2013 MOEMS-MEMS
SPIE Photonics West
Call for Papers

Location
The Moscone Center
San Francisco, California, USA

Conferences and Courses
2–7 February 2013

Exhibition
BiOS Expo: 2–3 February
Photonics West: 5–7 February

Call for Papers
Submit your abstract by 23 July 2012

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2013 MOEMS-MEMS
SPIE Photonics West

Advance your research by showcasing your results at MOEMS-MEMS

Technologies
- Micro/Nanofabrication
- Devices/Applications/Reliability
- Green Photonics

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The Moscone Center
San Francisco, California, USA
Plan to Participate

Share your research and development activities with colleagues, sponsors, customers, technologists, engineers, scientists, and clients in the growing industry of micro- and nanofabrication of MOEMS and MEMS. Micro- and nanofabricated electromechanical and optical components, created by batch processing, provide the missing links to the mass-produced miniaturized products and systems of the future, superior in cost, performance, and reliability. Now more than ever, these technologies help provide an engine for future economic growth. Be a part of this evolution by presenting at this international premier symposium event.

Moving toward our 18th annual symposium on MOEMS-MEMS, we have recognized exceptional growth in the fields of micro- and nano-optics, especially through their merger with MEMS/BioMEMS and Microfluidics. We also enter our eleventh year as a part of SPIE Photonics West; collocation with other Photonics West symposia on biomedical optics, laser applications, and integrated optoelectronics devices adds tremendous value to our symposium: it is an ideal forum for discussing emerging applications of micro- and nanotechnologies in these hot areas.

It is our goal to provide papers in new developments of MOEMS and MEMS technologies at both basic research and commercialization stages. One of the unique features of this symposium is the strong presence of industrial and international participants. Our symposium brings multiple exciting conferences to the forefront, covering a wide variety of topics related to microfabrication processes; device and system reliability; and packaging, testing, and characterization of MEMS and MOEMS. Other topics include adaptive optics, microfluidics, BioMEMS and medical microsystems, advanced micro- and nano-fabrication technologies for optics and photonics, MOEMS displays and imaging, and miniaturized microsystems and their applications. Awards for Best Papers will be presented within many of the conferences.

Our 2013 symposium will feature exciting joint sessions among our conferences and other SPIE Photonics West symposia, facilitating interaction of a larger and diversified group of attendees and participants. Our symposium will kick off, as always, with outstanding plenary speakers covering cross-cutting and synergistic topics, while our individual technical conferences will stimulate audiences on more focused topics with excellent keynote speakers, invited papers, and exciting panel discussions. Many selected courses will be offered throughout the week of the symposium. As a participant, you will have the opportunity to meet innovative people, undertake new initiatives, invigorate your thinking, and motivate yourself toward your goals and objectives.

Symposium Chair
Harald Schenk
Fraunhofer Institute for Photonic Microsystems (Germany)

Symposium Cochair
David L. Dickensheets
Montana State Univ. (USA)
Executive Organizing Committee

Holger Becker, microfluidic ChipShop GmbH (Germany)
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Thomas J. Suleski, The Univ. of North Carolina at Charlotte (USA)
Marilyn Gorsuch, SPIE (USA)

GREEN PHOTONICS

Be part of the solution—present your work in green technologies and be recognized by your peers

Symposium Chair

Stephen J. Eglash
Precourt Institute for Energy, Stanford Univ. (USA)

The global community recognizes the need for sustainable and renewable energy sources, as well as the need to conserve resources and spur economic growth.

SPIE Green Photonics virtual symposium highlights the latest photonics and optoelectronic tools and materials that will reduce power consumption, enable cleaner manufacturing, and create new energy generation for a broad range of applications.

To be considered for inclusion in the SPIE Green Photonics virtual symposium, when submitting your abstract, enter “GREEN PHOTONICS” as your first keyword in the online submission wizard, and upload a 1-2 page summary explaining how your research is “green”. If your paper is selected by Green Photonics selection committee, your presentation will be cross-listed in the SPIE Green Photonics Virtual Program, and you are eligible to win an SPIE Green Photonics Best Paper Award. Papers are solicited on the following and related topics:

- **Solid State Lighting and Displays**
  Efficient new light sources will provide long-lived and economical illumination for human activities and information display.

- **Laser-assisted Manufacturing and Micro/ Nano Fabrication**
  Optoelectronic sensors and concentrated optical energy sources will enable precision fabrication with low waste.

- **Communications**
  The next generation of optical networks will operate with increased bandwidth and reduced power consumption.

- **Renewable Energy Generation: Fusion and Photovoltaics**
  Small carbon footprint technologies will help meet the world’s increasing demand for energy in a sustainable manner.
Successful MEMS and MOEMS products depend on the development of novel and cost-effective manufacturing techniques and fabrication processes. This conference is intended to bring together process developers and integrators, device and system creators, and manufacturing engineers and researchers who are interested in the present and future state of MEMS/MOEMS process technologies. The topics covered in the conference will include novel fabrication, packaging and assembly techniques, process integration of MEMS/MOEMS and ICs, new applications of process technology, and manufacturing-driven process development. Special emphasis will be placed on the application of MEMS/MOEMS processes to new commercial products and issues such as manufacturability, yield management, reliability and process characterization associated with bringing these products to high-volume manufacturing.

The topics for this conference include, but are not limited to:

**Microfabrication Techniques for MEMS/MOEMS**
- bulk and surface micromachining
- lift-off processes
- 3D and ink jet printing
- deposition techniques including ALD (atomic layer deposition)
- lamination and multi-layer deposition
- growth techniques
- texturing, patterning and etching techniques including wet etching
- use of lasers in MEMS/MOEMS manufacturing
- grinding, polishing and planarization techniques
- lithography including soft lithography, nano-imprinting, dip-pen, plasmonic and holographic
- mask making and grey scale masks
- e-beam and direct write patterning methods.

**High-Aspect Ratio Microfabrication Technologies**
- DRIE and deep-trench etching
- thick resist materials and processes
- conformal deposition and trench fill processes
- LIGA
- Electroplating.

**Fabrication Processes and Technologies**
- fabrication technologies for new categories of devices such as microphotonic, microfluidic and energy-scavenging devices
- nanotechnologies
- display and camera process technologies
- glass and plastic processes.
- silicon on insulator (SOI) processes
- photonic crystal fabrication
- high frequency device fabrication including plasmonics
- scaffolding and biomaterial deposition and growth
- quantum scale device fabrication
- novel photovoltaic and waveguide processing.

**Materials and Materials Characterization**
- thick polysilicon, porous silicon
- polymers and resins
- novel materials
- III-V and II-VI materials
- ceramics
- magnetic materials
- sol gels
- meta-materials
- anti-stiction and wear-resistant coatings
- nanomaterials
- materials compatibility
- material properties and their measurement
- test structures.

**Manufacturability Issues**
- processing effects on yield and reliability
- yield management and enhancement
- in-situ metrology
- design for manufacturability.

**MEMS and Electronics Co-manufacturing Processes**
- process integration between MEMS/MOEMS and IC processes
- silicon photonics processes
- MEMS and Integrated circuits
- photonic interconnects
- on-chip light generation.

**Packaging Technologies**
- wafer level capping
- TSV (through silicon vias)
- chip stacking
- packaging for multiple MEMS/MOEMS and electronics
- SiP (system in package)
- manufacturable packaging techniques
- wafer scale devices and packaging
- cleaning, dicing, bonding, and assembly methods.

**MEMS Foundries and Product Development**
- technology transfer
- rapid prototyping
- foundry processes
- multi-project wafer processes
- process issues for high volume manufacturing.

**Software for MEMS Design and Manufacturing**
- numerical analysis software for device, process and device simulation
- software for MEMS device design and analysis
- software for MEMS/MOEMS modeling, compact modeling, reduced order modeling
- modeling of micro-scale and nano-scale phenomena
- statistical analysis, yield analysis and optimization
- manufacturing costing tools and software.
Advanced Fabrication Technologies for Micro/Nano Optics and Photonics VI (MF106)

Conference Chairs: Georg von Freymann, Technische Univ. Kaiserslautern (Germany); Winston V. Schoenfeld, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA); Raymond C. Rumpf, The Univ. of Texas at El Paso (USA)

Program Committee: Stefano Cabrini, Lawrence Berkeley National Lab. (USA); Aaron R. Hawkins, Brigham Young Univ. (USA); Babak Heidari, OBDU CaT AB (Sweden); Saulius Juodkazis, Swinburne Univ. of Technology (Australia); Shalanyn A. Kemme, Sandia National Labs. (USA); Ernst-Bernhard Kley, Friedrich-Schiller-Univ. Jena (Germany); Dwayne L. LaBrake, Molecular Imprints, Inc. (USA); Akhlesh Lakhtakia, The Pennsylvania State Univ. (USA); Uriel Levy, The Hebrew Univ. of Jerusalem (Israel); Wen Liu, Accelink Technologies Co., Ltd. (China); Marko Loncar, Harvard Univ. (USA); Robert R. McLeod, Univ. of Colorado at Boulder (USA); Yosuke Mizuyama, Panasonic Boston Lab. (USA); Patrick P. Naulleau, Lawrence Berkeley National Lab. (USA); Mahesh Pitchumani, Ostendo Technologies, Inc. (USA); Menelaos K. Poutous, The Univ. of North Carolina at Charlotte (USA); Dennis W. Prather, Univ. of Delaware (USA); John A. Rogers, Univ. of Illinois at Urbana-Champaign (USA); Pradeep Srinivasan, Intel Corp. (USA); Thomas J. Suleski, The Univ. of North Carolina at Charlotte (USA); Michael Thiel, Nanoscribe GmbH (Germany); Jian Jim Wang, OmniPV Inc. (USA); Mike P. C. Watts, Impattern Solutions (USA)

Technologies for fabrication of optics and photonics at the micro- and nano-scales continue to advance and diversify due to rising demands for miniaturization, cost reduction, functional integration, and increased performance in optical and photononic systems. Examples include diffractive optics, sub-wavelength optics, microrefractive optics, optical waveguides, photonic crystals, plasmonic devices, and heterogeneously integrated active and passive micro- and nano-optical devices. These devices are playing increasing roles in a wide range of applications, including sensors, communications, imaging, biomedical, data storage, and other areas.

Both conventional and unconventional micro- and nano-fabrication techniques serve as fundamental enablers for wide ranges of passive and active optical components and devices. To this end, this conference provides a forum for exchange of viewpoints and reports on new techniques and advances in fabrication methods for optics and photonics at the micro- and nano-scales. Applications enabled through these novel fabrication processes are also appropriate.

Topics of interest include, but are not limited to:

Non-Conventional Lithography
- nano-imprint lithography
- plasmonic lithography
- dip-pen lithography
- two-photon processes for two-dimensional and three-dimensional micro- and nanostructures
- ink jet printing
- soft-lithography
- STED inspired lithography.

Lithographic Fabrication Approaches
- fabrication methodologies based on binary, grayscale, interferometric, and laser direct-write techniques
- additional techniques, such as additive lithography, and lift-off processes for sub-micron patterning.

Electron Beam Fabrication of Micro- and Nano-optics
- single and multilayer resists
- analog and multi-exposure methods
- unique patterning and beam controls.

Ultrafast Laser Micromachining
- surface and bulk micromachining for micro- and nano-optics, fabrication of 2D and 3D waveguides, and the fabrication of novel optical elements.

Etching Technologies
- reactive ion etch (RIE) and chemically assisted etching of analog surfaces and high-aspect ratio structures
- focused ion beam and plasma jet etching
- processing of micro/nano optics and photonics in glass, silicon, and III-V and II-VI materials.

Deposition and Growth Technologies
- self-assembly and nucleation site control (2D and 3D)
- atomic-layer deposition
- lithographically defined selective growth
- pre-patterned and strain engineered templates.

Materials Issues and Technologies for Polymeric and Sol-Gel Micro- and Nano-optics
- LIGA, SLIGA, and related processes
- sol-gel processing methods for free-space and guided wave optics
- polymer replication.

Processing of Nanophotonic Devices
- holographic lithography and multi-beam exposure methods for photonic crystals
- patterning and etching of multilayer DBR structures
- porous silicon
- selective etching techniques for 2D and 3D photonic crystal fabrication
- fabrication of polarization optics
- nano-patternning for site selective growth
- texturing and patterning for enhanced light extraction
- fabrication of plasmonic devices
- quantum device fabrication for micro and nano-devices.

Micro- and Nano-optical Integration and Manufacturing
- passive and/or active integration
- quality and metrology issues
- volume fabrication techniques for micro- and nano-optics and photonics.

Mechanical Machining of Micro- and Nano-optics
- mechanical ruling and diamond turning
- microgrinding, flycutting, and multi-axis free-form micro-machining of micro- and nano-optics.
Laser Applications in Microelectronic and Optoelectronic Manufacturing (LAMOM) XVIII (LA110)

Conference Chairs: Xianfan Xu, Purdue Univ. (USA); Guido Hennig, Daetwyler Graphics AG (Switzerland); Yoshiki Nakata, Osaka Univ. (Japan); Stephan W. Roth, BLZ Bayerisches Laserzentrum GmbH (Germany)

Program Committee: Craig B. Arnold, Princeton Univ. (USA); J. Thomas Dickinson, Washington State Univ. (USA); Henry Helvajian, The Aerospace Corp. (USA); Ralf Knappe, LUMERA Laser GmbH (Germany); Yongfeng Lu, Univ. of Nebraska-Lincoln (USA); Michel Meunier, Ecole Polytechnique de Montréal (Canada); Alberto Piqué, U.S. Naval Research Lab. (USA); Gediminas Raciukaitis, Ctr. for Physical Sciences and Technology (Lithuania); Andrei V. Rode, The Australian National Univ. (Australia); Klaus Sokolowski-Tinten, Univ. Duisburg-Essen (Germany); Razvan Stoian, Lab. Hubert Curien (France); Koji Sugiyama, RIKEN (Japan)

The aim of this conference is to provide a forum for discussion of fundamentals, methods, and techniques in laser materials processing and their relation to the applications and manufacturing of micro- and nanoscale electronic, photonic, optical, mechanical, fluidic, energy, and hybrid devices. As in previous years, we expect to offer awards for the best student poster and student oral presentations. Papers are solicited on, but not limited to, the following topics within the broad area of microelectronics and optoelectronics manufacturing:

- fundamental aspects of laser-materials interaction
- laser modification of materials (annealing, doping, intermixing, photosensitivity)
- laser cleaning, texturing, bending and repair
- laser microscale materials processing and manufacturing
- laser nanoscale materials processing and manufacturing, including near-field nano-optical lithography and materials processing
- pulsed-laser deposition, laser-assisted thin-film epitaxy, atomic-layer epitaxy, resonant infrared pulsed-laser deposition, thin film and wafer processing
- rapid prototyping and direct-write technologies including laser pattern transfer and laser-induced forward transfer
- laser 3D fabrication
- parallel laser manufacturing
- laser processing from cw to fs time scales
- laser processing across wavelength scales from VUV to IR
- laser manufacturing of MEMS and microsystems, including microfluidic chips
- laser processing in microelectronic and optoelectronic manufacturing including laser micro processing of electronic or optoelectronic material for advanced devices and integrated systems
- generation and dynamics of laser ablation plumes, including gas-dynamic effects, charge generation and charge transfer
- modeling of laser-materials and laser-plume interactions for quantitative prediction of process parameters
- novel laser systems and optics for materials processing and device fabrication
- laser-induced modification of glasses or transparent materials for applications in optoelectronic and photonics.

JOINT SESSIONS

Joint session with LA111: Laser-based Micro- and Nanopackaging and Assembly VI on “Photovoltaics, Alternative Energy Sources, and Advanced Energy Storage Systems”

This session is addressed to recent progresses in laser-assisted development and fabrication of advanced solar cell devices, energy sources, and advanced energy storage systems and materials. A broad range of advanced laser processes are of interest including materials research and applications such as hole drilling, groove formation, edge isolation, cutting, doping, soldering, and laser thin film ablation for silicon or organic solar cells, energy source, and advanced energy storage systems (e.g. lithium-ion batteries).

Joint session with LA112: Synthesis and Photonics of Nanoscale Materials IX on “Laser Modification of Nanomaterials”

The intent of this session is to present recent research in laser interactions with nanomaterials for the development of new laser-based processing techniques. This includes laser interactions with nanomaterials resulting in physical transformations such as melting, alloying, shaping, welding, sintering, and solidification, laser-induced chemical modifications to nanomaterials, mechanisms of laser-induced defect formation or healing, laser processing techniques to move, self-assemble, or separate nanomaterials, as well as laser-based processing techniques for producing plasmonic nanostructures.

Joint session with LA113: Frontiers in Ultrafast Optics: Biomedical, Scientific and Industrial Applications XII on “Ultrafast Laser Micromachining”

This session will address important emerging technologies at the picosecond, femtosecond and attosecond time scale, for a broad audience of researchers in the fields of ultra-fast lasers and laser processing, together with experts at the forefront of alternative micro- and nanofabrication technologies. The topics will cover, but will not be limited to, ultra-fast laser sources, fundamentals of ultra-fast laser-matter interaction, and novel machining techniques.


This is a forum focused on a manufacturing process that is gaining acceptance because it enables precision 3D free form fabrication of structures that are difficult to fabricate conventionally. The three elements to be discussed in this session are the powder specialty powders (i.e. nano/micro) used, the lasers sources that make it possible and the material processing controls required. Of special interest is research developments that push the technique to enable fabrication of graded materials, novel alloys and structures that have seamless boundaries that cross material classes (e.g., metal-insulator, insulator-plastic, metal-plastic).
Laser-based Micro- and Nanopackaging and Assembly VII (LA111)

Conference Chairs: Udo Klotzbach, Fraunhofer IWS Dresden (Germany); Yongfeng Lu, Univ. of Nebraska-Lincoln (USA); Kunihiko Washio, Paradigm Laser Research Ltd. (Japan)

Program Committee: Jose A. Alvarez-Chavez, Ctr. de Investigacion e Innovacion Tecnologica (Mexico); Craig B. Arnold, Princeton Univ. (USA); Friedrich G. Bachmann, LUMERA LASER GmbH (Germany); Francois Couvoisier, Univ. de Franche-Comte (France); Ramona Eberhardt, Fraunhofer-Institut für Angewandte Optik und Feinmechanik (Germany); Duncan P. Hand, Heriot-Watt Univ. (United Kingdom); Miguel Holgado Bolaños, Univ. Politecnica de Madrid (Spain); Minghui Hong, National Univ. of Singapore (Singapore); Nam Seong Kim, EO Technics Co., Ltd. (Korea, Republic of); Sonja M. Kittel, Robert Bosch GmbH (Germany); Rainer Kling, ALPHANOV (France); Thomas Klotzbücher, Institut für Mikrotechnik Mainz GmbH (Germany); Xiaoning Liu, Panasonic Boston Lab. (USA); Yasu Osako, Electro Scientific Industries, Inc. (USA); Roberto Osellame, Istituto di Fotonica e Nanotecnologia, CNR, Politecnico di Milano (Italy); Andreas Ostendorf, Ruhr-Univ. Bochum (Germany); Wilhelm Pfleging, Karlsruher Institut für Technologie (Germany); Alberto Piqué, U.S. Naval Research Lab. (USA); Marius Przybylski, ATL Lasertechnik GmbH (Germany); Razvan Stoian, Lab. Hubert Curien, CNRS, Univ. Jean Monnet Saint-Etienne (France); Koji Sugioka, RIKEN (Japan); Akira Watanabe, Tohoku Univ. (Japan); Xianfan Xu, Purdue Univ. (USA); Haiyan Zhao, Tsinghua Univ. (China)

This conference of related interest is part of LASE 2013, co-located at Photonics West: spie.org/lasecall

Cutting-edge technological visions and applications are increasingly based on micro- and nano-system technologies. The realization of such devices or functional prototypes is often a new challenge for patterning, packaging and assembly. Scientists and engineers are increasingly confronted with tasks that cannot be accomplished with conventional tools.

Demands in high-tech industries are growing for specialized prototype and high-throughput devices with micro- and nano-scaled structures including fluidic, biologic, chemical, electronic, mechanical or photonic features. Nano-materials and nano-patterning technology increasingly coexist with micro-materials and micro-structuring technologies leading to new applications and research fields but also to new challenges for appropriate assembly and packaging technologies.

Laser-assisted packaging is emerging as an increasingly important technology which can be established in new technical approaches, in order to overcome apparent process limitations on nearly each material and for different length scaling. The aim of this conference is to bring together scientists and engineers working on laser-based processes on micro- and nanometer scale for advanced applications such as for photovoltaics, energy storage systems, photonic devices (OLED), MOEMS, MEMS, micro- and nano-fluidic devices, analytical systems (e.g. lab-on-chip) or bio-compatible devices. Papers are solicited on the following application-oriented topics and other packaging related issues:

- fundamental physical and chemical issues in laser-based micro- and nano-fabrication, packaging and assembly
- laser material processing for metals, polymer, ceramics, semiconductor, or dissimilar materials
  - laser ablation (cutting, scribing, dicing, drilling, cleaving)
  - laser joining (welding, soldering, bonding, splicing, sealing)
- advanced adaptive optics and beam engineering methods for improving laser processes, yields and throughput.
- innovative “green photonics” for micro- and nano-packaging and assembly.

Joint Session

Joint session with LA110: Laser Applications in Microelectronic and Optoelectronic Manufacturing (LAMOM) on “Photovoltaics, Alternative Energy Sources, and Advanced Energy Storage Systems”

This session is addressed to recent progresses in laser-assisted development and fabrication of advanced solar cell devices, energy sources, and advanced energy storage systems and materials. A broad range of advanced laser processes are of interest including materials research and applications such as hole drilling, groove formation, edge isolation, cutting, doping, soldering, and laser thin film ablation for silicon or organic solar cells, energy source, and advanced energy storage systems (e.g., lithium-ion batteries).
Reliability, Packaging, Testing, and Characterization of MOEMS/MEMS and Nanodevices XII (MF102)

Conference Chairs: Rajeshuni Ramesham, Jet Propulsion Lab. (USA); Herbert R. Shea, Ecole Polytechnique Fédérale de Lausanne (Switzerland)

Program Committee: Paul A. Bierden, Boston Micromachines Corp. (USA); Sonia M. García-Blanco, Univ. Twente (Netherlands); Christopher K. Harrison, Schlumberger-Doll Research Ctr. (USA); Allyson Hartzell, Qualcomm Inc. (USA); Albert K. Henning, Nanolink, Inc. (USA); Maurice S. Karpman, Draper Lab. (USA); Richard C. Kullberg, Vacuum Energy, Inc. (USA); Kee-Keun Lee, Ajou Univ. (Korea, Republic of); Jose M. Pozo, TNO (Netherlands); Tolga Tekin, Technische Univ. Berlin (Germany); Yanzhu Zhao, Medtronic, Inc. (USA)

The purpose of this conference is to provide a technical stage to present and publish recent advances in the reliability, packaging, testing, and characterization of microelectromechanical systems (MEMS) and micro-optoelectromechanical systems (MOEMS) for various applications. We are soliciting high-quality papers on the following topics:

1. Packaging process reliability, including packaging materials, assembly processes, bonding materials, wafer-level packaging, high-vacuum packaging, hermeticity, leak testing, new testing tools to monitor hermeticity, thin-film getters and activation techniques, packaging without hermeticity, MEMS assembly cleanroom science, issues in integration of MEMS/MOEMS and ICs/ASICs/FPGAs, nondestructive evaluation of packaged systems (x-ray, acoustic microscopy, IR), effects of extreme and harsh environments (low and high temperature, radiation, shock, vibration), commercial-off-the-shelf (COTS) solutions, simulations/models, lead-free solder, and predictions of lifetime of packaged MEMS systems.

2. BEOL process reliability issues, including production and yield improvement, yield improvement by reducing stiction, parametric test methods and/or test structures used to assure fabrication processes, release methods and techniques, yield modeling and process control methodologies.

3. Reliability methodology, including aging, dormancy, early life failures, accelerated life testing, predictive models, acceleration factors, design of experiments, physics of failure, reliability in design, measurement techniques and properties, data reduction and visualization, scaling issues, reliability tool development, automation, and device/system reliability.

4. Reliability of surfaces, including stiction, adhesion, lubrication, critical point drying methods, self-assembled monolayers (SAMs) or other coating materials, tribology, surface molecular contamination, particulate contamination, and contact resistance.

5. Reliability of materials, including fracture, static and cyclic fatigue, wear, and life-cycle predictability.

6. Testing methods, including qualification of devices or systems, environmental testing (shock, vibration, temperature extremes, humidity, power cycling, contact cycling), highly accelerated life-time testing (HALT), verification, and automation.

7. Standards development including testing and measurement standards of devices or MEMS materials properties.

8. Characterization methods, including metrology tool development, laser Doppler vibrometry, interferometric methods, confocal microscopy, automation, calibration, and comparison to models.

9. Failure analysis, including identification of failure modes and mechanisms, novel analysis techniques, novel tools, and case histories.


11. New Industrial Session: Hot Commercial MEMS/ MOEMS Products: MOEMS/MEMS devices are not a mere research topic but are finding widespread in a large number of commercial products, as a result of many years of research and development in MEMS fabrication and reliability. In this session, leading worldwide experts/vendors/developers from the MOEMS/MEMS industry are invited to submit 10-min presentations showing the state-of-the-art in commercial MOEMS/MEMS devices, their reliability and packaging. No full paper submission is required, just the 10-min presentation slides that will be made available to the registered participants.
Call for Papers

JOINT SESSION

Joint session with MF105 and MF107 on “MEMS/ MOEMS, Nanodevices, and Miniaturized Systems for Space Exploration”

MOEMS/MEMS and nanotechnology are key in the miniaturization of systems for Space instrumentation. The utilization of MOEMS/MEMS and nanotechnology in Nano- and Pico-Sat missions allows not only a cost and size reduction but also an acceleration of the instrument development cycle, therefore increasing the number of science experiments that can be carried out in Space. Furthermore, miniaturized systems are of utmost importance in Planetary Exploration Missions, where such devices can be integrated in different Rovers to perform a great variety of analyses. A great deal of work is still needed, though, to ensure that the MEMS/MOEMS based microdevices present the required reliability to be included in Space Missions and to develop standards and MOEMS Space Qualification plans.

In this Special Focused Session, papers are solicited in the following topics:

- Miniaturized systems based on the use of MEMS/MOEMS; micro-assembly and nanotechnologies for use in Space. Particular areas of interest include: photonic devices, microbolometers, microfluidic devices and lab-on-a-chip for use in Space applications and Space Exploration, DMD, adaptive optics, microenergetics, micro-propulsion devices, RF MEMS, etc.
- Miniaturized instrumentation for use in Space Exploration, such as the Mars Rover.
- MEMS applications in astronomy and Earth observation.
- Packaging of MEMS/MOEMS and nanodevices and packaging reliability issues.
Laser Micro-/Nanoengineering

Microfluidics, BioMEMS, and Medical Microsystems XI (MF104)

Conference Chair: Holger Becker, microfluidic ChipShop GmbH (Germany)
Cochair: Bonnie L. Gray, Simon Fraser Univ. (Canada)
Program Committee: Brian W. Anthony, Massachusetts Institute of Technology (USA); Bruce K. Gale, The Univ. of Utah (USA); Albert K. Henning, Nanoink, Inc. (USA); Yu-Cheng Lin, National Cheng Kung Univ. (Taiwan); Yuehe Lin, Pacific Northwest National Lab. (USA); Ciara K. O’Sullivan, Univ. Rovira i Virgili (Spain); Ian Papautsky, Univ. of Cincinnati (USA); Thomas Stieglitz, Albert-Ludwigs-Univ. Freiburg (Germany); Albert van den Berg, Univ. Twente (Netherlands); Wanjun Wang, Louisiana State Univ. (USA); Bernhard H. Weigl, PATH (USA)

Conference Cosponsors:

The purpose of this conference is to provide an international technical forum to showcase recent advances in microfluidics, BioMEMS, and medical Microsystems. Microfluidic devices and systems have created a tremendous interest in many application fields, including life sciences, point of care (POC) diagnostics, and environmental applications. They offer many advantages over the existing macroscale systems, including compact size, disposability, higher speed and parallelism of analyses, increased functionality and decreased sample/reagent volumes. In the life sciences, recent research efforts have focused on bio/chemical analyses, pharmaceutical high-throughput systems, and biomaterial surface modification. The interaction of microsystems with living cells or tissues opens a pathway to novel methods of medical diagnostics and therapeutics. Thus, the range of interests has expanded from the molecular scale over single cells to more complex biological systems, and finally, living organisms. Further, the conventional methods in medical technology have also been shifting towards miniaturization and MEMS technologies, including minimally invasive surgery, in vivo and ex vivo monitoring, and smart implants. Last, but not least, environmental applications have focused on developing inexpensive sensors for in situ monitoring of contaminants in the environment for public safety or measuring a person’s exposure to environmental contamination.

For many of these applications, microfluidics and other MEMS technologies are essential, as they provide the functional basis of many research tools as well as commercial devices and applications. Thus, over the past several years, there has been a significant increase in the activities associated with understanding, development, and application of micromechanical and microfluidic devices and systems for BioMEMS and medical Microsystems.

Papers are solicited on the following major topics and other related subjects:

**Micro/Nano Fluidic Components**
- fluid delivery, transport, and control
- microvalves and micropumps
- micromixers and microrreactors
- micro-heating/cooling devices
- fluidic interconnects, assembly, and packaging technologies
- nanofluidic devices and systems
- CAD, modeling, and analysis.

**Microfabrication Technologies for Microfluidics and BioMEMS**
- polymer microfabrication methods
- fluidic modules and interconnects
- fluidic packaging and assembly
- microstructuring of organic materials
- functional materials for microfluidics and BioMEMS
- surface texturing and modification.

**Applications of Microfluidics, BioMEMS and Medical Microsystems**
- sensors and systems for point-of-care (POC) monitoring and diagnosis
- nano bio/medical sensors
- on-chip waveguide and optical detection technologies
- cell-based sensing devices and systems, flow cytometry
- smart MEMS implants for medical applications
- sensors and systems for environmental monitoring
- sensors and systems for in vitro/in vivo monitoring and diagnosis
- microfluidic-based drug development and analysis.

**JOINT SESSION with BiOS B0112**

Microfluidics plays an important role as an enabling technology in the realization of devices and systems used for pathogen detection in applications like food safety or biothreat detection. Miniaturization and functional integration can lead to portable instruments which can be field-deployed or applied in-line in production monitoring. The recent advances in this field and its growing importance will be recognized in a joint session between the two conferences “Frontiers in Biological Detection” (B0112) and “Microfluidics, BioMEMS and Medical Microsystems” (MF104).
SPECIAL SESSION on Dip-Pen Lithography

Precision, rapid, and flexible nanoscale deposition and removal of material is a fundamental requirement for nanoscience research, development, and commercial implementation. Dip Pen Nanolithography (DPN) is a leading technique for achieving these goals. Application fields range from semiconductor photomask repair, to pharmaceutical discovery, to micro- and nano-arrays for advanced proteomic R&D. DPN is based on scanning probe microscopy (SPM) technology, and operates under ambient conditions, making it suitable to deposit a wide range of biological and inorganic materials. DPN is fundamentally enabled by MEMS devices tailored for microfluidic delivery of either liquid or dry inks. Recent advances in the field are targeted with this Special Session.

BEST STUDENT PAPER AWARD

A $500 cash prize sponsored by NanoInk Inc. and microfluidic ChipShop GmbH will be awarded to the best student paper.

Judging and Requirements

Presentations and manuscripts will be judged based on scientific merit, impact, and clarity. Candidates for the award need to be the presenting author, a full-time student, must have conducted the majority of the research presented in the paper, and must submit their manuscript by the deadline (7 January 2013).

Nominations

To be considered, select “Consider for Best Student Paper” as your First Choice under “Topic Area” during online submission of your abstract.

Critical Dates

Abstract Due Date: 23 July 2012
Post-Meeting Manuscript Due Date: 7 January 2013

Please Note: Submissions imply the intent of at least one author to register, attend the conference, present the paper as scheduled, and submit a full-length manuscript for publication in the conference proceedings.
Laser Micro-/Nanoengineering

MOEMS and Miniaturized Systems XII (MF105)

Conference Chairs: Wibool Piyawattanametha, NECTEC (Thailand) and Chulalongkorn Univ. (Thailand); Yong-Hwa Park, Samsung Advanced Institute of Technology (Korea, Republic of)

Program Committee: Wyatt O. Davis, MicroVision, Inc. (USA); David L. Dickensheets, Montana State Univ. (USA); Jean-Christophe Eloy, Yole Développement (France); Sonia M. Garcia-Blanco, Univ. Twente (Netherlands); Jason C. Heikenfeld, Univ. of Cincinnati (USA); Il-Woong Jung, Argonne National Lab. (USA); Jonathan T. C. Liu, Stony Brook Univ. (USA); Veljko Milanovic, Microracle Technologies, Inc. (USA); Harald Schenk, Fraunhofer Institute for Photonic Microsystems (Germany); Jason B. Stewart, MIT Lincoln Lab. (USA); Wanjun Wang, Louisiana State Univ. (USA); Guangya Zhou, National Univ. of Singapore (Singapore)

Conference Cosponsor: Bridger Photonics

Micro and nano-technology based optical components and sub-systems are enabling the creation of highly functional systems with diverse applications including optical switches and spectrum analyzers, human interface components, imaging instruments, direct-write lithography tools and all-optical signal processing modules. MOEMS (for Micro-Opto-Electro-Mechanical-Systems) are MEMS devices or systems that sense or manipulate light. They exploit refraction, reflection or diffraction principles to control light intensity, polarization or phase. Prominent applications include spatial light modulators and devices for beam steering and beam shaping. The SPIE conference on MOEMS and Miniaturized Systems will address various aspects relating to theory, design, fabrication, new materials, device characterization and testing (including reliability issues), and integration of systems enabled by MOEMS technology.

Original technical papers related to device or technology development, systems integration, and new applications related to the following topics are solicited:

**MOEMS Devices**
- design and simulation of MOEMS devices
- MOEMS for beam shaping, aberration correction, focus control devices, enhanced imaging, and visual aids
- micro optical 1D, 2D, and 3D beam steering components
- micromirror arrays and spatial light modulators
- micromachined diffraction gratings, interferometric display and imaging devices
- micromachined microbolometer, pyroelectric, and other IR and thermal imaging sensors
- micromachined ultrasonic transducer arrays
- spectroscopic imaging devices
- tunable devices, tunable filters, lasers, lenses, microlens arrays, and DOE
- photonic crystals, waveguides and filters
- optical shutters and optical switching devices.

**MOEMS for testing, characterization and testing (including reliability issues) and integration of systems enabled by MOEMS technology.**

**Technology Development**
- fabrication techniques for MOEMS
- integration of CMOS and MEMS for optical applications
- integration of photonics and MEMS (fabrication and functionality)
- integration of waveguides, integrated optics or photonic crystals with MEMS
- MOEMS-based III-V and II-VI compound semiconductors
- new approaches for MOEMS fabrication technologies (e.g. nanoimprinting)
- enhanced capabilities through novel materials including silicon, silica, non-silicon materials and polymers
- packaging, testing, and characterization schemes for MOEMS
- MOEMS technology transfer to manufacturing
- interfacing techniques for MOEMS.

**SPECIAL SESSION on MEMS for Robotics or MicroRobotics**
- design methodologies, physical investigations and manufacturing techniques involving various microsensors, microactuators and other Microsystems
- inertial sensor suites for control and guidance
- miniature wall-climbing robots using micro/nano-fiber adhesives
- arrayed MEMS probe manipulators for tip-based nanomanufacturing
- gas and oil chemical sensor arrays for early warning systems
- ultra-compliant neural probes for brain-computer interfaces.

**Systems, Subsystems, and Applications**
- novel miniaturized optical subsystems, systems and instrumentation
- MOEMS for telecommunication, computer, automotive, and military applications
- MOEMS display systems (2D, 3D, holographic) and imaging systems
- MOEMS for biomedical/biological imaging systems (confocal, two-photon, SHG, fluorescence, Raman, multimodality imaging) including endoscopic imaging systems and ultrasonic imaging
- Digital Micromirror Device (DMD) applications
- MOEMS for medical diagnostics and health monitoring (Bio-MOEMS) and bench-on-a-chip
- MOEMS for sensing systems
- photonic crystal based subsystems and applications
- MOEMS for nanotechnology
- design and simulation of MOEMS based subsystems and systems
- control schemes and circuits for MOEMS
- MEMS based laser beam optical trapping.

**MicroRobotics**
- MOEMS for biomedical/biological imaging
- MOEMS for medical diagnostics and health monitoring (Bio-MOEMS) and bench-on-a-chip
- MOEMS technology transfer to manufacturing
- interfacing techniques for MOEMS.
JOINT SESSION

Joint session with MF102 and MF107 on MEMS/MOEMS, Nanodevices, and Miniaturized Systems for Space Exploration

MOEMS/MEMS and nanotechnology are key in the miniaturization of systems for Space instrumentation. The utilization of MOEMS/MEMS and nanotechnology in Nano- and Pico-Sat missions allows not only a cost and size reduction but also an acceleration of the instrument development cycle, therefore increasing the number of science experiments that can be carried out in Space. Furthermore, miniaturized systems are of utmost importance in Space Exploration Missions, where such devices can be integrated in different Rovers to perform a great variety of analyses. A great deal of work is still needed, though, to ensure that the MEMS/MOEMS based microdevices present the required reliability to be included in Space Missions and to develop standards and MOEMS Space Qualification plans.

In this Special Focused Session, papers are solicited in the following topics:

- Miniaturized systems based on the use of MEMS/MOEMS; micro-assembly and nanotechnologies for use in Space. Particular areas of interest include: photonic devices, microbolometers, microfluidic devices and lab-on-a-chip for use in Space applications and Space Exploration, DMD, adaptive optics, microenergetics, micro-propulsion devices, RF MEMS, etc.
- Miniaturized instrumentation for use in Space Exploration, such as the Mars Rover
- MEMS applications in astronomy and Earth observation
- Packaging of MEMS/MOEMS and nanodevices and packaging reliability issues

JOINT SESSION

Joint session with MF109 on Picoprojector Technologies and Developments

Various technologies including MEMS, LCD, lasers, and OLED are under development to build high-performance picoprojectors. They are needed to provide large display sizes in comparison to integrated displays for mobile phones, digital cameras and personal digital assistants with ever decreasing size. This special session in conjunction with MF109 will give a comprehensive overview about recent development activities and results of the various technologies. It focuses on picoprojector technologies from modulators to system integration up to novel applications.

BEST PAPER AWARDS

We are pleased to announce that a cash prize, sponsored by Bridger Photonics, will be awarded to the best paper and best student paper in MOEMS and Miniaturized Systems. Qualifying papers will be evaluated by the awards committee. Manuscripts will be judged based on scientific merit, impact, and clarity. The winners will be announced during the conference, and the presenting authors will be awarded a cash prize.

To be eligible for the Best Paper Award, you must:
- be listed as an author on an accepted paper within MF105
- have conducted the majority of the work to be presented
- submit your manuscript online by 7 January
- present your paper as scheduled.

To be eligible for the Best Student Paper Award, you must:
- be a student without a doctoral degree (undergraduate, graduate, or PhD student)
- be listed as an author on an accepted paper within MF105
- have conducted the majority of the work to be presented
- submit your manuscript online by 7 January
- present your paper as scheduled.

Nominations

To be considered, select either “Consider for Best Paper” or “Consider for Best Student Paper” as your First Choice under “Topic Area” during the online submission of your abstract.
Adaptive optics (AO) are routinely used on large ground-based telescopes and in high-energy laser systems. Adaptive optics are also rapidly finding use in other areas, such as medicine, communications and remote sensing. Many applications of adaptive optics could benefit from compact, robust, high-performance, inexpensive wave front correction devices. Devices using MOEMS technology have the potential to achieve some or all of these characteristics. MOEMS adaptive optics devices have made considerable recent technical progress and are now in use in many application areas. This conference will cover all aspects of the development and use of MOEMS technology for adaptive optics.

Technical papers concerning the following aspects of adaptive optics are appropriate for submission and consideration:

- AO scientific applications such as:
  - astronomy, microscopy, vision science, scientific laser systems

- AO commercial applications such as:
  - consumer imaging, bio-photonics, industrial inspection, lithography, industrial and medical lasers, optical communications, vision care and ophthalmology

- AO security applications such as:
  - surveillance, communications, targeting and tracking, laser systems, vibrometry, hyperspectral imaging
  - theory, modeling, and simulation of AO devices and systems
  - devices and fabrication approaches to achieve AO goals
  - electronics and control methods for AO devices and systems
  - measurement and characterization of AO devices
  - reliability of AO devices and systems
  - performance assessment of MEMS-based AO systems.

Joint session with MF102 and MF105 on “MEMS/MOEMS, Nanodevices and Miniaturized Systems for Space Exploration”

MOEMS/MEMS and nanotechnology are key in the miniaturization of systems for Space instrumentation. The utilization of MOEMS/MEMS and nanotechnology in Nano- and Pico-Sat missions allows not only a cost and size reduction but also an acceleration of the instrument development cycle, therefore increasing the number of science experiments that can be carried out in Space. Furthermore, miniaturized systems are of utmost importance in Space Exploration Missions, where such devices can be integrated in different Rovers to perform a great variety of analyses. A great deal of work is still needed, though, to ensure that the MEMS/MOEMS based microdevices present the required reliability to be included in Space Missions and to develop standards and MOEMS Space Qualification plans.

In this Special Focused Session, papers are solicited in the following topics:


- Miniaturized systems based on the use of MEMS/MOEMS; micro-assembly and nanotechnologies for use in Space. Particular areas of interest include: photonic devices, microbolometers, microfluidic devices and lab-on-a-chip for use in Space applications and Space Exploration, DMD, adaptive optics, microenergetics, micro-propulsion devices, RF MEMS, etc.

- Miniaturized instrumentation for use in Space Exploration, such as the Mars Rover.

- MEMS applications in Astronomy and Earth Observation.

- Packaging of MEMS/MOEMS and nanodevices and packaging reliability issues.
Call for Papers

Emerging Digital Micromirror Device Based Systems and Applications V (MF109)

Conference Chairs: Michael R. Douglass, Texas Instruments Inc. (USA); Patrick I. Oden, Texas Instruments Inc. (USA)

Program Committee: Michael F. Becker, The Univ. of Texas at Austin (USA); Hal Bellis, Keynote Technologies, LLC (USA); Sara L. Best, Univ. of Wisconsin School of Medicine and Public Health (USA); Jason Geng, Xigen, LLC (USA); Yuval Kapellner Rabinovitz, EKB Technologies Ltd. (USA); Benjamin L. Lee, Texas Instruments Inc. (USA); Raecine Meza, Texas Instruments Inc. (USA); Paul Rancuret, Texas Instruments Inc. (USA); Yongzhi Yang, Wintech Digital Systems Technology Corp. (USA); Karel J. Zuzak, Digital Light Innovations (USA)

Conference Cosponsor:

The Digital Micromirror Device (DMD) was conceived at Texas Instruments in 1987, following a decade of work on analog deformable-mirror and cantilever-mirror devices. This particular MOEMS device has been applied most famously to conference room and portable projectors, large-screen high-definition televisions, and digital cinema projection systems, all of which were enabled by DLP® technology.

As evidenced in this well-attended conference at Photonics West 2012, the DMD and associated development platforms are enabling many exciting new systems and applications beyond traditional display technologies. By bringing together scientists, technologists, and developers, the goal of this conference is to highlight new and interesting means of applying DMD technology to end applications within these emerging markets.

Technical areas of particular interest include, but are not limited to:

• 3D Displays (volumetric, light-field, multiviews, and holographic)
• augmented reality
• beam/wave-front shaping
• biochemical visualization
• compressive sensing
• embedded and portable systems
• holography
• intelligent lighting
• lithography
• medical devices
• metrology and machine vision, including 3D microscopy
• optical micromanipulation
• optical telecommunications
• rapid prototyping and 3D printing
• security and surveillance
• structured light 3D imaging
• spectrally tunable light sources
• spectroscopy and hyperspectral imaging
• UV and IR applications.

JOINT SESSION

Joint session with MF105 on Picoprojector Technologies and Developments

Various technologies including MEMS, LCD, lasers, and OLED are under development to build high-performance picoprojectors. They are needed to provide large display sizes in comparison to integrated displays for mobile phones, digital cameras and personal digital assistants with ever decreasing size. This special session in conjunction with MF105 will give a comprehensive overview about recent development activities and results of the various technologies. It focuses on picoprojector technologies from modulators to system integration up to novel applications.

JOINT SESSION

Joint session with BiOS BO400 on Biomedical Imaging and Cell Manipulation using MEMS

This special joint session is in conjunction with BiOS conference BO400: Imaging, Manipulation, and Analysis of Biomolecules, Cells, and Tissues XI. The utilization of the DMD and other MEMS devices to manipulate light has numerous medical applications ranging from cancer detection to operating room aids to the manipulation of individual cells.

Papers are solicited that address:

• spectroscopy and hyperspectral imaging
• oxygenation measurements
• tissue illumination
• optoelectronic tweezers
• selectable wavelength light sources
• confocal microscopes.

Critical Dates

Abstract Due Date:
23 July 2012

Post-Meeting Manuscript Due Date:
7 January 2013

Please Note: Submissions imply the intent of at least one author to register, attend the conference, present the paper as scheduled, and submit a full-length manuscript for publication in the conference proceedings.
MOEMS-MEMS Best Paper Awards
We are pleased to announce that a cash prize will be awarded to the best paper and best student paper in MOEMS-MEMS.

To be eligible for the MOEMS-MEMS Best Paper Award, you must:
• be listed as an author on an accepted paper within MOEMS-MEMS
• have conducted the majority of the work to be presented
• submit your manuscript online and send your nomination to SPIE by 7 January 2013
• present your paper as scheduled.

To be eligible for the MOEMS-MEMS Best Student Paper Award, you must:
• be a student without a doctoral degree (undergraduate, graduate, or PhD student)
• be listed as an author on an accepted paper within MOEMS-MEMS
• have conducted the majority of the work to be presented
• submit your manuscript online and send your nomination to SPIE by 7 January 2013
• present your paper as scheduled.

Call for Nominations
Send nominations to Harald Schenk (mailto: harald.schenk@ipms.fraunhofer.de) by 7 January 2013 (include the presenter's name, email, paper title, and paper number, and indicate which award to be considered for). Qualifying papers will be evaluated by the awards committee. Manuscripts will be judged based on scientific merit, impact, and clarity. The winners will be announced during the MOEMS-MEMS Plenary Session and the presenting authors will be awarded a cash prize.
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Registration
SPIE Photonics West registration will be available October 2012

All participants, including invited speakers, contributed speakers, session chairs, co-chairs, and committee members, must pay a registration fee. Authors, coauthors, program committee members, and session chairs are accorded a reduced symposium registration fee.

Fee information for conferences, courses, a registration form, and technical and general information will be available on the SPIE website in October 2012.

Hotel Information
Opening of the hotel reservation process for SPIE Photonics West 2013 is scheduled for the beginning of July 2012. SPIE will arrange special discounted hotel rates for SPIE conference attendees.

The website will be kept current with any updates.

Student Travel Grants
A limited number of SPIE student travel grants will be awarded based on need. Applications must be received no later than 26 November 2012. Eligible applicants must present an accepted paper at this meeting. Offer applies to undergraduate/graduate students who are enrolled full-time and have not yet received their PhD.

Clearance Information
If government and/or company clearance is required to present and publish your presentation, start the process now to ensure that you receive clearance if your paper is accepted.

Important News for All Visitors from Outside the United States
Find important requirements for visiting the United States on the SPIE Photonics West website. There are new steps that ALL visitors to the United States need to follow.

Online at: spie.org/visa

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• Abstracts should contain enough detail to clearly convey the approach and the results of the research. Accepted abstracts will be published and made available at the meeting. Please submit a 250-word abstract for review.
• Please also submit a 100-word text summary suitable for early release. If accepted, this summary text will be published prior to the meeting in the online or printed programs promoting the conference.
• OPTIONAL: If your research is working toward improvements in energy, sustainability, and conservation, enter GREEN PHOTONICS as your 1st keyword, and upload a 1-2 page summary explaining how your research is “green.” Accepted papers will be cross-listed in the virtual program on Green Photonics and will be judged for the Green Photonics Awards.
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• Commercial papers, papers with no new research/development content, and papers where supporting data or a technical description cannot be given for proprietary reasons will not be accepted for presentation in this conference.
• Please do not submit the same, or similar, abstracts to multiple conferences.

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When submitting your manuscript to the proceedings, we encourage you to consider also submitting it to the SPIE peer-reviewed Journal of Micro/Nanolithography, MEMS, and MOEMS (JM3). Manuscripts submitted to the journal will go through the normal JM3 peer-review process. No reformatting is necessary for initial submission to the journal, but manuscripts intended to be reviewed by JM3 must adhere to the generally higher standards of content required of a refereed journal. For more information, please visit the JM3 Author Information at http://spie.org/x85041.xml or contact jm3@spie.org
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