75] SPS1, [7274-66]SPS1
Cheng, Yang-Chun [7271-133] SPS6, [7274-109]SPS5
Cheon, Hwan-Sung [7273-85] SPS2
Chiba, Hiroshi [7271-69]S14
Chih, Ming-Hui [7274-99]SPS4
Chijimatsu, Tatsuo [7274-49]S12
Child, Amy [7274-52]S13
Chin, Eric [7275-46]SPS1
Chiu, Ming-Chien [7272-86] SPS1
Chiu, Yuan-Hun [7272-24]S5, [7272-64]S13
Cho, Byeong-Ok [7272-52]S11
Cho, Byung-Ug [7274-144] SPS9
Cho, Han-Ku [7271-12]S4, [7271-147]SPS8, [7272-51] S11, [7273-140]SPS6, [7273-141]SPS6
Cho, Hyeon Mo [7273-88]SPS2
Cho, In Wook [7273-140]SPS6, [7273-141]SPS6
Cho, Jin H. [7274-03]S2
Cho, Jun Dong [7275-26]S6
Cho, Kyoungyong [7274-25]S7
Cho, Sung-seo [7273-14]S4
Cho, Wonil [7272-51]S11
Cho, Woojin [7274-130]SPS7
Choi, DongSub [7272-120]SPS1
Choi, Hakyu [7273-62]SPS1
Choi, HeungSoo [7272-147] SPS1
Choi, Hyungsam [7273-89]SPS2
Choi, Jae-Seung [7274-144] SPS9
Choi, Jae-Sung [7272-123] SPS1, [7273-90]SPS2
Choi, Jaeyoung [7274-77]SPS3
Choi, Ji-Hyeon [7272-51]S11
Choi, Jin [7271-61]S13
Choi, Jin-Phil [7272-126]SPS1, [7273-76]SPS1
Choi, Jinyoung [7274-91]SPS4
Choi, Joon-Ho [7275-70]SPS1
Choi, Jung Hoe [7275-26]S6
Choi, Kang-Hoon [7271-95] SPS2
Choi, Kwang-Seon [7272-144] SPS1, [7273-62]SPS1, [7273-171]SPS9, [7274-122]SPS6, [7274-130]SPS7
Choi, Kwang-Woo [7272-104] SPS1, [7273-36]S9
Choi, Munkang [7275-56]SPS1
Choi, Peter [7271-106]SPS4
Choi, Seong-Woon [7271-40]S9, [7271-146]SPS8, [7272-45] S10, [7272-106]SPS1, [7273-14]S4, [7274-25]S7, [7274-28] S7, [7274-81]SPS4, [7274-83] SPS4, [7274-94]SPS4, [7274-95]SPS4
Choi, Soohan [7275-14]S4
Chokani, Ndaona [7271-105] SPS4, [7271-107]SPS4
Chou, Dyiann [7274-123]SPS7
Chou, Li-Heng [7274-107]SPS5
Chou, Ryan [7274-123]SPS7
Chou, Shuo-Yen [7274-140] SPS9
Christie, Phillip [7275-16]S4
Chrobak, Christopher P. [7271-119]SPS4
Chua, Gek Soon [7274-124] SPS7
Chung, Dong Won [7273-14]S4
Chung, Joyce [7272-09]S3
Ciambra, Maurizio [7273-92] SPS2
Cicoria, Michael J. [7272-62] S12
Clarke, James S. [7271-37]S8
Clifford, Chris H. [7271-50]S10
Cobb, Jonathan L. [7271-46] S10
Coene, Wim M. J. [7272-155] SPS1
Cohen, Avi [7274-76]SPS3
Cohen, S. [7273-157]SPS7
Cohen, Yoel [7272-32]S7, [7272-42]S9
Cohen-Yasour, Moran [7275-54] SPS1
Colburn, Matthew E. [7273-96] SPS3, [7274-03]S2, [7274-145]SPS9
Coley, Suzanne [7273-92]SPS2
Collarert, Nadine [7272-27]S6
Colonna de Lega, Xavier [7272-163]SPS1
Conley, Amiad [7272-25]S5
Conley, Willard E. [7273-139] SPS5, 7274 ProgComm, 7274 S9 SessChr, 7274 S2 SessChr, [7274-20]S5
Conrad, Edward W. [7275-08]S2
Constancias, Christophe [7271-27]S6, [7271-142]SPS7
Constantoudis, Vassilios [7272-177]SPS1, [7273-177]SPS6
Corboy, Scott [7272-170]SPS1, [7272-171]SPS1
Cordes, Aaron M. [7272-138] SPS1
Cork, Christopher M. [7274-39] S9, [7275-69]SPS1
Corliss, Daniel A. [7272-33]S7, [7273-139]SPS5, [7274-09]S3, [7274-27]S7
Corthout, Marc [7271-08]S3, [7271-09]S3
Coskun, Tamer H. [7274-10]S3
Cote, Michel L. [7275-77]SPS1
Cotti, Gina [7273-84]SPS2
Couturier, Laurent [7275-07]S2
Croffie, Ebo H. [7274-43]S10, [7275-68]SPS1
Cross, Andrew [7272-147]SPS1
Crouse, Michael M. [7273-04]S2
Culp, James A. [7275-15]S4
Cumbie, Michael [7271-05]S2
Cummings, Kevin D. 7271 ProgComm, [7271-03]S1, [7271-31]S7, [7271-43]S9, [7273-35]S8
Cutler, Charlotte A. [7273-05] S2

D

Daggett, Joseph W. SC780 Inst
Dai, Huixiong [7274-14]S4, [7274-148]SPS10, [7274-149] SPS10, [7275-59]SPS1
Dai, Junyan [7273-12]S3, [7273-107]SPS3
Dai, Vito [7271-52]S11, [7274-03]S2, [7275-52]SPS1
Dainty, Christopher J. [7274-136]SPS8
Dallas, Andrew J. [7272-79] SPS1
Damen, Marcel [7271-09]S3
Dammel, Ralph R. SC118 Inst, SC120 Inst, SC616 Inst, 7273 ProgComm, 7273 S7 SessChr, 7273 S9 SessChr, [7273-64] SPS1, [7273-104]SPS3, [7273-148]SPS7
Daniels, Michael [7273-142] SPS6
Dasari, Prasad [7272-06]S2, [7272-41]S9
Dave, Aasutosh [7274-40]S10, [7274-68]SPS1, [7274-129] SPS7
Davidson, Mark P. [7272-163] SPS1
Davis, Blake W. [7273-157]SPS7
Davis, Robert E. [7272-44]S10
Dawson, Dean J. [7272-109] SPS1
De Bisschop, Peter [7272-108] SPS1, [7273-45]S10, [7274-60]S15, [7275-60]SPS1
de Boeij, Wim P. [7274-152] SPS11
De Chiara, Elio G. [7274-118] SPS6
de Groot, Peter J. [7272-163] SPS1
de Jong, Fred [7274-64]S15
de Jong, Marteijn [7274-152] SPS11
de Klerk, Jos W. [7274-62]S15
de Pablo, Juan J. [7273-58]S12
De Silva, Anuja [7273-149] SPS7, [7273-152]SPS7
De Simone, Danilo [7273-84] SPS2
Deen, Jochem [7271-62]S13
Deguenther, Markus [7274-62] S15
Deleporte, Alain G. 7272 ProgComm
Deline, Vaughn R. [7273-41]S9
den Boef, Arie J. [7271-95]SPS2
Denbeaux, Gregory P. [7271-76] S15, [7271-135]SPS6, [7271-138]SPS6, [7271-139]SPS6, [7271-153]SPS9
Deng, Yunfei [7271-03]S1, [7271-45]S10, [7273-35]S8, [7274-03]S2, [7274-40]S10, [7274-111]SPS6, [7274-142] SPS9
Denham, Paul E. [7271-32]S7
Depre, Jerome [7272-132]SPS1
Derouin, Tim [7272-150]SPS1
Derra, Günther H. [7271-08]S3, [7271-09]S3
DeSisto, Jason [7273-27]S7
Devilliers, Anton J. [7273-103] SPS3, [7274-112]SPS6, [7274-113]SPS6
Dhar, Preeti [7273-32]S8
D’havé, Koen [7272-12]S3, [7272-128]SPS1
Di Maria, Jean-Luc [7274-41] S10
Diab, Hesham A. [7274-142] SPS9
Dietze, Uwe U. [7271-88]SPS1
Dimov, Stefan S. [7271-98]SPS2
Ding, Bangzhou [7272-112] SPS1
Ding, Yifu [7271-63]S13, [7271-79]S16
Ding, Zejun [7272-28]S6
Dinu, Berta A. [7272-15]S4, [7272-40]S9
Dioses, Alberto [7273-91]SPS2
Dixson, Ronald G. [7272-01]S1, [7272-08]S2, PanelModerator
Do, Thuy [7272-108]SPS1, [7274-60]S15, [7275-60]SPS1
Dobisz, Elizabeth A. 7271 ProgComm, 7271 S16 SessChr
Doedel, Wim [7272-178]SPS1
Doering, Hans-Joachim [7271-26]S6, [7271-97]SPS2
Doh, Ji-Seong [7275-70]SPS1
Doi, Masao [7273-173]SPS9
Dolev, Ido [7272-25]S5
Dolezel, Pavel [7271-23]S6
Domnenko, Vitaly M. [7271-145]SPS8
Donnelly, Thomas M. [7274-89] SPS4
Doskolovich, Leonid L. [7272-161]SPS1, [7272-168]SPS1
Dress, Peter [7271-88]SPS1
Droste, Richard [7274-64]S15
Dual, Jurg [7271-65]S13
Dubey, Madan [7273-53]S12
Duffy, Grainne [7271-106]SPS4
Dumitrescu, Michail [7271-58] S12
Dunn, Derren [7274-34]S9, [7274-37]S9, [7274-97]SPS4, [7274-128]SPS7
Dunn, Shannon [7272-62]S12, [7273-96]SPS3
Dunstan, Wayne J. [7274-158] SPS11
Duray, Frank [7272-91]SPS1
Dusa, Mircea V. SC885 Inst, 7274 CoChr, 7274 S SessChr, 7274 S1 SessChr, 7274 S SessChr

E

Ebihara, Takeaki [7274-55]S14
Ebm, C. [7271-98]SPS2
Echigo, Masatoshi [7273-155] SPS7
Economikos, Laertis [7275-76] SPS1
Eder-Kapl, S. [7271-98]SPS2
Ehara, Keisuke [7273-126]SPS5
Eichelberger, Brad J. [7272-115] SPS1
Eichenlaub, Sean K. [7271-14] S4
Elakkumanan, Praveen [7275-15]S4
Ellenson, Jim E. [7271-05]S2
Elster, Thomas [7271-26]S6
Ema, Tatsuhiko [7273-15]S4, [7274-51]S12
Endo, Akira [7271-07]S3, [7271-114]SPS4, [7271-115]SPS4
Endo, Kazumasa [7272-49]S11

Index of Authors, Chairs, and Committee Members

Bold = SPIE Member

Engblom, Peter [7274-113]SPS6
Engelen, Andre [7274-09]S3, [7274-56]S14, [7274-62]S15
Engelstad, Roxann L. [7271-17]S4, [7271-131]SPS5
Englard, Ilan [7272-88]SPS1, [7272-91]SPS1
Enomoto, Masashi [7273-13]S4
Eom, Tae-Seung [7271-41]S9, [7271-51]S10
Erdmann, Andreas [7271-144]SPS8, [7274-24]S6, [7274-67]SPS1
Ershov, Alex I. [7271-02]S1, [7271-119]SPS4
Esswein, Katherine [7273-06]S2
Evanschitzky, Peter [7271-144]SPS8, [7274-24]S6, [7274-67]SPS1
Eynon, Benjamin G. 7271 ProgComm, 7271 S13 SessChr

F

Fakhry, Moutaz [7274-09]S3
Falch, Bradley J. [7274-43]S10, [7275-68]SPS1
Fan, Susan [7274-20]S5
Fan, Yongfa [7274-43]S10, [7274-137]SPS8, [7275-68]SPS1
Fan, Yu-Jen [7271-76]S15, [7271-138]SPS6, [7271-139]SPS6
Fan, Zheguang [7272-112]SPS1
Fang, Chien-Chih [7273-81]SPS1
Faradzhev, Nadir [7271-39]S8
Farrar, Nigel R. 7274 ProgComm, 7274 S14 SessChr, 7274 S8 SessChr, [7274-115]SPS6
Farrell, Timothy [7275-01]S1
Farys, Vincent [7272-57]S12, [7272-67]S14, [7274-41]S10
Fathy, Rami [7274-101]SPS4, [7275-73]SPS1
Faurie, Pascal [7272-102]SPS1
Fay, Martin F. [7272-163]SPS1
Fayaz, Mohammed [7275-76]SPS1
Fedynyshyn, Theodore H. [7271-84]S17, [7273-48]S11, [7273-52]S11, [7273-121]SPS4
Fei, Yetai [7272-112]SPS1
Feigl, Torsten [7271-10]S3, [7271-37]S8
Feijoo, Gonzalo R. [7274-50]S12
Felix, Nelson [7273-149]SPS7
Feng, Jui-Hsuan [7274-99]SPS4
Ferreras Paz, Vaeriano [7271-95]SPS2
Fiege, Ronald [7272-58]S12
Filippov, Michael [7272-37]S8
Filitchkin, Paul S. [7272-108]SPS1
Finders, Jo M. [7272-91]SPS1, [7272-127]SPS1, [7273-13]S4, [7274-26]S7
Fischer, Andreas [7271-141]SPS7
Fischer, Andreas [7272-131]SPS1, [7272-145]SPS1
Fischer, Daniel S. [7274-34]S9, [7274-88]SPS4, [7274-97]SPS4
Flagello, Donis G. SympChair, SC706 Inst, [7274-09]S3
Flaitz, Philip [7272-44]S10
Flanigan, Kyle Y. [7273-28]S7, [7273-107]SPS3
Fleischer, Goeran [7272-165]SPS1
Fletcher, Brian [7271-88]SPS1
Fleurov, Vladimir B. [7274-159]SPS11
Flynn, Kathleen M. [7273-149]SPS7
Födisch, Rainer [7271-90]SPS1
Fomenkov, Igor V. [7271-02]S1, [7271-10]S3, [7271-119]SPS4
Fonseca, Carlos [7273-69]SPS1, [7273-167]SPS8, [7274-17]S5
Fornof, Ann [7271-82]S17
Fortner, Vilay [7272-113]SPS1
Foubert, Philippe [7272-128]SPS1, [7273-75]SPS1, [7274-66]SPS1
Foucher, Anne-Lise [7272-101]SPS1
Foucher, Johann [7272-23]S5, [7272-67]S14, [7272-101]SPS1, [7272-102]SPS1, [7272-125]S12
Foussadier, Franck [7272-57]S12, [7274-41]S10
Franken, Oliver [7271-09]S3
Frase, Carl G. [7271-97]SPS2
Freedman, Dan [7273-32]S8
French, Roger H. 7274 ProgComm
Frommer, Jane E. [7271-82]S17
Fu, Joseph [7272-08]S2
Fuard, David [7272-57]S12, [7272-156]SPS1
Fühner, Tim [7271-144]SPS8, [7274-24]S6, [7274-67]SPS1
Fujii, Akiko [7272-56]S12
Fujii, Takayoshi [7272-50]S11
Fujii, Toru [7274-155]SPS11
Fujii, Toshiaki [7272-127]SPS1
Fujimori, Yoshihiko [7272-59]S12
Fujimoto, Junichi [7274-153]SPS11, [7274-156]SPS11
Fujise, Hiroharu [7273-15]S4, [7274-51]S12
Fujita, Masafumi [7274-103]SPS5
Fujiwara, Koichi [7273-10]S3, [7273-101]SPS3
Fujiwara, Masaki [7273-22]S6
Fujiwara, Tomoharu [7273-16]S4, [7273-160]SPS7, [7274-61]S15, [7274-157]SPS11
Fukazawa, Kazuhiko [7272-59]S12
Fukuda, Yasuaki [7271-134]SPS6, [7271-136]SPS6
Fukushima, Kazuya [7273-151]SPS7
Fumar-Pici, Anita [7271-03]S1, [7271-45]S10, [7273-35]S8
Funk, Merritt L. [7272-124]SPS1
Furukawa, Hiroyuki [7271-110]SPS4
Furukawa, Kikuo [7273-123]SPS4
Furukawa, Shinichi [7272-56]S12
Furukawa, Taiichi [7271-80]S16
Fuse, Takashi [7271-19]S5, [7271-25]S6
Futatsuya, Hiroki [7274-49]S12

G

Gabor, Allen H. [7274-48]S12, [7274-52]S13
Gahr, Markus [7272-145]SPS1
Gallatin, Gregg M. SC886 Inst
Galvier, Jean [7272-178]SPS1
Gambino, J. [7273-157]SPS7
Gapin, Florent [7272-148]SPS1
Gardin, Christian [7274-41]S10
Garg, Rashi [7271-76]S15, [7271-138]SPS6
Garza, Cesar M. [7274-20]S5
Gatefait, Maxime [7272-178]SPS1
Gau, Tsai-Sheng [7272-13]S3, [7272-155]SPS1, 7274 ProgComm, 7274 S7 SessChr, 7274 S12 SessChr, [7274-140]SPS9
Gaurigan, Stephanie [7273-05]S2
Gavrilenko, Valeriy P. [7272-37]S8, [7272-87]SPS1
Gbondo-Tugbawa, Tamba [7275-76]SPS1
Gebauer, Klaus [7274-52]S13
Geh, Bernd [7274-113]SPS6
George, Simi A. [7271-32]S7, [7271-33]S7
Georger, Jacque [7271-73]S15, [7271-153]SPS9
Germer, Thomas A. [7271-79]S16, [7272-01]S1, [7272-30]S7, [7272-31]S7
Geshel, Mark [7272-131]SPS1
Ghaida, Rani S. [7275-47]SPS1
Ghan, Justin [7275-27]S6, [7275-50]SPS1
Gheith, Mohamed [7274-44]S11, [7274-142]SPS9
Ghinovker, Mark [7272-117]SPS1
Giannelis, Emmanuel P. [7273-132]SPS5, [7273-137]SPS5
Gibbons, Sarah [7273-32]S8
Gibson, Ryan [7272-91]SPS1
Gielissen, Kurt [7271-108]SPS4, [7271-111]SPS4
Gil, Dario [7274-50]S12
Gil, Jaswinder [7274-102]SPS5
Giovannini, Andrea [7271-105]SPS4
Glinsner, Thomas [7271-90]SPS1
Glodde, Martin [7273-38]S9, [7273-157]SPS7
Glushkov, Denis [7271-111]SPS4
Gnieser, Dominic J. [7271-97]SPS2
Goad, Scott [7275-32]SPS1
Godny, Stephane [7272-166]SPS1
Goeckeritz, Jens [7272-131]SPS1, [7272-145]SPS1
Goethals, Mieke [7271-29]S7, [7271-152]SPS9
Gogolides, Evangelos [7272-177]SPS1, [7273-177]SPS6
Goh, Yong Keng [7273-39]S9
Göhnemeier, Aksel [7271-47]S10
Goldberg, Kenneth A. [7271-32]S7, [7271-50]S10, [7271-72]S14, [7271-125]SPS5, [7271-129]SPS5, [7272-71]SPS1
Goldfarb, Dario L. [7273-139]SPS5, [7274-145]SPS9
Goldstein, Michael 7271 ProgComm, 7271 S3 SessChr
Golotsvan, Anna [7272-15]S4, [7272-122]SPS1
Gomei, Yoshio [7271-136]SPS6
Gomez, Juan-Manuel M. [7273-25]S7
Gonsalves, Kenneth E. [7273-117]SPS4, [7273-119]SPS4
Goo, DooHoon [7271-40]S9, [7271-146]SPS8
Goodman, Russell B. [7271-84]S17
Goodwin, Francis 7271 ProgComm, 7271 S3 SessChr
Goodwin, Frank [7271-31]S7, [7271-118]SPS4, [7271-139]SPS6
Goossens, Ronald [7274-114]SPS6
Gotkis, Yehiel [7273-48]S11
Gotlinsky, Barry [7273-70]SPS1
Goto, Tomohiro [7273-135]SPS5
Götze, Sven [7271-08]S3
Gouraud, Pascal [7272-178]SPS1
Goyal, Sanjay [7271-15]S4
Graitzer, Erez [7274-76]SPS3
Granik, Yuri [7274-89]SPS4, [7274-142]SPS9, [7275-35]SPS1
Grantham, Steven E. [7271-38]S8, [7271-140]SPS7
Gräupner, Paul [7271-47]S10
Graur, Ioana C. [7274-36]S9, [7275-08]S2
Graves, Trey [7273-42]S10, [7274-22]S6, [7275-34]SPS1
Greco, Stephen [7275-76]SPS1
Greenberg, Gadi [7272-25]S5
Greenway, Robert T. [7271-103]SPS3, [7274-67]SPS1
Gronheid, Roel [7271-152]SPS9, [7273-21]S6, [7273-46]S10, [7273-50]S11, [7273-75]SPS1, [7273-167]SPS8, [7274-17]S5
Gros, Philippe [7272-178]SPS1
Gross, Gerhard [7271-23]S6
Groves, Timothy R. 7271 ProgComm, 7271 S6 SessChr
Gscheidlen, Dieter [7272-131]SPS1
Gu, Xinyu [7273-98]SPS3
Gu, Yili [7275-66]SPS1
Gubiotti, Thomas [7272-170]SPS1, [7272-171]SPS1
Guerrero, Douglas J. 7273 ProgComm, 7273 S7 SessChr
Guo, Yao-Wen [7274-114]SPS6
Gupta, Puneet [7275-47]SPS1
Gustafson, Deborah S. [7271-121]SPS4
Gutjahr, Karsten [7272-117]SPS1
Guttman, Charles M. [7273-149]SPS7

H

Ha, Ji-Hyun [7272-123]SPS1, [7273-90]SPS2
Ha, Jung-Ik [7273-76]SPS1
Haag, Martin [7271-105]SPS4, [7271-107]SPS4
Hada, Hideo [7273-143]SPS6
Hada, Kazunari [7271-67]S14
Hafeman, Scott [7274-100]SPS4
Haffner, Henning [7274-52]S13
Hagio, Yoshinori [7275-33]SPS1
Hagiwara, Takuya [7273-129]SPS5
Hahmann, Peter [7271-97]SPS2
Hahn, Jae W. [7271-104]SPS3
Hajdaj, Russell E. [7272-08]S2
Halbmaier, David [7271-18]S4
Halle, Scott D. [7274-03]S2, [7274-09]S3, [7274-48]S12
Haller, Mitch [7272-163]SPS1
Hamaguchi, Akira [7272-143]SPS1, [7272-174]SPS1
Hamatani, Masato [7274-54]S14
Hamieh, Bassem [7274-128]SPS7
Hampton, Elizabeth [7272-124]SPS1
Han, Geng [7274-03]S2, [7274-05]S2
Han, Hakseung [7271-12]S4
Han, Jae-Won [7273-62]SPS1, [7273-171]SPS9, [7274-130]SPS7
Han, Sang-In [7271-03]S1, [7271-43]S9, [7273-35]S8
Han, Wenda [7272-159]SPS1
Han, Woo-Sung [7271-40]S9, [7271-146]SPS8, [7272-45]S10, [7272-106]SPS1, [7273-14]S4, [7274-28]S7, [7274-81]SPS4, [7274-83]SPS4, [7274-94]SPS4, [7274-95]SPS4
Hanawa, Tetsuro [7273-129]SPS5, [7274-131]SPS8
Hanotte, Marc [7272-148]SPS1
Hansen, Steven G. [7271-47]S10, [7274-62]S15
Hanson, Cynthia 7271 ProgComm, 7271 S5 SessChr
Hapli, John [7275-69]SPS1
Hara, Arisa [7273-146]SPS6
Harakawa, Hideaki [7274-51]S12
Harel, Daniel [7272-25]S5
Harned, Noreen [7271-01]S1
Hartig, Carsten [7272-32]S7, [7272-58]S12
Hartley, John G. [7271-31]S7
Hartung, Frank [7274-09]S3
Harumoto, Masahiko [7273-71]SPS1, [7273-133]SPS5, [7273-138]SPS5
Hasebe, Kazuhide [7273-146]SPS6
Hasegawa, Norio [7272-95]SPS1
Hasegawa, Shunsuke [7274-51]S12
Hasegawa, Takayuki [7271-68]S14
Hasegawa, Yasuo [7274-57]S14
Hashimoto, Hideaki [7272-90]SPS1
Hashimoto, Kohji [7271-74]S14, [7271-81]S16, [7275-33]SPS1
Hassanein, Ahmed [7272-73]S4
Hatakeyama, Jun [7273-67]SPS1
Hatakeyama, Shinichi [7273-50]S11, [7274-17]S5, [7274-66]SPS1
Hauptmann, Marc [7271-95]SPS2
Hauschild, Jan [7272-164]SPS1
Hayano, Fuminori [7272-49]S11

Hayano, Katsuya [7272-94] SPS1
Hayashi, Hiroyuki [7272-26]S6
Hayashi, Naoya [7271-94]SPS1
Hayes, Alan V. [7271-124]SPS5
Hazart, Jerome [7272-156]SPS1
Hazelton, Andrew J. [7271-34] S7, [7274-31]S8, [7274-32]S8
He, Long [7271-18]S4, [7271-31]S7
He, Yuan [7273-103]SPS3, [7274-112]SPS6, [7274-113] SPS6
Heil, Tilmann [7271-47]S10
Hellebusch, Daniel J. [7271-93] SPS1
Hellerqvist, Monica [7272-145] SPS1
Hendel, Rudolf H. [7271-103] SPS3
Henderson, Clifford L. 7273 Chr, 7273 S5 SessChr, 7273 S SessChr, [7273-17]S5, [7273-19]S5, [7273-37]S9, [7273-40] S9, [7273-44]S10, [7273-116] SPS4
Hendrickx, Eric [7271-15]S4, [7271-29]S7, [7275-35]SPS1
Heng, Chun Huat [7275-43] SPS1
Heng, Fook-Luen SC889 Inst, [7275-45]SPS1
Heo, Jinseok [7272-45]S10
Heo, Junggun [7273-24]S6
Her, Jin-Seok [7272-52]S11
Hermans, Jan [7271-15]S4, [7271-29]S7
Hernandez, Mike [7272-08]S2
Herold, Klaus [7274-34]S9, [7274-37]S9
Herr, Daniel J. C. 7271 ProgComm, 7271 S11 SessChr, 7272 ProgComm
Hesse, Steven [7271-141]SPS7
Hibbeler, Jason [7275-10]S3
Hibbs, Michael S. [7274-08]S3
Hibino, Daisuke [7272-38]S8
Hickman, Craig [7272-91]SPS1, [7274-112]SPS6
Hieda, Hiroyuki [7271-102]SPS3
Higashiki, Tatsuhiko 7271 ProgComm, 7271 S11 SessChr, [7271-81]S16, [7272-21]S4, 7274 ProgComm, 7274 S14 SessChr, 7274 S3 SessChr
Higgins, Craig D. [7271-75] S15, [7271-153]SPS9, [7273-32]S8
Hill, Shannon B. [7271-39]S8
Hilton, Al [7272-08]S2
Himel, Marc D. [7274-10]S3
Hindawy, Nader M. [7275-73] SPS1
Hingerl, Kurt [7271-57]S12
Hinsberg, William D. [7271-83] S17, [7272-44]S10
Hirai, Yoshihiko [7273-77]SPS1
Hiraka, Takaaki [7271-94]SPS1
Hirano, Ryoichi [7272-90]SPS1
Hirayama, Taku [7273-30]S8
Hiroi, Yoshiomi [7273-166]SPS8
Hirono, Masatoshi [7272-90] SPS1
Hisai, Akihiro [7273-71]SPS1, [7273-133]SPS5, [7273-138] SPS5
Hishiro, Yoshi [7273-29]S8
Ho, Jonathan [7275-31]SPS1
Hoef, Brian [7271-32]S7
Hoeft, Jon-Tobias [7272-58]S12
Hofemann, Paul [7271-56]S12
Hoffnagle, John A. [7274-09]S3
Hohle, Christoph K. [7271-23] S6, [7271-95]SPS2, 7273 ProgComm, 7273 S11 SessChr, 7273 S2 SessChr
Hojo, Yutaka [7275-60]SPS1
Holfeld, Christian [7271-43]S9
Holmes, Steven J. [7274-03]S2
Honda, Tokuyuki [7271-68]S14
Hong, Ji-Suk [7275-70]SPS1
Hong, Jongkyun [7272-132] SPS1
Hong, Le [7274-87]SPS4, [7275-75]SPS1
Hong, Min-Jong [7274-95]SPS4
Hong, Min-Jung [7274-94]SPS4
Hong, Qi-Zhong [7275-12]S3
Hong, Sukjoon [7274-71]SPS2
Hong, Sungeun [7273-82]SPS1
Hooge, Joshua S. [7274-66] SPS1
Horak, David V. [7271-03]S1, [7274-20]S5
Hori, Masafumi [7273-10]S3
Horiguchi, Yusuke [7273-57] S12, [7273-80]SPS1
Horne, Stephen F. [7271-121] SPS4
Hornung, Brian [7275-21]S5
Horth, Wesley [7272-80]SPS1
Hoshi, Hiromichi [7271-100] SPS2
Hoshiko, Kenji [7273-10]S3
Hoshino, Hideo [7271-07]S3
Hotta, Kazuaki [7271-120]SPS4
Houle, Frances A. 7271 ProgComm, 7271 S16 SessChr, [7271-78]S16, [7271-80]S16, [7272-44]S10, [7273-41]S9
Houlihan, Francis M. [7273-91] SPS2
House, Matthieu [7271-14]S4
Hovsepyan, Henrik [7275-18]S4
Howard, Lowell P. [7272-157] SPS1
Hsieh, Simon [7274-114]SPS6
Hsu, Te-shao [7273-81]SPS1
Hsu, Wei-Te [7272-63]S13
Hsueh, Bo-Yun [7272-121]SPS1
Hu, Jiangtao [7272-65]S13, [7274-40]S10
Hu, Jimmy [7272-09]S3, [7272-155]SPS1
Hua, Xiang [7275-76]SPS1
Huang, C. L. [7272-64]S13
Huang, Chao-Tien [7272-119] SPS1, [7272-136]SPS1
Huang, Chia Wei [7275-73]SPS1
Huang, Chien-Jen [7272-121] SPS1
Huang, Chih-Hao [7273-102] SPS3
Huang, Chin-Chou K. [7272-119]SPS1, [7272-121]SPS1, [7272-136]SPS1
Huang, Chun-Yen [7272-20]S4, [7274-12]S4
Huang, George K. C. [7272-121] SPS1
Huang, Haigou [7275-76]SPS1
Huang, Hung-Chin [7273-68] SPS1, [7273-92]SPS2
Huang, Jacky [7272-09]S3, [7272-155]SPS1
Huang, Jason H. [7274-137] SPS8
Huang, Li-Da [7275-74]SPS1
Huang, Rondy [7275-79]SPS1
Huang, Wen-Chun [7271-49] S10, [7274-99]SPS4
Huang, Wu-Song [7273-27]S7
Hubbard, Graham [7271-57]S12
Huckabay, Judith A. [7275-59] SPS1
Hughes, Gregory P. [7271-34] S7
Huh, Sungmin [7271-31]S7, [7271-72]S14, [7271-129] SPS5, [7271-139]SPS6
Hui, Colin C. W. [7275-74]SPS1, [7275-76]SPS1, [7275-77] SPS1
Huijbregtse, Jeroen [7273-41]S9
Huli, Lior [7273-35]S8
Hung, Albert [7271-82]S17
Hung, Chia-Tsung [7272-20]S4
Hung, Raymond [7274-149] SPS10
Hung, Yung Long [7273-174] SPS9, [7275-58]SPS1
Hunsche, Stefan [7274-04]S2
Hurat, Philippe [7275-21]S5, [7275-37]S2, [7275-77]SPS1
Hwang, Chan [7272-106]SPS1, [7274-28]S7
Hwang, Nam-Woo [7272-139] SPS1
Hyun, Yoon-Suk [7271-41]S9, [7271-51]S10, [7271-149] SPS8

I

Icard, Beatrice [7271-27]S6
Idgunji, Sachin [7275-19]S5
Iessi, Umberto [7274-118]SPS6
Ihm, Dongchul [7272-109]SPS1
Iida, Kazunori [7273-16]S4
Iida, Satoshi [7271-100]SPS2
Ikegami, Toru [7272-105]SPS1
Imai, Akira [7274-131]SPS8
Ina, Hideki [7272-130]SPS1
Inai, Kensuke [7272-26]S6, [7272-103]SPS1
Inanami, Ryouichi [7271-74]S14
Inatomi, Yuichiro [7273-146] SPS6
Inoue, Soichi [7274-18]S5, [7274-35]S9, [7274-51]S12, [7274-134]SPS8, [7275-23]S5
Inoue, Tadanobu [7274-08]S3
Inoue, Tadao [7275-28]SPS1
Iriuchijima, Yasuhiro [7273-160] SPS7, [7274-61]S15, [7272-25]S5
Irmscher, Mathias [7271-23] S6, [7271-64]S13
Isawa, Miki [7272-27]S6
Ishibashi, Takeo [7273-129] SPS5
Ishibashi, Yasuhiko [7272-38] S8, [7272-161]SPS1
Ishida, Tatsuya [7274-51]S12
Ishiduka, Keita [7273-143]SPS6
Ishigo, Kazutaka [7272-21]S4
Ishihara, Sunao [7271-130]SPS5
Ishihara, Takanobu [7271-07]S3
Ishihara, Toshihiko [7274-159] SPS11
Ishihara, Toshinobu [7273-67] SPS1
Ishii, Hiroyuki [7274-33]S8
Ishii, Yuuki [7273-09]S3, [7273-16]S4, [7273-160]SPS7
Ishikawa, Tomonori [7273-64] SPS1
Ishimoto, Toru [7272-95]SPS1
Ishitani, Tohru [7272-103]SPS1
Isoyan, Artak [7271-133]SPS6
Issaschrof, Limor [7272-42]S9
Itani, Toshiro [7271-74]S14, [7273-34]S8, [7273-111]SPS4, [7273-112]SPS4, [7273-113] SPS4, [7273-114]SPS4, [7273-115]SPS4, [7273-125]SPS4
Ito, Hiroshi [7273-22]S6
Ito, Katsuki [7273-151]SPS7
Ito, Masamitsu [7271-81]S16
Ito, Shinichi [7273-16]S4, [7273-57]S12
Itoh, Hiroshi [7272-70]S14, [7272-72]SPS1
Ivan, Marius G. [7271-62]S13
Ivanchikov, Andrey [7272-161] SPS1, [7272-174]SPS1
Iwai, Takeshi [7273-07]S2, [7273-30]S8, [7273-122]SPS4
Iwai, Toshimichi [7271-64]S13
Iwanaga, Takehiko [7274-55]S14
Iwao, Fumiko [7273-61]SPS1, [7273-146]SPS6
Iwasaki, Teruo [7271-71]S14, [7271-127]SPS5
Iwashita, Jun [7273-07]S2, [7273-30]S8
Iwashita, Mitsuaki [7273-57]S12
Izikson, Pavel [7272-05]S2

J

Jack, Kevin [7273-175]SPS4
Jacobsson, Michael B. [7271-93]SPS1
Jacques, Robert N. [7274-158] SPS11, [7274-159]SPS11
Jain, Himanshu [7273-53]S12
Jak, Martin J. [7271-108]SPS4, [7271-111]SPS4
James, Christopher R. [7273-86] SPS2
Janda, Eric A. [7274-113]SPS6
Jang, Stephen [7271-46]S10, [7271-148]SPS8
Jang, Yun Kyeong [7273-14]S4
Jannesary, Reyhaneh [7271-57] S12
Jarvis, Bob [7275-30]SPS1
Jaschinsky, Philipp [7271-23]S6, [7271-95]SPS2
Jau, Jack Y. [7272-26]S6
Jayaram, Srividya [7274-98] SPS4, [7274-123]SPS7, [7275-75]SPS1
Jayasuriya, Darshana [7275-06] S2
Jayathi, Subramanian [7275-76] SPS1
Jeauneau, Jonathan [7273-84] SPS2
Jedrasik, Piotr [7271-101]SPS2
Jee, Ronald [7272-82]SPS1
Jen, Wei-Lun [7271-93]SPS1, [7273-21]S6
Jeong, Chang-Hyun [7271-12] S4
Jeong, HeeJun [7273-47]S10
Jeong, Kwangok [7271-103] SPS3
Jeong, MoonGyu [7274-83] SPS4
Jeong, YongTeak [7272-135] SPS1
Jeyakumar, Augustin [7272-113] SPS1
Jhaveri, Tejas K. [7274-42]S10, [7275-10]S3
Jiang, Fan [7271-133]SPS6
Jiang, Li [7272-158]SPS1, [7274-105]SPS5
Jiang, Xunya [7272-159]SPS1
Jiang, Yun Tao [7272-100]SPS1
Jin, Jaklyn [7274-149]SPS10
Jin, Sang-Won [7272-139]SPS1
Jindal, Vibhu [7271-135]SPS6
Jockusch, Steffen [7273-127] SPS5
Johnkadaksham, Arun [7271-14]S4
Johnson, Gloria [7272-178] SPS1
Johnson, Richard [7273-139] SPS5, [7274-20]S5
Jonckheere, Rik M. [7271-29] S7, [7271-152]SPS9
Jonkers, Jeroen [7271-08]S3, [7271-09]S3
Jost, Andrew M. [7274-38]S9
Joubert, Olivier P. [7272-23]S5
Joy, David C. 7272 ProgComm
Jun, ChungSam [7272-34]S7
Jun, Sungho [7274-77]SPS3
Jung, Areum [7272-53]S11
Jung, Howon [7271-104]SPS3
Jung, Jaewook [7272-85]SPS1
Jung, Meng-An [7273-90]SPS2
Jung, Minhee [7274-71]SPS2
Jung, Woo Yung [7274-13]S4
Jungblut, Reiner M. [7272-164] SPS1
Jurajda, Darron [7273-84]SPS2

K

Kadomin, Ivan [7272-161]SPS1
Kadomina, Elena [7272-168] SPS1
Kadowaki, Motoki [7272-143] SPS1, [7272-174]SPS1
Kagami, Hiroyuki [7273-170] SPS9
Kahng, Andrew B. [7271-103] SPS3
Kaiser, Norbert [7271-10]S3, [7271-37]S8
Kajiyashiki, Tsuyoshi [7273-124] SPS4
Kakizaki, Kouji [7271-07]S3, [7274-156]SPS11
Kakizawa, Tomohiro [7273-10] S3
Kaku, Masanori [7271-113] SPS4
Kakuta, Junichi [7272-96]SPS1
Kakutani, Yukinobu [7271-134] SPS6, [7271-136]SPS6
Kallingal, Chidam [7274-52] S13, [7274-128]SPS7
Kalnov, Vladimir [7272-87]SPS1
Kamat, Vishnu G. [7274-10]S3
Kamigaki, Tetsuya [7275-18]S4
Kamimura, Sou [7273-11]S3
Kamna, Marilyn [7271-15]S4
Kamo, Takashi [7271-74]S14, [7271-128]SPS5
Kamohara, Itaru [7274-16]S5
Kampe, Annett [7271-141]SPS7
Kampherbeek, Bert J. [7271-27] S6, [7271-55]S11
Kan, Kobi [7272-25]S5
Kanai, Kenichi [7272-26]S6
Kanaoka, Masashi [7273-126] SPS5

Index of Authors, Chairs, and Committee Members

Bold = SPIE Member

Kandel, Daniel [7272-15]S4, [7272-40]S9
Kaneko, Kenichiro [7274-111] SPS6
Kaneyama, Koji [7273-111] SPS4, [7273-115]SPS4
Kang, HoSung [7272-135]SPS1
Kang, Hyun-Jae [7275-70]SPS1
Kang, In-Yong [7271-12]S4
Kang, Jae-Hyun [7274-77]SPS3, [7274-101]SPS4
Kang, Seokho [7273-14]S4
Kang, Shuhui [7273-36]S9
Kang, Xiao Hui [7274-85]SPS4, [7275-66]SPS1, [7275-67] SPS1
Kang, Young-Seog [7272-126] SPS1, [7273-76]SPS1
Kapasi, Sanjay H. [7274-132] SPS8, [7275-34]SPS1, [7275-58]SPS1
Kaplan, Simon G. [7274-73] SPS2
Kapteyn, Henry C. [7272-14]S3
Karsenti, Laurent [7272-131] SPS1, [7275-07]S2
Kasthuri, Bala [7275-21]S5, [7275-37]S2, [7275-77]SPS1
Katakamsetty, Ushasree [7275-74]SPS1, [7275-76]SPS1
Katayama, Kazuhiro [7273-67] SPS1
Kato, Cindy [7272-05]S2
Kato, Hirokazu [7273-16]S4, [7273-57]S12
Kato, Takeshi [7273-131]SPS5
Katsanes, Ron [7273-28]S7, [7273-107]SPS3
Katte, Henning T. [7272-77] SPS1
Katto, Masahito [7271-113] SPS4
Kawada, Hiroki [7272-36]S8, [7272-84]SPS1, [7272-97] SPS1
Kawai, Akitoshi [7272-49]S11
Kawai, Hidemi [7271-67]S14
Kawai, Yoshio [7273-67]SPS1
Kawakubo, Tadamasa [7273-160]SPS7
Kawamura, Daisuke [7271-74] S14, [7273-34]S8, [7273-111] SPS4, [7273-113]SPS4
Kawano, Naoya [7273-151] SPS7
Kawanobe, Yoshio [7274-55] S14
Kawasaki, Ryosuke [7272-26]S6
Kawasaki, Tetsu [7273-09]S3, [7273-61]SPS1, [7273-146] SPS6
Kawasuji, Yasufumi [7274-156] SPS11
Kawata, Shintaro [7271-134] SPS6, [7271-136]SPS6
Kawaue, Akiya [7273-143]SPS6
Kazanskiy, Nikolay L. [7272-161] SPS1
Kazinczi, Robert [7272-91] SPS1, [7274-09]S3, [7274-62] S15
Ke, Chih-Ming 7272 ProgComm, [7272-09]S3, [7272-13]S3, [7272-36]S8, [7272-155]SPS1
Kearney, Patrick A. [7271-18] S4, [7271-124]SPS5
Kearney, Patrick [7272-165] SPS1
Kehoe, Timothy [7271-65]S13
Keil, Katja [7271-95]SPS2
Kelling, Mark [7272-58]S12, [7274-52]S13
Kem, Lilly [7275-11]S3
Kemp, Charles [7271-33]S7
Kenmochi, Daisuke [7272-114] SPS1
Kennedy, Joseph T. [7273-28] S7, [7273-107]SPS3, [7274-102]SPS5
Kerrien, Gurwan [7272-67]S14, [7274-41]S10
Kershner, Ryan J. [7271-82]S17
Kesenich, Grace [7272-80]SPS1
Khachatryan, Nikolay [7275-18] S4
Khalil, Diaa A. [7274-135]SPS8
Khamankar, Rajesh [7275-21]S5
Khodykin, Oleh V. [7271-02]S1, [7271-10]S3, [7271-119]SPS4
Khorram, Hamid R. [7273-160] SPS7
Kihara, Naoko [7271-102]SPS3
Kikuchi, Takuo [7275-18]S4
Kikuiri, Nobutaka [7272-90] SPS1
Kim, Bobae [7273-164]SPS8
Kim, Cheol-Kyun [7271-149] SPS8, [7274-91]SPS4, [7274-144]SPS9
Kim, Dae-Wook [7272-139] SPS1
Kim, Dae-Wook [7275-70]SPS1
Kim, Deog-Bae [7273-120] SPS4, [7273-161]SPS7
Kim, Do Wan [7273-164]SPS8
Kim, Dongwan [7271-12]S4
Kim, Eun-Jin [7271-147]SPS8
Kim, Ha-Soo [7273-76]SPS1
Kim, Helen H. K. [7272-32]S7
Kim, Ho-Cheol [7271-83]S17, [7271-85]S17
Kim, Hong-Ik [7272-123]SPS1, [7273-90]SPS2
Kim, Hoon [7271-12]S4
Kim, Ho-Seob [7272-139]SPS1
Kim, Hoyeon [7274-25]S7
Kim, Hung-Eil [7274-90]SPS4
Kim, HyeongSoo [7271-41]S9, [7271-51]S10
Kim, Hyun-Jin [7273-120]SPS4
Kim, Hyunsu [7273-140]SPS6, [7273-141]SPS6, [7273-164] SPS8
Kim, Insung [7271-40]S9, [7271-146]SPS8
Kim, Jae-Hyun [7273-120]SPS4, [7273-128]SPS5, [7273-161] SPS7
Kim, Jaisoon [7274-71]SPS2
Kim, Jeong Soo [7272-132] SPS1
Kim, Jeonghun [7273-126]SPS5
Kim, Jeong-Sik [7273-161]SPS7
Kim, Jeong-Woo [7273-120] SPS4
Kim, Jong-Doo [7274-77]SPS3, [7274-101]SPS4
Kim, Jong-Seob [7273-85] SPS2, [7273-88]SPS2
Kim, Jungchan [7272-53]S11, [7274-91]SPS4
Kim, Ki-Ho [7272-135]SPS1
Kim, Min-Soo [7273-85]SPS2
Kim, Mi-Young [7273-88]SPS2
Kim, Moonseok [7274-71]SPS2
Kim, Ryoung-Han [7273-08] S3, [7273-12]S3, [7274-03] S2, [7274-126]S12, [7274-129] SPS7
Kim, Sang Kyun [7273-88] SPS2
Kim, Sangcheol [7271-92]SPS1
Kim, Sang-Kon [7273-73]SPS1
Kim, Sang-Wook [7274-81] SPS4
Kim, Seok [7271-104]SPS3
Kim, Seong-Sue [7271-12]S4, [7271-147]SPS8, [7273-140] SPS6, [7273-141]SPS6
Kim, Sue Ryeon [7273-92] SPS2, [7273-93]SPS2
Kim, Suhyun [7273-89]SPS2
Kim, T. S. [7275-12]S3
Kim, Taekyu [7272-19]SPS1
Kim, Taesung [7272-34]S7, [7273-128]SPS5
Kim, Won-Sun [7272-51]S11
Kim, Yongchul [7273-89]SPS2
Kim, Yong-Hoon [7272-51]S11
Kim, Yongwoo [7271-104]SPS3
Kim, Young [7274-09]S3
Kim, Young-Chang [7274-81] SPS4, [7274-94]SPS4, [7274-95]SPS4
Kim, Young-Chul [7272-139] SPS1
Kim, Youngho [7273-128]SPS5
Kim, YoungKi [7272-132]SPS1
Kim, Youngmi [7274-77]SPS3, [7274-101]SPS4
Kiminori, Yoshino [7272-140] SPS1
Kimmel, Kurt R. 7271 S4 SessChr, 7274 ProgComm, 7274 S8 SessChr, 7274 S13 SessChr, 7274 S11 SessChr
Kingsborough, Richard P. [7271-84]S17
Kini, Sumanth [7271-43]S9
Kinoshita, Hidetoshi [7271-19] S5, [7271-25]S6
Kinoshita, Hiroo [7273-165] SPS8
Kinoshita, Hiroshi [7272-114] SPS1
Kita, Naonori [7274-58]S14
Kitamura, Yosuke [7273-15]S4, [7274-51]S12
Kitamura, Yuya [7274-151] SPS11
Kitano, Junichi [7273-55]S12
Kitano, Takahiro [7273-57]S12
Klatchko, Asher [7274-03]S2
Klein, Christof [7271-23]S6
Klein, Juergen [7271-09]S3
Kleinschmidt, Jürgen [7271-08] S3
Klikovits, Jan [7271-23]S6
Klimpel, Thomas [7271-145] SPS8, [7274-21]S6
Klingbeil, Patrick [7272-133] SPS1
Klingler, Wolfram [7271-23]S6
Klostermann, Ulrich K. [7273-45]S10
Kneer, Bernhard [7274-09]S3, [7274-62]S15
Ko, Sungwoo [7274-144]SPS9
Koay, Chiew-seng [7271-03] S1, [7271-30]S7, [7271-43]S9, [7271-45]S10, [7271-48]S10, [7273-35]S8, [7274-03]S2
Kobayashi, Katsutoshi [7273-16]S4
Kobayashi, Masatoshi [7274-57] S14
Kobayashi, Naohiro [7275-57] SPS1
Kobayashi, Shinji [7273-111] SPS4, [7273-114]SPS4, [7273-115]SPS4
Kodera, Katsuyoshi [7274-35]S9
Koh, Chawon [7271-31]S7, [7271-32]S7, [7271-73]S15, [7271-129]SPS5
Koh, Sang Ran [7273-88]SPS2
Kohama, Yoshiaki [7271-67]S14
Kohno, Hirotaka [7274-54]S14
Koida, Keigo [7271-134]SPS6
Koike, Fumihiro [7271-110]SPS4
Koji, Kanayama [7273-112] SPS4
Kojima, Akira [7271-96]SPS2
Kojima, Toshiyuki [7274-55]S14
Kokkoris, George [7273-177] SPS6
Kolarik, Vladimir [7271-23]S6
Kolbow, Steven P. [7271-18]S4
Komami, Hideaki [7271-20]S5
Komatsuda, Hideki [7271-69] S14
Komine, Nobuhiro [7272-21]S4
Komizo, Toru [7273-66]SPS1
Komori, Hiroshi [7271-07]S3, [7271-115]SPS4
Komuro, Hitoshi [7275-60]SPS1
Komuro, Yoshitaka [7273-143] SPS6
Kondo, Hiroyuki [7271-69]S14
Kone, Issiaka [7272-156]SPS1
Konno, Yusaku [7272-50]S11
Kono, Akemi [7272-38]S8, [7272-105]SPS1
Kono, Takuya [7272-21]S4, [7274-51]S12
Kontio, Juha [7271-58]S12
Koo, Sunyoung [7271-41]S9, [7271-51]S10
Kools, Jacques [7271-11]S3
Kopp, Jennifer [7272-145]SPS1
Koret, Roy [7272-42]S9
Korivi, Naga S. [7274-105]SPS5
Korlahalli, Rahul [7272-41]S9
Koshiba, Takeshi [7271-74]S14, [7271-81]S16
Koshida, Nobuyoshi [7271-96] SPS2
Koshihara, Shunsuke [7272-38]S8, [7272-96]SPS1
Kosugi, Hitoshi [7273-13]S4, [7273-55]S12, [7273-69]SPS1
Kotani, Toshiya [7274-18]S5, [7274-35]S9
Kotsugi, Tadashi [7271-19]S5
Kou, Jay [7272-164]SPS1
Kovalskyy, Andriy [7273-53]S12
Kozawa, Takahiro [7273-122] SPS4, [7273-123]SPS4
Kramer, Uwe [7272-03]S2
Krasnoperova, Azalia [7274-03] S2, [7274-11]S3, [7274-36]S9
Kreindl, Gerald [7271-90]SPS1
Kretz, Johannes [7271-23]S6, [7271-95]SPS2
Kritsun, Oleg [7271-70]S14, [7272-06]S2, [7272-41]S9, [7274-40]S10, [7274-111] SPS6
Krug, Dave J. [7271-63]S13
Kruger, Seth [7271-75]S15, [7273-32]S8
Krysak, Marie E. [7273-152] SPS7
Kteyan, Armen [7275-18]S4
Ku, Yao-Ching [7274-99]SPS4
Ku, Yi-Sha [7272-63]S13
Kuan, Barry [7274-12]S4
Kubis, Michael [7272-117]SPS1
Kubodera, Shoichi [7271-113] SPS4
Kucherov, Victor [7272-32]S7
Kudo, Takanori [7273-82]SPS1, [7273-91]SPS2
Kudo, Yuji [7272-59]S12
Kuekes, Philip J. [7271-05]S2
Kuepper, Felix [7271-09]S3
Kuiper, V. [7271-55]S11
Kumada, Teruhiko [7273-129] SPS5
Kumar, Surender [7272-25]S5
Kumazaki, Takahito [7274-153] SPS11
Kuo, Cheng-Cheng [7274-99] SPS4
Kuo, Sven [7275-79]SPS1
Kupers, Michiel [7272-133]SPS1
Kuribayashi, Takaaki [7274-115] SPS6
Kurihara, Tomoki [7273-27]S7
Kurita, Hiroyuki [7272-05]S2
Kuriyama, Koki [7271-94]SPS1
Kurosu, Akihiko [7274-156] SPS11
Kushibiki, Jun-ichi [7271-123] SPS5
Kushibiki, Masato [7273-09]S3, [7273-61]SPS1, [7273-146] SPS6
Kushida, Yuki [7273-168]SPS8
Kusnadi, Ir [7272-108]SPS1, [7275-60]SPS1
Kusumoto, Shiro [7273-10]S3, [7273-134]SPS5
Kuwada, Hideaki [7272-26]S6
Kwak, Minkeun [7273-89]SPS2
Kwok, Amy [7273-93]SPS2
Kye, Jongwook [7271-45]S10, [7274-03]S2, [7274-142]SPS9, [7273-08]S3, [7273-12]S3, [7274-111]SPS6
Kyoh, Suigen [7274-51]S12, [7275-23]S5
Kyouda, Hideharu [7274-157] SPS11
Kyoung, Jaisun [7272-85] SPS1, [7273-140]SPS6

L

LaBrake, Dwayne L. [7271-56] S12
LaCour, Pat J. [7274-68]SPS1
Ladanyi, Laszlo [7274-08]S3
La Fontaine, Bruno M. 7271 CoChr, 7271 S1 SessChr, [7271-03]S1, [7271-30]S7, [7271-32]S7, [7271-43]S9, [7271-45]S10, [7273-35]S8
Lai, Jun-Cheng N. [7272-16]S4, [7272-119]SPS1, [7274-147] S4
Lai, Kafai SC887 Inst, 7274 ProgComm, 7274 S10 SessChr, 7274 S2 SessChr, [7274-08]S3, [7274-09]S3, [7274-11]S3, [7274-50]S12
Laidler, David [7271-29]S7, [7272-12]S3, [7272-15]S4, [7272-95]SPS1, [7272-128] SPS1, [7273-133]SPS5
Laine, Richard M. [7271-63]S13
Lalev, G. [7271-98]SPS2
Lalovic, Ivan [7274-60]S15
Lam, Michael [7274-60]S15
Landis, Stefan [7272-101]SPS1

Bold = SPIE Member

La-o-Vorakiat, Chan [7272-14] S3
Lapeyre, Céline [7274-31]S8, [7274-69]SPS1
Laske, Frank [7272-114]SPS1
LaTulipe, Doug [7274-20]S5
Laubis, Christian [7271-141] SPS7
Laursen, Thomas [7271-43]S9
Lawson, Peggy C. [7273-139] SPS5, [7274-52]S13
Lawson, Richard A. [7273-17] S5, [7273-19]S5, [7273-40] S9, [7273-44]S10, [7273-116] SPS4
Lay, Chao-Wen [7274-12]S4
Layton, Larry [7275-37]S2
Lazaryan, Hasmik [7275-18]S4
Le Denmat, Jean-Christophe [7274-41]S10, [7275-07]S2
Le Gratiet, Bertrand [7272-107] SPS1
Lee, Anice [7272-169]SPS1
Lee, Brian [7271-31]S7
Lee, Byeong-Cheol [7274-25]S7
Lee, Byoung-Ho 7272 ProgComm, [7272-11]S3, [7272-52]S11, [7272-147] SPS1
Lee, Byoung-Hyun [7275-19]S5
Lee, ChangHo [7272-135]SPS1
Lee, Chulseung [7272-120] SPS1
Lee, Dohwa [7272-120]SPS1
Lee, Dongchan [7272-144]SPS1
Lee, Dong-Gun [7271-12]S4
Lee, Dongjin [7274-91]SPS4, [7274-144]SPS9
Lee, Dongkwan [7272-149] SPS1
Lee, Eungman [7271-104]SPS3
Lee, H. J. [7273-102]SPS3
Lee, Hae-Jeong [7271-92]SPS1
Lee, Heng-Jen [7274-114]SPS6
Lee, Hong Wen [7274-12]S4
Lee, Hye-Sung [7273-171] SPS9, [7274-77]SPS3
Lee, Hyung-Rae [7273-25]S7, [7274-128]SPS7
Lee, Hyun-Jong [7274-95]SPS4
Lee, Jae-Woo [7273-120]SPS4, [7273-161]SPS7
Lee, Jeonghoon [7271-40]S9, [7271-146]SPS8
Lee, Jia-Yun [7274-114]SPS6
Lee, Jin-Kyun [7273-158]SPS7
Lee, Jung Youl [7273-120]SPS4
Lee, Junghyeon [7272-19]SPS1
Lee, Ki Lyoung [7273-93]SPS2
Lee, Moonk-Keun [7272-109] SPS1
Lee, Nae-In [7273-89]SPS2
Lee, Poshin [7272-86]SPS1
Lee, Sang-Ho [7274-28]S7, [7272-126]SPS1, [7273-76] SPS1
Lee, Sang-Hoon [7275-70]SPS1
Lee, Sanghwa [7274-25]S7
Lee, Sang-Uk [7273-90]SPS2
Lee, Sangyouk [7272-85]SPS1
Lee, Shiyong [7273-14]S4
Lee, SooChul [7272-135]SPS1
Lee, Sook [7273-92]SPS2
Lee, SukJoo 7274 ProgComm, 7274 S4 SessChr, 7274 S9 SessChr, [7274-81]SPS4, [7274-83]SPS4, [7274-94] SPS4, [7274-95]SPS4
Lee, Sungkoo [7273-24]S6, [7273-93]SPS2
Lee, Sung-Woo 7271 ProgComm, 7271 S10 SessChr, [7274-25]S7, [7274-81]SPS4
Lee, Sunpyo [7272-51]S11
Lee, Taehyeong [7272-53]S11
Lee, Tae-Jong [7272-123]SPS1, [7273-90]SPS2
Lee, Tae-Yong [7272-147]SPS1
Lee, Timothy [7273-153]SPS7
Lee, W. Y. [7272-24]S5
Lee, Wen-Lung [7275-79]SPS1
Lee, Woojin [7273-88]SPS2
Leenders, Martijn [7274-56]S14
Leeson, Michael J. [7271-42]S9, [7271-152]SPS9, [7273-167] SPS8, [7273-175]SPS4
Lei, Xue-Gong [7273-127]SPS5
Leinonen, Tomi [7271-58]S12
Leray, Philippe J. [7272-15]S4, [7272-40]S9, [7272-128]SPS1, [7273-133]SPS5, [7274-66] SPS1
Lercel, Michael J. 7271 ProgComm, 7271 S9 SessChr, [7271-60]S13
Letzkus, Florian [7271-23]S6
Levi, Shimon [7272-25]S5
Levin, James P. [7273-66]SPS1
Levinson, Harry J. [7271-45] S10, [7273-08]S3, [7273-12] S3, 7274 Chr, 7274 S SessChr, 7274 S1 SessChr, 7274 S SessChr
Li, Cheng He [7274-85]SPS4, [7275-67]SPS1
Li, Chenghong [7273-153]SPS7
Li, Jianliang [7274-43]S10, [7275-68]SPS1
Li, Jie [7272-06]S2, [7272-41] S9, [7274-40]S10
Li, Jin [7273-64]SPS1
Li, Meng [7273-91]SPS2
Li, Qiao [7274-87]SPS4
Li, Shu [7273-127]SPS5
Li, Song [7275-76]SPS1
Li, Xiaohai [7274-39]S9
Li, Xuema [7271-05]S2, [7271-59]S12
Li, Yong [7274-38]S9
Liang, C. R. [7272-09]S3
Liang, Fu-Jye [7274-116]SPS6
Liang, Ted [7271-42]S9, [7271-50]S10
Liao, Chien Mao [7274-12]S4
Liao, Chun Te [7274-12]S4
Liao, Chun-Cheng [7274-123] SPS7, [7275-58]SPS1
Liberman, Vladimir [7274-74] SPS2
Liddle, James A. 7271 ProgComm, 7271 S1 SessChr, 7271 S2 SessChr
Liebmann, Lars W. SC942 Inst, 7275 ProgComm, 7275 S3 SessChr, 7275 SPL SessChr, [7275-10]S3, [7275-15]S4
Lien, Chien Ming [7274-12]S4
Likhachev, Dmitriy [7272-165] SPS1
Lim, Chang-Moon [7271-41] S9, [7271-51]S10, [7271-149] SPS8
Lim, Heeyoul [7273-24]S6
Lin, Bill [7273-92]SPS2
Lin, Burn J. [7274-140]SPS9
Lin, C. C. [7271-124]SPS5
Lin, Chia-Chi [7272-16]S4, [7274-147]S4
Lin, Chin-Hsiang [7274-114] SPS6
Lin, Chung-Yi [7272-169]SPS1
Lin, Eric K. [7273-36]S9
Lin, Hsiao-Chiang [7272-119] SPS1
Lin, Hua-Tai [7274-99]SPS4
Lin, Kuang Kuo [7275-77]SPS1
Lin, Li [7275-12]S3
Lin, Michael W. [7273-80]SPS1
Lin, Qinghuang SC833 Inst, 7273 ProgComm, 7273 S11 SessChr, [7273-157]SPS7
Lin, Qunying [7274-124]SPS7
Lin, Shy-Jay [7271-54]S11
Lin, Xi-Wei [7275-56]SPS1
lindman, ofer [7272-131]SPS1
Lindner, Paul [7271-90]SPS1
Ling, Moh-Lung [7274-124] SPS7
Liniger, E. [7273-157]SPS7
Liou, Yi-An [7272-119]SPS1
Lipscomb, William P. [7272-43] S9
Litt, Lloyd C. 7271 ProgComm, 7271 S12 SessChr, [7271-34] S7, [7271-60]S13
Liu, Daisy [7275-67]SPS1
Liu, Daniel H. [7274-146]SPS10
Liu, Ding-I [7275-79]SPS1
Liu, E. T. [7273-92]SPS2
Liu, Frank [7275-78]SPS1
Liu, Heng-Hsin [7274-114]SPS6
Liu, Heping [7273-175]SPS4
Liu, Hua-Yu [7274-04]S2
Liu, Hung Jen [7274-12]S4
Liu, Jerry [7274-12]S4
Liu, Qingwei [7274-79]SPS4
Liu, Ru-Gun [7274-99]SPS4
Liu, Sen [7273-38]S9
Liu, Walter W. [7273-94]SPS2
Liu, Yanwei [7271-125]SPS5
Liu, Yi-Yu [7275-79]SPS1
Liu, Zhuan [7272-06]S2, [7272-65]S13
Lo, Fred [7274-80]SPS4
Lobert, Jürgen M. [7272-81] SPS1
Loeschner, Hans 7271 ProgComm, 7271 S5 SessChr, [7271-23]S6, [7271-98]SPS2
Lofgren, Bob [7271-35]S8
Lorusso, Gian F. [7271-15]S4, [7271-29]S7
Lowes, Joyce A. [7273-87] SPS2
Lowisch, Martin [7271-01]S1, [7271-47]S10
Lu, Chih-Yuan [7273-102]SPS3, [7274-80]SPS4
Lu, Chun-Hung [7275-79]SPS1
Lu, Ping-Hung [7273-91]SPS2, [7273-153]SPS7
Lu, Wei [7272-02]S1, [7272-69] S14
Lu, Xiaoming [7271-61]S13
Lucas, Kevin [7271-46]S10, [7271-148]SPS8, [7274-39]S9, [7274-43]S10, [7275-68]SPS1, [7275-69]SPS1
Lucatorto, Thomas B. [7271-38] S8, [7271-39]S8, [7271-140] SPS7
Luehrmann, Paul F. [7272-91] SPS1, PanelModerator
Lui, Xiaoping [7272-62]S12
Lukanc, Todd [7274-90]SPS4
Luk-Pat, Gerry [7274-39]S9
Luo, Boren [7271-49]S10
Lyons, Adam [7274-106]SPS5
Lystad, John [7271-18]S4
Lytle, Wayne M. [7271-122] SPS5

M

Ma, Ning [7275-50]SPS1
Ma, Xu [7274-139]SPS9
Ma, Yuangsheng [7274-03]S2
Maas, Raymond [7273-13]S4, [7273-138]SPS5
Mabuchi, Toshiro [7274-151] SPS11
Mack, Chris A. SC116 Inst, [7273-145]SPS6, [7273-147] SPS6, [7273-172]SPS9, [7274-160]SPS11
Mackay, R. Scott 7271 ProgComm, 7271 S4 SessChr, [7271-103]SPS3
MacNaughton, Craig W. [7272-170]SPS1, [7272-171]SPS1
Mader, Arnaud [7271-09]S3, [7271-11]S3
Madey, Theodore E. [7271-36] S8, [7271-39]S8
Maeda, Shimon [7275-23]S5
Maeda, Tatsuya [7272-27]S6, [7272-38]S8, [7272-94]SPS1, [7272-105]SPS1
Maemori, Satoshi [7273-03]S2
Maeng, Jae-Yeol [7274-88] SPS4, [7274-97]SPS4
Maenhoudt, Mireille [7274-23]S6
Mage, Lucile [7274-69]SPS1
Magome, Nobutaka [7274-31] S8, [7274-32]S8
Magoshi, Shunko [7271-44]S9, [7271-116]SPS4, [7271-137] SPS6
Majima, Noriaki [7273-166]SPS8
Maki, Koichi [7273-112]SPS4
Makiyama, Tadamasa [7274-55] S14
Malik, Irfan A. [7272-118]SPS1
Mallmann, Joerg [7273-13]S4, [7273-138]SPS5
Malloy, Matt [7271-60]S13
Malzer, Alois [7271-90]SPS1
Manabe, Hironobu [7271-100] SPS2
Manakli, Serdar [7271-20]S5, [7271-27]S6, [7271-55]S11
Manayam, Jedsada [7273-18]S5
Mangan, Shmoolik [7272-88] SPS1, [7272-89]SPS1, [7272-91]SPS1, [7272-129]SPS1
Manickam, Mayandithevar [7273-18]S5
Manka, James R. [7272-05] S2, [7272-115]SPS1, [7272-120]SPS1, [7272-121]SPS1, [7272-136]SPS1
Mansfield, Scott M. [7274-03] S2, [7274-05]S2, [7274-34]S9, [7274-37]S9
Manukyan, Levon [7275-18]S4
Manuylov, Vadim V. [7274-133] SPS8
Marchelli, Anat [7272-15]S4, [7272-117]SPS1
Marconi, Mario C. [7271-125] SPS5, [7271-133]SPS6
Marcuccilli, Gino [7272-118] SPS1
Marek-Sadowska, Malgorzata [7275-49]SPS1
Markosian, Ara [7275-18]S4
Martin, Mickael [7272-23]S5
Martin, Sven [7272-111]SPS1
Martinelli, Catherine [7272-57] S12, [7272-67]S14, [7274-41] S10
Martinez, Fabian C. [7271-15]S4
Martinick, Brian N. [7273-04]S2
Marzani, Jeremy [7273-70]SPS1
Masamichi, Morita [7273-169] SPS8
Mason, Mark E. 7275 ProgComm, 7275 S5 SessChr
Massin, Jean [7272-107]SPS1
Masson, Georgeta [7273-06]S2
Masuyuki, Takashi [7274-111] SPS6
Matsui, Miyako [7272-54]S11
Matsukawa, Daisaku [7273-77] SPS1
Matsumaro, Kazuyuki [7273-131]SPS5
Matsumaru, Shogo [7273-07]S2
Matsumoto, Nobuaki [7273-151] SPS7
Matsumoto, Shinichi [7274-153] SPS11
Matsumura, Nobuji [7273-134] SPS5
Matsunaga, Kentaro [7273-57] S12
Matsunaga, Shuji [7273-124] SPS4
Matsunaga, Takashi [7274-153] SPS11, [7274-156]SPS11
Matsunari, Shuichi [7271-134] SPS6, [7271-136]SPS6
Matsuoka, Ryoichi [7272-94] SPS1, [7275-60]SPS1, [7275-72]SPS1
Matsuoka, Yasuo [7275-33] SPS1
Matsuyama, Tomoyuki [7274-07]S3, [7274-58]S14
Matsuzawa, Kensuke [7273-143]SPS6
Matsuzawa, Nobuyuki N. 7273 ProgComm, 7273 S8 SessChr
Matthew, Itty [7273-26]S7, [7274-128]SPS7
Matyi, Richard J. [7271-153] SPS9
Maul, Manfred [7274-09]S3, [7274-63]S15
Maurer, Wilhelm 7274 ProgComm
Maury, Patrick [7274-69]SPS1
Maxim, Nicolae [7273-41]S9
Mbanaso, Chimaobi [7271-76] S15
McCallum, Martin [7274-31]S8, [7274-111]SPS6, [7275-42] SPS1
McCarthy, Patrick M. [7274-107]SPS5
McGarvey, Steve A. [7272-150] SPS1
McGowan, Sarah N. [7274-52] S13
McIntyre, Greg [7271-45]S10, [7274-09]S3, [7271-03]S1, [7271-30]S7, [7271-48]S10, [7272-76]SPS1, [7274-106] SPS5
McKenzie, Douglas S. [7273-153]SPS7
McLellan Martin, Erin [7274-03] S2

Bold = SPIE Member

McMackin, Ian [7271-66]S13, [7271-88]SPS1
Meador, Jim D. [7273-87]SPS2
Medvedeva, Marina G. [7274-142]SPS9
Mehrotra, Vikas [7275-76]SPS1
Mehta, Sohan S. [7274-128] SPS7
Meier, Winfried W. [7274-111] SPS6, [7275-42]SPS1
Meiling, Hans 7271 S7 SessChr, [7271-01]S1
Meinders, Erwin [7271-62]S13
Meiring, Jason E. [7274-05]S2, [7274-48]S12, [7275-08]S2
Mekias, Kader [7271-88]SPS1
Melina, Tapia-Tapia [7273-119] SPS4
Melville, David O. [7274-08] S3, [7274-09]S3, [7274-11] S3, [7274-50]S12, [7274-145] SPS9
Melvin, Lawerence S. [7274-92]SPS4, [7274-138]SPS8, [7275-68]SPS1
Melzner, Hanno [7275-65]SPS1
Menadeva, Ovadya [7272-29] S6, [7275-36]SPS1, [7275-54] SPS1
Menger, Jasper [7274-113]SPS6
Menguelti, Kevin [7272-23]S5
Menon, Rajesh [7271-28]S6
Menoni, Carmen S. [7271-125] SPS5
Mercado, Ramil-Marcelo L. [7273-87]SPS2
Mesawich, Michael [7273-70] SPS1
Meshulach, Doron [7272-25]S5
Metz, Andrew W. [7273-96] SPS3
Meyerson, Bernard S. [AL09PL-03]SPL3
Meyette, Eric [7272-124]SPS1
Meynen, Herman [7273-176] SPS8
Miao, Jianwei [7272-14]S3
Miao, Liyan [7273-23]S6, [7274-149]SPS10
Michaelson, Timothy B. [7273-126]SPS5
Michallon, Philippe [7271-142] SPS7
Micheel, Christine [7271-82]S17
Michio, Tanaka [7273-71]SPS1
Mii, Y. J. [7272-24]S5, [7272-64] S13
Mikami, Koji [7274-33]S8
Mikami, Shinji [7271-81]S16
Mikami, Toru [7272-161]SPS1
Mikkelson, Andrew R. [7271-17] S4
Milenin, Alexey [7274-23]S6
Miller, Andy [7274-23]S6
Miller, Dan [7271-25]S6
Miller, Dolores C. [7271-78]S16, [7271-80]S16, [7272-44]S10
Miller, Elizabeth [7273-53]S12
Miller, Marshal A. [7274-78] SPS3
Miller, Michael L. [7271-56]S12
Miller, Robert D. [7273-157] SPS7
Miller, Ron [7271-90]SPS1
Milster, Thomas D. SC707 Inst
Mimotogi, Shoji [7273-15]S4, [7274-51]S12, [7274-134] SPS8
Mimura, Takeyoshi [7273-30]S8, [7273-122]SPS4
Min, Ke [7273-06]S2, [7273-20] S5, [7273-29]S8
Min, Young-Hong [7274-125] SPS7
Minnaert-Janssen, Ingrid [7272-91]SPS1
Mirkarimi, Paul B. [7271-124] SPS5
Mishra, Sandipan [7275-50] SPS1
Mita, Michihiro [7273-10]S3
Mitra, Thomas [7272-153]SPS1
Mitsuhashi, Takashi [7271-20] S5
Mitsui, Tadashi [7272-56]S12
Mitsukura, Kazuyuki [7273-77] SPS1
Miura, Akihiro [7272-38]S8
Miura, Takaharu [7271-67]S14
Miyakawa, Ryan H. [7272-71] SPS1
Miyake, Akira [7271-134]SPS6
Miyasaka, Mami [7272-18]S4
Miyashita, Katsura [7274-51] S12
Miyauchi, Tomofumi [7273-129] SPS5
Miyazaki, Noriyuki [7274-151] SPS11
Mizoguchi, Hakaru [7271-07] S3, [7274-153]SPS11, [7274-156]SPS11
Mizokoshi, Hiroshi [7271-120] SPS4
Mizuno, Hiroyuki [7271-03]S1, [7271-30]S7, [7271-43]S9, [7271-45]S10, [7271-48]S10, [7273-35]S8
Mizuochi, Jun [7271-94]SPS1
Mochi, Iacopo [7271-50]S10, [7271-72]S14, [7271-129] SPS5
Moert, Manfred [7271-95]SPS2
Mohan, Jayanth J. [7274-50] S12
Mohri, Hiroshi [7271-94]SPS1
Mojumder, Niladri N. [7275-45] SPS1
Mokaberi-Nezhad, Babak [7271-61]S13
Momonoi, Yoshinori [7272-97] SPS1
Montgomery, Cecilia [7271-31] S7
Montgomery, Warren M. [7271-32]S7
Moon, Jae-In [7271-149]SPS8
Moon, Joo-Tae [7274-83]SPS4, [7274-94]SPS4, [7274-95] SPS4
Moon, Juhyoung [7272-110] SPS1
Moon, Seung-Chan [7271-41] S9, [7271-51]S10, [7273-24]S6
Moore, Bobby [7274-119]SPS6
Morecroft, Deborah [7271-59] S12
Morgan, Ray E. [7271-23]S6, [7271-55]S11
Morgenfeld, Bradley J. [7274-06]S2, [7274-11]S3
Mori, Glen [7272-128]SPS1, [7273-12]S3, [7273-60]SPS1, [7273-71]SPS1, [7273-107] SPS3, [7273-133]SPS5
Mori, Hideto [7271-116]SPS4
Mori, Ichiro [7271-13]S4, [7271-74]S14
Mori, Ken-ichiro [7274-55]S14
Mori, Mike [7273-93]SPS2
Morikawa, Yasutaka [7271-94] SPS1
Morimoto, Takafumi [7272-70] S14
Morishima, Hideki [7271-68]S14
Morita, Akihiko [7273-126]SPS5
Morita, Hiroshi [7273-173]SPS9
Morita, Kenji [7271-67]S14
Morita, Satoshi [7271-25]S6
Moriya, Masato [7271-07]S3, [7271-114]SPS4
Morohoshi, Hiroshi [7274-55] S14
Moroz, Victor [7275-56]SPS1
Morshed, Ahmed H. [7274-135] SPS8
Morton, Rob [7274-111]SPS6
Moyer, Eric S. [7273-176]SPS8
Mozdzen, Grazyna [7271-99] SPS2
Mukai, Hidefumi [7275-33]SPS1
Mukhopadhyay, Sudip [7274-102]SPS5
Mulder, Melchior [7274-62]S15, [7274-09]S3
Mülders, Thomas [7273-45]S10
Mulholland, Tom C. [7271-131] SPS5
Mulkens, Jan C. H. [7274-56] S14
Müller, Rainer [7271-08]S3
Munoz, Andres [7272-58]S12
Murakami, Hiroki [7273-146] SPS6
Murakami, Katsuhiko [7271-67] S14, [7271-69]S14, [7271-134] SPS6, [7271-136]SPS6
Murakami, Miki [7273-151]SPS7
Murakami, Takashi [7273-15]S4, [7274-51]S12
Muramatsu, Ken-ichi [7274-155] SPS11
Muramatsu, Makoto [7273-57] S12
Murayama, Ken [7272-97]SPS1
Murnane, Margaret M. [7272-14] S3
Murray, Todd W. [7272-80]SPS1
Muta, Hidemasa [7274-08]S3
Muto, Daizo [7273-16]S4
Myers, Alan M. [7271-15]S4, [7271-42]S9
Myers, Dave W. [7271-02]S1, [7271-119]SPS4

N

Na, Young-Hye [7271-83]S17
Nackaerts, Axel [7271-49]S10, [7275-16]S4
Nafisi, Kourosh [7273-139]SPS5
Nafus, Kathleen R. [7273-13]S4, [7273-50]S11, [7274-17]S5, [7274-66]SPS1
Nagahama, Ichirota [7275-33] SPS1
Nagahara, Seiji [7273-15]S4, [7274-51]S12
Nagai, Satoshi [7274-53]S13
Nagai, Shinji [7271-07]S3, [7274-156]SPS11
Nagaishi, Hiroshi [7272-54]S11
Nagano, Hitoshi [7271-07]S3, [7274-156]SPS11
Nagaoka, Shirou [7272-25]S5
Najmabadi, Farrokh [7271-109] SPS4, [7271-117]SPS4
Nakagawa, Seiji [7273-126] SPS5
Nakagawa, Shinichiro [7273-15] S4, [7274-51]S12
Nakagawa, Yasutada [7271-81] S16
Nakajima, Fumiharu [7274-18] S5
Nakajima, Yasuyuki [7273-80] SPS1, [7273-166]SPS8
Nakajima, Yumi [7271-74]S14
Nakamura, Daisuke [7271-115] SPS4
Nakamura, Junji [7273-125] SPS4
Nakamura, Shinichi [7272-25]S5
Nakamura, Takayuki [7271-64] S13
Nakamura, Tsuyoshi [7273-03] S2
Nakano, Katsushi [7273-160] SPS7, [7274-61]S15
Nakano, Masaki [7271-07]S3, [7271-115]SPS4
Nakao, Shuji [7274-131]SPS8
Nakarai, Hiroaki [7274-153] SPS11, [7274-156]SPS11
Nakashima, Toshiharu [7274-07] S3
Nakasugi, Tetsuro [7271-81] S16, [7272-21]S4
Nakata, Toshihiko [7272-70]S14
Nakayama, Takahiro [7271-134] SPS6, [7271-136]SPS6
Nakayama, Yoshinori [7272-84] SPS1
Nam, Byoung-Sub [7271-149] SPS8
Nam, Byung-Ho M. [7271-149] SPS8
Nam, Hyunhee [7273-90]SPS2
Nam, Sangmo [7272-19]SPS1
Nam, Yunsuk [7273-89]SPS2
Naruoka, Takehiko [7273-134] SPS5
Nath, Pranay [7274-105]SPS5
Naulleau, Patrick P. SC888 Inst, 7271 ProgComm, 7271 S10 SessChr, 7271 S15 SessChr, [7271-32]S7, [7271-33]S7, [7271-72]S14, [7271-73]S15, [7271-125]SPS5, [7272-10]S3, [7272-71]SPS1, [7273-35]S8, [7273-51]S11
Nawata, Teruhiko [7274-151] SPS11
Nealey, Paul F. [7271-86]S17
Neef, Charles J. [7273-86] SPS2
Neef, Jody C. [7274-104]SPS5
Neff, Willi [7271-09]S3
Negoro, Sei [7273-71]SPS1
Neikirk, Colin C. [7273-21]S6
Neisser, Mark [7273-91]SPS2, [7273-153]SPS7
Nelson, A. [7273-157]SPS7
Nesterenko, Viatcheslav [7271-37]S8
Neumann, Martin J. [7271-122] SPS5
Neumayer, D. [7273-157]SPS7
Neureuther, Andrew R. SC102 Inst, [7271-50]S10, [7274-45] S11, [7274-78]SPS3, [7275-06]S2, [7275-11]S3, [7275-22] S5, [7275-46]SPS1
Ng, Edward [7273-91]SPS2
Ng, Hoi Tou [7271-22]S5
Ng, Sern Loong [7272-100] SPS1
Ng, Teng H. [7272-132]SPS1
Ng, Walter [7275-77]SPS1
Ngai, Anthony [7274-04]S2
Ngai, Chris [7274-148]SPS10, [7274-149]SPS10, [7275-59] SPS1
Ngo, Yit Sung [7272-134]SPS1
Ni, Candice [7274-12]S4
Nieh, Chester [7274-12]S4
Niekrewicz, Brian [7271-31]S7
Niell, Fred M. [7271-121]SPS4
Nielson, Ryan R. [7272-33]S7
Niemi, Tapio [7271-58]S12
Niibe, Masahito [7271-134] SPS6, [7271-136]SPS6
Nikolic, Borivoje [7275-22]S5
Nikolsky, Peter [7274-04]S2
Nishihara, Katsunobu [7271-110]SPS4
Nishikawa, Jin [7271-69]S14
Nishikawa, Naoyuki [7273-31] S8, [7273-34]S8, [7273-108] SPS4
Nishikawa, Takeshi [7271-110] SPS4
Nishikido, Shuuichi [7273-79] SPS1
Nishimura, Eiichi [7273-61] SPS1, [7273-146]SPS6
Nishimura, Naosuke [7271-130] SPS5, [7271-132]SPS5
Nishinaga, Hisashi [7274-30]S8
Nishisaka, Toshihiro [7271-07] S3
Nishiyama, Yasushi [7271-13]S4
Noda, Tomoya [7274-07]S3
Noga, David [7273-17]S5, [7273-116]SPS4
Nogatch, John T. [7271-23]S6, [7271-55]S11
Noguchi, Kohei [7271-25]S6
Nomachi, Akiko [7274-51]S12
Nomura, Kazushi [7271-69]S14
Noordman, Oscar [7274-62]S15, [7274-63]S15
Noot, Marc [7272-155]SPS1
Northrop, Gregory A. [7275-10] S3
Nouh, Ahmed [7272-46]S10
Novikov, Yury A. [7272-37]S8, [7272-87]SPS1
Nowak, Krzysztof M. [7271-07] S3
Numaguchi, Toru [7273-54]S12

O

Oba, Toshihide [7271-64]S13
Ober, Christopher K. [7273-58] S12, [7273-132]SPS5, [7273-137]SPS5, [7273-149]SPS7, [7273-152]SPS7, [7273-158] SPS7
Oberai, Assad A. [7274-50]S12
Oberschmidt, James M. [7274-36]S9, [7274-88]SPS4, [7274-97]SPS4, [7275-08]S2
O'Brien, Kelly [7272-115]SPS1
O'Brien, Kevin [7274-158] SPS11
O'Connell, Kathleen M. [7273-92]SPS2, [7273-93]SPS2
Odaka, Takahiro [7272-54]S11
Oemardani, Shiany [7274-149] SPS10
Oga, Toshihiro [7274-115]SPS6
Ogata, Yoichi [7273-29]S8
Ogawa, Riki [7272-90]SPS1
Ogawa, Tsuyoshi [7271-93] SPS1
Ogino, Hirotaka [7274-151] SPS11

Oguro, Dai [7273-155]SPS7
Oh, Changil [7273-24]S6
Oh, Hye-Keun [7271-147]SPS8, [7272-85]SPS1, [7273-47]S10, [7273-73]SPS1, [7273-140] SPS6, [7273-141]SPS6, [7273-164]SPS8, [7274-71]SPS2
Oh, Seok-Hwan [7273-14]S4
Oh, Seyoung [7274-91]SPS4
Oh, Sung Bae [7273-85]SPS2
Oh, Tae-Hwan [7273-89]SPS2
Oh, Tae-Sik [7272-139]SPS1
Ohashi, Tomoya [7273-80]SPS1
Ohmori, Katsumi [7273-03]S2
Ohno, Hidetoshi [7273-151] SPS7
Ohta, Takeshi [7274-156]SPS11
Ohya, Kaoru [7272-26]S6, [7272-103]SPS1
Ohyi, Hideyuki [7271-96]SPS2
Oizumi, Hiroaki [7273-111] SPS4, [7273-114]SPS4
Ojima, Tomoko [7274-51]S12
Okada, Naotada [7272-50]S11
Okada, Tatsuo [7271-115]SPS4
Okamura, Haruyuki [7273-77] SPS1, [7273-112]SPS4, [7273-166]SPS8
Okazaki, Kota [7271-115]SPS4
Okazaki, Shinji 7271 ProgComm, 7271 S14 SessChr, 7271 S7 SessChr
Okoroanyanwu, Uzodinma [7271-03]S1, [7271-43]S9
Okubo, Yukiharu [7271-67]S14
Okuyama, Ken-ichi [7273-159] SPS7
Olivares, Marc [7275-30]SPS1
Olubuyide, Oluwamuyiwa O. [7275-12]S3
Onoda, Naka [7274-103]SPS5
Onodera, Junichi [7273-122] SPS4, [7273-143]SPS6
Onoue, Seiji [7275-18]S4
Onvlee, Hans [7274-152]SPS11
Oori, Tomoya [7273-57]S12
Ori, Tomoya [7273-16]S4
Orji, Ndubuisi G. [7272-08]S2, PanelModerator
Orlikovsky, Alexander A. [7272-87]SPS1
Orshansky, Michael [7275-15]S4
Orvek, Kevin [7271-18]S4, [7271-76]S15
Osaki, Mayuka [7272-39]S8, [7272-93]SPS1
Oshino, Tetsuya [7271-69]S14
Ostrovski, Y. [7273-157]SPS7
O'Sullivan, Gerry D. [7271-106] SPS4
Ota, Hitoshi [7272-114]SPS1
Ota, Kazuya [7271-126]SPS5, [7271-130]SPS5, [7271-132] SPS5
Ota, Takumi [7271-81]S16
Otsuka, Takahisa [7273-13]S4, [7273-69]SPS1
Owa, Soichi 7274 ProgComm, 7274 S5 SessChr, [7274-61] S15
Owada, Takanori [7273-156] SPS7
Owe-Yang, Dah-Chung 7273 ProgComm, 7273 S4 SessChr
Ozawa, Ken 7274 ProgComm, 7274 S5 SessChr, 7274 S11 SessChr, 7274 S13 SessChr
Ozerin, Yury [7272-37]S8

P

Padmanaban, Munirathna [7273-82]SPS1, [7273-91] SPS2
Pae, YeonHo [7272-135]SPS1, [7272-147]SPS1
Paek, Seung Weon [7275-71] SPS1
Pagdanganan, Cindy [7275-79] SPS1
Pain, Laurent 7271 ProgComm, 7271 S6 SessChr, [7271-20] S5, [7271-27]S6, [7271-55]S11
Painter, Benjamin D. [7274-38] S9
Pakdaman, Nader [7272-178] SPS1
Paleari, Flavio [7272-40]S9
Palmacci, Steven T. [7274-74] SPS2
Palmer, Richard E. [7273-18]S5
Palmieri, Frank L. [7271-93] SPS1
Pan, David Z. [7275-53]SPS1
Panda, Rajendran [7275-53] SPS1
Pandey, Yamini [7274-102]SPS5
Pang, Liang-Teck [7275-22]S5
Paraskevopoulos, Anagnostis [7271-53]S11
Pargon, Erwine [7272-23]S5, [7273-177]SPS6
Parisoli, Lidia [7271-64]S13
Park, Chang Min [7271-40]S9, [7271-146]SPS8
Park, Chan-Ha [7274-125]SPS7
Park, Dong Woon [7274-83] SPS4
Park, Dong-Heok [7273-93] SPS2
Park, In-Ho [7274-71]SPS2
Park, Jae-eun [7275-19]S5
Park, Jai-Kyun [7275-70]SPS1
Park, Jeong-Lyeol [7272-123] SPS1
Park, Jinho [7273-62]SPS1, [7273-171]SPS9
Park, JinHong [7271-40]S9, [7271-146]SPS8, [7272-45] S10, [7272-52]S11
Park, Jongcheon [7274-91] SPS4
Park, Joon-Min [7273-47]S10, [7273-140]SPS6, [7273-164] SPS8, [7274-71]SPS2
Park, Joon-Soo [7272-106] SPS1
Park, Joonwoo [7273-47]S10
Park, Joo-On [7271-40]S9, [7271-73]S15, [7271-146] SPS8
Park, Jung-Chul [7272-06]S2
Park, Jun-Taek [7271-41]S9, [7271-51]S10
Park, Ki-Yeop [7274-125]SPS7
Park, Minyoung [7272-46]S10
Park, O-Seo [7274-97]SPS4
Park, Sang-Min [7271-85]S17
Park, Sarohan [7271-41]S9, [7271-51]S10
Park, Seh-Jin [7271-15]S4
Park, Seung-Ryong [7273-62] SPS1, [7273-171]SPS9, [7274-122]SPS6
Park, Seung-Wook [7273-164] SPS8
Park, Sinjeung [7271-104]SPS3
Park, Songyi [7272-85]SPS1
Park, Sungki [7271-41]S9, [7272-53]S11, [7274-125] SPS7, [7274-144]SPS9
Park, Tae-Hoon [7274-94]SPS4
Park, Yong Hee [7275-26]S6
Park, Young-Kyou [7272-126] SPS1, [7273-76]SPS1
Parker, N. William [7271-19]S5, [7271-25]S6
Parkinson, Blake [7272-124] SPS1
Parthasarathy, Deepa [7273-82] SPS1, [7273-91]SPS2
Parthier, Lutz [7274-59]S14
Partlo, William N. [7271-02]S1, [7271-119]SPS4, [7274-159] SPS11
Partlow, Matthew J. [7271-121] SPS4
Patel, Jyotica [7273-157]SPS7
Patel, Neil S. [7274-107]SPS5
Patil, Manish J. [7272-74]SPS1
Patra, Michael [7274-62]S15, [7274-63]S15
Patrick, Heather J. [7271-79] S16, [7272-30]S7
Patsis, George P. [7273-177] SPS6
Pauer, Hagen [7271-10]S3
Paul, Ariel [7272-14]S3
Paunescu, Margareta [7273-65] SPS1
Pawloski, Adam R. 7273 ProgComm, 7273 S6 SessChr, 7273 S10 SessChr
Pawlowski, Georg [7273-65] SPS1
Pedaci, Francesco [7271-125] SPS5
Pelella, Mario M. [7272-178] SPS1
Peltinov, Ram [7275-36]SPS1
Peng, Ray-Chen [7274-114] SPS6
Pepper, Susanne [7272-82] SPS1
Perez, Joseph [7271-61]S13
Perez, Valerio [7275-77]SPS1
Perlitz, Sascha [7272-47]S10
Perraud, Loic [7274-41]S10
Perret, Damien [7273-05]S2
Perske, Marco [7271-10]S3, [7271-37]S8
Pessa, Markus [7271-58]S12
Peter, Kai [7275-65]SPS1
Peters, Jan Hendrik 7271 ProgComm
Petersen, John S. [7271-103] SPS3, [7274-67]SPS1
Petric, Paul F. [7271-06]S2
Petrillo, Karen E. [7271-03]S1, [7271-43]S9, [7273-35]S8, [7273-96]SPS3, [7273-139] SPS5, [7274-03]S2, [7274-20] S5
Pickup, Lance D. [7275-19]S5
Pierson, Bill [7271-03]S1, [7271-43]S9, [7271-73]S15, [7273-35]S8
Pierzchala, Edmund [7275-55] SPS1
Pike, Michael [7272-44]S10
Pikon, Amandine [7273-05]S2
Pikus, Fedor G. [7275-49] SPS1, [7275-54]SPS1, [7275-55]SPS1
Pileggi, Larry SC942 Inst, [7274-42]S10, [7275-10]S3
Pilz, Wolfgang [7271-23]S6
Pirri, Fabrizio [7274-109]SPS5
Piscani, Emil C. [7273-39]S9, [7274-104]SPS5
Planchot, Jonathan [7274-41] S10
Platzgummer, Elmar [7271-23] S6, [7271-98]SPS2
Pletner, Baruch [7272-80]SPS1
Pohling, Lua [7272-132]SPS1
Politi, Gary [7274-63]S15
Pollentier, Ivan K. A. [7271-152] SPS9
Polli, Marco [7272-118]SPS1
Polonsky, Netanel [7272-89] SPS1, [7272-129]SPS1
Pomerantsev, Michael [7274-89] SPS4
Ponomarenco, Denis [7273-45] S10
Poolla, Kameshwar [7275-03] S1, [7275-50]SPS1
Poonawala, Amyn A. [7274-38] S9
Popova, Irene Y. [7273-25]S7, [7273-139]SPS5
Popova, Vera [7271-63]S13
Popove, Irene [7273-27]S7
Poppe, Wojtek J. [7275-06]S2
Pottebaum, Indira [7273-52]S11
Potzick, James E. [7272-48]S10
Prabhu, Vivek M. 7273 ProgComm, 7273 S10 SessChr, 7273 S6 SessChr, [7273-36]S9, [7273-149]SPS7
Pradelles, Jonathan [7271-27] S6
Prager, Daniel [7272-124]SPS1
Praseuth, David [7273-92]SPS2
Prea, Marco [7271-11]S3
Preece, Jon A. [7273-18]S5
Price, Jimmy M. [7272-104] SPS1
Prins, Steven L. [7275-12]S3
Printz, Wallace P. [7273-106] SPS3
Pritschow, Marcus [7271-64] S13
Progler, Christopher J. SympChair, [7275-17]S4
Prokopowicz, Gregory P. [7273-27]S7
Puls, Jana [7271-141]SPS7
Purushothaman, Sampath [7273-157]SPS7
Putna, Ernisse S. [7271-42]S9, 7273 ProgComm, 7273 S8 SessChr, 7273 S12 SessChr, [7273-33]S8, [7273-110]SPS4
Pylneva, Lyudmila [7273-153] SPS7
Pyo, Yu-Jin [7275-70]SPS1

Q

Qian, Kun [7275-04]S2
Qiu, Yilin [7273-87]SPS2
Quaglio, Marzia [7274-109] SPS5
Quan, Chenggen [7274-124] SPS7
Quek, Shyue Fong [7275-77] SPS1
Quintanilha, Richard [7272-157] SPS1

R

Rabello, Silvio [7272-06]S2, [7272-65]S13
Rafac, Robert J. [7274-159] SPS11
Raffard, Herve [7275-69]SPS1
Raghunathan, Sudhar [7271-03] S1
Raghunathan, Sudharshanan [7271-31]S7, [7273-35]S8
Rahman, M. Dalil [7273-153] SPS7
Raines, Kevin [7272-14]S3
Raj, Daemian [7275-79]SPS1
Rajagopal, Arjun [7275-21]S5
Raju, Ramasamy [7271-35]S8, [7271-112]SPS4, [7271-118] SPS4, [7271-122]SPS5
Rakov, Alexander [7272-37]S8, [7272-87]SPS1
Ramaswamy, Vasu [7271-17]S4
Rana, Narender [7272-02]S1, [7272-69]S14
Ranade, Rajiv [7274-52]S13
Randive, Rajul V. [7271-124] SPS5
Rangarajan, Srinivasan [7272-58]S12
Rankin, Jed H. [7272-44]S10
Rao, Jian [7274-87]SPS4
Rao, Rajasekhar [7274-159] SPS11
Rao, Zhilong [7271-103]SPS3
Rastegar, Abbas [7271-14]S4
Rastogi, Abhinav [7273-58]S12
Rathsack, Benjamin M. [7273-50]S11
Rauscher, Michael [7272-127] SPS1
Rayasam, Mahidhar [7273-08] S3
Raymond, Christopher J. 7272 CoChr, 7272 S SessChr
Raymondson, Daisy A. [7272-14]S3
Reboud, Vincent [7271-65]S13
Reese, Bryan W. [7272-152] SPS1
Reilly, Michael T. [7273-42]S10, [7273-43]S10
Reiss, Ira [7271-124]SPS5
Rekawa, Senajith B. [7271-33] S7
Ren, Liping [7271-31]S7, [7271-73]S15, [7271-129]SPS5
Ren, Racel [7272-91]SPS1
Renegar, Thomas B. [7272-08] S2
Renwick, Stephen P. [7274-86] SPS4
Resnick, Douglas J. SC622 Inst, 7271 ProgComm, 7271 S12 SessChr, [7271-56]S12, [7271-66]S13
Rettner, Charles T. [7271-82] S17, [7271-83]S17, [7271-85] S17
Revuru, Srividya [7271-75]S15, [7273-32]S8
Reyes, Santos [7273-70]SPS1
Rice, Bryan J. [7274-72]SPS2
Richter, Lee J. [7271-79]S16
Richter, Rigo [7272-111]SPS1
Rieger, Michael L. 7275 CoChr, 7275 S6 SessChr, AL09SE S SessChr
Riffel, Bryan D. [7274-30]S8
Riggleman, Robert A. [7273-58] S12
Rigolli, Pierluigi [7272-40]S9, [7274-118]SPS6
Rijpers, Bart [7272-127]SPS1

Index of Authors, Chairs, and Committee Members

Bold = SPIE Member

Rikhi, Sunit [7275-02]S1
Riley, Deborah [7275-12]S3
Rio, David [7271-27]S6
Riviere Cazaux, Lionel [7275-30]SPS1, [7275-37]S2
Ro, Hyun Wook [7271-63]S13, [7271-79]S16
Robert, Frederic [7274-41]S10
Roberts, Jeanette M. [7273-52]S11, [7273-121]SPS4
Robertson, Stewart A. [7273-42]S10, [7273-43]S10, [7273-46]S10, [7274-22]S6, [7274-132]SPS8, [7275-34]SPS1, [7275-58]SPS1
Robinett, Warren [7271-05]S2
Robinson, Alex P. G. [7273-18]S5
Robinson, Christopher F. [7273-139]SPS5
Robinson, John C. [7272-05]S2, [7272-115]SPS1, [7272-120]SPS1, [7272-136]SPS1
Rocca, Jorge J. [7271-125]SPS5, [7271-133]SPS6
Rochelle, Timothy [7273-21]S6
Rodriguez, Norma P. [7275-50]SPS1, [7275-52]SPS1
Rodriguez, Robert [7273-132]SPS5, [7273-137]SPS5
Rohmund, Frank [7274-09]S3, [7274-62]S15
Rokitski, Slava [7274-159]SPS11
Rolick, JoAnn [7273-25]S7
Rolick DiGiacomio, JoAnn [7274-106]SPS5
Roller, John [7271-32]S7
Rollinger, Bob [7271-105]SPS4, [7271-107]SPS4
Ronse, Kurt G. [7274-02]S1
Rooyackers, Rita [7272-27]S6
Röpke, Christoph [7274-76]SPS3
Rosenbluth, Alan E. [7274-08]S3, [7274-09]S3, [7274-11]S3, [7274-50]S12, [7274-145]SPS9
Rosslee, Craig A. [7272-128]SPS1, [7273-75]SPS1, [7273-133]SPS5
Rost, Daniel L. [7272-91]SPS1
Röth, Klaus-Dieter [7272-114]SPS1
Rothemund, Paul W. K. [7271-82]S17
Rothschild, Mordechai [7274-74]SPS2
Rotshtein, Israel [7275-36]SPS1
Routh, Robert M. [7271-03]S1, [7271-43]S9, [7273-04]S2, [7273-35]S8
Rovner, Vyacheslav [7274-42]S10, [7275-10]S3
Rowley, Steven [7272-176]SPS1
Rozzoni, Laura [7272-40]S9
Rubin, Mark E. [7275-57]SPS1
Rubinstein, Juliet A. [7274-45]S11, [7275-06]S2
Russ, Carsten [7274-09]S3
Ruzic, David N. [7271-35]S8, [7271-112]SPS4, [7271-118]SPS4, [7271-122]SPS5, [7273-49]S11

S

Sagan, John P. [7273-64]SPS1, [7273-82]SPS1
Sagar, Prashanth [7275-19]S5
Sagawa, Natsuko [7273-160]SPS7
Sagiv, Amir M. [7272-89]SPS1, [7272-129]SPS1
Sahoo, Pratap [7273-32]S8
Sahouria, Emile [7274-89]SPS4
Said, Mazen [7272-57]S12
Saied, Mazen [7274-41]S10
Saini, Rahul [7272-118]SPS1
Saito, Misako [7272-26]S6
Sakai, Hideo [7272-94]SPS1
Sakai, Junjiro [7274-131]SPS8
Sakai, Yuko [7271-94]SPS1
Sakajiri, Kyohei [7275-35]SPS1
Sakaki, Masashi [7271-94]SPS1
Sakamoto, Masaharu [7274-08]S3
Sakurai, Koichi [7272-54]S11
Sallee, Christopher A. [7274-132]SPS8, [7275-34]SPS1
Salmaso, Guido [7271-11]S3
Salski, Bartlomiej W. [7272-15]S4, [7272-40]S9
Salvetat, Vincent [7274-31]S8
Samarakone, Nandasiri [7274-65]SPS1
Samoto, Norihiko [7271-100]SPS2
Sanada, Masakazu [7273-135]SPS5
Sanchez, Martha I. 7272 ProgComm
Sandberg, Richard L. [7272-14]S3
Sanders, Daniel P. [7271-83]S17, [7273-139]SPS5
Santillan, Julius Joseph S. [7273-114]SPS4
Sarma, Chandrasekhar [7274-34]S9
Sarroukh, Ouassima [7271-106]SPS4
Sasaki, Akira [7271-110]SPS4
Sasaki, Shiho [7271-94]SPS1
Sasaki, Takashi [7273-118]SPS4
Sasaki, Youichi [7271-07]S3, [7271-115]SPS4
Satake, Masaki [7273-15]S4, [7274-51]S12
Sato, Hiodetoshi [7272-94]SPS1
Sato, Hiroto [7271-120]SPS4
Sato, Kazuya [7274-53]S13
Sawada, Masayasu [7274-155]SPS11
Schacht, Jochen [7274-123]SPS7, [7275-73]SPS1
Scheer, Steven A. [7273-69]SPS1, [7273-106]SPS3, [7274-17]S5
Schefske, Jeff A. [7272-115]SPS1
Scheinberg, Katya [7274-08]S3
Schellenberg, Frank M. 7271 Chr, 7271 S SessChr, 7271 S2 SessChr
Scherübl, Thomas [7272-111]SPS1
Scheuermann, Hans [7271-09]S3
Schiavone, Patrick [7272-57]S12, [7272-156]SPS1
Schlotter, William [7272-14]S3
Schmid, Gerard M. [7271-56]S12
Schmoeller, Thomas [7271-145]SPS8, [7273-45]S10, [7274-16]S5, [7274-21]S6
Scholze, Frank [7271-141]SPS7
Schreel, Koen [7272-164]SPS1
Schriever, Guido [7271-08]S3, [7271-09]S3, [7271-11]S3
Schroeder, Uwe P. [7274-06]S2
Schulz, Bernd [7272-17]S4, [7272-58]S12
Schulze, Steffen F. [7274-89]SPS4
Schulze, Uwe [7272-07]S2
Schumaker, Phil [7271-61]S13
Schürmann, Mark [7271-10]S3, [7271-37]S8
Schürmann, Max C. [7271-08]S3, [7271-11]S3, [7271-37]S8
Schwartz, Evan [7273-06]S2
Sczyrba, Martin [7274-76]SPS3
Seamons, Martin [7275-79]SPS1
Seifert, Frank [7274-59]S14
Seifert, Uwe [7272-131]SPS1
Seino, Yuriko [7273-15]S4, [7274-51]S12
Seitz, Christoph [7274-59]S14
Seitz, Holger [7272-111]SPS1
Seki, Miyoshi [7273-131]SPS5
Seki, Rei [7274-61]S15
Sekiguchi, Atsushi [7273-105]SPS3
Sekiguchi, Kohei [7272-95]SPS1
Sekino, Satoshi [7272-70]S14
Sekito, Toshiyuki [7272-25]S5, [7274-61]S15
Selinidis, Kosta S. [7271-66]S13
Seltmann, Rolf [7272-07]S2, [7272-17]S4, [7274-111]SPS6
Sendelbach, Matthew [7272-32]S7, [7272-58]S12
Sendler, Michael [7272-32]S7
Sentoku, Koichi [7272-130]SPS1
Seo, Hwan-Seok [7271-12]S4
Seong, Nakgeuon [7272-126]SPS1
Sequioa, Kevin L. [7271-117]SPS4, [7271-109]SPS4
Ser, Jung-Hoon [7274-94]SPS4
Serebriakov, Alexander [7272-132]SPS1
Servin, Isabelle [7274-31]S8, [7274-69]SPS1
Seshimo, Takehiro [7273-143]SPS6
Settlemyer, Kenneth [7274-36]S9
Sevegney, Michael S. [7273-70]SPS1
Severgnini, Ermes [7272-40]S9
Sezginer, Apo [7274-10]S3, [7275-27]S6
Sha, Jing [7273-152]SPS7, [7273-158]SPS7
Shabty, Saar [7272-25]S5
Shacham-Diamand, Yosi Y. [7275-36]SPS1
Shao, Dong-Bing [7274-88]SPS4
Shao, Feng [7274-24]S6, [7274-67]SPS1
Shao, Wenjin [7274-114]SPS6
Sharma, Puneet [7275-30]SPS1, [7275-77]SPS1
Sharma, Shalini [7273-29]S8
Shauly, Eitan N. [7272-29]S6, [7275-29]SPS1, [7275-36]SPS1, [7275-54]SPS1
Shen, Regina [7275-73]SPS1
Shibata, Tsuyoshi [7272-62]S12, [7273-13]S4, [7273-69]SPS1, [7273-134]SPS5
Shibayama, Koichiro [7272-56]S12
Shibazaki, Yuichi [7274-54]S14
Shibuya, Akinori [7273-63]SPS1
Shieh, Jason J. S. [7272-164]SPS1
Shigemori, Kazuhito [7273-135]SPS5, [7273-138]SPS5
Shigemura, Hiroyuki [7271-13]S4, [7272-90]SPS1
Shih, Chiang Lin [7274-12]S4
Shih, Chi-Yuan [7274-114]SPS6
Shim, Seongbo [7274-83]SPS4, [7274-81]SPS4, [7274-94]SPS4
Shimoaoki, Takeshi [7273-13]S4
Shimokawa, Tsutomu [7273-10]S3
Shimura, Satoru [7273-09]S3, [7273-61]SPS1, [7273-146]SPS6
Shin, Changyeop [7272-75]SPS1
Shin, Eunkyung [7273-24]S6
Shin, Hong-Jae [7273-89]SPS2
Shin, Hyungjoo [7271-35]S8, [7271-112]SPS4
Shin, Jang Ho [7272-19]SPS1
Shin, Min-Jung [7272-109]SPS1
Shin, Seung-Wook [7273-88]SPS2
Shindo, Hiroyuki [7275-60]SPS1
Shiobara, Eishi [7273-57]S12
Shiono, Daiju [7273-165]SPS8
Shioya, Takeo [7273-10]S3
Shirai, Masamitsu [7273-77]SPS1, [7273-112]SPS4, [7273-166]SPS8
Shirai, Seiichiro [7271-44]S9, [7271-116]SPS4, [7271-137]SPS6
Shiraishi, Masayuki [7271-69]S14
Shirakawa, Michihiro [7273-63]SPS1
Shirasaki, Hirokimi [7272-160]SPS1, [7272-167]SPS1
Shishido, Chie [7272-39]S8, [7272-93]SPS1
Shitani, Seiji [7273-126]SPS5
Shite, Hideo [7273-13]S4, [7273-55]S12
Shiu, Weicheng [7274-12]S4
Shneyder, Dmitriy [7272-58]S12
Sho, Koutaro [7273-16]S4
Shoji, Masahiro [7275-28]SPS1
Shoval, Lior [7272-88]SPS1, [7272-91]SPS1
Shu, Emily Y. [7271-15]S4
Shu, Jen [7275-59]SPS1
Shykind, David [7273-06]S2
Shyu, Deh-Ming [7272-63]S13
Siany, Amit [7275-36]SPS1
Siddiqui, Shahab [7274-36]S9
Sidelnikov, Yurri [7271-111]SPS4
Siebert, Joachim [7274-21]S6
Siemons, Guido [7271-09]S3
Silver, Richard M. 7272 ProgComm, [7272-01]S1, [7272-30]S7, [7272-43]S9, [7272-157]SPS1, PanelModerator
Simmons, Michelle Y. [7271-04]S2
Simon, Julia [7273-05]S2
Simonyi, Eva [7273-157]SPS7
Singh, Lovejeet [7272-06]S2
Singh, Rama N. SC889 Inst, [7275-45]SPS1
Singh, Sherjang [7271-88]SPS1
Singh, Vivek 7275 Chr, 7275 S1 SessChr, PanelModerator
Sirat, Gabriel Y. [7274-160]SPS11
Sirotkin, Vadim [7271-89]SPS1
Sitzmann, Wolfgang [7272-122]SPS1
Sivakumar, Sam 7274 ProgComm, 7274 S10 SessChr, 7274 S3 SessChr
Slezak, Mark [7273-71]SPS1, [7273-96]SPS3
Slodowski, Matthias [7271-26]S6
Slonaker, Steven D. [7274-30]S8, [7274-119]SPS6
Slot, Erwin [7271-27]S6, [7271-55]S11
Smayling, Michael C. [7271-103]SPS3, [7274-19]S5
Smith, Arlene [7274-136]SPS8
Smith, Brian A. [7274-104]SPS5
Smith, Bruce W. SC117 Inst, SC124 Inst, [7273-167]SPS8, 7274 ProgComm, 7274 S12 SessChr, 7274 S15 SessChr, [7274-01]S1
Smith, Donald K. [7271-121]SPS4
Smith, Henry I. [7271-28]S6
Smith, Mark D. SC102 Inst, [7273-42]S10, [7273-46]S10, [7274-22]S6, [7274-132]SPS8, [7275-34]SPS1
Smith, Nigel P. [7272-41]S9
Smith, Taber [7275-76]SPS1
Snijkers, Rob [7271-08]S3, [7271-09]S3
Socha, Robert J. SC707 Inst
Soer, Wouter A. [7271-108]SPS4, [7271-111]SPS4
Sogard, Michael R. [7271-17]S4
Sohn, Jaewoong [7271-18]S4
Sohn, Sung-Joon [7272-51]S11
Sohn, Yeungjoon [7272-157]SPS1
Sohn, Younghoon [7272-34]S7
Solak, Harun H. [7273-32]S8
Solecky, Eric P. [7272-58]S12
Soles, Christopher L. [7271-63]S13, [7271-79]S16, [7271-92]SPS1, PanelModerator
Somervell, Mark H. 7273 ProgComm, 7273 S12 SessChr, 7273 S5 SessChr, [7273-50]S11, [7274-17]S5
Someya, Hiroshi [7271-07]S3
Song, Chulgi [7272-85]SPS1
Song, Chul-Gi [7272-109]SPS1
Song, Ilho [7272-144]SPS1, [7274-122]SPS6, [7274-130]SPS7
Song, Jae-Hoon [7275-70]SPS1
Song, Jee-Yun [7273-85]SPS2
Sooriyakumaran, Ratnam [7273-157]SPS7
Soper, Robert A. [7275-21]S5
Sotomayor Torres, Clivia M. [7271-65]S13
Soulan, Sébastien [7272-156]SPS1
Soumagne, Georg [7271-07]S3, [7271-114]SPS4
Soyano, Akimasa [7273-134]

SPS5
Spanos, Costas J. [7275-04]S2, [7275-20]S5, [7275-50]SPS1
Sparka, Christian [7272-117]SPS1, [7272-122]SPS1
Spence, Christopher A. [7274-03]S2, [7275-32]SPS1
Sporre, John [7271-35]S8, [7271-118]SPS4
Sreenivasan, S. V. [7271-66]S13, [7271-56]S12, [7271-61]S13, SC622 Inst
Srivastava, Shailendra N. [7271-119]SPS4
Stack, Jared D. [7274-10]S3
Stadelhoff, Christian [7271-141]SPS7
Starikov, Alexander 7272 ProgComm
Stedman, David [7272-82]SPS1
Steigerwald, Michael [7273-127]SPS5
Steinbrueck, Gary [7272-178]SPS1
Stobert, Ian P. [7274-36]S9
Stock, Laurent [7272-148]SPS1
Stocker, Michael D. [7272-43]S9
Stolberg, Ines A. [7271-26]S6
Strahan, Jeffrey R. [7273-21]S6, [7273-167]SPS8
Streller, Uwe [7272-145]SPS1
Streutker, Gert [7274-62]S15
Strocchia-rivera, Carlos [7272-58]S12
Strojwas, Andrzej J. [7274-42]S10
Stroud, Charlyn [7273-87]SPS2
Struck, Corey R. [7273-49]S11
Sturtevant, John L. [7272-108]SPS1, 7275 ProgComm, [7275-60]SPS1, [7275-75]SPS1
Su, Lisa T. [AL09PL-01]SPL1
Subramanian, Jayathi [7275-30]SPS1
Sudo, Takashi [7271-134]SPS6
Suetin, Nikolay V. [7273-06]S2
Suga, Osamu [7271-13]S4, [7271-71]S14, [7271-126]SPS5, [7271-127]SPS5, [7271-128]SPS5, [7271-132]SPS5
Suganuma, Takashi [7271-07]S3, [7271-114]SPS4, [7271-115]SPS4
Sugihara, Makoto [7271-21]S5
Sugimachi, Hisanori [7273-55]S12, [7273-101]SPS3
Sugiyama, Akiyuki [7275-60]SPS1
Sugiyama, Takashi [7271-124]SPS5
Sukegawa, Takashi [7274-57]S14
Sukharev, Valeriy [7275-18]S4
Suko, Kazuyuki [7274-131]SPS8
Suleski, Thomas J. [7272-31]S7
Sullivan, Neal T. 7272 ProgComm
Sumitani, Akira [7271-07]S3, [7271-114]SPS4, [7271-115]SPS4
Sun, Shiyu [7274-148]SPS10, [7274-149]SPS10
Sunahara, Atsushi [7271-110]SPS4
Sundaramoorthi, Annapoorani [7273-37]S9
Sundararajan, Radha [7272-124]SPS1
Sundareswaran, Savithri [7275-53]SPS1
Sundberg, Linda K. [7273-22]S6, [7273-139]SPS5
Sung, Jin Wuk [7273-27]S7
Surla, Vijay [7271-35]S8, [7271-118]SPS4
Sutou, Takanori [7271-94]SPS1
Suzuki, Akiyoshi [7274-33]S8
Suzuki, Kazuaki 7271 ProgComm, 7271 S8 SessChr
Suzuki, Toru [7274-153]SPS11, [7274-156]SPS11
Svintsov, Alexander A. [7271-89]SPS1, [7271-98]SPS2, [7271-99]SPS2, [7273-72]SPS1
Sweis, Jason [7275-59]SPS1
Szikszai, László [7271-95]SPS2
Szmanda, Charles R. [7273-05]S2, [7273-12]S3

T

Tabery, Cyrus E. [7272-17]S4, [7274-03]S2, [7274-06]S2, [7274-46]S12, [7274-142]SPS9
Tagawa, Seiichi [7273-122]SPS4, [7273-123]SPS4
Taguchi, Takao [7271-126]SPS5, [7271-132]SPS5
Takahara, Kenichi [7272-90]SPS1
Takahashi, Hidenori [7273-34]S8, [7273-108]SPS4
Takahashi, Kazuhiro 7274 ProgComm, 7274 S7 SessChr, [7274-33]S8, [7274-55]S14, [7274-57]S14
Takahashi, Makoto [7274-90]SPS4
Takahashi, Masanori [7274-134]SPS8
Takahata, Kazuhiro [7273-15]S4, [7274-51]S12
Takakuwa, Manabu [7272-21]S4, [7274-51]S12
Takano, Yusuke [7273-64]SPS1
Takase, Hiromitsu [7271-134]SPS6, [7271-136]SPS6
Takashi, Kanemura [7273-169]SPS8
Takasu, Ryoichi [7273-03]S2
Takayuki, Yabu [7271-07]S3
Takeda, Kazuhiro [7273-15]S4, [7274-51]S12
Takei, Satoshi [7273-57]S12, [7273-80]SPS1
Takeshita, Masaru [7273-03]S2, [7273-04]S2
Takeya, Koji [7271-19]S5, [7271-25]S6
Takizawa, Kazutaka [7271-102]SPS3
Takizawa, Masahiro [7271-20]S5
Talmi, Maati [7271-53]S11
Tamura, Takao [7274-103]SPS5, [7274-115]SPS6
Tanaka, Hiroyuki [7271-44]S9, [7271-74]S14, [7271-116]SPS4, [7271-137]SPS6
Tanaka, Junichi [7272-97]SPS1
Tanaka, Keiichi [7273-125]SPS4
Tanaka, Maki [7272-27]S6, [7272-39]S8, [7272-93]SPS1
Tanaka, Manabu [7273-58]S12
Tanaka, Michio [7273-133]SPS5
Tanaka, Ryo [7273-09]S3, [7274-157]SPS11
Tanaka, Satoshi [7274-18]S5, [7274-35]S9, [7274-134]SPS8
Tanaka, Satoshi [7274-153]SPS11, [7274-156]SPS11
Tanaka, Shinji [7273-151]SPS7
Tanaka, Toshihiko [7271-74]S14, [7271-127]SPS5, [7271-128]SPS5, [7271-150]SPS8
Tanaka, Toshuhiko [7271-71]S14
Tanaka, Yukako [7272-56]S12
Tanaka, Yuusuke [7271-44]S9, [7271-74]S14, [7271-116]SPS4, [7271-137]SPS6
Tang, Cherry [7273-96]SPS3
Tang, Qian-Ying [7275-20]S5
Tang, Steve [7275-79]SPS1
Tang, Yu-Po [7274-99]SPS4
Tanizaki, Hirokazu [7274-157]SPS11
Tanriseven, Orhangazi [7273-138]SPS5
Tao, Hun-Yuan [7272-24]S5, [7272-64]S13
Tao, Yezheng [7271-109]SPS4, [7271-117]SPS4
Tarrio, Charles [7271-38]S8, [7271-39]S8, [7271-140]SPS7
Tarutani, Shinji [7273-11]S3
Tatsuya, Yanagida [7271-07]S3
Tawarayama, Kazuo [7271-44]S9, [7271-74]S14, [7271-116]SPS4, [7271-137]SPS6
Tawfik, Tamer M. [7274-117]SPS6, [7274-135]SPS8
Tay, Arthur E. [7272-134]SPS1, [7275-43]SPS1
Tay, Cho Jui [7274-124]SPS7
Tchikoulaeva, Anna [7271-03]S1, [7271-43]S9
Tedeschi, Len [7272-128]SPS1, [7273-138]SPS5
Teh, Siew Hong [7275-43]SPS1
Tejnil, Edita [7274-117]SPS6
Tenaglia, Enrico [7273-84]SPS2
Terai, Mamoru [7273-129]SPS5
Teramoto, Yusuke [7271-120]SPS4
Terasawa, Tsuneo [7271-13]S4, [7271-71]S14, [7271-127]SPS5
Terashima, Shigeru [7271-134]SPS6, [7271-136]SPS6
Terechko, Andrei S. [7275-16]S4
Terng, L. G. [7272-09]S3
Terry, Mark [7275-21]S5
Thackeray, Jim W. [7273-46]S10
Thiele, Joerg 7275 ProgComm
Thiyagarajan, Muthiah [7273-82]SPS1
Thomas, Robin [7273-139]SPS5
Thomas, Sherilyn [7273-87]SPS2
Thompson, Larry F. SC101 Inst
Thompson, Matthew A. [7275-30]SPS1, [7275-77]SPS1
Thrum, Frank [7271-23]S6, [7271-95]SPS2
Tian, Kehan [7274-08]S3, [7274-09]S3, [7274-11]S3, [7274-50]S12, [7274-145]SPS9
Tien, David C. [7272-115]SPS1, [7272-119]SPS1, [7272-121]SPS1, [7272-122]SPS1, [7272-136]SPS1
Tillack, Mark S. [7271-109]SPS4, [7271-117]SPS4
Timko, Allen G. [7273-153]SPS7
Tirapu-Azpiroz, Jaione [7274-08]S3, [7274-09]S3, [7274-11]S3, [7274-36]S9, [7274-50]S12
Todua, Pavel A. [7272-37]S8, [7272-87]SPS1
Toepperwein, Gregory N. [7273-58]S12
Tokareva, Nataliya [7273-85]SPS2
Tokue, Hiroshi [7271-81]S16
Tokui, Akira [7273-09]S3, [7274-32]S8
Tolbert, Laren M. [7273-17]S5, [7273-19]S5
Tomie, Toshihisa [7271-71]S14, [7271-127]SPS5
Tominaga, Makoto [7273-15]S4, [7274-51]S12
Tomita, Tadatoshi [7273-55]S12
Tommila, Juha [7271-58]S12
Tong, William M. 7271 ProgComm, 7271 S13 SessChr, [7271-05]S2
Top, Mame-Kouna [7272-57]S12, [7274-41]S10
Toriumi, Keigo [7272-21]S4
Toriumi, Minoru [7273-162]SPS8, [7273-163]SPS8
Torng, Terry [7274-146]SPS10
Torres, J. Andres [7275-24]S6, [7275-49]SPS1, [7275-54]SPS1, [7275-55]SPS1
Tortai, Jean-Hervé [7272-156]SPS1
Toublan, Olivier R. [7275-54]SPS1
Touge, Shunsuke [7271-113]SPS4
Toukhy, Medhat A. [7273-65]SPS1
Toussaint, Rene [7274-152]SPS11
Townsend, Ethan [7272-14]S3
Trichkov, Alexander [7275-35]SPS1
Trikeriotis, Markos [7273-137]SPS5
Trintchouk, Fedor [7274-159]SPS11
Tritchkov, Alexander V. [7274-68]SPS1
Trofimov, O. [7273-72]SPS1
Trogisch, Sven [7272-172]SPS1
Trouiller, Yorick [7272-57]S12, [7274-41]S10
Truffert, Vincent P. [7274-23]S6
Truong, Chi [7273-12]S3
Truong, Hoa D. [7273-41]S9
Truskett, Van [7271-61]S13
Tsacoyeanes, James G. [7274-63]S15
Tsai, Cheng-Kun [7274-99]SPS4
Tsai, Meng-Feng [7272-16]S4, [7274-147]S4
Tsai, Pei Ru [7275-73]SPS1
Tsai, Shih-Lung [7274-80]SPS4
Tsai, Yi-Yien [7274-80]SPS4
Tschischgale, Joerg [7272-133]SPS1, [7272-172]SPS1
Tseng, Nick [7274-12]S4
Tseng, Shih-En [7272-164]SPS1
Tseng, Tsu-Li [7274-12]S4
Tseng, Wan-Ju [7273-92]SPS2
Tseng, Wei-Jui [7272-86]SPS1
Tsou, Len Y. [7274-34]S9
Tsubaki, Hideaki [7273-11]S3, [7273-31]S8, [7273-33]S8, [7273-34]S8
Tsuboi, Kyo [7271-25]S6
Tsuchihashi, Tooru [7273-33]S8, [7273-108]SPS4
Tsuchimura, Tomotaka [7273-31]S8, [7273-108]SPS4
Tsuda, Shigeko [7272-56]S12
Tsujita, Koichiro [7274-33]S8, [7274-55]S14
Tsuneo, Yamashita [7273-169]SPS8
Tsunoda, Dai [7271-101]SPS2
Tsushima, Hiroaki [7274-156]SPS11
Tsuzuki, Shuichi [7273-54]S12
Tu, Richard Y. [7272-76]SPS1
Tuckermann, Martin [7272-145]SPS1
Tung, Clarion [7273-06]S2, [7273-29]S8
Tung, Min-Hin [7272-136]SPS1
Turner, Courtney [7273-06]S2
Turner, Kevin T. 7271 ProgComm, 7271 S17 SessChr
Turovets, Igor [7272-42]S9, [7272-166]SPS1
Turro, Nicholas J. [7273-127]SPS5
Tychkov, Andrey [7274-63]S15
Tyminski, Jacek K. [7274-29]S7

U

Uchida, Junichi [7272-165]SPS1
Uchida, Ryusuke [7273-03]S2, [7273-04]S2
Uchiyama, Takayuki [7272-18]S4, [7273-15]S4, [7274-103]SPS5, [7274-115]SPS6
Ueda, Kenichi [7272-62]S12, [7273-96]SPS3
Ueki, Makoto [7273-15]S4
Uemura, Ryoichi [7273-55]S12
Ueno, Yoshifumi [7271-07]S3, [7271-115]SPS4
Uenoyama, Yohitaka [7273-151]SPS7
Ukraintsev, Vladimir A. SC943 Inst, 7272 ProgComm, WorkshopChair, [7272-04]S2, [7272-109]SPS1, PanelModerator
Ulm, Gerhard [7271-141]SPS7
Umeda, Daisuke [7272-18]S4
Umeda, Hiroshi [7274-156]SPS11
Umeda, Toru [7273-54]S12
Urban'ski, Lukasz [7271-133]SPS6
Utsumi, Yoshiyuki [7273-143]SPS6
Uzawa, Shigeyuki [7271-68]S14

V

Vagos, Pedro P. T. [7272-65]S13
Vaid, Alok [7272-32]S7, [7272-58]S12
Valeri, David [7273-27]S7
Valerie, Lappras [7271-142]SPS7

Valiev, Kamil [7272-87]SPS1
Valsecchi, Giuseppe [7271-11] S3
van Adrichem, Paul J. M. [7274-04]S2
van de Kerkhof, Mark A. [7272-09]S3
Van de Kerkhove, Jeroen [7272-108]SPS1, [7273-45]S10, [7275-60]SPS1
van de Mast, Frank [7274-64] S15
Van Den Heuvel, Dieter [7273-75]SPS1
van der Heijden, Eddy [7273-13] S4
Van der Mast, Karel D. [7272-09]S3, [7272-155]SPS1
van der Mullen, Joost [7271-111]SPS4
van der Pasch, Bert [7274-64] S15
van der Schaar, Maurits [7272-09]S3
van der Wel, Pieter [7271-09]S3
Van Dijk, Andre [7271-29]S7
van Dommelen, Youri [7271-43] S9, [7273-04]S2
van Herpen, Maarten M. [7271-108]SPS4, [7271-111]SPS4
van Ingen Schenau, Koen [7271-47]S10
van Setten, Eelco [7273-13]S4
Vandenberghe, Geert 7274 ProgComm, 7274 S6 SessChr, 7274 S4 SessChr, [7275-35] SPS1
Vandentop, Gilroy J. [7271-37] S8, [7271-42]S9, [7273-01]S1
VanderHart, David L. [7273-149] SPS7
Vandeweyer, Tom [7272-27]S6
Vaney, Jean-Baptiste [7271-62] S13
Vanlennhove, Anja [7273-21]S6
Varanasi, Pushkara R. [7273-27] S7, [7273-38]S9, [7273-139] SPS5
Vasanthan, Sumathy [7273-91] SPS2
Vaschenko, Georgiy O. [7271-02]S1, [7271-119]SPS4
Vasconi, Mauro [7272-15]S4, [7272-40]S9
Vaserman, Yosi [7275-29]SPS1
Vaudrevange, Dominik [7271-09]S3
Vautrin, Florent [7274-41]S10
Veendrick, Harry [7275-16]S4
Veltman, Peter [7271-27]S6, [7271-55]S11
Verghese, Nishath [7275-21]S5, [7275-37]S2
Verhaart, Gerardous J. [7271-62]S13
Verspaget, Coen [7273-13]S4, [7273-138]SPS5
Vest, Robert E. [7271-38]S8, [7271-140]SPS7
Vickers, James S. [7272-178] SPS1
Viheriälä, Jukka [7271-58]S12
Viljanen, Milla-Riina [7271-58] S12
Villaret, Alexandre [7272-67] S14, [7274-41]S10
Villarrubia, John S. [7272-28] S6
Viswanathan, Ramya [7274-128] SPS7
Vitorino, Nelson [7272-149] SPS1
Vlcek, Miroslav [7273-53]S12
Vleeming, Bert [7274-64]S15
Volk, Cheslav [7272-37]S8
Volotovskiy, Sergey [7272-168] SPS1
Voorma, Harm-Jan [7274-152] SPS11
Vorburger, Theodore V. [7272-08]S2
Voss, Sven-Hedrik [7271-53]S11
Vyklicky, Libor [7273-27]S7

W

Wachulak, Przemyslaw W. [7271-125]SPS5, [7271-133] SPS6
Waechter, Andreas [7274-08]S3
Wagner, Alfred [7272-44]S10, [7273-139]SPS5
Wagner, Christian [7271-01]S1
Waits, Christopher M. [7273-53] S12
Wakabayashi, Osamu [7271-07] S3, [7274-156]SPS11
Wakamatsu, Gouji [7273-10]S3
Wakamizu, Shinya [7274-157] SPS11
Wakamoto, Shinji [7274-32]S8, [7274-111]SPS6
Wakana, Katsuhiko [7274-153] SPS11
Wakayama, Hiroyuki [7273-77] SPS1
Wakimoto, Osamu [7271-100] SPS2
Walf, Godehard [7271-53]S11
Wallace, William E. [7273-149] SPS7
Wallow, Thomas I. 7271 S15 SessChr, [7271-03]S1, [7271-32]S7, [7271-45]S10, [7271-73]S15, [7273-08]S3, [7273-12]S3, [7273-35]S8, [7273-107]SPS3
Wallraff, Gregory M. [7271-82] S17, 7273 ProgComm, 7273 S9 SessChr
Walsh, Michael E. [7271-28]S6
Wang, ChangAn [7274-52]S13
Wang, Chengqing [7272-104] SPS1
Wang, Ching-Heng [7274-79] SPS4
Wang, Liyuan [7273-154]SPS7
Wang, Lynn T. N. [7275-11]S3, [7275-22]S5
Wang, Mingxing [7273-117] SPS4, [7273-119]SPS4
Wang, Shiang Bau [7272-24]S5, [7272-64]S13
Wang, Shih-Yuan [7271-59]S12
Wang, Suping [7273-138]SPS5
Wang, Tao [7274-109]SPS5
Wang, Troy [7274-12]S4
Wang, Vivien [7272-09]S3, [7272-155]SPS1
Wang, Wei-Long [7271-49]S10
Wang, Willie Y. H. [7272-09]S3, [7272-155]SPS1
Wang, Xian Bin [7275-76]SPS1
Wang, Yan [7275-31]SPS1
Wang, Yeuh [7273-175]SPS4
Wang, Yong [7271-125]SPS5
Wang, Yong-Dong [7274-100] SPS4
Wang, Yubao [7274-104]SPS5
Ward, Brandon L. [7274-90] SPS4
Ward, Brian S. [7271-46]S10, [7271-148]SPS8
Ware, Adam [7273-27]S7
Warisawa, Shin'ichi [7271-130] SPS5
Watanabe, Kenji [7272-27]S6, [7272-95]SPS1
Watanabe, Masahiro [7272-70] S14
Watanabe, Takeo [7273-165] SPS8
Watanabe, Yukio [7271-07]S3
Watanabe, Yutaka [7271-134] SPS6, [7271-136]SPS6
Watso, Robert [7271-03]S1, [7273-35]S8
Watts, Andrew J. [7272-44]S10
Wayton, Gerald [7273-92]SPS2
Wehner, Arno [7272-131]SPS1, [7272-145]SPS1
Wehrhan, Gunther [7274-59]S14
Wei, Yayi [7273-91]SPS2, [7273-153]SPS7
Weichert, Heiko [7271-154] SPS9, [7273-55]S12
Weling, Milind [7275-59]SPS1
Wen, Youxian [7272-62]S12
Weng, Lannie [7275-74]SPS1
Wenren, Qingqing [7275-66] SPS1
Westendorf, Chad H. [7273-176] SPS8
White, John K. [7271-106]SPS4
Whittaker, Andrew K. [7273-39] S9, [7273-175]SPS4
Widmann, Amir [7272-117]SPS1
Wieland, Marco J. [7271-24]S6
Wiesner, John C. [7271-25]S6
Williams, Daniel J. SC780 Inst
Williams, R. Stanley [7271-05] S2, [7271-59]S12
Willson, C. Grant SC101 Inst, SC103 Inst, SC622 Inst, [7271-93]SPS1, [7273-02]S1, [7273-21]S6, [7273-80]SPS1, [7273-167]SPS8, [7273-172] SPS9
Wiltshire, Timothy J. [7272-33] S7, [7274-27]S7
Wimplinger, Markus [7271-90] SPS1
Winter, Thomas E. [7272-62] S12, [7273-96]SPS3
Wiraatmadja, Sandy [7271-50] S10
Wisnieff, R. [7273-157]SPS7
Witt, Martin [7271-23]S6
Wolfer, Elizabeth [7272-149] SPS1
Won, Seungmin [7272-85]SPS1
Wong, Alfred K. 7275 ProgComm, 7275 S2 SessChr, [7275-09]S2
Wong, Sabrina [7273-92]SPS2, [7273-93]SPS2
Woo, Changsoo [7273-88]SPS2
Wood, Obert 7271 S9 SessChr, [7271-03]S1, [7271-30]S7, [7271-43]S9, [7271-45]S10, [7273-35]S8
Word, James C. [7274-44]S11, [7274-98]SPS4, [7274-142] SPS9
Wright, Noelle [7272-155]SPS1
Wu, Aiwen [7272-149]SPS1
Wu, Benjamin [7273-28]S7
Wu, Benjamin Z. Y. [7273-107] SPS3
Wu, Calvin [7275-73]SPS1
Wu, Chih-Huang [7274-12]S4
Wu, Chung-hsi J. [7274-52]S13
Wu, Chun-Sheng [7275-79] SPS1
Wu, Hengpeng [7273-153]SPS7
Wu, Hsiao Ting [7274-12]S4
Wu, Hsing-Chien R. [7272-119] SPS1
Wu, Jan-Shiun [7274-12]S4
Wu, Kevin [7275-30]SPS1
Wu, Lei-Ken [7272-136]SPS1
Wu, Peter [7275-74]SPS1
Wu, Steven [7273-92]SPS2
Wu, Timothy Y. [7271-49]S10
Wu, Vincent [7274-12]S4
Wu, Wei [7271-05]S2, [7271-59] S12
Wu, Wei-Ming [7272-119]SPS1
Wu, Wen Bin [7274-12]S4
Wu, Wen-Li [7272-104]SPS1, [7273-36]S9
Wuest, Andrea F. [7271-34] S7, [7271-76]S15, [7271-135]SPS6, [7271-138]SPS6, [7271-139]SPS6, [7271-153] SPS9, 7271 S8 SessChr
Wurm, Stefan [7271-18]S4, [7271-31]S7, [7271-32]S7, [7271-73]S15, [7271-129] SPS5
Wuu, Jen-Yi [7275-49]SPS1
Wyndham, Edmund [7271-106] SPS4

X

Xia, Qiangfei [7271-05]S2, [7271-59]S12
Xiao, Hong [7272-11]S3, [7272-55]S11
Xiao, Shuaigang [7271-87]S17
Xie, Peng [7274-70]SPS1
Xie, SongYuan [7273-28]S7
Xie, Xu [7274-04]S2, [7274-114] SPS6
Xu, Cheng Bai [7273-14]S4
Xu, Frank Y. [7271-61]S13
Xu, Hao [7273-109]SPS4
Xu, Ping [7274-149]SPS10
Xu, Xumou [7273-23]S6, [7274-148]SPS10, [7274-149]SPS10, [7275-59]SPS1
Xu, Yuan [7271-87]S17

Y

Yabe, Kazuo [7273-146]SPS6
Yabu, Nobuhiko [7274-57]S14
Yaegashi, Hidetami [7273-146] SPS6
Yakimov, Eugeny E. [7271-99] SPS2
Yakshinskiy, Boris V. [7271-36] S8
Yamabe, Masaki [7271-100] SPS2, [7275-28]SPS1
Yamada, Yohei [7273-08]S3
Yamada, Yoshiaki [7274-108] SPS5
Yamaguchi, Atsuko [7272-97] SPS1
Yamaguchi, Masanori [7273-08] S3
Yamaguchi, Naoaki [7272-25]S5
Yamaguchi, Shuhei [7273-63] SPS1
Yamaguchi, Yoshikazu [7273-10] S3, [7273-134]SPS5
Yamamoto, Hiroki [7273-122] SPS4
Yamamoto, Jiro [7272-84]SPS1
Yamamoto, Takeshi [7271-130] SPS5
Yamamoto, Tomohiko [7274-49] S12
Yamamoto, Yoshihiro [7273-27] S7, [7273-68]SPS1
Yamanaka, Kazuhiro [7273-22] S6
Yamanaka, Takuya [7272-103] SPS1
Yamane, Takeshi [7271-71]S14, [7271-127]SPS5
Yamasaki, Toshinari [7273-126] SPS5
Yamashita, Asao [7272-124] SPS1
Yamashita, Katsuhiro [7273-31]S8, [7273-34]S8, [7273-108]SPS4
Yamazaki, Taku [7274-156] SPS11
Yamazaki, Yuichiro [7272-38]S8, [7272-49]S11, [7272-59]S12, [7272-127]SPS1, [7272-143] SPS1, [7272-50]S11, [7272-56]S12, [7272-161]SPS1, [7272-174]SPS1
Yan, Wendy [7274-52]S13
Yanagida, Tatsuya [7271-115] SPS4
Yanagihara, Toshiaki [7275-57] SPS1
Yang, Chin-Cheng [7273-102] SPS3
Yang, Chuen-Huei [7275-73] SPS1
Yang, Ellyn [7274-85]SPS4
Yang, Elvis [7273-102]SPS3, [7274-80]SPS4
Yang, Hyunjo [7272-53]S11, [7274-125]SPS7
Yang, Jianhua [7271-05]S2
Yang, Jie [7275-52]SPS1
Yang, Joel [7271-59]S12
Yang, Kyoungmo [7272-96] SPS1
Yang, Ta-Hung [7273-102]SPS3, [7274-80]SPS4
Yang, XiaoMin [7271-87]S17
Yankulin, Leonid [7271-76]S15, [7271-138]SPS6, [7271-139] SPS6
Yasuda, Shuichi [7273-126] SPS5
Ye, Hong [7274-159]SPS11
Ye, Yun [7275-78]SPS1
Yeh, Anthony [7275-11]S3
Yeh, C. W. [7273-102]SPS3
Yeh, Wendy [7275-79]SPS1
Yeh, Ya-Tsz [7272-136]SPS1
Yen, Anthony [7271-49]S10
Yeo, Jeong-Ho [7271-40]S9, [7271-146]SPS8, [7272-45] S10, [7272-52]S11, [7272-106] SPS1, [7274-28]S7
Yeo, Sky [7275-19]S5, [7275-77] SPS1
Yesilada, Emek [7272-57]S12, [7272-67]S14, [7274-41]S10

Yi, Yi [7273-153]SPS7
Yim, Donggyu [7271-149]SPS8, [7274-91]SPS4, [7274-125] SPS7, [7272-53]S11, [7274-144]SPS9
Yokokoji, Osamu [7273-118] SPS4
Yokoyama, Takuma [7271-120] SPS4
Yoneda, Ikuo [7271-81]S16
Yonemitsu, Hiroki [7273-15]S4, [7274-51]S12
Yoo, Gyun [7272-53]S11
Yoo, Minae [7274-125]SPS7
Yoo, Moon-Hyun [7275-70] SPS1
Yoon, Gi-Sung [7274-95]SPS4
Yoon, Hui Chan [7273-88]SPS2
Yoon, Jinyoung [7273-14]S4
Yoon, Kwang-Sub [7273-14]S4
Yoon, Kyong-Ho [7273-85]SPS2
Yoon, Sangwoong [7273-80] SPS1
Yoon, SeungHoon [7272-120] SPS1
Yoshiaki, Yamada [7273-125] SPS4
Yoshida, Masato [7274-61]S15
Yoshida, Yuichi [7273-134]SPS5
Yoshida, Yuko [7273-63]SPS1
Yoshihara, Kousuke [7273-134] SPS5
Yoshihara, Takao [7273-67] SPS1
Yoshihara, Toshiyuki [7274-55] S14, [7274-57]S14
Yoshikawa, Satoshi [7274-49] S12
Yoshimochi, Kazuyuki [7274-115]SPS6
Yoshimoto, Kenji [7273-08]S3, [7274-142]SPS9
Yoshino, Kiminori [7272-49]S11, [7272-50]S11, [7272-59]S12
Yoshino, Masaya [7274-153] SPS11, [7274-156]SPS11
Yoshioka, Masaki [7271-08]S3, [7271-09]S3
Yoshito, Tanaka [7273-169] SPS8
Yosuke, Kishikawa [7273-169] SPS8
You, Jee-Hye [7271-147]SPS8, [7273-47]S10
You, Taejun [7274-125]SPS7
Young, Roger M. [7272-33]S7
Younkin, Todd R. [7271-42] S9, [7271-73]S15, [7271-75] S15, [7273-17]S5, [7273-19] S5, [7273-20]S5, [7273-29] S8, [7273-32]S8, [7273-33] S8, [7273-36]S9, [7273-37]S9, [7273-109]SPS4, [7273-175] SPS4
Yu, Anguang [7273-175]SPS4
Yu, Cao [7274-114]SPS6
Yu, Chun Chi [7273-92]SPS2, [7272-121]SPS1
Yu, James J. [7272-98]SPS1, [7274-149]SPS10
Yu, Jeong Yun [7273-92]SPS2, [7273-93]SPS2
Yu, Jinxing [7273-154]SPS7
Yu, Jue-Chin [7274-143]SPS9
Yu, Peichen [7274-143]SPS9
Yu, S. S. [7273-102]SPS3
Yu, Sheng-Hsiung [7272-136] SPS1
Yuan, Chi-Min [7275-30]SPS1, [7275-76]SPS1, [7275-77] SPS1
Yuan, Kiwi [7272-09]S3, [7272-155]SPS1
Yueh, Wang [7271-75]S15, [7273-32]S8, [7273-36]S9
Yulin, Sergiy A. [7271-10]S3, [7271-37]S8
Yun, Henry K. [7271-124]SPS5
Yun, Young-Je [7272-144] SPS1, [7273-62]SPS1, [7273-171]SPS9, [7274-122]SPS6, [7274-130]SPS7
Yusa, Satoshi [7271-94]SPS1
Yuspeh, Sam [7271-109]SPS4, [7271-117]SPS4

Z

Zaitsev, Sergey I. [7271-89] SPS1, [7271-98]SPS2, [7271-99]SPS2, [7273-72]SPS1
Zaitz, Mary Ann [7272-58]S12
Zakharov, Sergey V. [7271-106] SPS4
Zakharov, Vasily S. [7271-106] SPS4
Zakhor, Avideh [7271-52]S11
Zalkind, Shimon [7271-36]S8
Zamiri Hossein Zahdeh, Saeid [7271-57]S12
Zastera, Dustin [7272-79]SPS1
Zavyalova, Lena [7271-46]S10, [7271-148]SPS8
Zettel, Michael F. [7273-132] SPS5, [7273-137]SPS5
Zeuske, Jacob R. [7271-131] SPS5
Zhang, Charlie Q. [7274-43]S10, [7275-68]SPS1
Zhang, Feng [7271-28]S6
Zhang, Guojing [7271-15]S4, [7271-42]S9
Zhang, Hongbo [7275-62]SPS1
Zhang, Liguo [7274-79]SPS4
Zhang, Lin [7273-91]SPS2
Zhang, Nien-Fan [7272-01]S1
Zhang, Ruzhi [7273-153]SPS7
Zhang, Xima [7274-90]SPS4
Zhang, Yingchun [7275-66] SPS1
Zhao, Qian [7274-04]S2
Zheng, Alan [7272-08]S2
Zheng, Xin [7274-137]SPS8
Zhikharev, Evgeniy [7272-87] SPS1
Zhong, Tom X. [7274-146] SPS10
Zhou, Brian [7275-66]SPS1
Zhou, Hui [7272-01]S1, [7272-43]S9
Zhou, Jianming [7274-113]SPS6
Zhu, Cynthia [7274-142]SPS9, [7275-55]SPS1, [7275-66] SPS1
Zhu, Liang [7275-66]SPS1
Zhu, Zhimin [7273-84]SPS2, [7274-104]SPS5
Zhuang, Lei L. [7274-03]S2
Zhuang, Vera [7272-22]S5
Zimmerman, Paul A. [7273-39] S9, [7273-127]SPS5, [7273-132]SPS5, [7273-137]SPS5, [7274-72]SPS2, [7274-74] SPS2
Zimmermann, Joerg [7274-09] S3, [7274-62]S15
Zin, Wang-Cheol [7273-161] SPS7
Zink, Peter [7271-08]S3, [7271-09]S3, [7271-11]S3
Zitzen, Oliver [7271-09]S3
Zocchi, Fabio E. [7271-11]S3
Zoldesi, Carmen [7273-13]S4
Zook, John R. [7273-153]SPS7
Zou, Yi [7274-03]S2, [7274-46] S12, [7274-142]SPS9
Zuniga, Christian D. [7274-40] S10, [7274-60]S15
Zurbrick, Larry S. PanelModerator

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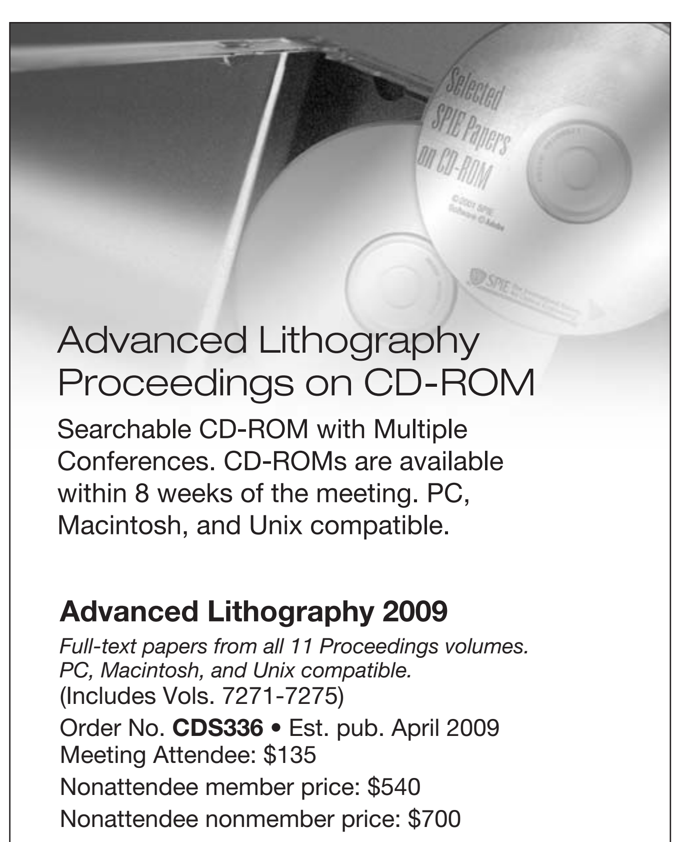

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Immersion Lithography Technical Papers

SPIE Advanced Lithography

Paper presentation, Monday, February 23, 5:30pm - 5:50pm

7273-12 : **Photoresist stabilization for double-patterning using 172-nm photoresist curing**
Advanced Micro Devices; SOKUDO; Rohm & Haas Electronic Materials; Advanced Micro Devices

Poster presentation, Monday, February 23, 5:30pm - 8:00pm

7272-128 : **Track optimization and control for 32-nm node double patterning and beyond**
IMEC; SOKUDO

7273-60 : **Improved CD uniformity for shrink-assisted patterning**
SOKUDO

7273-71 : **Post-develop blob defect reduction**
SOKUDO; JSR Micro

7273-75 : **Analysis of the effect of point-of-use filtration on microbridging defectivity**
Entegris; IMEC; SOKUDO

7273-107 : **Performance of an ArF siloxane BARC exposed to a 172-nm UV cure for double patterning applications**
Honeywell Electronic Materials; Advanced Micro Devices; SOKUDO; Applied Materials

7273-126 : **CD and defect improvement challenges for immersion processes**
Toshiba; SOKUDO

7273-133 : **Integration of improved develop process for topcoat-less immersion resists**
SOKUDO; IMEC

7273-135 : **Backside EBR process performance with various wafer properties**
SOKUDO

7273-138 : **Defectivity process optimization on immersion topcoat less resist stacks**
SOKUDO; ASML

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  - 6922-158 : Immersion Lithography Bevel Solutions
  - 6922-109 : Film Stacking Architecture for Immersion Lithography Process
- ***SPIE Lithography Asia***
  - 7140-74 : Cluster optimization to improve total CD control as an enabler for double patterning
- ***Int'l Symposium on Immersion Lithography Extensions***
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