



2011 Optifab

Technical Program

Connecting minds **for global solutions**

Conference dates

9–12 May 2011

Exhibition dates

10–12 May 2011

Rochester Riverside Convention Center
Rochester, New York, USA

spie.org/optifab

Technologies

- Optical Manufacturing
- Advanced Fabrication Equipment
- Diamond Turning
- Coating Equipment and Processes
- Metrology Developments and Equipment

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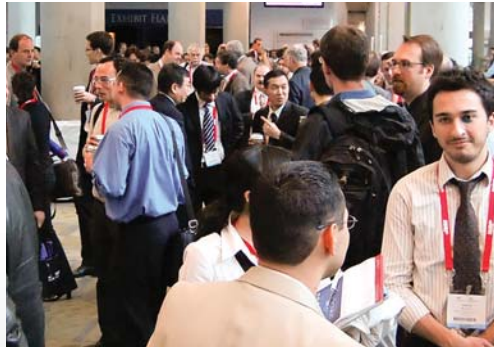
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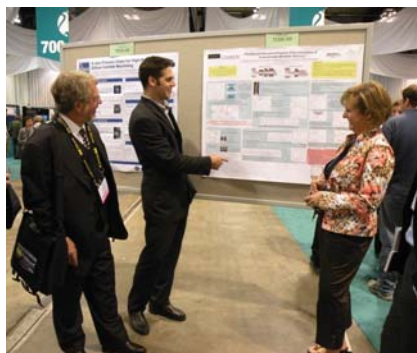
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SPIE and APOMA are dedicated to promoting and advancing science, technology and business opportunities for the precision optics industrial base.





Daily Event Schedule

Monday	Tuesday	Wednesday	Thursday
Technical Conference (Kumler, Pfaff)			
SC1040 Geometric Dimensioning and Tolerancing (Prystaj) 8:30 am to 5:30 pm, p. 11	SC1019 Mounting of Optical Components (Burge) 8:30 am to 5:30 pm, p. 11	WS1042 Patenting Fundamentals for Optics Professionals (Hammond, Gunderman) 8:30 to 11:30 am, p. 13	SC321 Thin Film Optical Coatings (Macleod) 8:30 am to 5:30 pm, p. 12
SC212 Modern Optical Testing (Wyant) 8:30 am to 12:30 pm, p. 13	SC1038 Optical Engineering Fundamentals (Walker) 8:30 am to 12:30 pm, p. 11		
SC350 Optical Manufacturing Overview (Novak) 8:30 am to 5:30 pm, p. 12	SC1039 Evaluating Aspheres for Manufacturability (Forbes, Murphy, Dumas) 1:30 to 5:30 pm, p. 10	SC1041 Computer Generated Holograms for Optical Testing (Zhao) 1:30 to 5:30 pm, p. 11	SC1011 Understanding Waviness and Roughness Specifications for Optics (Aikens) 8:30 am to 12:30 pm, p. 11
SC848 Fundamentals of Single Point Diamond Turning (Schaefer) 1:30 to 5:30 pm, p. 13	SC700 Understanding Scratch and Dig Specifications (Aikens) 1:30 to 5:30 pm, p. 12	SC015 Structural Adhesives for Optical Bonding (Daly) 1:30 to 5:30 pm, p. 12	
See SPIE Cashier to register for the Technical Conference or a course.	Exhibition		
	10:00 am to 5:00 pm	10:00 am to 6:00 pm	10:00 am to 3:00 pm
		Industry Panel Discussions— Empire Hall, 2:00 to 4:30 pm, p. 5	
Exhibitor Product Demonstrations, 10:30 to 3:00 pm			
Networking Reception and Poster Viewing, Empire Hall, 4:30 to 6:00 pm			

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Technical Program

Monday-Thursday 9-12 May 2011

Optifab

Conference Chairs: **Matthias Pfaff**, OptoTech Optikmaschinen GmbH (Germany); **Jay Kumler**, Jenoptik Optical Systems, Inc. (United States)

Program Committee: **Michael J. Bechtold**, OptiPro Systems (United States); **Christopher T. Cotton**, ASE Optics, Inc. (United States); **Walter C. Czajkowski**, Edmund Optics Inc. (United States); **Thomas Danger**, Schneider GmbH & Co. KG (Germany); **Michael A. DeMarco**, QED Technologies, Inc. (United States); **Apostolos Deslis**, JENOPTIK Optical Systems, Inc. (United States); **Toshihide Dohi**, OptiWorks, Inc. (Japan); **Edward M. Fess**, Univ. of Rochester (United States); **Thomas Godin**, Satisloh North America Inc. (United States); **Heidi Hofke**, OptoTech Optical Machinery Inc. (United States); **Hans Lauth**, Reflexite Energy Solutions (Germany); **Justin Mahanna**, Universal Photonics Inc. (United States); **Michael Mandina**, Optimax Systems, Inc. (United States); **Paul Meier-Wang**, AccuCoat Inc. (United States); **Richard A. Nasca**, Corning Inc. (United States); **Michael N. Naselaris**, Sydor Optics, Inc. (United States); **John J. Nemechek**, Metrology Concepts LLC (United States); **Buzz Nesti**, Naked Optics Corp. (United States); **Robert F. Novak**, BAN Optical (United States); **Paul R. Tolley**, Infotonics Technology Ctr. (United States); **Martin J. Valente**, College of Optical Sciences, The Univ. of Arizona (United States); **Kirk J. Warden**, LaCroix Optical Co. (United States)

Monday 9 May

SESSION 1

Room: Highland A/B Mon. 8:00 to 10:00 am

Grinding and Polishing Processes

Session Chair: **Cody B. Kreischer**, Kreischer Optics, Ltd. (United States)

8:00 am: **More that meets the eye**, Ray Williamson, Ray Williamson Consulting (United States) [TD07-01]

8:20 am: **Nanodiamond: tiny particles with lots of polishing power**, Ron Abramshe, NanoDiamond Products Ltd. (Ireland) [TD07-02]

8:40 am: **OptiPro's fabrication and metrology solutions for aspheres and freeform surfaces**, David E. Mohring, Edward M. Fess, Michael J. Bechtold, OptiPro Systems (United States) [TD07-03]

9:00 am: **Conformal lap polishing for novel materials and optical surfaces**, Jessica DeGroot Nelson, Alan Gould, Daniel Dworzanski, Charles Klinger, Robert A. Wiederhold, Michael Mandina, Optimax Systems, Inc. (United States) . [TD07-04]

9:20 am: **Sophisticated process chain for industrial production of high quality aspheres**, Fabian Schwalb, Satisloh GmbH (Germany) [TD07-05]

9:40 am: **Colloidal silica free polishing of A-plane sapphire windows using CMP-D diamond slurry**, Elina Kasman, Engis Corp. (United States) . . . [TD07-06]

Coffee Break 10:00 to 10:30 am

SESSION 2

Room: Highland A/B Mon. 10:30 am to 12:10 pm

Grinding and Polishing Processes II

Session Chair: **Kirk J. Warden**, LaCroix Optical Co. (United States)

10:30 am: **Grinding freeform surfaces using CAD-CAM software**, Christian Vogt, University of Applied Sciences Deggendorf (Germany); Stefan Sinzinger, Technical University of Ilmenau (Germany); Florian Schneider, Roland Maurer, Markus Schinhaerl, Sebastian Draxinger, University of Applied Sciences Deggendorf (Germany) [TD07-07]

10:50 am: **Considerations for smoothing and measurement of optical surfaces**, Michael G. Martucci, Robert A. Wiederhold, Optimax Systems, Inc. (United States) [TD07-08]

11:10 am: **Evaluating the influence of vibrations in precision polishing**, Mohammad Mainuddin, Brigid A. Mullany, The Univ. of North Carolina at Charlotte (United States) [TD07-09]

11:30 am: **Increasing the determinism of sub-aperture polishing**, Scott Bambrick, Michael J. Bechtold, David E. Mohring, Scott DeFisher, OptiPro Systems (United States) [TD07-10]

11:50 am: **Ion beam figuring of calcium fluoride optics**, Marcel Demmler, Frank Allenstein, Thoralf Dunger, Michael Zeuner, Roth & Rau MicroSystems GmbH (Germany); Sven R. Kiontke, asphericon GmbH (Germany) [TD07-11]

Lunch Break 12:10 to 1:40 pm

SESSION 3

Room: Highland A/B Mon. 1:40 to 3:00 pm

Aspheric and Meter Class Optics

Session Chair: **Matthias Pfaff**, OptoTech Optikmaschinen GmbH (Germany)

1:40 pm: **Precision polishing tungsten carbide molds using Magnetorheological Finishing (MRF®)**, Tobias Nitzsche, Christopher A. Hall, Paul Dumas, Yuji Horie, Tamotsu Kume, QED Technologies, Inc. (United States) [TD07-12]

2:00 pm: **Processing of 3D optical surfaces**, Roland Mandler, OptoTech Optikmaschinen GmbH (Germany) [TD07-14]

2:20 pm: **Path forward to meter class single crystal silicon (SCSi) primary mirrors**, Douglas R. McCarter, Eloise T. McCarter, Roger A. Paquin, McCarter Technology, Inc. (United States) [TD07-15]

2:40 pm: **Ultraform finishing (UFF) spotting technique for studying polishing process conditions for optical materials**, Shai N. Shafir, OptiPro Systems (United States); Christopher Roll, Paul D. Funkenbusch, Univ. of Rochester (United States); Scott Bambrick, OptiPro Systems (United States) [TD07-16]

Coffee Break 3:00 to 3:30 pm

SESSION 4

Room: Highland A/B Mon. 3:30 to 5:10 pm

Meter Class Optics

Session Chair: **Martin J. Valente**, College of Optical Sciences, The Univ. of Arizona (United States)

3:30 pm: **Polishing results of an 84 cm primary mirror with HyDRa**, Erika Sohn, Elfego Ruiz, Luis Salas, Esteban A. Luna, Joel Herrera, Fernando Quiroz, Manuel Nuñez, Eduardo Lopez, Univ. Nacional Autónoma de México (Mexico) . . [TD07-17]

3:50 pm: **Large precision optics manufacturing platforms at L-3 IOS Brashear**, Francois Piche, Andrew R. Clarkson, L-3 Brashear (United States) [TD07-18]

4:10 pm: **Large aperture optical manufacturing for megajoule-class laser systems using Magnetorheological Finishing (MRF®)**, Joseph A. Menapace, Lawrence Livermore National Lab. (United States) [TD07-19]

4:30 pm: **ELT primary mirror prototype segment manufacturing and testing**, Eric Ruch, Sagem Défense Sécurité (France) [TD07-20]

4:50 pm: **Prototype development for the fast steering mirror of Giant Magellan Telescope**, Young-Soo Kim, Kwi-Jong Park, Korea Astronomy and Space Science Institute (Korea, Republic of); Myung K. Cho, National Optical Astronomy Observatory (United States); Ho-Soon Yang, Korea Research Institute of Standards and Science (Korea, Republic of); Ho-Sang Kim, Institute for Advanced Engineering (Korea, Republic of); Hyo-Sung Ahn, Gwangju Institute of Science and Technology (Korea, Republic of); Jaemann Kyeong, In-Soo Yuk, Byeong-Gon Park, Korea Astronomy and Space Science Institute (Korea, Republic of) [TD07-21]

Tuesday 10 May

SESSION 5

Room: Highland A/B Tues. 8:00 am to 12:00 pm

Metrology

Session Chair: **Richard A. Nasca**, Corning Incorporated (United States)

8:00 am: **In situ surface roughness measurement**, Robert E. Parks, Optical Perspectives Group, LLC (United States) [TD07-22]

8:20 am: **High precision interferometric testing of transparent, thin plane-parallel parts**, Leslie L. Deck, Peter J. de Groot, James A. Soobitsky, Zygo Corp. (United States) [TD07-23]

8:40 am: **Wave aberration sensing via image moment analysis of through-focus point spread functions**, Hanshin Lee, The Univ. of Texas at Austin (United States) [TD07-24]

9:00 am: **Non-contact surface measurement of freeform and conformal optics with ultrasurf**, Scott DeFisher, Michael J. Bechtold, David E. Mohring, OptiPro Systems (United States) [TD07-25]

9:20 am: **Freeform optical metrology using a four-beam low-coherence optical probe (Quad-Probe)**, Damon W. Diehl, Christopher T. Cotton, Christopher J. Ditchman, Nathan E. Burdick, ASE Optics, Inc. (United States) [TD07-26]

9:40 am: **Surface quality diagnostic using quadri-wave lateral shearing interferometry**, Pascal Delage, William Boucher, Benoit F. Wattellier, PHASICS S.A. (France) [TD07-27]

Coffee Break 10:00 to 10:20 am

10:20 am: **Universal compact interferometer**, Aiko K. Ruprecht, Stefan Krey, TRIOPTICS GmbH (Germany); Ricarda Kafka, Thomas Blümel, Ralf Neubert, TRIOPTICS Berlin GmbH (Germany) [TD07-28]

10:40 am: **Status and future of optical slope measuring tests**, Robert E. Parks, Peng Su, James H. Burge, College of Optical Sciences, The Univ. of Arizona (United States) [TD07-29]

11:00 am: **Laser radar metrology for fabrication, alignment, and verification of large mirrors**, Raymond G. Ohl IV, NASA Goddard Space Flight Ctr. (United States); Anthony R. Slotwinski, Pyxisvision Inc. (United States); Bente H. Eegholm, Sigma Space Corp. (United States) [TD07-30]

11:20 am: **High dynamic wave front sensing for lens group characterization**, Benoit F. Wattellier, William Boucher, Sabrina Velghe, Francou Pierrick, PHASICS S.A. (France) [TD07-31]

11:40 am: **Nano-radian resolution gradient integrated surface profiler: a new compact measurement instrumentation**, Yasuo Higashi, Xia-Wei Zhang, Tatsuya Kume, Kazuhiro Enami, High Energy Accelerator Research Organization (Japan); Katsuyoshi Endo, Junichi Uchikoshi, Osaka Univ. (Japan) [TD07-32]

Wednesday 11 May

SESSION 6

Room: Highland A/B Wed. 8:00 to 10:00 am

Optical and Opto-Mechanical Engineering I

Session Chair: **Apostolos Deslis**, JENOPTIK Optical Systems, Inc. (United States)

8:00 am: **Optomechanical analysis in the fabrication of conformal and free form optics**, Victor L. Genberg, Gregory J. Michels, Gary R. Bisson, Sigmadyne, Inc. (United States) [TD07-33]

8:20 am: **6-DOF nanopositioning technologies for automated manufacturing of optomechanical components**, Rainer Gloess, Physik Instrumente (PI) GmbH & Co. KG (Germany) [TD07-34]

8:40 am: **Aspheric surface slope error specifications for 150+ visible integral-field replicable unit spectrograph**, Hanshin Lee, Gary J. Hill, The Univ. of Texas at Austin (United States) [TD07-35]

9:00 am: **Homogeneity tolerances for optical elements (Invited Paper)**, John R. Rogers, Optical Research Associates (United States) [TD07-36]

9:20 am: **Default tolerances on optical drawings (Invited Paper)**, Richard N. Youngworth, Light Capture, Inc. (United States); David M. Aikens, Savvy Optics Corp. (United States) [TD07-37]

9:40 am: **Improving asphere manufacturability using Forbes polynomials**, Dave Stephenson, JENOPTIK Optical Systems, Inc. (United States) [TD07-38]

Coffee Break 10:00 to 10:30 am

SESSION 7

Room: Highland A/B Wed. 10:30 am to 12:30 pm

Optical and Opto-Mechanical Engineering II

Session Chair: **Walter C. Czajkowski**, Edmund Optics Inc. (United States)

10:30 am: **Current developments of optical design and coatings for multispectral infrared (IR) imaging systems**, Marcus Serwazi, Matthias Esselbach, Elvira Gittler, JENOPTIK Optical Systems GmbH (Germany) [TD07-40]

10:50 am: **Heat transfer coefficients of industrial coolants and lubricants**, Kohei Hamano, Frank Wolfs, Roger F. Gans, John C. Lambropoulos, Univ. of Rochester (United States) [TD07-41]

11:10 am: **Accounting for as-manufactured centration errors in lenses**, Brandon Light, Optimax Systems, Inc. (United States) [TD07-42]

11:30 am: **A multidisciplinary analysis approach to predict mirror performance in real world conditions**, Peter Klimas, Sheng-Hai Zheng, Hua Lin, David A. Aldridge, Clinton E. Evans, Ashley McColgan, COM DEV Canada (Canada) [TD07-43]

11:50 am: **Manufacturing aspheres considerations for the designer**, Mark E. Schickler, Robert A. Wiederhold, Michael Mandina, Optimax Systems, Inc. (United States) [TD07-44]

12:10 pm: **R&D at Optimax**, Andrew A. Haefner, Robert A. Wiederhold, Michael Mandina, Jessica DeGroote Nelson, Optimax Systems, Inc. (United States) [TD07-45]



Industry Panel Discussions

Empire Hall Wed. 2:00 to 4:30 pm

Don't miss these Industry Panel Discussions in the Exhibition Hall, See pg. 9 for details.

2:00 pm: **The Forbes Polynomial Surface: The Road Forward; A Return to Manufacturable Aspheres**



Panel Moderator:
Kevin P. Thompson
Optical Research Associates (United States)

Coffee Break

3:30 pm: **The Future of Optical Manufacturing in North America**



Panel Moderator:
Thomas Battley
New York Photonics Industry Association
(United States)

Technical Program



POSTER SESSION

Empire Hall Wed. 4:30 to 6:00 pm

Poster authors may display their posters on Wednesday from 10:00 am to 4:00 pm. Poster authors should check in at the SPIE Registration prior to displaying their posters.

Authors will be present for discussion during the Networking Reception from 4:30 to 6:00 pm.

Using design of experiments to improve precision molding of chalcogenides, Benn Gleason, Peiman Mosaddegh, Peter Wachtel, J. David Musgraves, Kathleen Richardson, Clemson Univ. (United States) [TD07-58]

Bound-abrasive polishing of surfaces of optical glass, Yuriy D. Filatov, Olexandr Y. Filatov, V. Bakul Institute for Superhard Materials NASU (Ukraine); Guy Monteil, Ecole Nationale Supérieure Mécanique et des Microtechniques de Besancon (France); Uwe Heisel, Michael G. Storchak, Univ. Stuttgart (Germany) ... [TD07-60]

Modern interference testing methods of large astronomical aspherical mirrors base on lenses and CGH wavefront correctors, Magomed A. Abdulkadyrov, Sergey P. Belousov, Vladimir E. Patrikeev, Alexander P. Semenov, Lytkarino Optical Glass Factory JSC (Russian Federation) [TD07-61]

ARIES project: fabrication of mirrors and testing in infrared and visible ranges, Alexander P. Semenov, Magomed A. Abdulkadyrov, Vladimir E. Patrikeev, Alexey P. Patrikeev, Vitaliy V. Pridnya, Lytkarino Optical Glass Factory JSC (Russian Federation) [TD07-62]

Research on improving the second pressing quality of asphere lens, Shaohui Yin, Kejun Zhu, Fengjun Chen, Yu Wang, Hunan Univ. (China) [TD07-63]

The compound ultra-precision processing for small single crystal silicon aspheric, Shaohui Yin, Zhiqiang Xu, Jianwu Yu, Fengjun Chen, Hunan Univ. (China) [TD07-64]

A study on ultra precision grinding of tungsten carbide with teathed diamond wheel, Yeon Hwang, Korea Photonics Technology Institute (Korea, Republic of); Min-Jae Kim, Chonnam National Univ. (Korea, Republic of); Tae Kyoung Kim, Hye-Jeong Kim, Jeong-Ho Kim, Korea Photonics Technology Institute (Korea, Republic of) [TD07-65]

Two-step form error compensation for ultra-high accuracy in the molding of aspherical glass lenses, Du Hwan Cha, Heung Su Park, Yeon Hwang, Jeong-Ho Kim, Hye-Jeong Kim, Korea Photonics Technology Institute (Korea, Republic of) [TD07-66]

Calibration of a laser triangulation probe for measuring rough surface at its grinding stage, Yuhao Wang, Peng Su, Robert E. Parks, Lirong Wang, James H. Burge, College of Optical Sciences, The Univ. of Arizona (United States) . [TD07-67]

Development of electroforming process for fabricating ultraprecise mirrors, Hidekazu Mimura, The University of Tokyo (Japan); Satoshi Matsuyama, Yasuhisa Sano, Kazuto Yamauchi, Osaka Univ. (Japan) [TD07-68]

Large convex optics metrology at L-3 IOS Brashear, Francois Piche, Andrew R. Clarkson, L-3 Brashear (United States) [TD07-69]

Wafer level fabrication and packaging of precise polymer optical elements, Jiri Cech, Rafael J. Taborski, Technical Univ. of Denmark (Denmark); Niels Christian R. Holme, Kaleido Technology ApS (Denmark) [TD07-70]

Sequential noise tolerant fast phase unwrapping system, Julio C. Estrada-Rico, Orlando M. Medina Cazares, Manuel Servin, Ctr. de Investigaciones en Óptica, A.C. (Mexico) [TD07-71]

Modulation and demodulation using pixelated linear phase carriers, Orlando M. Medina Cazares, Julio C. Estrada-Rico, Manuel Servin, Ctr. de Investigaciones en Óptica, A.C. (Mexico) [TD07-72]

Residual stresses in multilayer stacks coated by the sol-gel process, Hervé Piombini, Xavier Dieudonné, Christophe Boscher, Philippe F. Belleville, Olivier Gobert, Commissariat à l'Énergie Atomique (France) [TD07-73]

Tailor-made X-ray optics: multilayers and high precision deposition, Markus Kraemer, Reiner M. Dietsch, Thomas Holz, Danny Weissbach, AXO DRESDEN GmbH (Germany) [TD07-74]

Studies of imaging and coherence properties of multilayer monochromators, Reiner M. Dietsch, Markus Kraemer, AXO DRESDEN GmbH (Germany); Alexander Rack, European Synchrotron Radiation Facility (France); Timm Weitkamp, Synchrotron SOLEIL (France); Markus Riotte, Tatjana Rack, Karlsruhe Institut für Technologie (Germany); Thomas Holz, Danny Weissbach, AXO DRESDEN GmbH (Germany); Christian Morawe, European Synchrotron Radiation Facility (France); Frank Siewert, Helmholtz-Zentrum Berlin für Materialien und Energie GmbH (Germany); Mojmir Meduna, Masaryk Univ. (Czech Republic); Peter Cloetens, Eric Ziegler, European Synchrotron Radiation Facility (France) [TD07-75]

Optical design of custom objectives for biological light microscopy, Alexey D. Frolov, Saint-Petersburg State Univ. of Information Technologies, Mechanics and Optics (Russian Federation); Olga A. Vinogradova, Dmitry N. Frolov, FOCUS Inc. (Russian Federation) [TD07-76]

Experience of creating lenses for advanced researching in polarizing microscopy, Alexey D. Frolov, Saint-Petersburg State Univ. of Information Technologies, Mechanics and Optics (Russian Federation); Olga A. Vinogradova, Dmitry N. Frolov, FOCUS Inc. (Russian Federation) [TD07-77]

Experience of objectives for digital microscopes, Alexey D. Frolov, Saint-Petersburg State Univ. of Information Technologies, Mechanics and Optics (Russian Federation); Olga A. Vinogradova, Dmitry N. Frolov, FOCUS Inc. (Russian Federation); Toshihide Dohi, OptiWorks, Inc. (Japan) [TD07-78]

Handy shop formulas, Ray Williamson, Ray Williamson Consulting (United States) [TD07-79]

Unification of microscope objectives in view of the assembly, Alexey D. Frolov, Saint-Petersburg State Univ. of Information Technologies, Mechanics and Optics (Russian Federation); Olga A. Vinogradova, Dmitry N. Frolov, FOCUS Inc. (Russian Federation); Svyatoslav M. Latyev, Saint-Petersburg State Univ. of Information Technologies, Mechanics and Optics (Russian Federation); Alexey G. Tabachkov, FOCUS Inc. (Russian Federation) [TD07-80]

KRISS profilometer for measuring 1 m optics, Ho-Soon Yang, Korea Research Institute of Standards and Science (Korea, Republic of); Kil-Jae Jung, Won-Hyun Park, Yonsei Univ. (Korea, Republic of); Hyug-Gyo Rhee, Korea Research Institute of Standards and Science (Korea, Republic of); Young-Soo Kim, Korea Astronomy and Space Science Institute (Korea, Republic of); Seok-Whan Kim, Yonsei Univ. (Korea, Republic of); Yun-Woo Lee, Korea Research Institute of Standards and Science (Korea, Republic of) [TD07-82]

Research on VOx uncooled infrared bolometer based on porous silicon, Bin Wang, Jianjun Lai, Wuhan National Lab. for Optoelectronics (China) and Huazhong Univ. of Science and Technology (China); Sihai Chen, Erjing Zhao, Haoming Hu, Wuhan National Lab. for Optoelectronics (China) [TD07-83]

Improvement of sol-gel optical coating stacking, Xavier Dieudonné, Commissariat à l'Énergie Atomique (France); Hervé Piombini, ; Karine Vallé, Philippe Belleville, Commissariat à l'Énergie Atomique (France) [TD07-85]

Shape deformation of a thin glass plate with ground back side under strain, Thomas Lanternier, Stéphane Bouillet, Eric A. G. Lavastre, Commissariat à l'Énergie Atomique (France) [TD07-86]

Laser sintering of c-YAG fiber, Jonathan T. Goldstein, David E. Zelmon, Geoff E. Fair, Air Force Research Lab. (United States); Heedong Lee, UES, Inc. (United States) [TD07-87]

Precision free-form grinding of metre-scale optics, Paul Morantz, Paul Comley, Xavier P. Tonnellier, Paul R. Shore, Cranfield Univ. (United Kingdom) [TD07-88]

Utilization of CAD/CAM-systems for modern optics manufacturing, Jens Bliedtner, Christian Schindler, Fachhochschule Jena (Germany) [TD07-89]

Optical Technology: a full-color, practical guide to optical technology and manufacturing, Jens Bliedtner, Fachhochschule Jena (Germany); Rupert Hector, DRS Optronics, Inc. (United States) [TD07-90]

Thursday 12 May

SESSION 8

Room: Highland A/B Thurs. 8:00 to 10:20 am

Diamond Turning and Polymer Optics

Session Chair: Chris Ghio, Ohara Corp. (United States)

8:00 am: **Cutting of Fresnel lenses by truncated diamond tools**, Wenda Jiang, LPI Precision Optics Ltd. (Hong Kong, China); Hon-Yuen Tam, City Univ. of Hong Kong (Hong Kong, China); Tik-Cheong Au-Yeung, City Univ. of Hong Kong (Hong Kong, China) and LPI Precision Optics Ltd. (Hong Kong, China) [TD07-46]

8:20 am: **Diamond turning of meltspun aluminium for visual optical applications**, Guido P. Gubbels, TNO Science and Industry (Netherlands); Roger Senden, RSP Technology B.V. (Netherlands); Xuwen Liu, Aalto Univ. (Finland) [TD07-47]

8:40 am: **Diamond machining of optical steel molds**, Benjamin Bulla, Fritz Klocke, Olaf Dambon, Fraunhofer-Institut für Produktionstechnologie (Germany) [TD07-48]

9:00 am: **Dramatic improvement in the microroughness and surface figure accuracy of precision surfaces by optimizing diamond turning parameters and post polishing approaches**, Christian Cimino, Marc Neer, JENOPTIK Optical Systems, Inc. (United States) [TD07-49]

9:20 am: **Possibilities of micro- and nano- structured optical components from plastics for Applications in Green Photonics**, Hans Lauth, Frank Kühnlenz, Hans-Martin Bitzer, Fresnel Optics GmbH (Germany) [TD07-50]

9:40 am: **Polymer micro-optics manufacturing for today's photonic devices**, Lynn Dobosz, JENOPTIK Optical Systems, Inc. (United States) [TD07-51]

10:00 am: **Prism peak rounding in injection molded Fresnel lens solar concentrators**, Arthur J. Davis, Kevin J. Levesque, Scott Wilt, Reflexite Energy Solutions (United States) [TD07-52]

Coffee Break 10:20 to 10:40 am

SESSION 9

Room: Highland A/B Thurs. 10:40 am to 12:40 pm

Glass Molding

Session Chair: Cody B. Kreischer, Kreischer Optics, Ltd. (United States)

10:40 am: **Sensitivity analysis on process parameters to press glass windows in a bench-top precision glass molding machine**, Peiman Mosaddegh, Benn Gleason, Peter Wachtel, J. David Musgraves, Kathleen Richardson, Clemson Univ. (United States) [TD07-53]

11:00 am: **An introduction to the Dyna Technologies Inc. precision molding machine**, Benn Gleason, Peiman Mosaddegh, Peter Wachtel, J. David Musgraves, Kathleen Richardson, Clemson Univ. (United States) [TD07-54]

11:20 am: **Injection-moulded 3dB coupler for POF communication**, Matthias Haupt, Ulrich H. P. Fischer-Hirchert, Hochschule Harz (Germany) [TD07-55]

11:40 am: **Identifying the optimum process parameters of precision glass molding for aspherical lenses**, Waqas Iqbal, Michelin North America, Inc. (United States); John Ziegert, Peiman Mosaddegh, Clemson Univ. (United States); Yazid E. Tohme, Moore Nanotechnology Systems, LLC (United States) [TD07-56]

12:00 pm: **A combined numerical and experimental approach to measuring gap conductance for precision glass molding**, Peiman Mosaddegh, Christopher Ostrouchov, John Ziegert, J. David Musgraves, Paul Joseph, Dhananjay Joshi, Kathleen Richardson, Clemson Univ. (United States) [TD07-57]

12:20 pm: **Wafer level glass optics by precision molding**, Daniel Hollstegge, Martin Hüntten, Olaf Dambon, Fritz Klocke, Fraunhofer-Institut für Produktionstechnologie (Germany) [TD07-59]

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 Thursday 10:00 am to 3:00 pm

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Industry Panel Discussions

Wednesday • 2:00 to 3:00 pm

The Forbes Polynomial Surface: The Road Forward; A Return to Manufacturable Aspheres

Panel Moderator: **Kevin P. Thompson**, Synopsys, Inc. (USA)

Panelists:

Gregory W. Forbes, QED Technologies Inc./Cabot Microelectronics Corp. (Australia)

Jessica DeGroot Nelson, Optimax Systems, Inc. (USA)

Sven Kiontke, asphericon GmbH (Germany)

John R. Rogers, Synopsys, Inc. (USA)

Dave Stephenson, JENOPTIK Optical Systems, Inc. (USA)

David M. Aikens, Savvy Optics Corp. (USA)

Christoph Menke, Carl Zeiss AG (Germany)

Wednesday • 3:30 to 4:30 pm

The Future of Optical Manufacturing in North America

Panel Moderator: **Thomas Battley**, New York Photonics Industry Association (USA)

Panelists:

Robert M. Edmund, Edmund Optics Inc. (USA)

Michael Toro, SCHOTT North America, Inc. (USA)

Stephen D. Fantone, Optikos Corp. (USA)

Chris L. Koliopoulos, Zygo Corporation (USA)

Andrew W. Kulawiec, QED Technologies, Inc. (USA)

Networking Reception and Poster Session

All attendees are invited to relax, socialize, and enjoy refreshments. Conference posters will be on display. Poster authors will be present for discussion about their research.

Product Demonstrations

Product Demonstrations are open to all attendees. Exhibiting companies will showcase new and successful products in half-hour demonstrations.

TUESDAY

11:30 am: **Non-Contact Metrology For Manufacturing Freeform**
Scott DeFisher, OptiPro Systems

1:30 pm: **CAMPos Postprocessor Interface**
Christian Leonhardt, Satisloh North America Inc.

2:30 pm: **Optikos LensCheck™**
Daniel Orband, Optikos Corporation

WEDNESDAY

10:30 am: **Q-flex - Next Generation MRF from QED Technologies**
Paul Dumas, QED Technologies

11:30 am: **WaveGauge: Optics Tester for Aspherics, IOL & Contact Lenses**
Igor Lyuboshenko, PhaseView

12:30 pm: **In-situ Roughness Measurement**
Bob Parks, Optical Perspectives Group, LLC

THURSDAY

10:30 am: **Compact Grinding and Polishing with new PRO 80 Series**
Mike Bechtold, OptiPro Systems

11:30 am: **UltraForm Finishing of Aspheres and Freeform Optics**
Scott Bambrick, OptiPro Systems

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

Registration Required

See SPIE Cashier.

Evaluating Aspheres for Manufacturability

SC1039

NEW

Course level: Introductory
CEU .35 \$325 / \$375 USD
Tuesday 1:30 to 5:30 pm

This course provides an overview of how aspheric surfaces are designed, manufactured, and measured. The primary goal of this course is to teach how to determine whether a particular aspheric surface design will be difficult to make and/or test. This will facilitate cost/performance trade off discussions between designers, fabricators, and metrologists.

We will begin with a discussion of what an asphere is and how they benefit optical designs. Next we will explain various asphere geometry characteristics, especially how to evaluate local curvature plots. We will also review flaws of the standard polynomial representation, and how the Forbes polynomials can simplify asphere analysis. Then we will discuss how various specifications (such as figure error and local slope) can influence the difficulty of manufacturing an asphere. Optical assembly tolerances, however, are beyond the scope of this course - we will focus on individual elements (lenses / mirrors).

The latter half of the course will focus on the more common technologies used to generate, polish, and/or measure aspheric surfaces (e.g. diamond turning, glass molding, pad polishing, interferometry). We'll give an overview of a few generic manufacturing processes (e.g. generate-polish-measure). Then we'll review the main strengths and weaknesses of each technology in the context of cost-effective asphere manufacturing.

INSTRUCTORS

Gregory Forbes is Senior Scientist at QED and has developed the mathematical core of the software that controls QED's machines for optical finishing and metrology. Dr. Forbes has recently published a series of papers discussing better ways to specify aspheric shapes by using tailored orthogonal polynomials, and they will also be discussed in this short course.

Paul Murphy is a Senior Optical Engineer at QED Technologies International, where he has developed advanced products and processes for aspheric optical manufacturing and metrology. He received his Ph.D. in interferometric non-null asphere testing from The Institute of Optics at the University of Rochester.

Paul Dumas is one of the founding members of QED Technologies, where he has developed software and processes for aspheric optical manufacturing, and managed various engineering groups throughout the company's history. He received his B.S. and M.S. in Optics from The Institute of Optics at the University of Rochester.

Computer Generated Holograms for Optical Testing

SC1041

NEW

Course level: Intermediate
CEU .35 \$325 / \$375 USD
Wednesday 1:30 to 5:30 pm

This course provides the attendees with a solid understanding of theory and useful practical skills for using computer generated holograms for optical testing. The class covers the following topics:

- Computer Generated Holograms - underlying principles, types of CGHs and tradeoffs
- Design of optical test systems that use CGHs for wavefront correction and alignment
- Fabrication methods and limitations for CGHs
- Error analysis for CGH testing
- Methods of aligning and calibrating the optical test system

INSTRUCTOR

Chunyu Zhao is an Associate Research Professor at the College of Optical Sciences, University of Arizona (www.optics.arizona.edu/loft), and co-founder and Chief Engineer at the Arizona Optical Metrology LLC (www.cgnulls.com). He received his PhD in Optical Sciences from the College of Optical Sciences, University of Arizona in 2002. Dr. Zhao has over ten years experience in optical testing and optical design. He has designed and performed a wide variety of interferometric test systems for aspheric optics that employ computer generated holograms.

Optical Engineering Fundamentals

SC1038

NEW

Course level: Introductory
CEU .35 \$370 / \$430 USD
Tuesday 8:30 am to 12:30 pm

This course will deal with the subject of optical engineering and it will illustrate many of the subjects that will be encountered while working in that field. Calling on the instructor's many years of working in this field, first as an optical engineer, then a lens designer and optical engineering manager, and now an independent consultant, this course will allow the attendee to better understand the many phases and aspects of optical engineering. General topics such as the history of optical engineering and the presence of optical phenomenon in our everyday lives, will be presented, along with more specific discussions dealing with the basic characteristics and the design of optical components and systems. All information will be presented in a conversational format, with no requirement for dealing with the complex theories and mathematics that are often encountered. The course will provide a bridge of understanding, one that will carry the student from a basic starting point to that next level of learning that is typically presented in such classic text books as Warren Smith's *Modern Optical Engineering*.

INSTRUCTOR

Bruce Walker founder and President of Walker Associates, has been active in the field of optical engineering and lens design since 1960. He worked as an optical engineer at General Electric for 11 years and then as a Senior Lens Designer and Manager of Optical Engineering at Kollmorgen Corp. for 20 years. Mr. Walker was an Editorial Advisor with the Laurin Publishing Co. from 1970 to 1992. He has authored more than 30 technical papers and two optical engineering text books that are published as part of SPIE's Tutorial Text series. Mr. Walker has worked as an independent consultant in the field since 1991, specializing in providing unique solutions to a variety of optical engineering and lens design problems, including design and production of "proof of concept" prototype models.

COURSE PRICE INCLUDES the text *Optical Engineering Fundamentals, Second Edition* (SPIE Press, 2009) by Bruce H. Walker.

Mounting of Optical Components

SC1019

NEW

Course level: Introductory
CEU .65 \$565 / \$655 USD
Tuesday 8:30 am to 5:30 pm

This course introduces the principles and standard practices for mounting of optical components such as lenses, mirrors, windows, prisms, and filters. Particular case studies are used to show how mount design is driven by a combination of the environmental and performance requirements.

Common mounting techniques are explained such as:

- Mounting of lenses into barrels using adhesives or retaining rings
- Mounting of prisms and small mirrors using adhesives
- Mounting of assemblies using flexures
- Mounting and sealing of windows

Engineering analysis is performed for each type of mount to predict stress, survivability, and performance.

INSTRUCTOR

James Burge is Professor of Optical Sciences and Astronomy at University of Arizona, leading research and curriculum development in the area of optomechanical engineering at the College of Optical Sciences. Dr. Burge has a BS degree from Ohio State University in Engineering Physics with Mechanical Engineering, and MS and PhD degrees in Optical Sciences from the University of Arizona.

COURSE PRICE INCLUDES the text *Mounting Optics in Optical Instruments, 2nd edition* (SPIE Press, 2008), by Paul R. Yoder, Jr.

Geometric Dimensioning and Tolerancing

SC1040

NEW

Course level: Introductory
CEU .65 \$530 / \$620 USD
Monday 8:30 am to 5:30 pm

Costly errors are made when Geometric Dimensioning concepts and tolerance characteristics are not fully understood. This course is designed to familiarize personnel responsible for interpreting a technical drawing to estimate, inspect, and manufacture a part or assembly with symbology, principles, and concepts, associated with Geometric Dimensioning and Tolerancing ASME Y14.5-2009.

This course will cover all topics related to GD&T, but will focus on Geometric Dimensioning and verification concepts as they apply to the Optics Industry.

INSTRUCTOR

Walt Prystaj is the director of PEN Associates LLC, a training and consulting firm, and adjunct faculty at Rochester Institute of Technology, as well as a trainer for Finger Lakes Community College, Monroe Community College, Genesee Community College, and other educational institutions. He is a graduate of the University of Oswego, completed a Tool and Die Apprenticeship at Eastman Kodak, and is a former tool and die company owner. Walt has been training Geometric Dimensioning and Tolerancing in industry for over twenty-five years at more than 150 companies.

Understanding Waviness and Roughness Specifications for Optics

SC1011

NEW

Course level: Intermediate
CEU .35 \$325 / \$375 USD
Thursday 8:30 am to 12:30 pm

This course was designed to bring photonics personnel up to an immediate working knowledge on surface texture specifications and the impact surface roughness and waviness can have on an optical system. The surface texture of a polished optical surface is an important, if misunderstood, surface property. Surface roughness causes scatter and system transmission loss, while waviness and mid-spatial frequency ripple can cause loss of resolution, image quality, veiling glare, beam modulation and a host of other issues.

Courses

Until recently, surface texture could be safely described by a single number, RMS roughness, following MIL-STD-10A, since most polished optical surfaces were manufactured using the same slurry-pitch process that had existed for decades. In the past 30 years, however, new manufacturing technologies have evolved using molding, diamond turning, synthetic lap polishing and deterministic figuring which have dramatically altered the surface finish of optics. In order to control the resultant surface texture errors, new specifications like gradients, correlation values, PSDs and MSF ripple specifications have been introduced. Most users do not completely understand these new notations however, and the meaning of even a simple RMS roughness specification has become obscure, or even meaningless.

The course begins with the origins and evolution of surface texture specifications in optics, and defines the terms and parameters used to control surface texture in the modern optical manufacturing world. The potential performance impact of surface texture errors will be covered, and some specific case studies will be used to show the impact of various amplitudes of these errors on precision optical instrument performance. The national and international standards are introduced, and the derivation of meaningful specification for texture and waviness for common applications is discussed. Finally, the identification, measurement and reduction of these manufacturing errors is treated.

INSTRUCTOR

David Aikens has been writing on the subject of surface texture and ripple for more than 20 years and is one of the foremost experts on optics mid-spatial frequency ripple today. Dave is President and founder of Savvy Optics Corp., is the head of the American delegation to ISO TC 172 SC1, and is chairman of the American Standards Committee for Optics, ASC/OP. He is also the project manager for ISO surface texture notation standards for optics.

Understanding Scratch and Dig Specifications

SC700

Course level: Introductory
CEU .35 \$395 / \$445 USD
Tuesday 1:30 to 5:30 pm

Surface imperfection specifications (i.e. Scratch-Dig) are among the most misunderstood, misinterpreted, and ambiguous of all optics component specifications. This course provides attendees with an understanding of the source of ambiguity in surface imperfection specifications, and provides the context needed to properly specify surface imperfections using a variety of specification standards, and to evaluate a given optic to a particular level of surface imperfection specification. The course will focus on the differences and application of the Mil-PRF-13830, ISO 10110-7, and BSR/OP1.002. Many practical and useful specification examples are included throughout, as well as a hands-on demonstration on visual comparison evaluation techniques.

The course is followed by SC1017 Optics Surface Inspection Workshop, which provides hands-on experience conducting inspections using the specification information provided in this course.

INSTRUCTOR

David Aikens is the president and CEO of Savvy Optics Corp, and has been designing and specifying optics for more than 20 years. He has been active in the development of surface imperfection standards since 1996, and is currently serving as Chairman of OEOSC's American Standards Committee for Optics, ASC/OP.

COURSE PRICE INCLUDES a copy of the latest ANSI approved surface imperfections specification standard.

Thin Film Optical Coatings

SC321

Course level: Intermediate
CEU .65 \$530 / \$620 USD
Thursday 8:30 am to 5:30 pm

Virtually no modern optical system could operate without optical coatings. Much of any optical system consists of a series of coated and shaped surfaces. The shape determines the power of the surface but it is the coating that determines the specular properties, the amount of light transmitted or reflected, the phase change, the emittance, the color, the polarization, the retardation, including even the mechanical properties. Optical coatings consist of assemblies of thin films of materials where interference properties combine with the intrinsic properties of the materials to yield the desired optical performance. They act to reduce the reflectance losses of lenses, increase the reflectance of mirrors, reduce glare and electromagnetic emission from display systems, improve the thermal insulation of buildings, protect eyes from laser radiation, analyze gases, act as anti-counterfeiting devices on banknotes, multiplex or demultiplex communication signals, separate or combine color channels in display projectors, and these are just a few of their roles. This course emphasizes understanding and takes students from fundamentals to techniques for design and manufacture.

INSTRUCTOR

H. Angus Macleod is President of Thin Film Center, a software, training and consulting company in optical coatings, and is Professor Emeritus of Optical Sciences at the University of Arizona. He has been deeply involved in optical coatings for over forty years.

Optical Manufacturing Overview

SC350

Course level: Introductory
CEU .65 \$530 / \$620 USD
Monday 8:30 am to 5:30 pm

This course provides a basic understanding of the methodology and processes used in the fabrication of precision optical elements. Emphasis is placed on the selection and use of tooling, materials and equipment used in the manufacturing process with specific examples.

INSTRUCTOR

Robert Novak is the president and CEO of BAN Optical, and has been designing and delivering courses in optical engineering for over 37 years. He is professor emeritus of optics at Monroe Community College where he was chairman of Optical Systems Technology for over 30 years. He is currently the Secretary of APOMA (American Precision Optics Manufacturing Association), a position he has held for over 20 years, and is an Honorary Member of the Rochester Section of the OSA.

Structural Adhesives for Optical Bonding

SC015

Course level: Intermediate
CEU .35 \$325 / \$375 USD
Wednesday 1:30 to 5:30 pm

Optomechanical systems require secure mounting of optical elements. This important aspect of the design can cause a production to stop if sound engineering is not applied. A wide variety of adhesives are discussed with respect to their relevant properties. Design considerations, differing mounting techniques, production concerns, and reliability are reviewed. The instructor gives success and failure case histories.

INSTRUCTOR

John Daly has been a consultant for the past 10 years. He has experience in the applications of adhesives to our industry. Daly has more than 20 years of experience in academia, aerospace, medical, commercial, and industrial fields. He has a B.S. in Mechanical Engineering Ph.D. in Applied Physics. His exposure to these areas for applications of laser, electro-optic, and photonic technologies has covered research, development, production, and management.

Modern Optical Testing

SC212

Course level: Intermediate
CEU .35 \$355 / \$405 USD
Monday 8:30 am to 12:30 pm

This course describes the basic interferometry techniques used in the evaluation of optical components and optical systems. It discusses interferogram interpretation, computer analysis, and phase-shifting interferometry, as well as various commonly used wavefront-measuring interferometers. The instructor describes specialized techniques such as testing windows and prisms in transmission, 90-degree prisms and corner cubes, measuring index inhomogeneity, and radius of curvature. Testing cylindrical and aspheric surfaces, determining the absolute shape of flats and spheres, and the use of infrared interferometers for testing ground surfaces are also discussed. The course also covers state-of-the-art direct phase measurement interferometers.

INSTRUCTOR

James Wyant is Dean of the College of Optical Sciences and Professor of Optical Sciences at the University of Arizona. He was a founder of the WYKO Corporation and served as its president from 1984 to 1997. Dr. Wyant was the 1986 President of SPIE.

COURSE PRICE INCLUDES the text *Field Guide to Interferometric Optical Testing* (SPIE Press, 2006) by Eric P. Goodwin and James C. Wyant.

Fundamentals of Single Point Diamond Turning

SC848

Course level: Introductory
CEU .35 \$325 / \$375 USD
Monday 1:30 to 5:30 pm

This course provides attendees with a basic working knowledge of single point diamond turning of optical components. The course covers a wide range of topics and should provide the attendee with an understanding of the process capabilities of this technology. Key subject matter includes; equipment, processes, cutting mechanics, material selection, fixturing, metrology, applications, component design, optical tolerancing, and producibility.

INSTRUCTOR

John Schaefer is a Sr. Principal Process Engineer for ELCAN Optical Technologies, a Raytheon Company, and has more than 25 years of hands-on experience in single point diamond turning. He has extensive experience in process development, concurrent engineering, production-ization, interferometry, asphere metrology, and equipment specification and procurement.

Registration Required

See SPIE Cashier.



Patenting Fundamentals for Optics Professionals

WS1042

NEW

Course level: Introductory
CEU .30 \$125 / \$150 USD
Wednesday 8:30 to 11:30 am

Innovating new products is essential to the long-term success of your company, but just as important is securing the rights to your inventions. The limited monopoly that is granted by a patent can provide a critical competitive advantage in the marketplace. It may enable sustained profitability in selling a given product, while adding to the overall asset base of your company. Attendees will learn the fundamentals of patents: the definition of a patent; history and legal basis of patents; types of patents; patentability; patentable subject matter; inventorship and ownership; good practices for inventors and businesses; invention disclosures; content, structure, and requirements of a patent application; and patent application and prosecution processes in the United States Patent and Trademark Office (USPTO). The second half of the workshop will provide a tutorial on the basics of accessing electronic records online in the USPTO, and patent searching within specific technical fields, including identifying the appropriate technology classes and subclasses. Example searches will be demonstrated, including an optics-technology related search.

INSTRUCTORS

John Hammond P.E. is a patent agent licensed to practice in the United States Patent and Trademark Office, and a licensed Professional Engineer in New York State. He has more than 24 years of work experience in product conception, product development, industrial research and development, and manufacturing at Xerox Corporation and Optimization Technology Inc. He is the founder of Patent Innovations LLC, a patent law practice in Rochester. He obtained a M.S. in Chemical Engineering from the University of Rochester, and is named as inventor on 25 U.S. patents in areas including thin films. He is a co-founder, along with Robert Gunderman, of PatentEducation.com and a co-author of "The Limited Monopoly", a monthly column on patent law that appears in the *Rochester Engineer*.

Robert Gunderman P.E. is a licensed patent agent in both the U.S. and Canada, and a licensed Professional Engineer in New York State. He is the founder of the patent law firm Patent Technologies, LLC. He has a Bachelor of Science degree in Electrical Engineering from Rochester Institute of Technology and a Master of Business Administration Degree from the University of Rochester's Simon School of Business. He has started five companies, the most recent being Hydratics, an advanced low power desalination and water purification company. He holds issued patents in the areas of software, energy storage, medical diagnostics and treatment, non-pesticide based insect control, and electrical devices. He is a co-founder, along with John Hammond, of PatentEducation.com and a co-author of "The Limited Monopoly", a monthly column on patent law that appears in the *Rochester Engineer*.

COURSE PRICE INCLUDES a CD-ROM of the course presentations, along with additional "how-to" primers on electronic records accessing and patent searching in the USPTO, and the entire collection of over 60 issues of "The Limited Monopoly" covering a wide range of patent law topics.

General Information

SPIE Registration

Registration Hours

Rochester Riverside Convention Center
Empire Lobby, Exhibit Level

Sunday 8 May 7:30 am to 4:00 pm*

*Exhibitors only

Monday 9 May 7:30 am to 5:00 pm

Tuesday 10 May 7:30 am to 5:00 pm

Wednesday 11 May 7:30 am to 6:00 pm

Thursday 12 May 7:30 am to 3:00 pm

Conference Registration Includes:

- Technical Digest
- Access to all presentations and the Exhibition
- Access to the poster sessions
- Welcome Reception and coffee breaks
- Courses are not included.

Exhibition days and hours:

Tuesday 10 May 10:00 am to 5:00 pm

Wednesday 11 May 10:00 am to 6:00 pm

Thursday 12 May 10:00 am to 3:00 pm

Course Materials Desk

Empire Lobby, near the SPIE Registration Area
Open during Registration hours

- If you have registered to attend a course, please stop by the Course Materials Desk AFTER you pick up your badge.
- You must obtain your course notes to find out class location.
- Ask at the Course Material Desk about the latest Education Services catalog (includes all SPIE courses, videos, and CD-ROM's) as well as customized in-company courses.

Onsite Services

Complimentary Wireless Internet Access

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The SPIE Cashier can assist with:

- **Registration Payments** - If you are paying by cash or check as part of your onsite registration, wish to add a course, workshop, or special event requiring payment, or have questions regarding your registration, please see the onsite cashier at the Cashier station in the registration area.
- **Receipts** - Preregistered attendees who did not receive a receipt prior to the meeting may obtain a new copy of their registration receipt onsite at the SPIE Cashier station in the registration area.
- **Badge Corrections** - Attendees who need a correction to their badge information onsite may do so at the SPIE Cashier station in the registration area. Please have your badge removed from the badge holder, marked with your changes, and ready to hand to the attendant upon approaching the counter.

Urgent Message Line

Messages will be taken during registration hours Monday through Thursday by calling the SPIE Urgent Message line at +1 585 770-2360.

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Author/Presenter Information

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:

- Please have it tested at your facility to make sure it has <5 mW power output. Laser pointers in Class II and IIIa (<5 mW) are eye safe if power output is correct - but don't automatically trust the labeling. Commercially available laser pointers, red or green (or any color), could be incorrectly labeled as to their wavelength and power output.
- 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.

Policies

Audio, Video, Digital Recording Policy

In the Meeting Rooms and Poster Sessions: For copyright reasons, recordings of any kind are strictly prohibited without prior written consent of the presenter in any conference session, 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 Registration 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.

Underage Persons on the 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.

Food and Beverage Services

Coffee Breaks

Tuesday morning coffee break
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Complimentary coffee will be served twice each day of the conference at approximately 10:00am and 3:00pm, and will be served in the Exhibition Hall Tuesday through Thursday. Please check the individual technical conference listings for exact times.

Refreshment Purchases

For attendee purchase of light refreshments, including continental breakfast, specialty carts will be set up throughout the convention center Sunday through Thursday.

Cash Lunches and Exhibition Concessions

Visit the Café Express located in the back of the exhibition halls on Tuesday, Wednesday, and Thursday featuring domestic and international cuisine. They will serve hot and cold snacks, beverages, deli-type sandwiches, salads, hot entrees, and pastries and will be open daily 11:00 am to 2:00pm.

Parking

Parking

All parking rates are subject to change.

Hyatt Regency Rochester

Self guest parking at their adjacent parking garage. Guests pay \$4 per night, per car, with in/out privileges.

Non guests: first hour free, \$2. for 2nd hour & \$1. each additional hour. Max of \$6.75 per day. Monday thru Friday. Same rates for the weekend/daily max is \$4.

Valet parking is available via the Motor Court Entrance on East Main St. at \$10 per night with in/out privileges.

Radisson Hotel Rochester Riverside

Guests pay the prevailing parking rate at the Radisson Hotel parking garage. The rate is currently \$7 per night with in/out privileges. No parking directly in front of the Hotel.

Riverside Convention Center Parking

If you enter the garage from the Stone St. entrance please proceed through the garage and follow the signs directing you to parking for the Convention Center. If your parking is validated please take your ticket to your destination, where it will be validated for you. When exiting, you have the option to pay at the exit using Visa/Mastercard. If paying cash, please use the pay on foot pay station located near the Hyatt entrance on level 2 Pink or the pay in lane pay station located at the South Ave exit gate, left hand lane.

The maximum vehicle height for this garage is 7 feet, any vehicles over 7 feet tall need to call the garage ahead of time to make special parking arrangements.

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 Optifab Conference attendee using the Hertz Meeting Code CV# 029B0015. In the United States call 1-800-654-2240

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Conference dates

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Exhibition dates

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