PROCEEDINGS OF SPIE

Metrology, Inspection, and Process Control for Microlithography XXI

Chas N. Archie
Editor

26 February–1 March 2007
San Jose, California, USA

Sponsored and Published by
SPIE—The International Society for Optical Engineering

Cooperating Organization
SEMATECH (USA)

Volume 6518
Part One of Three Parts

The International Society for Optical Engineering

Proceedings of SPIE—The International Society for Optical Engineering, 9780819466372, v. 6518

SPIE is an international technical society dedicated to advancing engineering and scientific applications of optical, photonic, imaging, electronic, and optoelectronic technologies.

The papers included in this volume were part of the technical conference cited on the cover and title page. Papers were selected and subject to review by the editors and conference program committee. Some conference presentations may not be available for publication. The papers published in these proceedings reflect the work and thoughts of the authors and are published herein as submitted. The publisher is not responsible for the validity of the information or for any outcomes resulting from reliance thereon.

Please use the following format to cite material from this book:
Author(s), "Title of Paper," in *Metrology, Inspection, and Process Control for Microlithography XXI*, edited by Chas N. Archie, Proceedings of SPIE Vol. 6518 (SPIE, Bellingham, WA, 2007) Article CID Number.

ISSN 0277-786X
ISBN 9780819466372

Published by
SPIE—The International Society for Optical Engineering
P.O. Box 10, Bellingham, Washington 98227-0010 USA
Telephone 1 360/676-3290 (Pacific Time) · Fax 1 360/647-1445
http://www.spie.org

Copyright © 2007, The Society of Photo-Optical Instrumentation Engineers

Copying of material in this book for internal or personal use, or for the internal or personal use of specific clients, beyond the fair use provisions granted by the U.S. Copyright Law is authorized by SPIE subject to payment of copying fees. The Transactional Reporting Service base fee for this volume is $18.00 per article (or portion thereof), which should be paid directly to the Copyright Clearance Center (CCC), 222 Rosewood Drive, Danvers, MA 01923. Payment may also be made electronically through CCC Online at http://www.copyright.com. Other copying for republication, resale, advertising or promotion, or any form of systematic or multiple reproduction of any material in this book is prohibited except with permission in writing from the publisher. The CCC fee code is 0277-786X/07/$18.00.

Printed in the United States of America.

Contents

Part One

xix *Symposium Committee*
xxi *Conference Committee*
xxiii *Plenary Paper: Lithography beyond 32nm: a role for imprint? M. Melliar-Smith, Molecular Imprints (USA)*

SESSION 1 KEYNOTE SESSION

651802 **Metrology challenges of double exposure and double patterning (Keynote Paper)** [6518-01]
W. H. Arnold, M. Dusa, ASML Technology Development Ctr. (USA); J. Flinders, ASML Holding, B. V. (Netherlands)

SESSION 2 PROCESS CONTROL I: LITHOGRAPHY CONTROL

651803 **Process monitor gratings (Invited Paper)** [6518-02]
T. A. Brunner, C. P. Ausschnitt, IBM, SRDC (USA)

651804 **Lithography process control using scatterometry metrology and semi-physical modeling** [6518-03]
K. Lensing, J. Cain, A. Prabhu, A. Vaid, R. Chong, R. Good, B. LaFontaine, O. Kritsun, Advanced Micro Devices (USA)

651805 **Comparison of back side chrome focus monitor to focus self-metrology of an immersion scanner** [6518-131]
K. D'havé, T. Machida, D. Laidler, S. Cheng, IMEC (Belgium)

651806 **Evaluating a scatterometry-based focus monitor technique for hyper-NA lithography** [6518-05]
C. S. Saravanan, S. Nirmalgandhi, Nanometrics, Inc. (USA); O. Kritsun, A. Acheta, R. Sandberg, B. La Fontaine, H. J. Levinson, K. Lensing, AMD (USA); M. Dusa, J. Hauschild, A. Pici, ASML US, Inc. (USA)

Pagination: Proceedings of SPIE follow an e-First publication model, with papers published first online and then in print and on CD-ROM. Papers are published as they are submitted and meet publication criteria. A unique, consistent, permanent citation identifier (CID) number is assigned to each article at the time of the first publication. Utilization of CIDs allows articles to be fully citable as soon they are published online, and connects the same identifier to all online, print, and electronic versions of the publication.

SPIE uses a six-digit CID article numbering system in which:
• The first four digits correspond to the SPIE volume number.
• The last two digits indicate publication order within the volume using a Base 36 numbering system employing both numerals and letters. These two-number sets start with 00, 01, 02, 03, 04, 05, 06, 07, 08, 09, 0A, 0B … 0Z, followed by 10-1Z, 20-2Z, etc.

The CID number appears on each page of the manuscript. The complete citation is used on the first page, and an abbreviated version on subsequent pages.

651807 **Focus and dose controls, and their application in lithography** [6518-06]
H. Ina, K. Sentoku, S. Oishi, T. Miyashita, T. Matsumoto, Canon, Inc. (Japan)

SESSION 3 CD FOR DEVELOPMENT I: OPC AND METROLOGY

651808 **Statistical optimization of sampling plan and its relation to OPC model accuracy** [6518-07]
G. Han, A. Brendler, S. Mansfield, J. Meiring, IBM Microelectronics (USA)

651809 **Automatic setup of in-line critical dimension (CD) recipes during OPC qualification in a foundry environment** [6518-08]
Y. Yudhistira, Q. S. Fong, C. S. Sun, K. H. Peng, Chartered Semiconductor Manufacturing, Ltd. (Singapore); R. Ren, S. L. Ng, Applied Materials South East Asia Pte., Ltd. (Singapore); A. Siany, S. Levi, Applied Materials Israel (Israel)

65180A **Quantification of two-dimensional structures generalized for OPC model verification** [6518-09]
X. Shi, J. F. Chen, D. Van Den Broeke, S. Hsu, M. Hsu, ASML MaskTools (USA)

65180B **Setting MRC rules: balancing inspection capabilities, defect sensitivity, and OPC** [6518-10]
I. Stobert, J. Bruce, IBM Semiconductor Research and Development Ctr. (USA); M. Gheith, A. Seoud, Mentor Graphics Corp. (USA)

65180C **Methodology to set up accurate OPC model using optical CD metrology and atomic force microscopy** [6518-11]
Y.-A. Shim, J. Kang, S.-U. Lee, J. Kim, K. Kim, DongbuElectronics (South Korea)

65180D **SEM-contour-based OPC model calibration through the process window** [6518-12]
J. Vasek, Freescale Semiconductor, Inc. (USA); O. Menedeva, D. Levitzky, O. Lindman, Y. Nemadi, Applied Materials, Inc. (Israel); G. E. Bailey, J. L. Sturtevant, Mentor Graphics Corp. (USA)

SESSION 4 OVERLAY

65180E **Meeting overlay requirements for future technology nodes with in-die overlay metrology (Invited Paper)** [6518-13]
B. Schulz, AMD Saxony LLC and Co. KG (Germany); R. Seltmann, AMD Fab36 LLC and Co. KG (Germany); J. Busch, AMD Saxony LLC and Co. KG (Germany); F. Hempel, AMD Fab36 LLC and Co. KG (Germany); E. Cotte, AMTC GmbH and Co. KG (Germany); B. Alles, Univ. of Technology Munich (Germany)

65180F **Zero-order imaging of device-sized overlay targets using scatterfield microscopy** [6518-14]
B. M. Barnes, National Institute of Standards and Technology (USA); L. P. Howard, National Institute of Standards and Technology (USA) and Precera, Inc. (USA); J. Jun, National Institute of Standards and Technology (USA); P. Lipscomb, ISMI SEMATECH (USA); R. M. Silver, National Institute of Standards and Technology (USA)

65180G **Blossom overlay metrology implementation** [6518-15]
C. P. Ausschnitt, W. Chu, D. Kolor, J. Morillo, J. L. Morningstar, W. Muth, C. Thomison, R. J. Yerdon, IBM (USA); L. A. Binns, P. Dasari, H. Fink, N. P. Smith, G. Ananew, Nanometrics, Inc. (USA)

65180H **The application of SMASH alignment system for 65-55-nm logic devices** [6518-16]
M. Miyasaka, H. Saito, T. Tamura, T. Uchiyama, NEC Electronics Corp. (Japan); P. Hinnen, H.-W. Lee, M. van Kemenade, M. Shahrjerdy, R. van Leeuwen, ASML (Netherlands)

65180I **Overlay metrology tool calibration** [6518-17]
L. A. Binns, P. Dasari, N. P. Smith, G. Ananew, H. Fink, Nanometrics, Inc. (USA); C. P. Ausschnitt, J. Morningstar, C. Thomison, R. J. Yerdon, IBM SRDC (USA)

65180J **Improved overlay control through automated high order compensation** [6518-105]
S. Wakamoto, Y. Ishii, K. Yasukawa, A. Sukegawa, Nikon Corp. (Japan); S. Maejima, Renesas Technology Corp. (Japan); A. Kato, KLA-Tencor Japan, Ltd. (Japan); J. C. Robinson, B. J. Eichelberger, KLA-Tencor Corp. (USA); P. Izikson, M. Adel, KLA-Tencor Corp. (Israel)

SESSION 5 CDSEM: TECHNIQUES, LIMITS, ETC.

65180K **Monte Carlo modeling of secondary electron imaging in three dimensions (Invited Paper)** [6518-19]
J. S. Villarrubia, N. W. M. Ritchie, J. R. Lowney, National Institute of Standards and Technology (USA)

65180L **Evaluation of CD-SEM measurement uncertainty using secondary electron simulation with charging effect** [6518-20]
H. Abe, A. Hamaguchi, Y. Yamazaki, Toshiba Corp. (Japan)

65180N **Carbon nanotube metrology in a CD SEM** [6518-22]
C. Yates, ON Semiconductor, Inc. (USA); T. Rueckes, Nantero, Inc. (USA); R. J. Carter, LSI Logic Corp. (USA)

65180O **Physical matching versus CD matching for CD SEM** [6518-23]
R. Kris, G. Zuckerman, E. Sommer, Z. Hadad, S. Dror, A. Tam, N. Shcolnik, Applied Materials Israel (Israel)

SESSION 6 INSPECTION

65180P **Developing the new ADC algorithm that enables to identify the defect source** [6518-24]
P.-Y. Tsai, W.-F. Chiu, T.-Y. Chen, Taiwan Semiconductor Manufacturing Co., Ltd. (Taiwan); F. Endo, Y. Kariya, K. Nemoto, Hitachi High-Technologies Corp. (Japan)

65180Q **Developing micro ADI methodology for new litho process monitoring strategies** [6518-25]
I. Mäge, U. Seifert, Qimonda AG (Germany); B. Saville, M. Tuckermann, KLA-Tencor GmbH (Germany)

65180S **Immersion lithography defectivity analysis at DUV inspection wavelength** [6518-27]
E. Golan, D. Meshulach, N. Raccah, J. H. Yeo, O. Dassa, Applied Materials (Israel); S. Brandl, C. Schwarz, Qimonda, North America Corp. (USA); B. Pierson, ASML (USA); W. Montgomery, Albany NanoTech Complex (USA)

65180T **Innovative metrology for wafer edge defectivity in immersion lithography** [6518-28]
I. Pollentier, IMEC (Belgium); F. Iwamoto, Matsushita Electric Industrial Co., Ltd. (Japan); M. Kocsis, Intel Corp. (USA); A. Somanchi, F. Burkeen, S. Vedula, KLA-Tencor Corp. (USA)

SESSION 7 SCATTEROMETRY TECHNIQUES, LIMITS, ETC.

65180U **Fundamental limits of optical critical dimension metrology: a simulation study (Invited Paper)** [6518-29]
R. Silver, T. Germer, R. Attota, B. M. Barnes, National Institute of Standards and Technology (USA); B. Bunday, J. Allgair, International Sematech Manufacturing Initiative (USA); E. Marx, J. Jun, National Institute of Standards and Technology (USA)

65180V **Detailed analysis of capability and limitations of CD scatterometry measurements for 65- and 45-nm nodes** [6518-30]
I. Pundaleva, R. Chalykh, J. Lee, S. Choi, W. Han, Samsung Electronics Co., Ltd. (South Korea)

65180W **Real-time profile shape reconstruction using dynamic scatterometry** [6518-31]
S. Soulan, M. Besacier, LTM-CNRS (France); T. Leveder, CEA-LETI (France); P. Schiavone, LTM-CNRS (France)

65180X **Mueller polarimetry in the back focal plane** [6518-32]
A. De Martino, S. Ben Hatit, M. Foldyna, LPICM-CNRS, Ecole Polytechnique (France)

65180Z **Modeling the effect of line profile variation on optical critical dimension metrology** [6518-34]
T. A. Germer, National Institute of Standards and Technology (USA)

SESSION 8 STANDARDS AND TECHNIQUES

651810 **TEM calibration methods for critical dimension standards** [6518-35]
N. G. Orji, R. G. Dixson, National Institute of Standards and Technology (USA); D. I. Garcia-Gutierrez, Advanced Technology Development Facility (USA); B. D. Bunday, M. Bishop, International SEMATECH Manufacturing Initiative (USA); M. W. Cresswell, R. A. Allen, National Institute of Standards and Technology (USA); J. A. Allgair, International SEMATECH Manufacturing Initiative (USA)

651811 **Image simulation and surface reconstruction of undercut features in atomic force microscopy** [6518-36]
X. Qian, Illinois Institute of Technology (USA); J. Villarrubia, National Institute of Standards and Technology (USA); F. Tian, Illinois Institute of Technology (USA); R. Dixson, National Institute of Standards and Technology (USA)

651812 **Statistical approach utilizing neural networks for CD error prediction** [6518-37]
M. Asano, M. Satake, S. Tanaka, S. Mimotogi, Toshiba Corp. (Japan)

651813 **Characterizing pattern structures using x-ray reflectivity** [6518-38]
H.-J. Lee, C. L. Soles, H. W. Ro, S. Kang, E. K. Lin, A. Karim, W. Wu, National Institute of Standards and Technology (USA); D. R. Hines, Univ. of Maryland (USA)

651814 **Accuracy in optical image modeling** [6518-39]
J. Potzick, E. Marx, National Institute of Standards and Technology (USA); M. Davidson, Spectel Research Corp. (USA)

651815 **Single crystal critical dimension reference materials (SCCDRM): process optimization for the next generation of standards** [6518-40]
R. G. Dixson, W. F. Guthrie, M. Cresswell, R. A. Allen, N. G. Orji, National Institute of Standards and Technology (USA)

SESSION 9 REFERENCE METROLOGY AND INSTRUMENTS

651816 **Comparison and uncertainties of standards for critical dimension atomic force microscope tip width calibration** [6518-41]
R. Dixson, N. G. Orji, National Institute of Standards and Technology (USA)

651818 **TEM validation of CD AFM image reconstruction** [6518-135]
G. A. Dahlen, L. Mininni, M. Osborn, H.-C. Liu, J. R. Osborne, Veeco Instruments, Inc. (USA); B. Tracy, A. del Rosario, Spansion, Inc. (USA)

651819 **Application of carbon nanotube probes in a critical dimension atomic force microscope** [6518-43]
B. C. Park, Korea Research Institute of Standards and Science (South Korea); J. Choi, Korea Research Institute of Standards and Science (South Korea) and Chungnam National Univ. (South Korea); S. J. Ahn, D.-H. Kim, Korea Research Institute of Standards and Science (South Korea); J. Lyou, Chungnam National Univ. (South Korea); R. Dixson, N. G. Orji, J. Fu, T. V. Vorburger, National Institute of Standards and Technology (USA)

65181B **In-line AFM characterization of STI profile at the 65 nm node with advanced carbon probes** [6518-45]
M. D. Sardo, STMicroelectronics (France); A. Berthoud, NXP Semiconductors (France); J.-C. Royer, CEA-LETI Minatec (France); C. Kusch, Nanotools GmbH (Germany)

SESSION 10 METROLOGY CHALLENGES

65181C **Impact of thin film metrology on the lithographic performance of 193-nm bottom antireflective coatings** [6518-46]
C. A. Mack, Lithoguru.com (USA); D. Harrison, C. Rivas, P. Walsh, MetroSol, Inc. (USA)

65181D **Dielectric-thickness dependence of damage induced by electron-beam irradiation of MNOS gate pattern** [6518-47]
M. Matsui, T. Mine, K. Hozawa, K. Watanabe, Hitachi, Ltd. (Japan); J. Inoue, H. Nagaishi, Renesas Technology Corp. (Japan)

65181E **OPC model data collection for 45-nm technology node using automatic CD-SEM offline recipe creation** [6518-48]
D. Fischer, M. Talbi, A. Wei, IBM Semiconductor Research and Development Ctr. (USA); O. Menadeva, Applied Materials Israel (Israel); R. Cornell, Applied Materials (USA)

65181F **Line width measurement below 60nm using an optical interferometer and artificial neural network** [6518-49]
C. W. See, R. J. Smith, M. G. Somekh, Univ. of Nottingham (United Kingdom); A. Yacoot, National Physical Lab. (United Kingdom)

65181G **Metrology challenges for advanced lithography techniques** [6518-50]
I. Englard, Applied Materials Europe (Netherlands); P. Vanoppen, J. Finders, I. Minnaert-Janssen, F. Duray, J. Meessen, G.-J. Janssen, ASML Netherlands (Netherlands); O. Adan, L. Gershtein, R. Peltinov, C. Masia, Applied Materials Europe (Israel); R. Piech, Applied Materials Europe (Netherlands)

SESSION 11 NEW TRENDS IN METROLOGY

65181H **Transition from precise to accurate critical dimension metrology (Invited Paper)** [6518-51]
V. A. Ukraintsev, M. C. Tsai, T. Lii, R. A. Jackson, Texas Instruments, Inc. (USA)

65181I **Device metrology with high-performance scanning ion beams** [6518-52]
D. C. Joy, Univ. of Tennessee (USA); B. J. Griffin, Univ. of Tennessee (USA) and Univ. of Western Australia (Australia); J. Notte, L. Stern, S. McVey, B. Ward, C. Fenner, ALIS Corp. (USA)

65181J **Beyond measurement uncertainty: improving the productivity of metrology tools through recipe error analysis** [6518-53]
E. Solecky, A. Bennasser, E. Weissmann, IBM Systems and Technology Group (USA)

65181K **Realizing value-added metrology (Invited Paper)** [6518-54]
B. Bunday, P. Lipscomb, J. Allgair, D. Patel, International SEMATECH Manufacturing Initiative (USA); M. Caldwell, Freescale (USA); E. Solecky, C. Archie, J. Morningstar, IBM Microelectronics (USA); B. J. Rice, SEMATECH (USA); B. Singh, J. Cain, I. Emami, Advanced Micro Devices (USA); B. Banke, IBM Microelectronics (USA); A. Herrera, Spansion (USA); V. Ukraintsev, J. Schlessinger, J. Ritchison, Texas Instruments (USA)

65181L **Improved dimension and shape metrology with versatile atomic force microscopy** [6518-138]
M. Caldwell, Freescale Semiconductor, Inc. (USA); T. Bao, Veeco Instruments, Inc. (USA); J. Hackenberg, B. McLain, O. Munoz, T. Stephens, V. Vartanian, Freescale Semiconductor, Inc. (USA)

65181M **Enabling immersion lithography and double patterning** [6518-56]
K. M. Monahan, Quantitative Yield Strategies (USA); A. Widmann, KLA-Tencor Corp. (USA)

Part Two

SESSION 12 LINE-EDGE AND LINE-WIDTH ROUGHNESS

65181N **Correlation length and the problem of line width roughness** [6518-57]
V. Constantoudis, G. P. Patsis, E. Gogolides, Institute of Microelectronics, NCSR (Greece)

65181O **Line edge roughness characterization of sub-50nm structures using CD-SAXS: round-robin benchmark results** [6518-195]
C. Wang, R. L. Jones, E. K. Lin, W. Wu, J. S. Villarrubia, K.-W. Choi, National Institute of Standards and Technology (USA); J. S. Clarke, B. J. Rice, M. Leeson, J. Roberts, R. Bristol, Intel Corp. (USA); B. Bunday, International SEMATECH Manufacturing Initiative (USA)

65181P **Characterization of line-edge roughness in Cu/low-*k* interconnect pattern** [6518-59]
A. Yamaguchi, D. Ryuzaki, J. Yamamoto, Hitachi, Ltd. (Japan); H. Kawada, T. Iizumi, Hitachi High-Technologies Corp. (Japan)

65181Q **Impact of acid diffusion length on resist LER and LWR measured by CD-AFM and CD-SEM** [6518-60]
J. Foucher, CEA/LETI/MINATEC (France); A. Pikon, C. Andes, J. Thackeray, Rohm and Haas Electronic Materials (USA)

65181R **Advanced edge roughness measurement application for mask metrology** [6518-61]
T. Marschner, J. Richter, U. Dersch, Advanced Mask Technology Ctr. (Germany); A. Moran, R. Katz, D. Chase, R. Falah, T. Coleman, Applied Materials Israel (Israel)

65181S **The coming of age of tilt CD-SEM** [6518-114]
B. Bunday, J. Allgair, International SEMATECH Manufacturing Initiative (USA); E. Solecky, C. Archie, IBM Microelectronics (USA); N. G. Orji, National Institute of Standards and Technology (USA); J. Beach, Advanced Technology Development Facility (USA); O. Adan, R. Peltinov, M. Bar-zvi, Applied Materials (Israel); J. Swyers, Applied Materials (USA)

SESSION 13 MASK METROLOGY

65181T **Scatterometry on pelliclized masks: an option for wafer fabs** [6518-63]
E. Gallagher, C. Benson, IBM Corp. (USA); M. Higuchi, Y. Okumoto, Toppan Electronics Inc. (USA); M. Kwon, S. Yedur, S. Li, Timbre Technologies, Inc. (USA); S. Lee, M. Tabet, Nanometrics, Inc. (USA)

65181U **Development of advanced mask inspection optics with transmitted and reflected light image acquisition** [6518-64]
R. Hirano, R. Ogawa, H. Suzuki, K. Takahara, Y. Tsuji, S. Murakami, N. Kikuiri, K. Usuda, Advanced Mask Inspection Technology, Inc. (Japan)

65181V **Real time monitoring of reticle etch process tool to investigate and predict critical dimension performance** [6518-65]
R. Deming, K. Yung, M. Guglielmana, D. Bald, K. Baik, F. Abboud, Intel Corp. (USA)

65181W **CAD-based line/space mix-up prevention for reticle metrology** [6518-66]
T. Marschner, M. Enger, F. Ludewig, Advanced Mask Technology Ctr. (Germany); R. Falah, S. Latinsky, O. Lindman, T. Coleman, Applied Materials (Israel)

65181X **Aspects and new developments on edge angle and edge profile metrology at PTB** [6518-67]
B. Bodermann, E. Buhr, A. Diener, Physikalisch-Technische Bundesanstalt (Germany); K. Dirscherl, Danish Fundamental Metrology Ltd. (Denmark); G. Ehret, C. G. Frase, M. Wurm, Physikalisch-Technische Bundesanstalt (Germany)

65181Y **Study of rigorous effects and polarization on phase shifting masks through simulations and in-die phase measurements** [6518-68]
K. M. Lee, M. Tavassoli, M. Lau, K. Baik, B. Lieberman, Intel Mask Operation (USA); S. Perlitz, U. Buttgereit, T. Scherübl, Carl Zeiss SMS GmbH (Germany)

SESSION 14 PROCESS CONTROL II

65181Z **Advances in process overlay: alignment solutions for future technology nodes** [6518-69]
H. Megens, R. van Haren, S. Musa, M. Doytcheva, S. Lalbahadoersing, M. van Kemenade, H.-W. Lee, P. Hinnen, F. van Bilsen, ASML (Netherlands)

651820 **Algorithm for lithography advanced process control system for high-mix low-volume products** [6518-70]
E. Kawamura, Fujitsu. Ltd. (Japan)

651821 **Advanced process control with design-based metrology** [6518-71]
H. Yang, J. Kim, J. Hong, D. Yim, J. Kim, Hynix Semiconductor, Inc. (South Korea); T. Hasebe, M. Yamamoto, NanoGeometry Research, Inc. (Japan)

651822 **Investigation of optimized wafer sampling with multiple integrated metrology modules within photolithography equipment** [6518-72]
T. L. Taylor, Micron Technology, Inc. (USA); E. Makimura, Tokyo Electron America, Inc. (USA)

651823 **Advanced lithography parameters extraction by using scatterometry system** [6518-73]
W. Zhou, M. Tang, H. Koh, M. Zhou, Chartered Semiconductor Manufacturing, Ltd. (Singapore)

SESSION 15 CD FOR DEVELOPMENT II

651824 **Line edge roughness impact on critical dimension variation** [6518-74]
Y. Ma, H. J. Levinson, T. Wallow, Advanced Micro Devices, Inc. (USA)

651825 **Predicting electrical measurements by applying scatterometry to complex spacer structures** [6518-75]
M. Sendelbach, J. Ayala, IBM Microelectronics (USA); P. Herrera, KLA-Tencor Corp. (USA)

651826 **Characterization of bending CD errors induced by resist trimming in 65 nm node and beyond** [6518-76]
Y. Gu, J. B. Friedmann, V. Ukraintsev, G. Zhang, T. Wolf, T. Lii, R. Jackson, Texas Instruments, Inc. (USA)

651827 **Characterization of capacitive 3D deep trench mask open structures using scatterometry** [6518-78]
S. Zangooie, IBM Microelectronics (USA); P. Herrera, KLA-Tencor (USA); A. Mesfin, C. Archie, M. Sendelbach, IBM Microelectronics (USA)

POSTER SESSION

651829 **Application of perturbation methods in optical scatterometry** [6518-33]
B. C. Bergner, T. J. Suleski, Univ. of North Carolina, Charlotte (USA)

65182B **SEM metrology for advanced lithographies** [6518-62]
B. Bunday, J. Allgair, International SEMATECH Manufacturing Initiative (USA); B. J. Rice, J. Byers, SEMATECH (USA); Y. Avitan, R. Peltinov, M. Bar-zvi, O. Adan, Applied Materials (Israel); J. Swyers, Applied Materials (USA); R. Z. Shneck, Ben Gurion Univ. of the Negev (Israel)

65182C **Across-wafer CD uniformity control through lithography and etch process: experimental verification** [6518-77]
Q. Zhang, Univ. of California, Berkeley (USA); C. Tang, Spansion, Inc. (USA); J. Cain, Advanced Micro Devices, Inc. (USA); A. Hui, T. Hsieh, N. Maccrae, Spansion Inc. (USA); B. Singh, Advanced Micro Devices, Inc. (USA); K. Poolla, C. J. Spanos, Univ. of California, Berkeley (USA)

65182D **Image analysis of alignment and overlay marks with compound structure** [6518-80]
R. Chalykh, I. Pundaleva, J.-H. Shin, S.-S. Kim, H.-K. Cho, J.-T. Moon, Samsung Electronics Co. (South Korea)

65182E **Methodical approach to improve defect detection sensitivity on lithography process using DUV inspection system** [6518-81]
C. Lee, S. Won, D. Seo, H. Kim, J. Kim, Hynix Semiconductor, Inc. (South Korea); J.-H. Yeo, I. Dolev, C.-H. Kwak, Applied Materials (Israel)

65182F **Etch process monitoring by electron beam wafer inspection** [6518-82]
L. Lin, J.-Y. Chen, W.-Y. Wong, Powerchip Semiconductor Co. (Taiwan); M. McCord, A. Tsai, S. Oestreich, I. De, J. Lauber, A. Kang, KLA-Tencor (USA)

65182G **Immersion-induced defect SEM-based library for fast baseline improvement and excursion** [6518-83]
I. Englard, Applied Materials Europe (Netherlands); R. Stegen, E. Van Brederode, P. Vanoppen, I. Minnaert-Janssen, F. Duray, T. der Kinderen, G. Tanriseven, I. Lamers, M. B. Mantecon, ASML Netherlands B.V. (Netherlands); L. Levin, E. Binyamini, N. Raccah, S. Dror, E. Valfer, O. Rotlevi, Applied Materials Europe (Israel); R. Schreutelkamp, R. Piech, Applied Materials Europe (France)

65182H **Novel technology of automatic macro inspection for 32-nm node and best focus detection** [6518-85]
K. Fukazawa, K. Endo, Nikon Corp. (Japan); K. Yoshino, Y. Yamazaki, Toshiba Corp. (Japan)

65182I **Results from a new die-to-database reticle inspection platform** [6518-86]
W. Broadbent, Y. Xiong, M. Giusti, R. Walsh, A. Dayal, KLA-Tencor Corp. (USA)

65182K **Inspection sensitivity improvement through optimization of lobe blocking on high-end memory devices** [6518-88]
C. Lee, S. Won, D. Seo, H. Kim, J. Kim, Hynix Semiconductor, Inc. (South Korea); J.-H. Yeo, I. Dolev, C.-H. Kwak, Applied Materials (Israel)

65182L **Use of automated EBR metrology inspection to optimize the edge bead process** [6518-89]
A. Carlson, T. Le, A. Pai, Rudolph Technologies (USA); J. Hallen, B. Rioux, National Semiconductor (USA)

65182M **High-throughput polarization imaging for defocus and dose inspection for production wafers** [6518-90]
G. Sun, E. Onoichenco, Y. Fu, Y. Liu, R. Amell, C. McCandless, R. Reddy, G. Kumar, M. Guest, Rudolph Technologies, Inc. (USA)

65182N **Real-time spatial control of photoresist development rate** [6518-91]
A. Tay, W.-K. Ho, N. Hu, C.-M. Kiew, National Univ. of Singapore (Singapore); K.-Y. Tsai, National Taiwan Univ. (Taiwan)

65182O **A predictive method to forecast spatial variability of stochastic processes for deep nanoscale semiconductor manufacturing** [6518-92]
Y. Chen, VIGMA Nanoelectronics (USA)

65182P **Advanced process control for hyper-NA lithography based on CD-SEM measurement** [6518-93]
T. Ishimoto, Hitachi High-Technologies Corp. (Japan) and IMEC (Belgium); K. Sekiguchi, Hitachi High Technologies Europe GmbH (Germany) and IMEC (Belgium); N. Hasegawa, T. Maeda, K. Watanabe, Hitachi High-Technologies Corp. (Japan); G. Storms, D. Laidler, S. Cheng, IMEC (Belgium)

65182Q **Application of integrated scatterometry (iODP) to detect and quantify resist profile changes due to resist batch changes in a production environment** [6518-94]
S. Ali, L. Chen, J. Tiffany, A. Yadav, Qimonda AG (USA); B. Swain, D. Dixon, S. Lickteig, Tokyo Electron America, Inc. (USA)

65182R **Litho cell control using MPX** [6518-95]
E. Apelgren, H. Kennemer, Spansion LLC (USA); C. Nelson, B. Eichelberger, J. Robinson, KLA-Tencor (USA)

65182S **Data sharing system for lithography APC** [6518-96]
E. Kawamura, Y. Teranishi, M. Shimabara, Fujitsu Ltd. (Japan)

65182T **CD measurement in flash memory using substrate current technology** [6518-97]
Y.-U, Ko, Fab Solutions, Inc. (USA); K. Yamada, T. Ushiki, Fab Solutions, Inc. (Japan)

65182U **Overlay metrology for dark hard mask process: simulation and experiment study** [6518-99]
J. Shin, R. Chalykh, H. Kang, S. Kim, S. Lee, H.-K. Cho, Samsung Semiconductor Research and Development (South Korea)

65182V **In-chip overlay metrology of 45nm and 55nm processes** [6518-100]
Y. S. Ku, C. H. Tung, Y. P. Li, H. L. Pang, Industrial Technology Research Institute (Taiwan); C. M. Ke, Y. H. Wang, D. C. Huang, Taiwan Semiconductor Manufacturing Co. (Taiwan); N. P. Smith, Nanometrics, Inc. (Taiwan); L. Binns, Nanometrics, Inc. (United Kingdom)

65182W **Evaluation of AIM overlay mark for thin film head application** [6518-101]
Y. Li, Seagate Technology (USA); A. Fan, KLA-Tencor Corp. (USA); G. Etheridge, G. Finken, D. Louder, Seagate Technology (USA)

65182X **Through-focus technique for overlay metrology** [6518-102]
A.-S. Liu, Y.-S. Ku, Industrial Technology Research Institute (Taiwan); N. Smith, Nanometrics, Inc. (Taiwan)

65182Y **Improvement of front-end process overlay in 60nm DRAM** [6518-103]
Y.-S. Hwang, W.-K. Ma, E. Kang, C.-M. Lim, S.-C. Moon, Hynix Semiconductor Industries Co., Ltd. South Korea); S.-J. An, K. Rhe, ASML (South Korea)

65182Z **Hardware, materials, and parameters optimization for improvement of immersion overlay** [6518-104]
W.-K. Ma, Y.-S. Hwang, E.-K. Kang, S. Park, J.-H. Kang, C.-M. Lim, S.-C. Moon, Hynix Semiconductor Industries Co., Ltd. (South Korea)

651831 **45nm design rule in-die overlay metrology on immersion lithography processes** [6518-106]
Y.-H. Shih, G. K. C. Huang, C.-C. Yu, United Microelectronics Corp. (Taiwan); M. Adel, KLA-Tencor Israel (Israel); C.-C. K. Huang, KLA-Tencor Corp. (USA); P. Izikson, E. Kassel, KLA-Tencor Israel (Israel); S. Mathur, C.-J. Huang, D. Tien, KLA-Tencor Corp. (USA); Y. Avrahamov, KLA-Tencor Israel (Israel)

651832 **Say good-bye to DOF: statistical process window analysis with inline lithographic process variations** [6518-107]
W. Zhou, M. Tang, H. Koh, M. Zhou, Chartered Semiconductor Manufacturing, Ltd. (Singapore)

651833 **Use of in-line AFM as LWR verification tool in 45nm process development** [6518-108]
M. H. Hsieh, K. H. Shi, J. H. Yeh, R. H. Hsu, M. Tsai, S. F. Tzou, United Microelectronics Corp. (Taiwan)

651834 **Die-to-database verification tool for detecting CD errors, which are caused by OPC features, by using mass gate measurement and layout information** [6518-109]
T. Kitamura, T. Hasebe, K. Kubota, F. Sakai, S. Nakazawa, D. Lin, M. J. Hoffman, M. Yamamoto, NanoGeometry Research, Inc. (Japan); M. Inoue, Topcon Corp. (Japan)

651835 **Major trends in extending CD-SEM utility** [6518-112]
B. Bunday, J. Allgair, International SEMATECH Manufacturing Initiative (USA); K. Yang, S. Koshihara, H. Morokuma, Hitachi High-Technologies Corp. (Japan); A. Danilevsky, C. Parker, L. Page, Hitachi High Technologies America, Inc. (USA)

651836 **Stochastic simulation of material and process effects on the patterning of complex layouts** [6518-115]
N. Tsikrikas, D. Drygiannakis, G. P. Patsis, G. Kokkoris, I. Raptis, E. Gogolides, Institute of Microelectronics (Greece)

651837 **MacroCD contact ellipticity measurements for lithography tool qualification** [6518-116]
I. Englard, Applied Materials Europe (Netherlands); E. van Setten, G.-J. Janssen, P. Vanoppen, I. Minnaert-Janssen, F. Duray, ASML Netherlands B.V. (Netherlands); O. Adan, A. Moran, L. Gershtein, R. Peltinov, Applied Materials Europe (Israel)

651838 **Sub-nanometer CD-SEM matching** [6518-117]
T. Lott, R. J. Elias, Cypress Semiconductor (USA)

651839 **Visible light angular scatterometry for nanolithography** [6518-118]
R. M. Al-Assaad, L. Tao, W. Hu, The Univ. of Texas at Dallas (USA)

65183A **Robust sub-50-nm CD control by a fast-goniometric scatterometry technique** [6518-119]
J. Hazart, P. Barritault, S. Garcia, CEA-LETI Minatec (France); T. Leroux, P. Boher, ELDIM (France); K. Tsujino, OMRON Corp. (Japan)

Part Three

65183B **Accurate and reliable optical CD of MuGFET down to 10nm** [6518-120]
P. Leray, G. F. Lorusso, S. Cheng, N. Collaert, M. Jurczak, IMEC (Belgium); S. Shirke, VLSI Standard (USA)

65183C **OCD metrology by floating n/k** [6518-121]
S.-S. Yu, J. Huang, C.-M. Ke, T.-S. Gau, B. J. Lin, A. Yen, Taiwan Semiconductor Manufacturing Co., Ltd. (Taiwan); L. Lane, V. Vuong, Y. Chen, Timbre Technologies, Inc. (USA)

65183D **High-resolution in-die metrology using beam profile reflectometry and ellipsometry** [6518-123]
C. Jun, J. Park, Samsung Electronics Co., Ltd. (South Korea); J. Opsal, H. Pois, I.-K. Kim, J.-W. Kim, L. Nicolaides, Therma-Wave, Inc. (USA)

65183E **The study to enhance the mask global CD uniformity by removing local CD variation** [6518-126]
Y. Choi, M. Kim, O. Han, Hynix Semiconductor (South Korea)

65183F **Achievement of sub nanometer reproducibility in line scale measurements with the nanometer comparator** [6518-128]
R. Köning, J. Flügge, H. Bosse, Physikalisch-Technische Bundesanstalt (Germany)

65183G **Aera193i: aerial imaging mask inspection for immersion lithography** [6518-129]
Y. Zabar, C. Braude, S. Mangan, Applied Materials (Israel); D. Rost, R. Mann, MP Mask Technology Ctr., LLC (USA)

65183H **Critical dimension measurements on phase-shift masks using an optical pattern placement metrology tool** [6518-130]
H. Bittner, D. Adam, J. Bender, A. Boesser, M. Heiden, K. Roeth, Vistec Semiconductor Systems GmbH (Germany)

65183J **Novel CD-SEM calibration reference consisting of 100-nm pitch grating and positional identification mark** [6518-133]
Y. Nakayama, Hitachi, Ltd. (Japan); H. Kawada, S. Yoneda, Hitachi High-Technologies Corp. (Japan); T. Mizuno, Hitachi High-Tech Science Systems Corp. (Japan)

65183K **Advanced CD-AFM probe tip shape characterization for metrology accuracy and throughput** [6518-134]
H.-C. Liu, J. R. Osborne, M. Osborn, G. A. Dahlen, Veeco Instruments, Inc. (USA)

65183L **An advanced AFM sensor: its profile accuracy and low probe wear property for high aspect ratio patterns** [6518-137]
M. Watanabe, S. Baba, T. Nakata, Hitachi, Ltd. (Japan); T. Kurenuma, Y. Kunitomo, M. Edamura, Hitachi Kenki FineTech Co., Ltd. (Japan)

65183M **New inline AFM metrology tool suited for LSI manufacturing at the 45-nm node and beyond** [6518-139]
M. Edamura, Y. Kunitomo, T. Morimoto, S. Sekino, T. Kurenuma, Y. Kembo, Hitachi Kenki FineTech Co., Ltd. (Japan); M. Watanabe, S. Baba, K. Hidaka, Hitachi, Ltd. (Japan)

65183N **Magnification calibration standards for sub-100nm metrology** [6518-140]
S. Deo, Univ. of Tennessee (USA); D. Joy, Univ. of Tennessee (USA) and Oak Ridge National Lab. (USA)

65183O **Advances in CD-AFM scan algorithm technology enable improved CD metrology** [6518-141]
L. Mininni, Veeco Instruments (USA); J. Foucher, P. Faurie, CEA/LETI/MINATEC (France)

65183P **Plasma-assisted cleaning by electrostatics (PACE)** [6518-142]
W. M. Lytle, H. Shin, D. N. Ruzic, Univ. of Illinois at Urbana-Champaign (USA)

65183Q **Optical characterization of microstructures of high aspect ratio** [6518-143]
T. Tamulevicius, S. Tamulevicius, M. Andrulevicius, G. Janusas, V. Ostasevicius, A. Palevicius, Kaunas Univ. of Technology (Lithuania)

65183R **Contrarian approach to and ultimate solution for 193nm reticle haze** [6518-144]
O. Kishkovich, A. Grayfer, F. V. Belanger, Entegris, Inc. (USA)

65183S **Thermal imaging of a lithography cell, including exposure tool, using a self-contained instrumented wafer** [6518-145]
Z. Reid, M. Wiltse, S. Burgan, G. Roche, SensArray Corp. (USA)

65183T **Optimization of lithography process to improve image deformation of contact hole sub-90 nm technology node** [6518-146]
S. Jun, J. Kim, E. Jeong, Y. Yun, J. Kim, K. Kim, DongbuElectronics (South Korea)

65183V **Resolution enhancement technique using oxidation process with nitride hardmask process** [6518-148]
E. Jeong, J. Kim, K. Kim, D. Kim, H. Lim, DongbuElectronics (South Korea)

65183W **Enhanced hole shape of flash devices in ArF lithography by eliptical mask bias technique** [6518-150]
Y.-D. Jeon, S. Jun, J.-H. Kang, S.-U. Lee, J. Kim, K. Kim, DongbuElectronics (South Korea)

65183Y **Purge micro-environment with ionized air to reduce chances of ESD damages to wafers** [6518-153]
H. Wang, Y. Liu, Entegris, Inc. (USA); M. Cisewski, Consultant (USA)

65183Z **Monitoring airborne molecular contamination: a quantitative and qualitative comparison of real-time and grab-sampling techniques** [6518-154]
A. M. Shupp, D. Rodier, S. Rowley, Particle Measuring Systems, Inc. (USA)

651841 **Optimizing surface finishing processes through the use of novel solvents and systems** [6518-156]
M. Quillen, P. Holbrook, Eastman Chemical Co. (USA); J. Moore, DAETEC, LLC (USA)

651842 **New filter media development for effective control of trimethysilanol (TMS) and related low molecular weight silicon containing organic species in the photobay ambient** [6518-157]
A. Grayfer, F. V. Belanger, P. Cate, D. Ruede, Entegris Inc. (USA)

651843 **Non-contacting electrostatic voltmeter for wafer potential monitoring** [6518-158]
M. A. Noras, W. A. Maryniak, Trek, Inc. (USA)

651844 **Optimized molecular contamination monitoring for lithography** [6518-159]
D. Rodier, Particle Measuring Systems (USA)

651845 **The novel advanced process control to eliminate AlCu-PVD induced overlay shift** [6518-160]
C. H. Huang, C. C. Yang, E. Yang, T. H. Yang, K. Chen, J. Ku, C. Y. Lu, Macronix International Co., Ltd. (Taiwan)

651846 **Low-pressure drop filtration of airborne molecular organic contaminants using open-channel networks** [6518-161]
A. J. Dallas, J. Joriman, L. Ding, G. Weineck, K. Seguin, Donaldson Co., Inc. (USA)

651847 **Novel method of under-etch defect detection for contact layers based on Si substrate using optic wafer inspection tools** [6518-162]
B.-H. Lee, J.-S. Choi, S.-B. Chin, D.-H. Cho, C.-L. Song, Samsung Electronics Co., Ltd. (South Korea)

651848 **CD-bias evaluation and reduction in CD-SEM linewidth measurements** [6518-163]
M. Tanaka, C. Shishido, W. Nagatomo, Hitachi, Ltd. (Japan); K. Watanabe, Hitachi High-Technologies Corp. (Japan)

651849 **Ellipsometric studies of the absorption of liquid by photo resist** [6518-164]
H. Jeong, J. Kyung, S. Park, K. Lee, H. Lee, H. Cheon, I. An, Hanyang Univ. (South Korea); S. Lee, Samsung Eletronics Co., Ltd. (South Korea)

65184A **Advanced defect definition method using design data** [6518-165]
K. Lim, D. Patel, International SEMATECH Manufacturing Initiative (USA); K. Yang, S. Koshihara, Hitachi High-Technologies Corp. (Japan); L. Page, A. Self, M. Martinez, Hitachi High-Technologies America, Inc. (USA)

65184B **Image quality improvement in inspection systems using double integrator illumination** [6518-166]
A. Takada, H. Suzuki, T. Tojo, Topcon Corp. (Japan); M. Shibuya, Tokyo Polytechnic Univ. (Japan)

65184C **Study of ADI (After Develop Inspection) on photo resist wafers using electron beam (II)** [6518-167]
T. Hayashi, M. Saito, K. Fujihara, S. Shibuya, Y. Kudou, Tokyo Electron, Ltd. (Japan); H. Nagaike, Tokyo Electron AT, Ltd. (Japan); J. Lin, J. Jau, Hermes Microvision, Inc. (USA)

65184D **3D anisotropic semiconductor grooves measurement simulations (scatterometry) using FDTD methods** [6518-168]
H. Shirasaki, Tamagawa Univ. (Japan)

65184E **Metrology of replicated diffractive optics with Mueller polarimetry in conical diffraction** [6518-169]
T. Novikova, A. De Martino, P. Bulkin, Q. Nguyen, B. Drévillon, LPICM, École Polytechnique (France); V. Popov, A. Chumakov, Moscow State Univ. (Russia)

65184F **Influence of wafer warpage on photoresist film thickness and extinction coefficient measurements** [6518-170]
X. Wu, A. Tay, National Univ. of Singapore (Singapore)

65184G **Angular scatterometry for line-width roughness measurement** [6518-171]
D.-M. Shyu, Y.-S. Ku, Industrial Technology Research Institute (Taiwan); N. Smith, Nanometrics, Inc. (Taiwan)

65184H **Charging measurement using SEM embedded energy filter** [6518-172]
F. Levitov, A. Karabekov, G. Eytan, Applied Materials Israel (Israel); G. Golan, Holon Institute of Technology (Israel) and The Open Univ. (Israel)

65184I **Contact leakage and open monitoring with an advanced e-beam inspection system** [6518-173]
S. Lei, H. Liu, M. Tsai, United Microelectronics Corp. (Taiwan); H.-C. Wu, Hermes Microvision, Inc. (Taiwan); H. Xiao, J. Jau, Hermes Microvision, Inc. USA (USA)

65184J **An approach to modeling and on-line identification for piezoelectric stack actuator** [6518-174]
Y. Wang, X. Zhao, W. Chu, Harbin Institute of Technology (China)

65184K **The optimization of photoresist profile for sub-90nm technology** [6518-175]
H. Jeon, C. Shim, J. Hong, J. Han, K. Kim, Dongbu Electronics (South Korea)

65184L **Study on micro-bubble defect induced by RRC coating** [6518-176]
Y.-H. Liu, W.-S. Liao, H.-H. Lin, C.-J. Chen, C. C. Huang, United Microelectronics Corp. (Taiwan)

65184M **Characterization of resist thinning and profile changes using scatterometry** [6518-178]
J. Fullam, K. Petrillo, IBM Corp. (USA)

65184N **Contamination removal from collector optics and masks: an essential step for next-generation lithography** [6518-179]
H. Shin, S. N. Srivastava, D. N. Ruzic, Univ. of Illinois at Urbana-Champaign (USA)

65184P **A new SEM CD operator verified against Monte Carlo simulations** [6518-181]
C. G. Frase, D. Gnieser, Physikalisch-Technische Bundesanstalt (Germany); K. Dirscherl, Danish Fundamental Metrology, Ltd. (Denmark); E. Buhr, H. Bosse, Physikalisch-Technische Bundesanstalt (Germany)

65184Q **Characterization and adjustment of high performance objectives for DUV applications** [6518-182]
S. Müller-Pfeiffer, L. Körner, S. Franz, O. R. Falkenstörfer, H. Lauth, JENOPTIK Laser, Optik, Systeme GmbH (Germany)

65184R **Phame: a novel phase metrology tool of Carl Zeiss for in-die phase measurements under scanner relevant optical settings** [6518-183]
S. Perlitz, U. Buttgereit, T. Scherübl, Carl Zeiss SMS GmbH (Germany)

65184S **Non-linear methods for overlay control** [6518-184]
M. Kupers, D. Choi, B. Habets, Qimonda Dresden GmbH and Co. OHG (Germany); G. Simons, E. Wallerbos, ASML Netherlands B.V. (Netherlands)

65184T **Leveraging LER to minimize linewidth measurement uncertainty in a calibration exercise** [6518-185]
J. Robert, B. Banke, IBM Microelectronics (USA); R. Dixson, National Institute of Standards and Technology (USA)

65184V **Köhler illumination analysis for high-resolution optical metrology using 193 nm light** [6518-187]
Y.-J. Sohn, R. M. Silver, National Institute of Standards and Technology (USA)

65184W **Critical dimension: MEMS road map** [6518-188]
M. Poulingue, Nanometrics France (France); P. Knutrud, Nanometrics (USA)

65184X **Enabling gate etch process development using scatterometry** [6518-189]
J. Koshy, M. Sendelbach, IBM Microelectronics (USA); P. Herrera, KLA-Tencor Corp. (USA)

65184Z **ArF pellicle degradation mechanism for resolving CD variation** [6518-191]
H. Choi, Y. Ahn, J. Ryu, Y. Lee, B. An, S. Lee, Samsung Electronics Co., Ltd. (South Korea)

651850 **Effect and procedures of post exposure bake temperature optimization on the CD uniformity in a mass production environment** [6518-192]
K. Ruck, H. Weichert, Tokyo Electron Europe, Ltd. (Germany); S. Hornig, F. Finger, G. Fleischer, Qimonda Dresden GmbH and Co. OHG (Germany); D. Hetzer, Timbre Technologies, Inc. (USA)

651851 **Scatterometry characterization of polysilicon gate profiles in a 90 nm logic process** [6518-193]
E. B. Maiken, Intel Corp. (USA)

651855 **Scatterometry solutions and vision for advanced lithography process control** [6518-199]
T. Levin, M. Livne, Intel Corp. (Israel); R. M. Gillespie, Intel Corp. (USA)

651856 **Scatterometry measurement of nested lines, dual space, and rectangular contact CD on phase-shift masks** [6518-200]
K. M. Lee, Intel Corp. (USA); S. Yedur, Timbre Technologies, Inc. (USA); S. Henrichs, M. Tavassoli, K. Baik, Intel Corp. (USA)

651857 **Implementation strategies and return on investment for integrated CD control** [6518-201]
L. Lane, B. Monteverde, Timbre Technologies, Inc. (USA)

Author Index

Symposium Committees

Symposium Chair

Roxann L. Engelstad, University of Wisconsin/Madison (USA)

Symposium Cochair

Christopher J. Progler, Photronics, Inc. (USA)

Technical Organizing Committees

Executive Committee

John A. Allgair, SEMATECH, Inc. (USA) and Freescale Semiconductors (USA)
Chas N. Archie, IBM Corporation (USA)
Roxann L. Engelstad, University of Wisconsin/Madison (USA)
Donis G. Flagello, ASML US, Inc. (USA)
Clifford L. Henderson, Georgia Institute of Technology (USA)
Michael J. Lercel, SEMATECH (USA) and IBM Corporation (USA)
Harry J. Levinson, Advanced Micro Devices, Inc. (USA)
Qinghuang Lin, IBM Thomas J. Watson Research Center (USA)
Christopher J. Progler, Photronics, Inc. (USA)
Franklin M. Schellenberg, Mentor Graphics Corporation (USA)
Vivek K. Singh, Intel Corporation (USA)
Alfred K. K. Wong, Magna Design Automation, Inc. (USA)

Advisory Committee

Robert D. Allen, IBM Almaden Research Center (USA)
William H. Arnold, ASML Netherlands B.V. (Netherlands)
Timothy A. Brunner, IBM Thomas J. Watson Research Center (USA)
Ralph R. Dammel, AZ Electronic Materials USA Corporation (USA)
Roderick R. Kunz, MIT Lincoln Laboratory (USA)
Harry J. Levinson, Advanced Micro Devices, Inc. (USA)
Burn Lin, Taiwan Semiconductor Manufacturing Company, Ltd. (Taiwan)
Chris A. Mack, LithoGuru.com
Victor Pol, Freescale Semiconductor, Inc. (USA)
Michael T. Postek, National Institute of Standards and Technology (USA)
Luc Van den Hove, IMEC (Belgium)
C. Grant Willson, The University of Texas at Austin (USA)
Anthony Yen, Taiwan Semiconductor Manufacturing Company, Ltd. (Taiwan) and Cymer, Inc. (USA)

Conference Committee

Conference Chair

Chas N. Archie, IBM Microelectronics (USA)

Conference Cochair

John A. Allgair, SEMATECH, Inc. (USA)

Program Committee

Ofer Adan, Applied Materials (Israel)
Michael J. Anderson, Rohm and Haas Electronic Materials (USA)
Jason P. Cain, Advanced Micro Devices, Inc. (USA)
Alain G. Deleporte, STMicroelectronics (France)
Daniel J. C. Herr, Semiconductor Research Corporation (USA)
David C. Joy, The University of Tennessee (USA)
Chih-Ming Ke, Taiwan Semiconductor Manufacturing Co., Ltd. (Taiwan)
Byoung-Ho Lee, Samsung Electronics Co., Ltd. (South Korea)
Christopher J. Raymond, Nanometrics, Inc. (USA)
Martha I. Sanchez, IBM Almaden Research Center (USA)
Richard M. Silver, National Institute of Standards and Technology (USA)
Bhanwar Singh, Advanced Micro Devices, Inc. (USA)
Michael W. Stan, MicroChem Corporation (USA)
Alexander Starikov, Intel Corporation (USA)
Neal T. Sullivan, Soluris, Inc. (USA)
Brian M. Trafas, KLA-Tencor Corporation (USA)
Vladimir A. Ukraintsev, Texas Instruments, Inc. (USA)

Session Chairs

1 Keynote Session
Chas N. Archie, IBM Microelectronics (USA)

2 Process Control I: Lithography Control
Christopher J. Raymond, Nanometrics, Inc. (USA)

3 CD for Development I: OPC and Metrology
Neal T. Sullivan, Soluris, Inc. (USA)
Chih-Ming Ke, Taiwan Semiconductor Manufacturing Co., Ltd. (Taiwan)
Chas N. Archie, IBM Microelectronics (USA)

4 Overlay
Alexander Starikov, Intel Corporation (USA)
Daniel J. C. Herr, Semiconductor Research Corporation (USA)

5 CDSEM: Techniques, Limits, Etc.
David C. Joy, The University of Tennessee (USA)
Byoung-Ho Lee, Samsung Electronics Company, Ltd. (South Korea)

6 Inspection
Brian M. Trafas, KLA-Tencor Corporation (USA)
Michael W. Stan, MicroChem Corporation (USA)

7 Scatterometry Techniques, Limits, Etc.
Christopher J. Raymond, Nanometrics, Inc. (USA)
Jason P. Cain, Advanced Micro Devices, Inc. (USA)

8 Standards and Techniques
Bhanwar Singh, Advanced Micro Devices, Inc. (USA)
Vladimir A. Ukraintsev, Texas Instruments, Inc. (USA)

9 Reference Metrology and Instruments
Richard M. Silver, National Institute of Standards and Technology (USA)
Michael J. Anderson, Rohm and Haas Electronic Materials (USA)

10 Metrology Challenges
Alexander Starikov, Intel Corporation (USA)
Ofer Adan, Applied Materials (Israel)

11 New Trends in Metrology
David C. Joy, The University of Tennessee (USA)
Vladimir A. Ukraintsev, Texas Instruments, Inc. (USA)

12 Line-edge and Line-width Roughness
Bhanwar Singh, Advanced Micro Devices, Inc. (USA)
Neal T. Sullivan, Soluris, Inc. (USA)

13 Mask Metrology
Martha I. Sanchez, IBM Almaden Research Center. (USA)
Daniel J. C. Herr, Semiconductor Research Corporation (USA)

14 Process Control II
Brian M. Trafas, KLA-Tencor Corporation (USA)
Jason P. Cain, Advanced Micro Devices, Inc. (USA)

15 CD for Development II
John A. Allgair, SEMATECH, Inc. (USA)
Chas N. Archie, IBM Microelectronics (USA)

Poster Session
Christopher J. Raymond, Nanometrics, Inc. (USA)