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2013 Optifab

Technical Program

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Conference and Courses:

14–17 October

Exhibition:

15–17 October

Rochester Riverside Convention Center
Rochester, New York, USA

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CONTENTS

General Information 2-3
Sponsors 4-5
Courses 6-7
Daily Event Schedule 8-11
Optifab Technical Conference . 12-30

Proceedings/CD of SPIE 30
Index of Authors, Chairs, and
Committee Members 32-36
Rochester Riverside Convention
Center Map Back Cover



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(USA)



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About SPIE

SPIE is an international society advancing an interdisciplinary approach to the science and application of light. www.SPIE.org

About APOMA

The American Precision Optics Manufacturers Association represents a broad constituency of precision optics manufacturers, the supporting industry, and academic associates, whose mutual interest is the advancement and expansion of optics manufacturing and technology. www.APOMA.org

General Information

Registration

Onsite Registration and Badge Pick-Up Hours
Galleria, 1st Floor

Sunday 13 October (<i>Exhibitor Registration Only</i>)	9:00 am to 4:00 pm
Monday 14 October	7:30 am to 5:00 pm
Tuesday 15 October	7:30 am to 5:00 pm
Wednesday 16 October	7:30 am to 6:00 pm
Thursday 17 October	7:30 am to 3:00 pm

Course and Workshop Registration

Courses and workshops are priced separately. Course-only registration includes your selected course(s), course notes, coffee breaks, and admittance to the exhibition. Course prices include applicable taxes.

SPIE Member, SPIE Student Member, and Student Pricing

- SPIE Members receive conference and course registration discounts. Discounts are applied at the time of registration.
- SPIE Student Members receive a 50% discount on all courses.
- Student registration rates are available only to undergraduate and graduate students who are enrolled full time and have not yet received their Ph.D. Post-docs may not register as students. A student ID number or proof of student status is required with your registration.

Press Registration

For credentialed press and media representatives only. Please email contact information, title, and organization to media@spie.org.

SPIE Cashier

Registration Area, Galleria
Open during registration hours

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, visit the SPIE Cashier.

Receipts and Certificate of Attendance

Preregistered attendees who did not receive a receipt or attendees who need a Certificate of Attendance may obtain those from the SPIE Cashier at Badge Corrections and Receipts.

Badge Corrections

Badge corrections can be made by the SPIE Cashier at the Badge Corrections station. Please have your badge removed from the badge holder and marked with your changes before approaching the counter.

Onsite Services

Internet Access

Empire Lobby and Lounge, 2nd Floor

Complimentary wireless access is available; instructions will be posted onsite.

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SPIE Bookstore

Galleria, 1st Floor

The SPIE Bookstore is your source for information on the latest SPIE Press Books, Proceedings, and Education and Professional Development materials. Become an SPIE Member and browse course offerings and the other education services available.

Restaurant and City Information

Empire Lobby, 2nd level

Monday through Wednesday 7:30 am to 5:00 pm

Urgent Message Line

An urgent message line is available during registration hours: **+1-585-770-2360**.

Lost and Found

Found items will be kept at Cashier until 5:00 pm each day and then turned over to Rochester Riverside Convention Center Security. At the end of the meeting, all found items will be turned over to Rochester Riverside Convention Center, **+1-585-232-7200**.

Food and Beverage Services

Coffee Breaks

Monday Highland Ballroom Foyer, 1st Floor
Tuesday through Thursday Exhibition Hall

Complimentary coffee will be served twice daily, at 10:00 am and 3:00 pm. Check individual conference listings for exact times and locations. There will not be a 3:00 coffee break on Thursday.

Sponsored by:



Food and Refreshments for Purchase

Café Express, back of the Exhibition Hall

Tuesday through Thursday 11:00 am to 2:00 pm
Hot and cold snacks, hot entrees, deli sandwiches, salads, and pastries are available for purchase. Cash and credit cards accepted.

Thanks to the following Sponsors

Coffee Break	
 <p>Booth #1109 www.goochandhousego.com</p>	 <p>Booths #511, 515 www.qedmf.com</p>
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Conference Bag Insert	
 <p>www.optatec-messe.de/en/optatec</p>	 <p>Booth #803 www.photonics.com</p>
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Courses

Improve your skills and make new connections

Top training developed with input from local industry leaders, courses range from optical fundamentals to current approaches in engineering and manufacturing, including aspheric optics, standards, thin films, and optomechanics.

Structural Adhesives for Optical Bonding

SC015 · Course Level: Intermediate · CEU: 0.35
\$360 Members · \$410 Non-Members USD
Wednesday 1:30 pm to 5:30 pm · Instructor: **John G. Daly**

Making Sense of Waviness and Roughness on Optics

SC1011 · Course Level: Intermediate · CEU: 0.35
\$460 Members · \$510 Non-Members USD
Monday 1:30 pm to 5:30 pm · Instructor: **David Aikens**

Mounting of Optical Components

SC1019 · Course Level: Introductory · CEU: 0.65
\$655 Members · \$745 Non-Members USD
Thursday 8:30 am to 5:30 pm · Instructor: **Keith Kasunic**

Evaluating Aspheres for Manufacturability

SC1039 · Course Level: Introductory · CEU: 0.35
\$360 Members · \$410 Non-Members USD
Monday 1:30 pm to 5:30 pm
Instructors: **Gregory Forbes, Paul Murphy, and Paul Dumas**

See SPIE Cashier to register for a course.

Courses

Designing Optical Systems with Manufacturable Aspheres

SC1061 · Course Level: Introductory · CEU: 0.35
\$360 Members · \$410 Non-Members USD
Monday 8:30 am to 12:30 pm · Instructor: **Julie Bentley**

Optical Materials, Fabrication and Testing for the Optical Engineer **NEW**

SC1086 · Course Level: Introductory · CEU: 0.35
\$360 Members · \$410 Non-Members USD
Wednesday 1:30 pm to 5:30 pm · Instructor: **Jessica DeGroot Nelson**

Subcontracting Custom Optics **NEW**

SC1119 · Course Level: Introductory · CEU: 0.35
\$360 Members · \$410 Non-Members USD
Wednesday 8:30 am to 12:30 pm · Instructor: **Michael Orr**

Thin Film Optical Coatings

SC321 · Course Level: Intermediate · CEU: 0.65
\$570 Members · \$660 Non-Members USD
Wednesday 8:30 am to 5:30 pm · Instructor: **H. Angus Macleod**

Optical Manufacturing Overview

SC350 · Course Level: Introductory · CEU: 0.65
\$570 Members · \$660 Non-Members USD
Monday 8:30 am to 5:30 pm · Instructor: **Robert Novak**

Optical System Design:

Layout Principles and Practice

SC690 · Course Level: Introductory · CEU: 0.65
\$690 Members · \$780 Non-Members USD
Tuesday 8:30 am to 5:30 pm · Instructor: **John Greivenkamp**

Introduction to Modern Optical Drawings – the ISO 10110 Standard

SC863 · Course Level: Introductory · CEU: 0.35
\$360 Members · \$410 Non-Members USD
Monday 8:30 am to 12:30 pm · Instructor: **David Aikens**

Fundamentals of Single Point Diamond Turning

SC848 · Course Level: Introductory · CEU: 0.35
\$360 Members · \$410 Non-Members USD
Tuesday 1:30 pm to 5:30 pm · Instructor: **John Schaefer**

Daily Event Schedule

See SPIE Cashier to register for a course.

	Monday 14 October	Tuesday 15 October
MORNING SESSIONS	Technical Conference 8:00 am to 12:10 pm	
	SC1061 Designing Optical Systems with Manufacturable Aspheres (<i>Bentley</i>) 8:30 am to 12:30 pm, p. 7	EXHIBITION 10:00 am to 5:00 pm
	SC863 Introduction to Modern Optical Drawings – the ISO 10110 Standard (<i>Aikens</i>) 8:30 am to 12:30 pm, p. 7	SC690 Optical System Design: Layout Principles and Practice (<i>Greivenkamp</i>) 8:30 am to 5:30 pm, p. 7
	SC350 Optical Manufacturing Overview (<i>Novak</i>) 8:30 am to 5:30 pm, p. 7	PLENARY SESSION Disruptive innovation: the story of the first digital camera, 11:00 am to 12:00 pm, Highland A/B, p. 17 Steven Sasson , Retired, Eastman Kodak Co. USA)
Lunch Break		

Wednesday 16 October	Thursday 17 October
8:00 am to 12:10 pm	
Walk the floor and see the latest in optical fabrication technologies	
10:00 am to 6:00 pm	10:00 am to 3:00 pm
SC1119 Subcontracting Custom Optics (<i>Orr</i>) 8:30 am to 12:30 pm, p. 7	SC1019 Mounting of Optical Components (<i>Kasunic</i>) 8:30 am to 5:30 pm, p. 6
SC321 Thin Film Optical Coatings (<i>Macleod</i>) 8:30 am to 5:30 pm, p. 7	OPEN FORUM Export Control: Reform Update and Tips for Compliance, 10:30 to 11:30 am • Exhibition Hall, p. 30

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

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



Download the
SPIE Conference App



Daily Event Schedule

See SPIE Cashier to register for a course.

	Monday 14 October	Tuesday 15 October
AFTERNOON SESSIONS	Technical Conference 1:10 to 6:20 pm	
	SC1039 Evaluating Aspheres for Manufacturability (<i>Forbes, Murphy, Dumas</i>) 1:30 to 5:30 pm, p. 6	SC848 Fundamentals of Single Point Diamond Turning (<i>Schaefer</i>) 1:30 to 5:30 pm. p. 7
	SC1011 Making Sense of Waviness and Roughness on Optics (<i>Aikens</i>) 1:30 to 5:30 pm, p. 6	
EVENING EVENTS		15th Annual Photonics Clambake (Co-located Event) 5:30 pm, Hyatt Ballroom <i>Tickets required, see p. 19</i>

Wednesday 16 October	Thursday 17 October
PLENARY SESSION NASA funding for optical fabrication and testing technology development, 1:10 to 2:00 pm, Highland A/B, p. 22 H. Philip Stahl , NASA Marshall Space Flight Center (USA)	
INDUSTRY EVENT Future of Metrology 2:00 to 3:00 pm, Highland A/B, p. 23 Panel discussion on the future developments of metrology.	
INDUSTRY EVENT Getting Hired in 2013 and Beyond 3:30 to 4:30 pm, Empire Hall, Exhibition Hall, p. 24 Panel discussion on careers in optics and photonics outside the academic world.	
SC1086 Optical Materials, Fabrication and Testing for the Optical Engineer (<i>DeGroot Nelson</i>) 1:30 to 5:30 pm, p. 7	
SC015 Structural Adhesives for Optical Bonding (<i>Daly</i>) 1:30 to 5:30 pm, p. 6	
Networking Reception and Poster Viewing 4:30 to 6:00 pm, Empire Hall, Exhibition Hall, p 27 All attendees are invited to relax, socialize, and enjoy refreshments.	
ROSA Optics Talks 7:00 to 8:30 pm, Highland A/B, p 27 (Co-located Event)	



Conference 8884

Monday - Thursday 14–17 October 2013
 Proceedings of SPIE Vol. 8884

Optifab 2013

Conference Chairs: **Julie L. Bentley**, Univ. of Rochester (USA);
Matthias Pfaff, OptoTech Optikmaschinen GmbH (Germany)

Monday 14 October

SESSION 1

Room: Highland A/B Mon 8:00 am to 9:40 am

Grinding and Polishing Processes I

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

8:00 am: **Cost effective fabrication method for large sapphire sensor windows**, Mark Walters, Alan R. Gould, Kevin Bartlett, Matthew R. Brophy, Jessica DeGroote Nelson, Optimax Systems, Inc. (USA) [8884-1]

8:20 am: **Effects of varying machine stiffness and contact area in UltraForm Finishing**, Dennis E. Briggs, Samantha Echaves, Brendan Pidgeon, Nathan Travis, Jonathan D. Ellis, Univ. of Rochester (USA) [8884-2]

8:40 am: **Determination of a suitable parameter field for the active fluid jet polishing process**, Roland Maurer, Heiko Biskup, Christian Trum, Rolf Rascher, Christine Wünsche, Hochschule Deggendorf (Germany) [8884-3]

9:00 am: **Magnetorheological finishing with chemically modified fluids for studying material removal of single-crystal ZnS**, Sivan Salzman, Henry J. Romanofsky, Yoem I. Clara, Luccas J. Gianechini, Garrett J. West, John C. Lambropoulos, Stephen D. Jacobs, Univ. of Rochester (USA) [8884-4]

9:20 am: **Dressing of fine grained diamond grinding wheels for ultra precision grinding of structured molds in brittle hard materials**, Thomas Bletek, Fritz Klocke, Martin Hüntten, Olaf Dambon, Fraunhofer-Institut für Produktionstechnologie (Germany) [8884-5]

Coffee Break Mon 9:40 am to 10:10 am

SESSION 2

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

Grinding and Polishing Processes II

Session Chair: **Jean-Jacques G. S. de Groote**, UNAERP (Brazil)

10:10 am: **The removal of mid-spatial frequency (MSF) errors using stress-polishing**, Peter C. Hill, Peter N. Blake, Carl R. Strojny, Shahram Shiri, Jason G. Budinoff, NASA Goddard Space Flight Ctr. (USA); Gregory J. Michels, Sigmadyne, Inc. (USA) [8884-6]

10:30 am: **Efficiency of magnetorheological fluid finishing on the elimination of defects in fused silica optics**, Rodolphe Catrin, Commissariat à l'Énergie Atomique (France); Daniel Taroux, Philippe Cormont, Cédric Maunier, Thomas Corbineau, Gérard Razé, Jérôme Néaupert, CEA (France) [8884-7]

10:50 am: **Optical surfacing process optimization using parametric smoothing model for mid-to-high spatial frequency error control**, Dae Wook Kim, College of Optical Sciences, The Univ. of Arizona (USA); Hubert M. Martin, The Univ. of Arizona (USA); James H. Burge, College of Optical Sciences, The Univ. of Arizona (USA) [8884-8]

11:10 am: **Relationships between subsurface damage depth and surface roughness of grinded glass optics**, Pierre Blaineau, Raynald Laheurte, Philippe Darnis, Univ. Bordeaux 1 (France); Nathalie Ferriou-Daurios, Commissariat à l'Énergie Atomique (France); Olivier Cahuc, Univ. Bordeaux 1 (France); Jérôme Néaupert, Commissariat à l'Énergie Atomique (France) [8884-9]

11:30 am: **Fabrication of optical surfaces of fused silica with ultralow subsurface damage**, Junlin Wang, Changchun Institute of Optics, Fine Mechanics and Physics (China) [8884-10]

11:50 am: **Multiwavelength digital holography for polishing tool shape measurement**, Vit Ledl, Institute of Plasma Physics of the ASCR, v.v.i. (Czech Republic); Pavel Psota, Technical Univ. of Liberec (Czech Republic); Jan Vaclavik, Institute of Plasma Physics of the ASCR, v.v.i. (Czech Republic); Roman Dolecek, Technical Univ. of Liberec (Czech Republic); Petr Vojtisek, Institute of Plasma Physics of the ASCR, v.v.i. (Czech Republic) [8884-11]
 Lunch Break Mon 12:10 pm to 1:10 pm

SESSION 3

Room: Highland A/B Mon 1:10 pm to 3:10 pm

Grinding and Polishing Processes III

Session Chair: **Michael J. Bechtold**, OptiPro Systems (USA)

1:10 pm: **Innovations within the process chain for ultraprecise optics fabrication**, Sebastian Stoebenau, Sebastian Stahringer, Roland Mandler, Matthias Pfaff, OptoTech Optikmaschinen GmbH (Germany) [8884-12]
 1:30 pm: **Deterministic polishing process for aspheric lenses in a production environment**, G. Stach, F. Schwalb, Satisloh GmbH (Germany) [8884-13]
 1:50 pm: **Deterministic finishing of aspheric optical components**, Teddy J. Lambropoulos, Ed Fess, Scott DeFisher, OptiPro Systems (USA) [8884-14]
 2:10 pm: **Efficient grinding and polishing processes for asphere manufacturing**, Markus Hinn, Schneider GmbH & Co. KG (Germany); Alex Pisarski, Schneider Optical Machines Inc. (USA) [8884-15]
 2:30 pm: **Getting the most out of your cerium oxide glass polishing slurry: reducing risk and improving performance with plasma produced particles**, Patrick G. Murray, Abigail Hooper, Nanophase Technologies Corp. (USA); Jason Keleher, Jordan Kaiser, Meghan Nichol, Lewis Univ. (USA) [8884-16]
 2:50 pm: **New developments in fixed abrasive grinding and their potential for the production of optical components**, Marcel Patraschkov, dopa diamond tools (Germany) [8884-17]
 Coffee Break Mon 3:10 pm to 3:40 pm

SESSION 4

Room: Highland A/B Mon 3:40 pm to 6:20 pm

Optical Fabrication of Freeform Surfaces

Session Chair: **Jonathan D. Ellis**, Univ. of Rochester (USA)

3:40 pm: **Developments in precision optical grinding technology**, Edward M. Fess, Michael J. Bechtold, Franciscus Wolfs, Rob Bechtold, OptiPro Systems (USA) [8884-18]
 4:00 pm: **Additive manufacturing of tools for lapping glass**, Wesley B. Williams, The Univ. of North Carolina at Charlotte (USA) [8884-19]
 4:20 pm: **Freeform polishing with UltraForm Finishing**, Franciscus Wolfs, Edward M. Fess, Scott DeFisher, OptiPro Systems (USA) [8884-20]
 4:40 pm: **Fabricating freeform multispectral-ZnS corrector lenses**, Matthew R. Brophy, Nathan Smith, Thomas J. Hordin, Alan R. Gould, Optimax Systems, Inc. (USA); Kate Medicus, Optimax Systems (USA); Mark Walters, Jessica DeGroot Nelson, Optimax Systems, Inc. (USA) . [8884-21]
 5:00 pm: **Efficient machining of ultra precise steel moulds with freeform surfaces**, Benjamin Bulla, son-x GmbH (Germany); David J. Robertson, Durham Univ. (United Kingdom); Olaf Dambon, Fritz Klocke, Fraunhofer-Institut für Produktionstechnologie (Germany) [8884-22]
 5:20 pm: **Integrated manufacturing of complex freeform surfaces**, Frank Niehaus, Stephan Huttenhuis, Schneider GmbH & Co. KG (Germany); Alex Pisarski, Schneider Optical Machines Inc. (USA) [8884-23]
 5:40 pm: **Conformal window manufacturing process development and demonstration for polycrystalline materials**, Nathan Smith, Alan R. Gould, Thomas J. Hordin, Kate Medicus, Mark Walters, Matthew R. Brophy, Jessica DeGroot Nelson, Optimax Systems, Inc. (USA) [8884-24]
 6:00 pm: **Fabrication of high precision metallic freeform mirrors with magnetorheological finishing (MRF)**, Matthias Beier, Fraunhofer-Institut für Angewandte Optik und Feinmechanik (Germany); Sebastian Scheiding, Fraunhofer-Institut für Angewandte Optik und Feinmechanik (Germany) and Friedrich Schiller Univ. Jena (Germany); Andreas Gebhardt, Roman Loose, Stefan Risse, Ramona Eberhardt, Fraunhofer-Institut für Angewandte Optik und Feinmechanik (Germany); Andreas Tünnermann, Fraunhofer-Institut für Angewandte Optik und Feinmechanik (Germany) and Friedrich-Schiller- Univ. Jena (Germany) [8884-91]

Tuesday 15 October

SESSION 5

Room: Highland A/B Tue 8:00 am to 10:40 am

Metrology I

Session Chair: **Paul Dumas**, QED Technologies, Inc. (USA)

8:00 am: **Comparison of alignment errors in asphere metrology between an interferometric null-test measurement and a non-null measurement with the tilted-wave-interferometer**, Goran B. Baer, Johannes Schindler, Christof Pruss, Wolfgang Osten, Univ. Stuttgart (Germany) [8884-25]

8:20 am: **Comparison of contact and non-contact asphere surface metrology devices**, Scott DeFisher, Edward M Fess, OptiPro Systems (USA) [8884-26]

8:40 am: **Non-contact metrology of aspheric surfaces based on MWLI technology**, Gernot Berger, Juergen Petter, Lumphos GmbH (Germany) [8884-27]

9:00 am: **Vertical interferometer workstation for testing large spherical optics**, Bruce E. Truax, Zygo Corp. (USA) [8884-28]

9:20 am: **Retrace error: interferometry's dark little secret**, Cody B. Kreisler, Kreisler Optics, Ltd. (USA) [8884-29]

9:40 am: **Round-robin measurements of toroidal window**, Kate Medicus, Optimax Systems, Inc. (USA); Scott DeFisher, OptiPro Systems (USA); Marcin Bauza, Carl Zeiss Industrial Metrology LLC (USA); Paul Dumas, QED Technologies, Inc. (USA) [8884-30]

10:00 am: **Improved averaging for non-null interferometry**, Jon F. Fleig, Paul E. Murphy, QED Technologies, Inc. (USA) [8884-31]

10:20 am: **Development of a high-speed nanop profiler using normal vector tracing method for high-accuracy mirrors**, Kohei Okuda, Takao Kitayama, Koji Usuki, Takuya Kojima, Kenya Okita, Junichi Uchikoshi, Osaka Univ. (Japan); Yasuo Higashi, High Energy Accelerator Research Organization (Japan); Katsuyoshi Endo, Osaka Univ. (Japan) [8884-32]

Coffee Break Tue 10:40 am to 11:00 am

SESSION 6

Room: Highland A/B Tue 11:00 am to 12:00 pm

Plenary Session I

Session Chair: **Julie L. Bentley**, Univ. of Rochester (USA)



Disruptive innovation: the story of the first digital camera

Steven Sasson, Retired, Eastman Kodak Co. (USA)

The creation of the first digital camera prototype in 1975 at the Eastman Kodak Company will be discussed as well as how the concept was demonstrated within Kodak during the following year. Subsequent technical innovations with megapixel imagers, image compression products in the mid 1980's, and the early commercialization of professional and consumer digital still cameras in the early 1990's will be discussed. The internal Kodak reaction to these developments will be highlighted as well as some of the learned observations about how to deal with disruptive innovation within an established corporate environment will be shared.

Steven Sasson attended Rensselaer Polytechnic Institute (RPI) in Troy N.Y. and in 1973; he graduated with a BS and a Masters degree in electrical engineering. After graduation Steven joined Eastman Kodak Company as an electrical engineer working in an applied research laboratory. He engaged in a number of early digital imaging projects. Among these was the design and construction of the first digital still camera and playback system in 1975. Steven continued to work throughout the 1980s in the emerging field of digital photography receiving over 10 key digital imaging patents. In 1989 he led the development of the first prototype mega pixel electronic digital camera utilizing DCT compression that stored images to flash memory cards. Steven continued his work throughout the 1990's by developing one of the first photographic quality thermal printing systems, derivatives of which are still in use in self-service imaging kiosks around the world today. Before retiring in 2009 Steven was a project manager in the Intellectual Property Transactions group at Kodak.

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

SESSION 7

Room: Highland A/B Tue 1:30 pm to 3:10 pm

Metrology II

Session Chair: **Kate Medicus**, Optimax Systems, Inc. (USA)

1:30 pm: **Ex and in situ metrology based on (Shack) Hartmann technique for sub-nanometric metrology**, Mourad Idir, Brookhaven National Lab. (USA); Guillaume Dovillaire, Imagine Optic SA (France); Pascal Mercère, Synchrotron SOLEIL (France) [8884-93]

1:50 pm: **Fabrication and metrology of high-precision freeform surfaces**, Chris Supranowitz, QED Technologies Inc (USA); Paul Dumas, QED Technologies, Inc. (USA); Tobias Nitzsche, QED Technologies Inc (USA); Jessica D. DeGroot Nelson, Brandon B. Light, Optimax Systems, Inc. (USA); Kate Medicus, Optimax Systems Inc. (USA); Nathan Smith, Optimax Systems, Inc. (USA) [8884-34]

2:10 pm: **A simple procedure to include a free-form measurement capability to standard coordinate measurement machines**, Florian Schneider, Rolf Rascher, Hochschule Deggendorf (Germany); Richard J. Stamp, Gordon Smith, Univ. of the West of England (United Kingdom) [8884-35]

2:30 pm: **3D-form metrology of arbitrary optical surfaces by absorption in fluids**, Juan Carlos Martinez-Anton, Juan Manuel Plaza Ortega, Jose Alonso Fernandez, Univ. Complutense de Madrid (Spain) [8884-36]

2:50 pm: **Worthwhile optical method for free-form mirrors qualification**, Giorgia Sironi, Rodolfo Canestrari, INAF - Osservatorio Astronomico di Brera (Italy); Giorgio Toso, INAF - IASF Milano (Italy); Giovanni Pareschi, INAF - Osservatorio Astronomico di Brera (Italy) [8884-37]

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

SESSION 8

Room: Highland A/B Tue 3:40 pm to 5:40 pm

Optical Materials, Cleaning, and Coating

Session Chair: **Dave Stephenson**, JENOPTIK Optical Systems (USA)

3:40 pm: **Characterization of structural relaxation in As_2Se_3 for analysis of lens shape change in glass press mold cooling and post-process annealing**, Erick Koontz, Peter Wachtel, J. David Musgraves, Kathleen Richardson, Univ. of Central Florida (USA) and Clemson Univ. (USA) [8884-38]

4:00 pm: **Compositional-tailoring of optical properties in IR transparent chalcogenide glasses for precision glass molding**, Benn H. Gleason, Peter Wachtel, J. David Musgraves, Clemson Univ. (USA); Amy Qiao, Norman Anheier, Pacific Northwest National Laboratory (USA); Kathleen Richardson, Clemson Univ. (USA) and CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA) [8884-39]

4:20 pm: **Aqueous cleaning of precision optics parts**, Henry P. Ederle, Borer Chemie AG (Switzerland) [8884-40]

4:40 pm: **SP-100 the fast and reliable machine for coating application in precision optics**, Gianni G. Monaco, Satisloh Italy S.p.A. (Italy); Marc Peter, Satisloh IPhotonics (Italy) and Satisloh Photonics (Switzerland); Arturo Colautti, Satisloh Italy S.r.l. (Italy); Tom Godin, Satisloh North America Inc. (USA); Steffan Gold, Satisloh Wetzlar (Italy); Michael Witzany, Satisloh Italy (Italy) and Satisloh Italy S.r.l. (Italy); Frank Breme, Satisloh AG (Switzerland) [8884-41]

5:00 pm: **Development of a high specification coating**, Peter E. MacKay, Gooch & Housego Plc (United Kingdom); Mike Wilde, Gooch & Housego (UK) Ltd (United Kingdom) [8884-42]

5:20 pm: **Refractive index of thin films realized by Satisloh SP reactive sputtering system**, Gianni G. Monaco, Satisloh Italy S.p.A. (Italy); Arturo Colautti, Cristina Allegro, Satisloh Italy S.r.l. (Italy); Tom Godin, Satisloh North America Inc. (USA); Steffan Gold, Satisloh GmbH (Germany); Michael Witzany, Satisloh Italy S.r.l. (Italy) [8884-43]

15th Photonics Clambake

Co-located event

Tuesday • 5:30 to 7:30 pm • Hyatt Ballroom
 Limited space available and tickets required.
 Ticket price is \$50.

Optifab 2013 Attendees and Exhibitors are welcome to attend.

For ticket availability onsite, stop by Sydor Optics Booth #502 and check with Mike Naselarlis.

Presented by 

Wednesday 16 October

SESSION 9

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

Optical Design

Session Chair: **Theodore Tienvieri**, Corning Tropel Corp. (USA)

8:00 am: **Optical design with orthogonal surface descriptions**, Gregory W. Forbes, QED Technologies, Inc. (USA); Christoph Menke, Carl Zeiss AG (Germany) [8884-44]

8:20 am: **Design of systems involving easily measurable aspheres**, Paul E. Murphy, QED Technologies, Inc. (USA); Dave Stephenson, JENOPTIK Optical Systems, LLC (USA); Andrew E. W. Jones, QED Technologies, Inc. (USA); Gregory W. Forbes, QED Technologies, Inc. (Australia) . . . [8884-45]

8:40 am: **Using Microsoft Excel as a pre-processor for CODE V optimization of air spaces when building camera lenses**, Dave Stephenson, JENOPTIK Optical Systems, LLC (USA) [8884-46]

9:00 am: **Integration of measurement data in the comprehensive modelling approach**, Ingo Sieber, Karlsruhe Institut für Technologie (Germany); Olaf Ruebenach, INGENERIC GmbH (Germany) [8884-47]

9:20 am: **Rapid design of LED optical elements with two free-form surfaces generating uniformly illuminated rectangular area**, Mikhail A. Moiseev, Leonid L. Doskolovich, Sergey V. Kravchenko, Image Processing Systems Institute (Russian Federation) [8884-48]

9:40 am: **Design of freeform optical elements generating a line-shaped directivity diagram**, Leonid L. Doskolovich, Anton Y. Dmitriev, Mikhail A. Moiseev, Image Processing Systems Institute (Russian Federation) [8884-49]

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

SESSION 10

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

Optical Engineering

Session Chair: **Christopher T. Cotton**, ASE Optics (USA)

10:30 am: **Optical characterization of window materials for aerospace applications**, Ken K. Tedjojuwono, Natalie Clark, William M. Humphreys Jr., NASA Langley Research Ctr. (USA) [8884-50]

10:50 am: **Development of a calibration standard for spherical aberration**, David C. Compertore, Philipp V. Ignatovich, Matthew E. Herbrand, Michael A. Marcus, Lumetrics, Inc. (USA) [8884-51]

11:10 am: **Metrology for multilayer Laue lenses**, Nathalie Bouet, Raymond Conley Jr., Juan Zhou, Hanfei Yan, Xiaojing Huang, Yong S. Chu, Brookhaven National Lab. (USA) [8884-52]

11:30 am: **Precision interferometric measurements of refractive index of polymers in air and liquid**, Michael A. Marcus, Kyle Hadcock, Don Gibson, Matthew E Herbrand, Philipp V. Ignatovich, Lumetrics, Inc. (USA) [8884-53]

11:50 am: **Optical test bench for high precision metrology and alignment of zoom sub-assembly components**, Francois Lepretre, Eric Levillain, Thales Angénieux S.A. (France); Benoit F. Wattellier, Pascal Delage, Djamel Brahmi, Antoine Gascon, PHASICS S.A. (France) . [8884-54]



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SESSION 11

Room: Highland A/B Wed 1:10 pm to 2:00 pm

Plenary Session II

Session Chair: **Julie L. Bentley**, Univ. of Rochester (USA)

NASA funding for optical fabrication and testing technology development

H. Philip Stahl, NASA Marshall Space Flight Center (USA)

Technologies to fabricate and test optical components are required for NASA to accomplish its highest priority science missions. For example, the NRC ASTRO2010 Decadal Survey states that an advanced large-aperture UVOIR telescope is required to enable the next generation of compelling astrophysics and exo-planet science; and that present technology is not mature enough to affordably build and launch any potential UVOIR mission concept. The NRC 2012 NASA Space Technology Roadmaps and Priorities report states that the highest priority technology in which NASA should invest to 'Expand our understanding of Earth and the universe' is a new generation of astronomical telescopes. And, each of the Astrophysics division Program Office Annual Technology Reports (PATR), identifies specific technology needs. NASA has a variety of programs to fund enabling technology development: SBIR (Small Business Innovative Research); the ROSES APRA and SAT programs (Research Opportunities in Space and Earth Science; Astrophysics Research and Analysis program; Strategic Astrophysics Technology program); and several Office of the Chief Technologist (OCT) technology development programs.

Dr. H. Philip Stahl is a Senior Optical Physicist at NASA MSFC currently leading an effort to mature technologies for a new large aperture telescope to replace Hubble. Previous assignments include Astrophysics Division Deputy Assistant Director for Technology and Mirror Technology lead for the James Webb Space Telescope (JWST). Dr. Stahl co-authored two NASA technology studies: Office of Chief Technologist Science Instruments, Observatories and Sensor Systems Technology Assessment (2011); and Advance Planning and Integration Office Advanced Telescope and Observatory Capability Roadmap (2005). Dr. Stahl is a leading authority in optical metrology, optical engineering, and phase-measuring interferometry. Many of the world's largest telescopes have been fabricated with the aid of high-speed and infrared phase-measuring interferometers developed by him, including the Keck, VLT and Gemini telescopes. At Raytheon Danbury he was lead optical engineer for the 4 meter LAMP mirror and the Spitzer secondary mirror. Dr. Stahl is a member of OSA and SPIE (Fellow) and 2013 SPIE President-Elect. He is a past ICO Vice President. He earned his PhD in Optical Science at the University of Arizona Optical Sciences Center in 1985.



INDUSTRY PANEL DISCUSSIONS

Room: Highland A/B Wed 2:00 pm to 3:00 pm

Future of Metrology

Short presentations will be followed by a moderated discussion.

WORKSHOP CHAIR AND MODERATOR:

Thomas Battley, New York Photonics Industry Association (USA)

SPEAKERS AND PANELISTS:

Scott DeFisher, OptiPro Systems (USA)

Measurement and tolerances on freeform optics

Freeform optics are now appearing in optical systems. Measurement of these surfaces to rough and optical tolerances is critical to the manufacturing process. Surface fitting, error calculation, and error mapping for corrective grinding and polishing will be discussed.

Andrew Kulawiec, QED Technologies, Inc. (USA)

Extending interferometry for even tighter tolerances and more complex shapes

Phase-shifting interferometry has been the optical fabricator's metrology tool of choice for several decades now. As the size and surface accuracy requirements of precision optical components have continued to increase, interferometry has kept up the pace. This trend will continue with the increasing use of on-axis aspheres and the recognition of the importance of mid-spatial frequencies. Further advancements in interferometry will come as the industry continues to move to more complex shapes such as off-axis aspheres and freeform surfaces.

Continued on next page ➔

INDUSTRY PANEL DISCUSSIONS continued

Erik Stover, AMETEK Precitech, Inc. (USA)
Latest developments in contact and non-contact profilometry for Aspheric optics

The growing demand of optical components being integrated into a wide-spread of new markets and technologies has driven the need to manufacture and measure a much wider range of shapes, sizes, frequencies and tolerance than seen before. The commercialization of these optical technologies has driven the need for lower cost manufacturing methods but with increased yields and tighter tolerance. The importance of metrology feedback to the manufacturing process is now critical to to achieve these goals. New profilometry capabilities and corrective feedback will be discussed.

Marc Tricard, Zygo Corp. (USA)
Metrology at the fringe

A brief and entertaining "teaser" of selected Zygo metrology developments will be presented to highlight "Better, Faster and Cheaper" approaches.

Steven VanKerkhove, Corning Inc. (USA)
Developing Metrology Solutions to Support Aspheric Fabrication

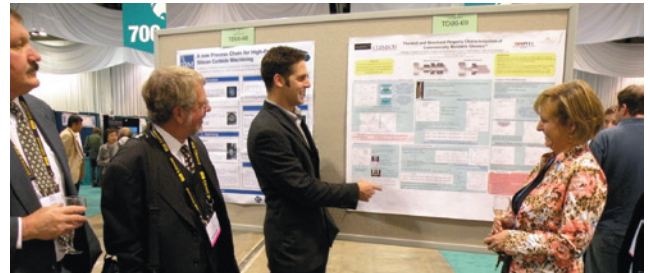
Aspheric fabrication processes are continuing to take hold throughout the optics industry as applications continue to emerge that are embracing aspheric solutions. Metrology processes must continue to follow this trend with cost effective solutions. A variety of nanometer level optical measurement probes are emerging and these devices, in conjunction with traditional null interferometry techniques, may evolve to meet the growing need to accurately measure aspheric form as well as mid frequency figure errors.

Panel Discussion

Getting Hired in 2013 and Beyond

Wednesday • 3:30 to 4:30 pm • Empire Hall Demo Area

Join us for a panel discussion on careers in optics and photonics outside the academic world. Learn about getting hired at tech-based companies and non-academic jobs directly from human resource professionals in the optics and photonics sector.



Posters - Wednesday

Room: Empire Hall Wed 4:30 pm 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 SPIE Registration prior to displaying their posters.

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

Position determination of disturbance along a modified Sagnac interferometer, Pang Bian, Yuan Wu, Bo Jia, Qian Xiao, Fudan Univ. (China) [8884-67]

Properties of Kummer beams in the structure of metamaterials, Marco Marin, Univ. EAFIT (Colombia) [8884-69]

Dewar-cooler-integrated high sensitivity MWIR wave front sensor, Sabrina Velghe, William Boucher, PHASICS S.A. (France); Serge Magli, SOFRADIR (France); Gilles Aubry, HGH Systèmes Infrarouges (France); Nicolas Guérineau, Sylvain Rommeluère, Julien Jaeck, ONERA (France); Benoit F. Wattellier, PHASICS S.A. (France) [8884-70]

Simulations and first manufacturing steps of a fully integrated WDM-element in the visible spectrum, Sebastian Höll, Matthias Haupt, Ulrich H. P. Fischer, Hochschule Harz (Germany) [8884-71]

Off-axis mirror fabrication from spherical surfaces under mechanical stress, Rafael Izazaga-Pérez, Instituto Nacional de Astrofísica, Óptica y Electrónica (Mexico); Daniel Aguirre-Aguirre, INAOE (Mexico); María-Elizabeth Percino-Zacarias, Fermin-Salomon Granados-Agustín, Instituto Nacional de Astrofísica, Óptica y Electrónica (Mexico) . . . [8884-72]

Current status of the prototype development of the fast steering mirror for Giant Magellan Telescope, Young-Soo Kim, Ju Heon Koh, Hwa Kyoung Jung, Ho June Jung, Korea Astronomy and Space Science Institute (Korea, Republic of); Myung K. Cho, National Optical Astronomy Observatory (USA); Ho-Soon Yang, Korea Research Institute of Standards and Science (Korea, Republic of); Ho-Sang Kim, Kyoung-Don Lee, Institute for Advanced Engineering (Korea, Republic of); Hyo-Sung Ahn, Gwangju Institute of Science and Technology (Korea, Republic of); Won Hyun Park, College of Optical Sciences, The Univ. of Arizona (USA); Sug-Whan Kim, Yonsei Univ. (Korea, Republic of); Yoon-Kyung Seo, In-Soo Yuk, Byeong-Gon Park, Korea Astronomy and Space Science Institute (Korea, Republic of) [8884-73]

Actuators delay analysis of active lap manufacturing, Hongshen Zhao, Bin Fan, Xiaojin Li, Zhige Zeng, Institute of Optics and Electronics (China) [8884-74]

Metrology of arbitrary optical surfaces by TOPAF, Juan Carlos Martínez-Anton, Juan Manuel Plaza Ortega, Jose Alonso Fernandez, Univ. Complutense de Madrid (Spain) [8884-75]

4D phase profile measurements using a single-shot phase shifting technique, Noel Ivan Toto-Arellano Sr., Univ. Tecnológica de Tulancingo (Mexico); Areli Montes Pérez, Amalia Martínez-García, David Ignacio Serrano-García, Ctr. de Investigaciones en Óptica, A.C. (Mexico); Luis Castelan-Olvera, Jonathan Martínez-Lozano, Univ. Tecnológica de Tulancingo (Mexico); Anuar Jorge-Muñoz, Emerald Knights Student Chapter of Universidad Tecnológica de Tulancingo (Mexico) [8884-77]

Wavefront measurements through optical diffraction interpretation, Stéphane Bouillet, Sandrine Chico, Laure Eupherte, Claude Rouyer, Jérôme Daurios, Commissariat à l'Énergie Atomique (France) [8884-80]

Absolute testing of freeform lens, Xin Jia, Tingwen Xing, Institute of Optics and Electronics (China) [8884-81]

The influence of calculating compensation force based on different response functions, Hongqiao Wang, Bin Fan, Yongqian Wu, Institute of Optics and Electronics (China) [8884-83]

Fabrication of solid immersion lens applied to infrared microscopy to improve the spatial resolution over its diffraction limit, Hyeong Sung, Myung Sang Huh, Gil Jae Lee, Kyesung Lee, Korea Basic Science Institute (Korea, Republic of); Youngsik Kim, College of Optical Sciences, The Univ. of Arizona (USA); Geunman Ryu III, Korea Basic Science Institute (Korea, Republic of); Sun Choeul Yang, Osong Medical Innovation Foundation (Korea, Republic of); Ky Joo Lee, Chan pil Park, Chungnam National Univ. (Korea, Republic of); Geonhee Kim II, Korea Basic Science Institute (Korea, Republic of) . . . [8884-84]

Slope-sensitive optical probe for freeform optics metrology, Michael A Echter, Andrew D. Keene, Univ. of Rochester (USA); Christopher D Roll, MIT Lincoln Lab. (USA); Jonathan D. Ellis, Univ. of Rochester (USA) . . [8884-85]

Crosstalk-immune fiber optic sensor based on wavelength-division-multiple for disturbance detection and location, Yuan Wu, Pang Bian, Bo Jia, Qian Xiao, Fudan Univ. (China) [8884-87]

Smart and precise alignment of optical systems, Patrik Langehanenberg, Josef Heinisch, Daniel Stickler, TRIOPTICS GmbH (Germany) . . . [8884-88]

OptiCentric lathe centering machine, Christian Buss, Josef Heinisch, TRIOPTICS GmbH (Germany) [8884-89]

Experimental study on SPDT machining of gallium phosphide, Jan Václavík, Roman Dolecek, Vit Ledl, Pavel Psota, Institute of Plasma Physics of the ASCR, v.v.i. (Czech Republic) [8884-92]

Improved MRF spot characterization with QIS metrology, Sandi Westover, Christopher A. Hall, Michael A. DeMarco, QED Technologies, Inc. (USA) [8884-94]

Hexapods with fieldbus interfaces for automated manufacturing of opto-mechanical components, Stephan Schreiber, Christian Muellerleile, Markus Frietsch, Rainer Gloess, Physik Instrumente (PI) GmbH & Co. KG (Germany) [8884-95]

Networking Reception and Poster Viewing

Wednesday • 4:30 to 6:00 pm • Empire Hall

All attendees are invited to relax, socialize, and enjoy refreshments. Conference posters will be on display. Poster authors will be present for discussion from 4:30 to 6:00 pm. Poster authors may set up their posters on Wednesday from 10:00 am to 4:00 pm. Poster authors should check in at SPIE Registration before displaying their posters.

ROSA Optics Talk

CO-LOCATED MEETING

Wednesday • 7:00 to 8:30 pm • Highland A/B

Open to all attendees and visitors

Hosted by: **ROSA, Rochester Optics Society**

SPEAKERS:

Jim Burge, The Univ. of Arizona
The Evolution of Optical Manufacturing Technologies

Ira Tiffen, Schneider Optics
How light can be manipulated to create mood, impart impact to the stories we tell. And to extend the careers of our best actors...

For more information visit the ROSA website at <http://www.osarochester.org> or contact program@osarochester.org

Thursday 17 October

SESSION 12

Room: Highland A/B Thu 8:00 am to 10:00 am

Meter Class Optics

Session Chair: **Ted Mooney**, ITT Exelis (USA)

8:00 am: **Low weight mirror substrates**, Peter E. MacKay, Gooch & Housego Plc (United Kingdom); Nicola L. Beveridge, Univ. of Glasgow (United Kingdom); Trevor Wood, Surrey Satellite Technology Ltd. (United Kingdom) [8884-55]

8:20 am: **New processing equipment for ASTRO optics**, Roland Mandler, Jochen Franz, Matthias Pfaff, OptoTech Optikmaschinen GmbH (Germany) [8884-56]

8:40 am: **Model-based polishing of meter size optics**, Jan-Claas Tiedemann, Marcel Achtsnick, Elisabeth Becker, Berliner Glas KGaA Herbert Kubatz GmbH & Co. (Germany) [8884-57]

9:00 am: **Slumping technique for the manufacturing of a representative x-ray grazing incidence mirror module for future space missions**, Mauro Ghigo, Laura Proserpio, Stefano Basso, Oberto Citterio, Marta M. Civitani, Giovanni Pareschi, Bianca Salmaso, Giorgia Sironi, Daniele Spiga, Giampiero Tagliaferri, Gabriele Vecchi, Alberto Zambra, INAF - Osservatorio Astronomico di Brera (Italy); Giancarlo Parodi, Francesco Martelli, BCV Progetti S.r.l. (Italy); Daniele Gallieni, Matteo Tintori, A.D.S. International S.r.l. (Italy); Marcos Bavdaz, Eric Wille, European Space Research and Technology Ctr. (Netherlands); Ivan Ferrario, INAF - Osservatorio Astronomico di Brera (Italy); Vadim Burwitz, MPE-Max-Planck-Institut für Extraterrestrische Physik (Germany) [8884-58]

9:20 am: **Thin monolithic glass shells for future high angular resolution and large collecting area x-ray telescope**, Marta M. Civitani, Oberto Citterio, Mauro Ghigo, INAF - Osservatorio Astronomico di Brera (Italy); Enrico Giovanni Mattaini, INAF/IASF (Italy); Giovanni Pareschi, INAF - Osservatorio Astronomico di Brera (Italy); Giancarlo Parodi, BCV Progetti (Italy) [8884-59]

9:40 am: **Effect of polishing plane vibration on large-size optical workpieces in continuous polishing**, Haiyang Shan, Chaoyang Wei, Xueke Xu, Hongbo He, Shijie Liu, Yingfeng Li, Kui Yi, Jianda Shao, Shanghai Institute of Optics and Fine Mechanics (China) [8884-60]

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

SESSION 13

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

Molded Optics

Session Chair: **Michael A. Marcus**, Lumetrics, Inc. (USA)

10:30 am: **Nanoscale optical features via hot-stamping of As₂Se₃ glass**, Sylvain Danto, Erick Koontz, Univ. of Central Florida (USA) and Clemson Univ. (USA); Yi Zou, Okechukwu Ogbuu, Univ. of Delaware (USA); Benn H. Gleason, Peter Wachtel, J. David Musgraves, Univ. of Central Florida (USA) and Clemson Univ. (USA); Hu Juejun, Univ. of Delaware (USA); Kathleen Richardson, Univ. of Central Florida (USA) and Clemson Univ. (USA) [8884-61]

10:50 am: **Chalcogenide-mold interactions during precision glass molding (PGM) of GeAsSe glasses**, Benn H. Gleason, Clemson Univ. (USA); Peter Wachtel, Clemson University (USA) and CREOL, University of Central Florida (USA); J. David Musgraves, IRradiance Glass (USA) and CREOL, University of Central Florida (USA) and Clemson University (USA); Ralf Steinkopf, Ramona Eberhardt, Fraunhofer-Institut für Angewandte Optik und Feinmechanik (Germany); Kathleen Richardson, Clemson Univ. (USA) [8884-62]

11:10 am: **Interaction of N-FK5 and L-BAL35 optical glass with various carbide and other precision glass mold tooling**, Erick Koontz, Peter Wachtel, Clemson Univ. (USA) and CREOL, University of Central Florida (USA); J. David Musgraves, Clemson Univ. (USA) and CREOL, University of Central Florida (USA) and IRradiance Glass (USA); Kathleen Richardson, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA) and Clemson University (USA); Safer Mourad, Michael Huber, Andreas F. Kunz, Martin Forrer, FISBA OPTIK AG (Switzerland) [8884-90]

11:30 am: **Novel testing facility for investigating wear on PGM sample tools**, Frank Bernhardt, Fraunhofer-Institut für Produktionstechnologie (Germany); Kyriakos Georgiadis, Olaf Dambon, Fritz Klocke, Fraunhofer Institute for Production Technology IPT, Aachen (Germany) [8884-64]

11:50 am: **Melt spun aluminum alloys for moulding optics**, Guido Gubbels, RSP Technology (Netherlands); Louis Tegelaers, Oerlikon Balzers Coating Benelux N.V. (Belgium); Roger Senden, RSP Technology (Netherlands) [8884-65]

12:10 pm: **Shaping of thin glass foils for the fabrication of mirrors with pronounced asphericity**, Rodolfo Canestrari, Giovanni Pareschi, Giorgia Sironi, INAF - Osservatorio Astronomico di Brera (Italy); Giorgio Toso, INAF - IASF Milano (Italy) [8884-66]

Export Control: Reform Update and Tips for Compliance – An Open Forum

Thursday • 10:30 to 11:30 am • Exhibition Hall

Join us for a fast-paced discussion of critical export control issues confronting the optics and photonics industry, including the status of export control reform efforts, and learn key techniques for growing your business while remaining compliant. If you design, develop, manufacture and/or sell any system or any component of a system utilized in an advanced application, you must take certain steps to ensure compliance with a wide range of U.S. export control laws and regulations, even if you don't think you are exporting. We will address best practices and reveal traps for the unwary. This will be an open forum, with the opportunity for audience input and questions.

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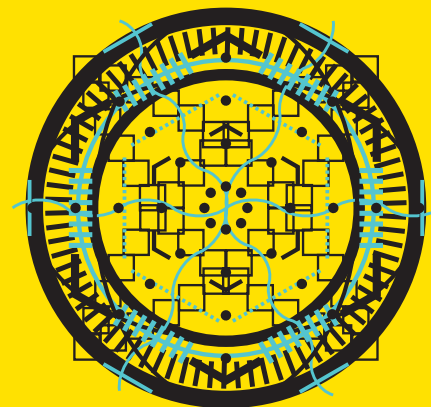


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Energy



Lasers



Nano/Micro Technologies



Sensors

Index of Authors, Chairs, and Committee Members

A

Achtsnick, Marcel [8884-57] S12
Aguirre-Aguirre, Daniel [8884-72] SPSWed
Ahn, Hyo-Sung [8884-73] SPSWed
Aikens, David M. SC1011, SC863
Allegro, Cristina [8884-43] S8
Alonso Fernandez, José [8884-36] S7, [8884-75] SPSWed
Anheier, Norman C. [8884-39] S8
Aubry, Gilles [8884-70] SPSWed

B

Baer, Goran B. [8884-25] S5
Bartlett, Kevin [8884-1] S1
Basso, Stefano [8884-58] S12
Battley, Thomas 8884 Program Committee
Bauza, Marcin [8884-30] S5
Bavdaz, Marcos [8884-58] S12
Bechtold, Michael J. 8884 Program Committee, 8884 S3 Session Chair, [8884-18] S4
Bechtold, Rob [8884-18] S4
Becker, Elisabeth [8884-57] S12
Beier, Matthias [8884-91] S4
Bentley, Julie L. Symposium Chair, 8884 Conference Chair, 8884 S11 Session Chair, 8884 S6 Session Chair, SC1061
Berger, Gernot [8884-27] S5
Bernhardt, Frank [8884-64] S13

Beveridge, Nicola L. [8884-55] S12
Bian, Pang [8884-67] SPSWed, [8884-87] SPSWed
Biskup, Heiko [8884-3] S1
Blaineau, Pierre [8884-9] S2
Blake, Peter N. [8884-6] S2
Bletek, Thomas [8884-5] S1
Boucher, William [8884-70] SPSWed
Bouet, Nathalie [8884-52] S10
Bouillet, Stéphane [8884-80] SPSWed
Brahmi, Djamel [8884-54] S10
Breme, Frank [8884-41] S8

Briggs, Dennis E. [8884-2] S1
Brophy, Matthew R. [8884-1] S1, [8884-21] S4, [8884-24] S4
Budinoff, Jason G. [8884-6] S2
Bulla, Benjamin [8884-22] S4
Burge, James H. [8884-8] S2
Burwitz, Vadim [8884-58] S12
Buß, Christian [8884-89] SPSWed

C

Cahuc, Olivier [8884-9] S2
Canestrari, Rodolfo [8884-37] S7, [8884-66] S13
Castelán-Olvera, Luis R. [8884-77] SPSWed
Catrin, Rodolphe [8884-7] S2
Chico, Sandrine [8884-80] SPSWed
Cho, Myung K. [8884-73] SPSWed
Chu, Yong S. [8884-52] S10

Citterio, Oberto [8884-58] S12, [8884-59] S12
Civitani, Marta M. [8884-58] S12, [8884-59] S12
Clara, Yoem I. [8884-4] S1
Clark, Natalie [8884-50] S10
Colautti, Arturo [8884-41] S8, [8884-43] S8
Compertore, David C [8884-51] S10
Conley, Raymond [8884-52] S10
Corbineau, Thomas [8884-7] S2
Cormont, Philippe [8884-7] S2
Cotton, Christopher T. 8884 Program Committee, 8884 S10 Session Chair
Czajkowski, Walter C. 8884 Program Committee

D

Daly, John G. SC015
Dambon, Olaf [8884-22] S4, [8884-5] S1, [8884-64] S13
Danger, Thomas 8884 Program Committee
Danto, Sylvain [8884-61] S13
Darbois, Nathalie [8884-9] S2
Darnis, Philippe [8884-9] S2
Daurios, Jérôme [8884-80] SPSWed
de Groot, Jean-Jacques G. S. 8884 S2 Session Chair
DeFisher, Scott [8884-14] S3, [8884-20] S4, [8884-26] S5, [8884-30] S5
DeGroot Nelson, Jessica E. [8884-1] S1, [8884-21] S4, [8884-24] S4, [8884-34] S7, SC1086
Delage, Pascal [8884-54] S10

Index of Authors, Chairs, and Committee Members

H

DeMarco, Michael A. 8884 Program Committee, [8884-94] SPSWed
Deslis, Apostolos 8884 Program Committee
Dmitriev, Anton Yu [8884-49] S9
Dohi, Toshihide 8884 Program Committee
Dolecek, Roman [8884-11] S2, [8884-92] SPSWed
Doskolovich, Leonid L. [8884-48] S9, [8884-49] S9
Dovillaire, Guillaume [8884-93] S7
Dumas, Paul 8884 S5 Session Chair, [8884-30] S5, [8884-34] S7, SC1039

E

Eberhardt, Ramona [8884-62] S13, [8884-91] S4
Echaves, Samantha [8884-2] S1
Echter, Michael A [8884-85] SPSWed
Ederle, Henry P. [8884-40] S8
Ellis, Jonathan D. 8884 S4 Session Chair, [8884-2] S1, [8884-85] SPSWed
Endo, Katsuyoshi [8884-32] S5
Eupherte, Laure [8884-80] SPSWed

F

Fan, Bin [8884-74] SPSWed, [8884-83] SPSWed
Ferrario, Ivan [8884-58] S12
Fess, Edward M. [8884-14] S3, [8884-18] S4, [8884-20] S4, [8884-26] S5

Fischer, Ulrich H. P. [8884-71] SPSWed
Fleig, Jon F. [8884-31] S5
Forbes, Gregory W. [8884-44] S9, [8884-45] S9, SC1039
Forrer, Martin [8884-90] S13
Franz, Jochen [8884-56] S12
Frietsch, Markus [8884-95] SPSWed

G

Gallieni, Daniele [8884-58] S12
Gascon, Antoine [8884-54] S10
Gebhardt, Andreas [8884-91] S4
Georgiadis, Kyriakos [8884-64] S13
Ghigo, Mauro [8884-58] S12, [8884-59] S12
Giannchini, Lucas J. [8884-4] S1
Gibson, Donald S. [8884-53] S10
Gleason, Benn H. [8884-39] S8, [8884-61] S13, [8884-62] S13
Gloess, Rainer [8884-95] SPSWed
Godin, Tom 8884 Program Committee, [8884-13] S3, [8884-41] S8, [8884-43] S8
Gold, Steffan [8884-41] S8, [8884-43] S8
Gould, Alan R. [8884-1] S1, [8884-21] S4, [8884-24] S4
Granados-Agustín, Fermín-Salomón [8884-72] SPSWed
Greivenkamp, John E. SC690
Gubbels, Guido [8884-65] S13
Guérineau, Nicolas [8884-70] SPSWed

Hadcock, Kyle J. [8884-53] S10
Hall, Christopher A. [8884-94] SPSWed
Haupt, Matthias [8884-71] SPSWed
He, Hongbo [8884-60] S12
Heinisch, Josef [8884-88] SPSWed, [8884-89] SPSWed
Herbrand, Matthew E. [8884-51] S10, [8884-53] S10
Higashi, Yasuo [8884-32] S5
Hill, Peter C. [8884-6] S2
Hinn, Markus [8884-15] S3
Hofke, Heidi 8884 Program Committee
Höll, Sebastian [8884-71] SPSWed
Hooper, Abigail [8884-16] S3
Hordin, Thomas J. [8884-21] S4, [8884-24] S4
Hu, Juejun [8884-61] S13
Huang, Xiaojing [8884-52] S10
Huber, Michael [8884-90] S13
Huh, Myung Sang [8884-84] SPSWed
Humphreys, William M. [8884-50] S10
Hüntten, Martin [8884-5] S1
Huttenhuis, Stephan [8884-23] S4

I

Ildir, Mourad [8884-93] S7
Ignatovich, Filip V. [8884-51] S10, [8884-53] S10
Izazaga-Pérez, Rafael [8884-72] SPSWed

Index of Authors, Chairs, and Committee Members

J

Jacobs, Stephen D. [8884-4] S1
Jaeck, Julien [8884-70] SPSWed
Jia, Bo [8884-67] SPSWed, [8884-87] SPSWed
Jia, Xin [8884-81] SPSWed
Jones, Andrew E. W. [8884-45] S9
Jorge-Muñoz, Anuar [8884-77] SPSWed
Jung, Ho June [8884-73] SPSWed
Jung, Hwa Kyoung [8884-73] SPSWed

K

Kaiser, Jordan [8884-16] S3
Kasunic, Keith J. SC1019
Keene, Andrew D. [8884-85] SPSWed
Keleher, Jason [8884-16] S3
Kim, Dae Wook [8884-8] S2
Kim, Geon-Hee [8884-84] SPSWed
Kim, Ho-Sang [8884-73] SPSWed
Kim, Sug-Whan [8884-73] SPSWed
Kim, Youngsik [8884-84] SPSWed
Kim, Young-Soo [8884-73] SPSWed
Kitayama, Takao [8884-32] S5
Klocke, Fritz [8884-22] S4, [8884-5] S1, [8884-64] S13
Koh, Ju Heon [8884-73] SPSWed
Kojima, Takuya [8884-32] S5
Koontz, Erick D [8884-38] S8, [8884-61] S13, [8884-90] S13

Kravchenko, Sergey V. [8884-48] S9
Kreischer, Cody B. [8884-29] S5
Kumler, James 8884 Program Committee
Kunz, Andreas F. [8884-90] S13
Kupfer, Jan-Claas [8884-57] S12

L

Laheurte, Raynald [8884-9] S2
Lambropoulos, John C. [8884-4] S1
Lambropoulos, Teddy J. [8884-14] S3
Langehanenberg, Patrik [8884-88] SPSWed
Lédal, Vít [8884-11] S2, [8884-92] SPSWed
Lee, Gil Jae [8884-84] SPSWed
Lee, Kye-Sung [8884-84] SPSWed
Lee, Kyoung-Don [8884-73] SPSWed
Leprêtre, Francois [8884-54] S10
Levillain, Eric [8884-54] S10
Li, Xiaojin [8884-74] SPSWed
Li, Yingfeng [8884-60] S12
Light, Brandon B. [8884-34] S7
Liu, Shijie [8884-60] S12
Loose, Roman [8884-91] S4

M

MacKay, Peter E. [8884-42] S8, [8884-55] S12
Macleod, H. Angus SC321
Magli, Serge [8884-70] SPSWed
Mahanna, Justin J. 8884 Program Committee
Mandler, Roland [8884-12] S3, [8884-56] S12

Marcus, Michael A. 8884 Program Committee, 8884 S13 Session Chair, [8884-51] S10, [8884-53] S10
Marín-Suárez, Marco [8884-69] SPSWed
Martelli, Francesco [8884-58] S12
Martin, Hubert M. [8884-8] S2
Martínez-Antón, Juan Carlos [8884-36] S7, [8884-75] SPSWed
Martínez-García, Amalia [8884-77] SPSWed
Martínez-Lozano, Jonathan [8884-77] SPSWed
Mattaini, Enrico Giovanni [8884-59] S12
Maunier, Cédric [8884-7] S2
Maurer, Roland [8884-3] S1
Medicus, Kate 8884 S7 Session Chair, [8884-21] S4, [8884-24] S4, [8884-30] S5, [8884-34] S7
Meier-Wang, Paul 8884 Program Committee
Menke, Christoph [8884-44] S9
Mercère, Pascal [8884-93] S7
Michels, Gregory J. [8884-6] S2
Moiseev, Mikhail A. [8884-48] S9, [8884-49] S9
Monaco, Gianni G. [8884-41] S8, [8884-43] S8
Montes Pérez, Areli [8884-77] SPSWed
Mooney, Ted 8884 Program Committee, 8884 S12 Session Chair
Mourad, Safer [8884-90] S13
Muellerleile, Christian [8884-95] SPSWed

Index of Authors, Chairs, and Committee Members

Murphy, Paul E. [8884-31] S5, [8884-45] S9, SC1039
Murray, Patrick G. [8884-16] S3
Musgraves, Jonathan David [8884-38] S8, [8884-39] S8, [8884-61] S13, [8884-62] S13, [8884-90] S13

N

Nasca, Richard A. 8884 Program Committee
Naselaris, Michael N. 8884 Program Committee
Néaupaort, Jérôme [8884-7] S2, [8884-9] S2
Nemeček, John J. 8884 Program Committee
Nesti, Buzz 8884 Program Committee
Nichol, Meghan [8884-16] S3
Niehaus, Frank [8884-23] S4
Nitzsche, Tobias [8884-34] S7
Novak, Robert F. 8884 Program Committee, SC350

O

Ogbuu, Okechukwu [8884-61] S13
Okita, Kenya [8884-32] S5
Okuda, Kohei [8884-32] S5
Orr, Michael SC1119
Osten, Wolfgang [8884-25] S5

P

Pareschi, Giovanni [8884-37] S7, [8884-58] S12, [8884-59] S12, [8884-66] S13
Park, Byeong-Gon [8884-73] SPSWed
Park, Chan pil [8884-84] SPSWed

Park, Won Hyun [8884-73] SPSWed
Parodi, Giancarlo [8884-58] S12, [8884-59] S12
Patraschkov, Marcel [8884-17] S3
Percino-Zacarias, Maria-Elizabeth [8884-72] SPSWed
Peter, Marc A. [8884-41] S8

Petter, Jürgen [8884-27] S5
Pfaff, Matthias Symposium Chair, 8884 Conference Chair, 8884 S1 Session Chair, [8884-12] S3, [8884-56] S12
Pidgeon, Brendan [8884-2] S1
Pisarski, Alex [8884-15] S3, [8884-23] S4
Plaza Ortega, Juan Manuel [8884-36] S7, [8884-75] SPSWed
Proserpio, Laura [8884-58] S12
Pruss, Christof [8884-25] S5
Psota, Pavel [8884-11] S2, [8884-92] SPSWed

Q

Qiao, Hong A. [8884-39] S8
R
Rascher, Rolf [8884-3] S1, [8884-35] S7
Raze, Gérard [8884-7] S2
Richardson, Kathleen A. [8884-38] S8, [8884-39] S8, [8884-61] S13, [8884-62] S13, [8884-90] S13
Risse, Stefan [8884-91] S4
Robertson, David J. [8884-22] S4
Roll, Christopher D. [8884-85] SPSWed

Romanofsky, Henry J. [8884-4] S1
Rommelure, Sylvain [8884-70] SPSWed
Rouyer, Claude [8884-80] SPSWed
Ruebenach, Olaf [8884-47] S9
Ryu, Geunman [8884-84] SPSWed

S

Salmaso, Bianca [8884-58] S12
Salzman, Sivan [8884-4] S1
Sasson, Steven [8884-500] S6
Schaefer, John P. SC848
Scheiding, Sebastian [8884-91] S4
Schindler, Johannes [8884-25] S5
Schneider, Florian [8884-35] S7
Schreiber, Steffen [8884-95] SPSWed
Schwalb, Fabian [8884-13] S3
Senden, Roger [8884-65] S13
Seo, Yoon-Kyung [8884-73] SPSWed
Serrano-García, David Ignacio [8884-77] SPSWed
Shan, Haiyang [8884-60] S12
Shao, Jianda [8884-60] S12
Shiri, Shahram [8884-6] S2
Sieber, Ingo [8884-47] S9
Sironi, Giorgia [8884-37] S7, [8884-58] S12, [8884-66] S13
Smith, Gordon [8884-35] S7
Smith, Nathan E. [8884-21] S4, [8884-24] S4, [8884-34] S7

Index of Authors, Chairs, and Committee Members

Spiga, Daniele [8884-58] S12
Stach, Gerd [8884-13] S3
Stahl, H. Philip [8884-50] S11

Stahringer, Sebastian [8884-12] S3
Stamp, Richard J. [8884-35] S7
Steinkopf, Ralf [8884-62] S13

Stephenson, Dave 8884 S8 Session Chair, [8884-45] S9, [8884-46] S9
Stickler, Daniel [8884-88] SPSWed

Stoebenau, Sebastian [8884-12] S3, [8884-56] S12

Strojny, Carl R. [8884-6] S2

Sung, Hayeong [8884-84] SPSWed

Supranowitz, Christopher M. [8884-34] S7

T

Tagliaferri, Gianpiero [8884-58] S12

Taroux, Daniel [8884-7] S2
Tedjouwono, Ken K. [8884-50] S10

Tegelaers, Louis [8884-65] S13

Tienvieri, Theodore 8884 S9 Session Chair

Tintori, Matteo [8884-58] S12

Tolley, Paul R. 8884 Program Committee

Toso, Giorgio [8884-37] S7, [8884-66] S13

Toto-Arellano, Noel-Ivan [8884-77] SPSWed

Townell, Robin B. [8884-31] S5, [8884-34] S7

Travis, Nathan [8884-2] S1

Truax, Bruce E. [8884-28] S5

Trum, Christian [8884-3] S1

Tünnermann, Andreas [8884-91] S4

U

Uchikoshi, Junichi [8884-32] S5

Usuki, Koji [8884-32] S5

V

Václavík, Jan [8884-11] S2, [8884-92] SPSWed

Valente, Martin J. 8884 Program Committee

Vecchi, Gabriele [8884-58] S12

Veighe, Sabrina [8884-70] SPSWed

Vojtisek, Petr [8884-11] S2

W

Wachtel, Peter [8884-38] S8, [8884-39] S8, [8884-61] S13, [8884-62] S13, [8884-90] S13

Walters, Mark [8884-1] S1, [8884-21] S4, [8884-24] S4

Wang, Hongqiao [8884-83] SPSWed

Wang, Junlin [8884-10] S2
Warden, Kirk J. 8884 Program Committee

Wattellier, Benoit F. [8884-54] S10, [8884-70] SPSWed

Wei, Chaoyang [8884-60] S12

West, Garrett J. [8884-4] S1

Westover, Sandi [8884-94] SPSWed

Wiederhold, Robert 8884 Program Committee

Wilde, Mike [8884-42] S8

Wille, Eric [8884-58] S12

Williams, Wesley B. [8884-19] S4

Witzany, Michael [8884-41] S8, [8884-43] S8

Wolfs, Franciscus [8884-18] S4, [8884-20] S4

Wood, Trevor [8884-55] S12

Wu, Yongqian [8884-83] SPSWed

Wu, Yuan [8884-67] SPSWed, [8884-87] SPSWed

Wünsche, Christine [8884-3] S1

X

Xiao, Qian [8884-67] SPSWed, [8884-87] SPSWed

Xing, Tingwen [8884-81] SPSWed

Xu, Xueke [8884-60] S12

Y

Yan, Hanfei [8884-52] S10
Yang, Ho-Soon [8884-73] SPSWed

Yang, Sun Choel [8884-84] SPSWed

Yee, Ki-Ju [8884-84] SPSWed

Yi, Kui [8884-60] S12

Yuk, In-Soo [8884-73] SPSWed

Z

Zambra, Alberto [8884-58] S12

Zeng, Zhige [8884-74] SPSWed

Zhao, Hongshen [8884-74] SPSWed

Zhou, Juan [8884-52] S10

Zou, Yi [8884-61] S13



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