Bruce W. Smith, Ph.D.

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Rochester Institute of Technology
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SUMMARY

Bruce Smith has over 30 years of research, academic, industry, and consulting engineering experience in IC (integrated circuit) processing, semiconductor device materials, microelectronics, microlithography, and LCD-TFT (thin film transistor) technology. He is a professor of Microelectronic Engineering and the Director of the Ph.D. program in Microsystems Engineering at the Rochester Institute of Technology. His industry experience includes manufacturing and R&D and he has worked with companies in the US, Europe, and Asia. Professor Smith is a Fellow of the IEEE, a Fellow of the OSA, a Fellow of SPIE, and a member of AVS, ASEE, and SID. He is the recipient of RIT's Trustees Scholarship Award, a SPIE Research Mentoring Award, RIT's Creators Award, and the Rush Henrietta Outstanding Alumni Award, among others, and has been inducted into RIT's Innovator Hall of Fame. Professor Smith has over 200 publications including technical papers, articles, textbooks, and textbook chapters. He holds 27 patents and has licensed his technology both nationally and internationally. Prof. Smith has expertise and is able to serve as an expert witness in semiconductor IC processes and fabrication, microlithography, thin films and etch processes, and TFT/LCD flat panel technology.

PROFESSIONAL EXPERIENCE

- Rochester Institute of Technology, Professor, Kate Gleason College of Engineering, 1988-present
  - Director and Professor, Microsystems Engineering Ph.D. Program, 2008-present
  - Intel Professor of Research and Technology, Microelectronic Engineering, 2000-2007
  - Associate Dean of Graduate Programs, Kate Gleason College of Engineering, 2001-2004
  - Director, Center for Nanolithography Research, 2004-present
  - Professor, Microelectronic Engineering Department, 1988-present
- IMEC (Interuniversity Microelectronics Center), Leuven, Belgium, Visiting Professor, 2008
- Lithographic Technology Corp / Amphibian Systems, President, 1998-present
- IMEC (Interuniversity Microelectronics Center), Leuven, Belgium, Visiting Professor, 2001
- International SEMATECH, Austin Texas, Visiting Scholar, 1997
- Rutherford Appleton Laboratories, Oxford, U.K., Visiting Scientist, 1995
- Digital Equipment Corp., Hudson, Mass., Advanced Development Center, 1986-1988
- Gould AMI Semiconductor, Santa Clara, Calif., Process Development Group, 1983-1986

EDUCATION

- B.S., M.S. Rochester Institute of Technology, College of Science, Imaging Science, Thesis: "Optically Transparent Heat Mirror Thin-Films of ZnS-Ag-ZnS," 1988.
- Ph.D., Rochester Institute of Technology, Center for Imaging Science, Thesis: "Excimer Laser Semiconductor Microlithography at 193nm," 1994.

LITIGATION SUPPORT EXPERIENCE

Date: 2017-
O'Melveny & Meyers LLP
Tessera Entities v. Samsung Electronics Co., Ltd. et al
ITC patent infringement case – Testifying Expert
Wafer-level packaging of semiconductor devices

Date: 2017-
O'Melveny & Meyers LLP
Elm 3DS Innovations, LLC v. Micron Technologies Inc., et al – Testifying Expert
Patent infringement (USDC Delaware)
Three dimensional semiconductor memory structures

Date: 2016-2017
Kellog, Huber, Hansen, Todd, Evans & Figel, PLLC
Covington & Burling LLP

	Case:	MIICS & Partners, America and Goldcharm v. Funai Electric Co. Ltd. and Samsung Display Co. Ltd.
	Project:	Patent infringement, US District Court, Delaware – Testifying Expert
	Field:	TFT/LCD flat panel display technology
Date:	2016-	Finnegan, Henderson, Farabow, Garrett & Dunner LLP
	Case:	Taiwan Semiconductor Manufacturing Ltd. v. Godo Kaisha IP Bridge
	Project:	Inter Partes Review (IPR) – Testifying Expert
	Field:	Semiconductor processing and metal interconnect structures
Date:	2013-	Wilmer Cutler Pickering Hale and Dorr LLP
	Case:	ASML Holding NV and Carl Zeiss SMT v. Nikon Corp.
	Project:	International Centre for Dispute Resolution (ICDR) – Testifying Expert
	Field:	Semiconductor lithography equipment ant processing
Date:	2013-2017	Dentons US LLP (McKenna Long & Aldridge LLP)
	Case:	Eidos Display, LLC v. AU Optronics Corp. et al (AU, Chi Mei Innolux, Chunghwa, Hannstar, and Hannspree)
	Project:	Patent Infringement (USDC, E. Texas) – Testifying Expert
	Field:	Thin film transistor (TFT) processing for LCD flat panel devices
Date:	2014-2015	Weil, Gotshal & Manges LLP
	Case:	DSS Technology Management, Inc. vs. Samsung Electronics Co. Ltd.
	Project:	Inter partes review petition
	Field:	Multiple patterning for integrated circuit processing
Date:	2013-2015	Ropes and Gray LLP
	Case:	Spansion LLC v. Macronix America Co., Ltd. et al
	Project:	ITC patent infringement case – Testifying Expert
	Field:	Flash memory chip method and processes
Date:	2013-2014	Mintz, Levin, Cohn, Ferris, Glovsky, and Pepeo PC
	Case:	Graphics Properties Holdings, Inc. v. Panasonic Corp. of North America et al (Toshiba, Barnes and Noble, Google, Hewlett-Packard, Lenova, and ZTE) – Testifying Expert
	Project:	Patent infringement (Delaware Federal District)
	Field:	Wide angle LCD display devices and backlighting
Date:	2012–2015	Bunsow, DeMory, Smith, & Allison LLP
	Case:	NXP B.V. v. Research in Motion Ltd. et. al. (TriQuint, SanDisk, Hynix, and Qualcomm)
	Project:	Patent Infringement (USDC, FLA Middle District), IPR (USPTO) – Testifying Expert
	Field:	Dummy pattern fill for integrated circuit fabrication
Date:	2011 –2012	Mintz, Levin, Cohn, Ferris, Glovsky, and Pepeo PC
	Case:	Graphics Properties Holdings v. Respondents (RIM, HTC, LG, Apple, Samsung, and Sony)
	Project:	ITC Patent Infringement – Testifying Expert
	Field:	LCD stack configuration for display devices
Date:	2011	O'Melveny and Meyers
	Case:	Samsung Electronics Co. Ltd. v. AU Optronics Corp. et al (Acer, BenQ, and SANYO)
	Project:	ITC Patent infringement
	Field:	Flat panel (LCD) display device manufacturing processes
Date:	2010-2011	McDermott Will & Emery
	Case:	Spansion Inc. v. Samsung Electronics Co
	Project:	ITC patent infringement case – Testifying Expert
	Field:	Contact hole processes for flash memory chips
Date:	2011-2014	Keker and Van Nest LLP

Case: STC UNM v. Intel Corp.
Project: Patent infringement (USDC, New Mexico) – Testifying Expert
Field: Lithography techniques and integrated circuit products

Date: 2010-2011 Irell & Manella LLP
Case: Patent re-examination
Project: USPTO re-examination and hearing – Testifying Expert
Field: Flat panel LCD illumination devices

Date: 2010 Keker and Van Nest LLP
Case: STC UNM v. Taiwan Semiconductor Manufacturing Co.
Project: ITC patent infringement
Field: Lithography techniques and integrated circuit products

Date: 2010-2011 McDermott Will & Emery
Case Spansion LLC v. Samsung Electronics Co. (and counter-claim)
Project: Patent infringement case (USDC, E.D. Va. District) – Testifying Expert
Field: Flash memory device processes

Date: 2010-2011 Irell & Manella LLP
Case: Chi Mei Innolux v. Sony Corporation
Project: ITC patent infringement case
Field LCD flat panel patterned electrodes

Date: 2010-2011 Ropes and Gray LLP
Case: Samsung Electronics Co. v. Spansion Japan Ltd.
Project: ITC patent infringement case
Field: Lithography and etch processing for flash memory products

Date: 2010 Sidley Austin LLP
Case: Agere Systems Inc. and LSI Corp. v. Xilinx, Inc.
Project: Patent infringement (S.D. N.Y.)
Field: Metallization of integrated circuits

Date: 2010 McDermott Will & Emery
Case: Samsung Electronics Co. v. Spansion LLC and Spansion Inc.
Project: ITC patent infringement case
Field: Lithography and etch processing for flash memory products

Date: 2010 Standley Law Group LLP
Case: American Panel v. Vertex
Project: Patent infringement arbitration
Field Flat panel display technology

Date: 2009-2011 Irell & Manella LLP
Case: Apeldyn Corp. v. Chi Mei Optoelectronics Corp. et al (AU, Samsung, Sharp, and Sony)
Project: Patent infringement (USDC, Delaware) – Testifying Expert
Field: LCD flat panel response time

Date: 2009-10 Fish and Richardson P.C.
Case: Semiconductor Energy Laboratory Co. Ltd. v. Eastman Kodak
Project: Patent interference case (USPTO)
Field: Organic light emitting diode (OLED) display devices

Date: 2009 Steptoe and Johnson, LLP
Case: Qimonda AG v. Seagate Technology
Project: ITC patent infringement case - Testifying Expert
Field: Polysilicon and amorphous silicon technology; silicon-oxi-nitride anti-reflection coating

deposition technology

Date: 2009 Fish and Richardson P.C.
Case: Sharp Corp. v. Samsung Electronics Co. Ltd.
Project: Patent infringement, (E.D. Tx.)
Field: Liquid crystal display polarizers and electro static discharge (ESD) technology

Date: 2008 Steptoe and Johnson, LLP
Case: Neumark-Rothschild v. Toshiba Corp.
Project: ITC patent infringement case
Field: Wide bandgap (II-VI and III-V) semiconductor materials processing for short-wavelength LEDs and laser diodes

Date: 2006 –2012 Wolf Block Schorr and Solis-Cohen, LLP
Bernstein Litowitz Berger & Grossmann LLP
Case: Anvik Corp. v. Nikon Corp., et al (Toshiba, Samsung, LG Electronics, Sharp, LG, Chi Mei, AU, AFPD, Panasonic, IPS, and Hitachi,)
Project: Patent infringement (USDC, S. NY District) – Testifying Expert
Field: Lithography method for LCD flat panel manufacturing

Date: 2007-08 Ropes & Gray, LLP
Case: Akrion Inc., v. Solid State Equipment Corp.
Project: Patent infringement
Field: Silicon wafer cleaning and preparation

Date: 2007-08 Fish and Richardson P.C.
Case: Renesas Technology v. Samsung Electronics
Project: ITC patent infringement case – Testifying Expert
Field: Thin film and diffractive elements for photomask mask light blocking

Date: 2005-06 Vinson & Elkins, LLP
Case: Advanced Micro Devices v. Oki Electronics
Project: Patent infringement (USDC, N. CA District) – Testifying Expert
Field: Silicon wafer preparation and coating

Date: 2004-05 Irell & Manella, LLP
Case: Ultratech Stepper, Inc. v. ASM Lithography, Inc.
Project: Patent infringement (USDC, N. CA District) – Testifying Expert
Field: Optical microlithography scanning

Date: 1997-03 Ward Norris Heller & Reidy, LLP – Testifying Expert
Case: IBM Fishkill, NY and Essex, VT, including Union Carbide Corp., Eastman Kodak, J. T. Baker Chemical, KTI, Shipley, Ashland Oil, E. I. DuPont de Nemours and Industri-Chem, suppliers of solvents for the IBM cleanroom operations
Field: Multi-state litigation, allegations regarding various chemicals used in the manufacturing of semiconductor devices

Date: 1997-03 Ward Norris Heller & Reidy, LLP – Testifying Expert
Kasowitz Benson Torres & Friedman, LLP
Steptoe & Johnson, LLP
Cases: San Jose IBM Workers Litigation v. Shipley Company
San Jose IBM Workers Litigation v. American Hoechst Corporation
San Jose IBM Workers Litigation v. Ashland Chemical Company, Union Carbide Corporation, Fischer Scientific Company, and Eastman Kodak Company
Rubio v. IBM et al.
Field: Allegations regarding various chemicals used in an manufacturing of semiconductor devices

SERVICE

Professional Associations

Fellow, SPIE International Society for Optical Engineering
Fellow, Optical Society of America (OSA)
Fellow, Institute of Electrical and Electronics Engineers (IEEE)
Member, American Vacuum Society (AVS)
Member, American Society for Engineering Education (ASEE)
Member, Society for Information Display (SID)

External Service

2014-2018 SPIE Microlithography Symposium Co-Chairman
2012-2014 OSA Awards Committee
1997-2014 SPIE Optical Microlithography, Program Committee
2010-2014 EIPBN Program Committee
2003-2014 SPIE Zernike Award Committee
2009-2010 Councilor, Optical Society of America (OSA), Rochester Section
2008-2009 Program Chairman, International Symposium on Immersion Lithography Extensions
2004-2005 Conference Chairman, SPIE Optical Microlithography Conference
1997-2002 EIPBN Program Committee
1997-1998 SPIE/ISMA Singapore Program Committee
1995-1997 Chairman, OSA Lithography / Patterning Technical Working Group
1990-1996 Faculty Advisor, SPIE Student Chapter

Honors and Awards

2017 American Vacuum Society – Excellence in Leadership Award
2016 Fellow, Institute of Electrical and Electronics Engineering (IEEE)
2014 IEEE Technology Innovation Award
2014 RIT College of Engineering Research and Publication Awards
2013 RIT Innovation Hall of Fame
2012 Fellow, Optical Society of America
2011 SPIE Research Mentor Award
2008 Visiting Professor, IMEC Micro and Nanoelectronics Research Center
2007 Trustees Excellence in Scholarship and Teaching Award, Rochester Institute of Technology
2007 Fellow, SPIE International Society for Optical Engineering
2007 Rush Henrietta Outstanding Alumni Award
2005 Million Dollar Principle Investigator Award, Rochester Institute of Technology
2005 Patenting Productivity Award, Rochester Institute of Technology
2002 Intellectual Property Productivity Award, Rochester Institute of Technology
2001 Visiting Professor, IMEC Micro and Nanoelectronics Research Center
2000 Intel Professor of Research and Technology, Intel Corp.
1999 RIT Creators Award, Rochester Institute of Technology
1997 Visiting Scholar, International Sematech
1993 Texas Instruments, Douglas Harvey Award
1991 Texas Instruments, Douglas Harvey Award

Editorial Review

Editorial review of IEEE, JVAC, JM3, and SPIE, journals.

PATENTS

1. 8,852,850 Method of photolithography using a fluid and a system thereof
2. 7,768,648 Method for aberration evaluation in a projection system
3. 7,345,735 Apparatus for aberration detection and measurement
4. 7,233,887 Method of photomask correction and its optimization using localized frequency analysis
5. 7,170,588 Reduction Smith-Talbot interferometer prism for micropatterning

6. 7,136,143 Method for aberration detection and measurement
7. 7,092,073 Method of illuminating a photomask using chevron illumination
8. 6,934,010 Optical proximity correction method utilizing gray bars as sub-resolution assist features
9. 6,881,523 Optical proximity correction method utilizing ruled ladder bars as sub-resolution assist features
10. 6,846,595 Method of improving photomask geometry
11. 6,835,505 Mask for projection photolithography at or below about 160 nm and a method thereof
12. 6,791,667 Illumination device for projection system and method for fabricating
13. 6,788,388 Illumination device for projection system and method for fabricating
14. 6,556,361 Projection imaging system with a non-circular aperture and a method thereof
15. 6,541,750 Modification of a projection imaging system with a non-circular aperture and a method thereof
16. 6,525,806 Apparatus and method of image enhancement through spatial filtering
17. 6,480,263 Apparatus and method for phase shift photomasking
18. 6,466,304 Illumination device for projection system and method for fabricating
19. 6,395,433 Photomask for projection lithography at or below about 160 nm and a method thereof
20. 6,388,736 Imaging method using phase boundary masking with modified illumination
21. 6,368,755 Masks for use in optical lithography below 180 nm
22. 6,309,780 Attenuated phase shift mask and a method for making the mask
23. 5,939,227 Multi-layered attenuated phase shift mask and a method for making the mask
24. JP2010079303 Method of improving photomask geometry
25. JP2006079117 Optical proximity correction method utilizing gray bar as sub-resolution assist feature
26. EP1240557 Imaging method using phase boundary masking with modified illumination

SELECTED PUBLICATIONS

1. “Image-based pupil plane characterization via a space-domain basis,” Zac Levinson, Andrew Burbine, Erik Verduijn, Obert Wood, Kenneth A Goldberg, Markus P Benk, Antoine Wojdyla, Bruce W Smith, Journal of Micro/Nanolithography, MEMS, and MOEMS, 16(2) 2017.
2. “Image-based pupil plane characterization for anamorphic lithography systems,” Zac Levinson, Bruce W Smith, SPIE International Society for Optics and Photonics, Extreme Ultraviolet (EUV) Lithography VIII 10143 (2017).
3. “Measurement of EUV lithography pupil amplitude and phase variation via image-based methodology,” Zachary Levinson ; Erik Verduijn ; Obert R. Wood ; Pawitter Mangat ; Kenneth A. Goldberg ; Markus P. Benk ; Antoine Wojdyla ; Bruce W. Smith, J. Micro/Nanolith. MEMS MOEMS. 15(2), 023508, 2016.
4. “Image-based pupil plane characterization via principal component analysis for EUVL tools,” Zac Levinson ; Andrew Burbine ; Erik Verduijn ; Obert Wood ; Pawitter Mangat ; Kenneth A. Goldberg ; Markus P. Benk ; Antoine Wojdyla ; Bruce W. Smith, Proc. SPIE 9776, Extreme Ultraviolet (EUV) Lithography VII, 977618, 2016.
5. “3D mask effects of absorber geometry in EUV lithography systems,” Riaz R. Haque ; Zac Levinson ; Bruce W. Smith, Proc. SPIE 9776, Extreme Ultraviolet (EUV) Lithography VII, 97760F, 2016.
6. “An automated image-based tool for pupil plane characterization of EUVL tools,” Zac Levinson ; Jack S. Smith ; Germain Fenger ; Bruce W. Smith, Proc. SPIE 9776, Extreme Ultraviolet (EUV) Lithography VII, 97762M, 2016.
7. “Bayesian inference for OPC modeling,” Andrew Burbine ; John Sturtevant ; David Fryer ; Bruce W. Smith, Proc. SPIE 9780, Optical Microlithography XXIX, 97800I, 2016.
8. “A method of image-based aberration metrology for EUVL tools,” Zac Levinson ; Sudharshanan Raghunathan ; Erik Verduijn ; Obert Wood ; Pawitter Mangat ; Kenneth Goldberg ; Markus Benk ; Antoine Wojdyla ; Vicky Philipsen ; Eric Hendrickx ; Bruce W. Smith, Proc. SPIE 9422, Extreme Ultraviolet (EUV) Lithography VI, 942215, 2015.
9. “Experimental measurements of telecentricity errors in high-numerical-aperture extreme ultraviolet mask images,” Sudharshanan Raghunathan, Obert R Wood, Pawitter Mangat, Erik Verduijn, Vicky Philipsen, Eric Hendrickx, Rik Jonckheere, Kenneth A Goldberg, Markus P Benk, Patrick Kearney, Zachary Levinson, Bruce W Smith, Journal of Vacuum Science & Technology B, Nanotechnology and Microelectronics: Materials, Processing, Measurement, and Phenomena, 32, 06F801, 2014.
10. “The saga of sigma: influences of illumination throughout optical generations,” BW Smith - SPIE Advanced Lithography, Proc. SPIE 9052, Optical Microlithography XXVII, 905204, 2014.

11. “Optical Projection Lithography,” B.W. Smith, Nanolithography: The Art of Fabricating Nanoelectronic and Nanophotonic Devices and Systems, Woodhead Publishing, 2014.
12. “Feasibility of compensating for EUV field edge effects through OPC,” C Maloney, J Word, GL Fenger, A Niroomand, BW Smith, SPIE Advanced Lithography, 2014.
13. “Optimization of image-based aberration metrology for EUV lithography,” Z Levinson, G Fenger, A Burbine, AR Schepis, BW Smith, SPIE Advanced Lithography, 2014.
14. “Study of angular effects for optical systems into the EUV,” A Burbine, Z Levinson, A Schepis, BW Smith, SPIE Advanced Lithography, 2014.
15. “Alternative method for variable aspect ratio vias using a vortex mask,” AR Schepis, Z Levinson, A Burbine, BW Smith - SPIE Advanced Lithography, 2014.
16. "Extreme ultraviolet lithography resist-based aberration metrology," Germain L. Fenger; Lei Sun; Sudharshanan Raghunathan; Obert R. Wood; Bruce W. Smith, J. Micro/Nanolith. MEMS MOEMS. 12 (4), 2013.
17. “The Impact of Pupil Plane Filtering on Mask Roughness Transfer,” Burak Baylav, Chris Maloney, Zac Levinson, Joost Bekaert, Alessandro Vaglio Pret, and Bruce W. Smith, J. Vac. Sci. Technol. B 31, 06F801, 2013.
18. “Modeling the effects of pupil-manipulated spherical aberration in optical nanolithography”, M. K. Sears, B.W. Smith, J. Micro/Nanolith. MEMS MOEMS. 12(1), 2013.
19. “Scanning interference evanescent wave lithography for sub-22-nm generations,” P. Xie, B. W. Smith, J. Micro/Nanolithography, MEMS, and MOEMS. 12(1), 2013.
20. “Lens wavefront compensation for 3D photomask effects in subwavelength optical lithography,” M.K. Sears, J. Bekaert, B.W. Smith, Applied Optics 52 (3), 314-322, 2013.
21. “Line edge roughness (LER) mitigation studies specific to interference-like lithography,: B Baylav, A Estroff, P Xie, BW Smith, Proc. SPIE 8683, Optical Microlithography XXVI, 86831Y, 2013
22. “Pupil wavefront manipulation to compensate for mask topography effects in optical nanolithography,” MK Sears, BW Smith, Proc. SPIE 8683, Optical Microlithography XXVI, 86830G, 2013.
23. “EUVL resist-based aberration metrology,” Germain L. Fenger ; Sudharshanan Raghunathan ; Lei Sun ; Obert R. Wood ; Bruce W. Smith, Proc. SPIE 8679, Extreme Ultraviolet (EUV) Lithography IV, 86790P, 2013.
24. “Tuning Metamaterials for Applications at DUV Wavelengths,” A. Estroff, B.W. Smith, Intl. Journal of Optics, 2012.
25. “Aqueous developable dual switching photoresists for nanolithography”, L. Chen, Y.K. Goh, H.H. Cheng, B.W. Smith, P. Xie, W. Montgomery, A.K. Whittaker, I. Blakey, Journal of Polymer Science Part A: Polymer Chemistry 1, 2012.
26. “The saga of lambda: spectral influences throughout lithography generations,” B.W. Smith, Proc. SPIE 8325, 2012.
27. “Pupil wavefront manipulation for optical nanolithography,” Monica Kempsell Sears, Joost Bekaert, and Bruce W. Smith, Proc. SPIE 8326, 2012.
28. “Longer wavelength EUV lithography (LW-EUVL),” Christopher W. Maloney and Bruce W. Smith, Proc. SPIE 8322, 2012.
29. “Scanning interference evanescent wave lithography for sub-22 nm generations,” Peng Xie and Bruce W. Smith, Proc. SPIE 8326, 2012.
30. “3D mask modeling for EUV lithography,” Julien Mailfert, Christian Zuniga, Vicky Philipsen, Konstantinos Adam, Michael Lam, James Word, Eric Hendrickx, Geert Vandenberghe, and Bruce Smith, Proc. SPIE 8322, 2012.
31. “Aqueous Developable Dual Switching Photoresists for Nanolithography,” Lan Chen, Yong Keng Goh, Han Hao Cheng, Bruce W. Smith, Peng Xie, Warren Montgomery, Andrew K. Whittaker, Idriss Blakey, Journal of Polymer Science Part A: Polymer Chemistry, 2012.
32. “Lithography beyond the IC”, B.W. Smith, Proc. SPIE, v 7973-01, 2011.
33. “PAG-free chain scissioning resists fro 193-nm immersion lithography that can be developed by aqueous base,” I. Blakey, L. Chen, Y. K. Goh, A. Dorgelo, P. Xie, N. Lafferty, B. Smith, P. Zimmerman, M.W. Montgomery, A. Whittaker, Proc. SPIE, v 7972-86, 2011.

34. “Development of an inorganic nanoparticle photoresist for EUV, e-beam, and 193-nm lithography,” M. Krysak, M. Trikeriotis, E. Schwarz, N. lafferty, P. Xie, B.W. Smith, P. Zimmerman, M.W. Montgomery, E. Giannelis, C. Ober, Proc. SPIE v 7972-48, 2011.

35. “Extending SMO into the pupil plane,” M. Kempsell Sears, B.W. Smith, Proc. SPIE v 7973-46, 2011.

36. “Projection lithography below lambda/7 through deep-ultraviolet evanescent optical imaging,” P. Xie and B. W. Smith, J. Vac. Sci. Technol. B 28, 2010.

37. “Photo-patternable inorganic hardmask,” Alan Telecky, Peng Xie, Jason Stowers, Andrew Grenville, Bruce Smith, and Douglas A. Keszler, J. Vac. Sci. Technol. B 28, 2010.

38. “Alternatives to Chemical Amplification for 193 nm Lithography,” Baylav, B.; Meng Zhao; Ran Yin; Peng Xie; Scholz, C.; Smith, B.; Smith, T.; Zimmerman, P. Source: Proceedings of the SPIE - The International Society for Optical Engineering, v 7639, 2010.

39. “Non-chemically amplified resists for 193-nm immersion lithography: influence of absorbance on performance,” Lan Chen; Yong-Keng Goh; Lawrie, K.; Smith, B.; Montgomery, W.; Zimmerman, P.A.; Blakey, I.; Whittaker, A.K., Proceedings of the SPIE - The International Society for Optical Engineering, v 7639, 2010

40. “Metamaterials for enhancement of DUV lithography,” Estroff, A.; Lafferty, N.V.; Peng Xie; Smith, B.W., Proceedings of the SPIE - The International Society for Optical Engineering, v 7640, 2010.

41. “Achieving Interferometric Double Patterning through Wafer Rotation,” Peng; Lafferty, N.V.; Smith, B.W. , Proceedings of the SPIE - The International Society for Optical Engineering, v 7640, 2010.

42. “Development of an inorganic photoresist for DUV, EUV, and electron beam imaging,” Trikeriotis, M.; Woo Jin Bae; Schwartz, E.; Krysak, M.; Lafferty, N.; Peng Xie; Smith, B.; Zimmerman, P.; Ober, C.K.; Giannelis, E.P., Proceedings of the SPIE - The International Society for Optical Engineering, v 7639, 2010.

43. “Analysis of higher order pitch division for sub-32 nm lithography,” Peng Xie; Smith, B.W. , Proceedings of the SPIE - The International Society for Optical Engineering, v 7274, 2009.

44. “Alternative optical technologies: more than curiosities?,” Smith, B.W., Proceedings of the SPIE - The International Society for Optical Engineering, v 7274, 2009

45. “Inverse lithography for 45-nm-node contact holes at 1.35 numerical aperture Kempsell, M.L.; Hendrickx, E.; Tritchkov, A.; Sakajiri, K.; Yasui, K.; Yoshitake, S.; Granik, Yu.; Vandenberghe, G.; Smith, B.W., Journal of Microlithography, Microfabrication, and Microsystems, v 8, n 4, Oct. 2009.

46. “EUV resist requirements: absorbance and acid yield,” Gronheid, R.; Fonseca, C.; Leeson, M.J.; Adams, J.R.; Strahan, J.R.; Willson, C.G.; Smith, B.W., Proceedings of the SPIE - The International Society for Optical Engineering, v 7273, 2009

47. “Design and analysis of a compact EUV interferometric lithography system,” B.W. Smith, J. Micro/Nanolith. MEMS MOEMS, Vol. 8, 021207, 2009.

48. “Enhancement of hyper-NA imaging through selective TM polarization,” B.W. Smith, J. Zhou, P. Xie, J. Vac. Soc. B: Microelectronics and Nanometer Structures, Volume 26 (6) 2008.

49. “Photomask image enhancement using grating generated surface waves,” N. Lafferty, A. Estroff, A. Bourov. B.W. Smith, J. Vac. Soc. B: Microelectronics and Nanometer Structures, Volume 26 (6) 2008.

50. “Applications of TM polarized illumination,” Bruce Smith, Jianming Zhou, and Peng Xie, Proc. SPIE 6924, 2008.

51. “Quantum state control interference lithography and trim double patterning for 32-16 nm nodes,” Robert D. Frankel, Bruce W. Smith, and Andrew Estroff , Proc. SPIE 6520, 2007.

52. “Snell or Fresnel – The influence of material index on hyper NA lithography,” B. W. Smith, J. Zhou, Proc. SPIE 6520, 2007.

53. “Immersion Lithography with Numerical Apertures above 2.0 using High Index Optical Materials," J. Zhou, N. Lafferty, B. W. Smith, J. H. Burnett, Proc. SPIE 6520, 2007.

54. “On the quality of measured optical aberration coefficients using phase wheel monitor,” L. Zavyalova, A. Robinson, A. Bourov, N. Lafferty, B. W. Smith, Proc. SPIE 6520, 2007.

55. “Mask Enhancement Using and Evanescent Wave Effect,” N. Lafferty, J. Zhou, B. W. Smith, Proc. SPIE 6520, 2007.

56. “Evanescent wave imaging in optical lithography,” Bruce W Smith, Yongfa Fan, Jianming Zhou, Neal Lafferty, Andrew Estroff, Proc. SPIE Optical Microlithography XIX, 6154, 2006.
57. “Effects of beam pointing instability on two-beam interferometric lithography,” Yongfa Fan, Anatoly Bourov, Michael Slocum, Bruce W Smith, Proc. SPIE Optical Microlithography XIX, 6154, 2006.
58. “Resist process window characterization for the 45-nm node using an interferometric immersion microstepper,” Anatoly Bourov, Stewart A Robertson, Bruce W Smith, Michael A Slocum, Emil C Piscani, Proc. SPIE Advances in Resist Technology and Processing XXIII, 6153, 2006.
59. “Comparison of immersion lithography from projection and interferometric exposure tools,” Stewart A Robertson, Joanne M Leonard, Bruce W Smith, Anatoly Bourov, Proc. Optical Microlithography XIX, 6154, 2006.
60. “Three-dimensional imaging of 30-nm nanospheres using immersion interferometric lithography,” Jianming Zhou, Yongfa Fan, Bruce W Smith, Proc. Optical Microlithography XIX, 6154, 2006.
61. “Experimental measurement of photoresist modulation curves, “Anatoly Bourov, Stewart A Robertson, Bruce W Smith, Michael Slocum, Emil C Piscani, Proc. Optical Microlithography XIX, 6154, 2006.
62. “Practical approach to full-field wavefront aberration measurement using phase wheel targets,” Lena V Zavyalova, Bruce W Smith, Anatoly Bourov, Gary Zhang, Venugopal Vellanki, Patrick Reynolds, Donis G Flagello, Proc. Optical Microlithography XIX, 6154, 2006.
63. “High NA 193nm Immersion Lithography for 32nm Half-Pitch Imaging’” J. Zhou, Y. Fan, A. Bourov, B.W. Smith, Appl. Opt., 2006.
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