



23 - 28 January 2010  
The Moscone Center  
San Francisco, California United States

## Laser Applications in Microelectronic and Optoelectronic Manufacturing XV

Conference 7584 - Proceedings of SPIE Volume 7584

Dates: Monday-Thursday 25 - 28 January 2010

Part of program track on

### Honorary Chair

Jan J. Dubowski, Univ. de Sherbrooke (Canada)

[Laser Micro-/Nanoengineering](#)

### Conference Chairs

Hiroyuki Niino, National Institute of Advanced Industrial Science and Technology (Japan); Michel Meunier, Ecole Polytechnique de Montréal (Canada); Bo Gu, IPG Photonics Corp.; Guido Hennig, MDC Max Daetwyler AG (Switzerland)

### Program Committee

Craig B. Arnold, Princeton Univ.; Philippe Bado, Translume, Inc.; Tommaso Baldacchini, Newport Corp.; Stephan Barcikowski, Laser Zentrum Hannover e.V. (Germany); Stephen Y. Chou, Princeton Univ.; J. Thomas Dickinson, Washington State Univ.; Jan J. Dubowski, Univ. de Sherbrooke (Canada); Henry Helvajian, The Aerospace Corp.; Andrew S. Holmes, Imperial College London (United Kingdom); Godai Miyaji, Kyoto Univ. (Japan); Henry Peng, GE China Technology Ctr. (China); Rafael Piestun, Univ. of Colorado at Boulder; Alberto Piqué, Naval Research Lab.; Zbigniew Sagan, ATT Advanced Track & Trace (France); Tomokazu Sano, Osaka Univ. (Japan); Koji Sugioka, RIKEN (Japan); Alexander Szameit, Friedrich-Schiller-Univ. Jena (Germany); Sascha Weiler, TRUMPF Laser GmbH & Co. KG (Germany)

Monday 25 January

## Welcome

Date: Monday 25 January

Time: 8:30 AM - 8:40 AM

Hiroyuki Niino, National Institute of Advanced Industrial Science and Technology (Japan)

## Session 1: Laser Processing of Exotic Materials

Date: Monday 25 January

Time: 8:40 AM - 10:10 AM

Session Chair: Hiroyuki Niino, National Institute of Advanced Industrial Science and Technology (Japan)

### Black silicon (Invited Paper)

Paper 7584-1

Author(s): Eric D. Mazur, Harvard Univ. (United States)

[Show Abstract](#)

### Femtosecond laser synthesis of metastable metallic nanoalloys in liquids

Paper 7584-2

Author(s): Michel Meunier, Sebastien Besner, Paul M. Boyer, Ecole Polytechnique de Montréal (Canada)

[Show Abstract](#)

### F<sub>2</sub> excimer laser generated transient absorption centers in single crystal CaF<sub>2</sub>

Paper 7584-3

Author(s): Sharon George, Steve C. Langford, J. Thomas Dickinson, Washington State Univ. (United States)

[Show Abstract](#)

### Limits to the nanoscale control during pulsed laser deposition

Paper 7584-4

Author(s): Giorgio Baraldi, Consejo Superior de Investigaciones Científicas (Spain); Vincenzo Resta, Consejo Superior de Investigaciones Científicas (Spain) and ENEA (Italy); Angel Perea Folgueras, Jose A. Gonzalo, Carmen N. Afonso, Consejo Superior de Investigaciones Científicas (Spain)

[Show Abstract](#)

## Session 2: Laser Direct Writing

Date: Monday 25 January

Time: 10:40 AM - 11:50 AM

Session Chair: Bo Gu, IPG Photonics Corp.

### Direct laser writing of photoresponsive colloids for microscale patterning of 3D porous structures (Invited Paper)

Paper 7584-5

Author(s): Paul V. Braun, Univ. of Illinois at Urbana-Champaign (United States)

[Show Abstract](#)

**Burst-train filamentation assisted laser machining of high aspect ratio holes in glass**

Paper 7584-6

Author(s): Saeid Rezaei, Univ. of Toronto (Canada); Dagmar Esser, RWTH Aachen (Germany); Jianzhao Li, Peter R. Herman, Univ. of Toronto (Canada)

[Show Abstract](#)

**Flexible 3D deep microstructure fabrication in silica glasses by laser-induced backside wet etching**

Paper 7584-7

Author(s): Tadataka Sato, Ryoza Kurosaki, Aiko Narazaki, Yoshizo Kawaguchi, Hiroyuki Niino, National Institute of Advanced Industrial Science and Technology (Japan)

[Show Abstract](#)

**Lunch Break** 11:50 AM - 1:30 PM

**Session 3: The LAMOM 15th Year Anniversary Session I**

Date: **Monday 25 January**

Time: **1:30 PM - 3:00 PM**

Session Chair: **Jan J. Dubowski**, Univ. de Sherbrooke (Canada)

**Pulsed laser deposition: 15 years later** (*Invited Paper*)

Paper 7584-8

Author(s): Richard F. Haglund, Jr., Vanderbilt Univ. (United States)

[Show Abstract](#)

**Laser manufacturing of durable goods: a 15-year perspective** (*Invited Paper*)

Paper 7584-9

Author(s): Jyotirmoy Mazumder, Univ. of Michigan (United States)

No abstract available

**Session 4: The LAMOM 15th Year Anniversary Session II**

Date: **Monday 25 January**

Time: **3:30 PM - 5:45 PM**

Session Chair: **Richard F. Haglund, Jr.**, Vanderbilt Univ.

**Pulsed laser deposition in device research and manufacturing** (*Invited Paper*)

Paper 7584-10

Author(s): Douglas B. Chrisey, Rensselaer Polytechnic Institute (United States)

[Show Abstract](#)

**Excimer ultraviolet sources for thin film deposition: a 15 year perspective** (*Invited Paper*)

Paper 7584-11

Author(s): Ian W. Boyd, Univ. College London (United Kingdom)

No abstract available

**Low-fluence laser interaction with materials: research and applications shaped by tools advancement** (*Invited Paper*)

Paper 7584-12

Author(s): Henry Helvajian, The Aerospace Corp. (United States)

No abstract available

**Tuesday 26 January**

**Session 5: Ultrashort Pulse Micromachining: Joint Session with Conference 7589**

Date: **Tuesday 26 January**

Time: **8:00 AM - 10:10 AM**

Session Chair: **Michel Meunier**, Ecole Polytechnique de Montréal (Canada)

**Holographic femtosecond laser processing** (*Invited Paper*)

Paper 7584-13

Author(s): Yoshio Hayasaki, Utsunomiya Univ. (Japan)

[Show Abstract](#)

**Industrial production with ultrafast laser workstations**

Paper 7589-35

Author(s): Eric Audouard, Univ. Jean Monnet Saint-Etienne (France); Hervé Soder, Impulsion SAS (France)

[Show Abstract](#)

**Micromachining of metal and silicon using high average power ultrafast fiber lasers**

Paper 7589-36

Author(s): Eric P. Mottay, Yoann Zaouter, Amplitude Systemes (France); Charlie Loumena, Marc Faucon, John Lopez, ALPhANOV (France)

No abstract available

**Ultrafast laser-based tools enable advanced silicon solar cell efficiency enhancement processes**

Paper 7589-37

Author(s): Finlay Colville, Coherent, Inc. (United States)

[Show Abstract](#)

**Picosecond laser patterning of NiCr thin film strain gauges**

Paper 7589-38

Author(s): Oliver Suttman, Jan Duesing, Ulrich Klug, Rainer Kling, Laser Zentrum Hannover e.V. (Germany)

[Show Abstract](#)

**High repetition rate femtosecond laser processing of metals**

Paper 7589-39

Author(s): Joerg Schille, Udo Loeschner, Robby Ebert, Univ. of Applied Sciences Mittweida (Germany); Patricia Scully, Nicholas Goddard, Univ. of Manchester (United Kingdom); Horst Exner, Univ. of Applied Sciences Mittweida (Germany)

[Show Abstract](#)

**Session 6: Femtosecond Laser Nanoprocessing: Joint Session with Conference 7589**

Date: **Tuesday 26 January**

Time: **10:40 AM - 12:10 PM**

Session Chair: **Guido Hennig**, MDC Max Daetwyler AG (Switzerland)

**Brighter light sources from the black metal** *(Invited Paper)*

Paper 7589-40

Author(s): Anatolij Y. Vorobyev, Chunlei Guo, Univ. of Rochester (United States)

No abstract available

**Gold nanorods enhanced femtosecond laser nanoablation of silicon**

Paper 7584-14

Author(s): Michel Meunier, Philippe Desjeans-Gauthier, Etienne Boulais, Ecole Polytechnique de Montréal (Canada)

[Show Abstract](#)

**Efficient femtosecond laser nanohole processing on substrate surface using high dielectric constant particles with small size parameter**

Paper 7584-15

Author(s): Yuto Tanaka, Go Obara, Akira Zenidaka, Minoru Obara, Keio Univ. (Japan)

[Show Abstract](#)

**Effect of target structure on interfering femtosecond laser processing**

Paper 7584-16

Author(s): Yoshiki Nakata, Takuya Hiromoto, Noriaki Miyanaga, Osaka Univ. (Japan)

[Show Abstract](#)

**Lunch/Exhibition Break 12:10 PM - 1:40 PM**

**Session 7: Nonlinear Processing: Joint Session with Conference 7589**

Date: **Tuesday 26 January**

Time: **1:40 PM - 3:20 PM**

Session Chair: **Wataru Watanabe**, National Institute of Advanced Industrial Science and Technology (Japan)

**Femtosecond laser processing of hybrid micro- and nano-structures in silicate glasses**

Paper 7584-17

Author(s): Pavel Mardilovich, Jonathan J. Witcher, Luke B. Fletcher, Subhash H. Risbud, Denise M. Krol, Univ. of California, Davis (United States)

[Show Abstract](#)

**Structure modification of glass-ceramics thin films and layers by ultrashort laser action**

Paper 7584-18

Author(s): Vadim P. Veiko, St. Petersburg State Univ. of Information Technologies, Mechanics and Optics (Russian Federation)

No abstract available

**Two-photon lithography and nanoprocessing with picojoule extreme ultrashort 12 femtosecond laser pulses**

Paper 7584-19

Author(s): Karsten König, Michael Schug, Huijing Zhang, Sumarie Saremi, Dara Feili, Helmut Seidel, Univ. des Saarlandes (Germany)

[Show Abstract](#)**Individually controlled multi-focus laser processing for two-photon polymerization**

Paper 7584-20

Author(s): Kotaro Obata, Jürgen Koch, Boris N. Chichkov, Laser Zentrum Hannover e.V. (Germany)

[Show Abstract](#)**Up-conversion of crystal oscillator frequency in silicon package by near infrared, ultra-short laser**

Paper 7584-21

Author(s): Yoshiro Ito, Rie Tanabe, Fumiya Sato, Yuuki Shinohe, Nagaoka Univ. of Technology (Japan); Kozo Tada, Citizen Finetech Miyota Co., Ltd. (Japan)

[Show Abstract](#)**Session 8: Three-Dimensional Direct Writing: Joint Session with Conference 7589**Date: **Tuesday 26 January**Time: **3:50 PM - 5:40 PM**Session Chair: **Stefan Nolte**, Friedrich-Schiller-Univ. Jena (Germany)**A frontier in optical data storage: five-dimensional optical data storage (Invited Paper)**

Paper 7589-41

Author(s): Min Gu, Swinburne Univ. of Technology (Australia)

[Show Abstract](#)**The influence of glass structure on femtosecond laser waveguide writing in erbium-doped phosphate glass**

Paper 7589-42

Author(s): Luke B. Fletcher, Jonathan J. Witcher, Denise M. Krol, Univ. of California, Davis (United States); Richard K. Brow, Missouri Univ. of Science and Technology (United States)

[Show Abstract](#)**Femtosecond laser fabrication of birefringent directional couplers in fused silica**

Paper 7584-22

Author(s): Luis A. Fernandes, Univ. of Toronto (Canada) and INESC Porto (Portugal); Jason R. Grenier, Peter R. Herman, J. S. Aitchison, Univ. of Toronto (Canada); Paulo V. S. Marques, INESC Porto (Portugal)

[Show Abstract](#)**Birefringent elements based on femtosecond laser-induced nanogratings**

Paper 7589-43

Author(s): Lourdes Ramirez, Matthias Heinrich, Sören Richter, Felix Dreisow, Robert Keil, Friedrich-Schiller-Univ. Jena (Germany); Alexander V. Korovin, Friedrich-Alexander-Univ. Erlangen-Nürnberg (Germany); Ulf Peschel, Stefan Nolte, Andreas Tünnermann, Friedrich-Schiller-Univ. Jena (Germany)

[Show Abstract](#)**Femtosecond laser written embedded diffractive optical elements and their applications**

Paper 7589-44

Author(s): Jiyeon Choi, Mark Ramme, Troy P. Anderson, Martin C. Richardson, CREOL, The College of Optics and Photonics, Univ. of Central Florida (United States)

[Show Abstract](#)**Posters-Tuesday**Date: **Tuesday 26 January**Time: **6:00 PM - 7:30 PM**

Conference attendees are invited to attend the LASE poster session on Tuesday evening. Come view the posters, enjoy light refreshments, ask questions, and network with colleagues in your field. Authors of poster papers will be present to answer questions concerning their papers. Attendees are required to wear their conference registration badges to the poster sessions. Poster authors, view poster presentation guidelines at <http://spie.org/x27476.xml>.

**An experimental identification of the relationship between laser scattering image and micro-surface roughness for solar cell wafer**

Paper 7584-36

Author(s): Yeon-Ki Hong, Gyung-Bum Kim, Young-Jun Jin, Chungju National Univ. (Korea, Republic of)

[Show Abstract](#)**Modeling of laser drilled microhole profiles in carbon fiber composites in low fluence regime**

Paper 7584-37

Author(s): Frank F. Wu, MetroLaser, Inc. (United States)

[Show Abstract](#)

**Comparison of the modeling and experimental data of the laser drilled microhole profiles in carbon fiber composites in low fluence regime**

Paper 7584-38

Author(s): Frank F. Wu, MetroLaser, Inc. (United States)

[Show Abstract](#)

**Second harmonic optimization of a hologram**

Paper 7584-39

Author(s): Satoshi Hasegawa, Yoshio Hayasaki, Utsunomiya Univ. (Japan)

[Show Abstract](#)

**Near-IR femtosecond and VUV nanosecond laser processing of TeO<sub>2</sub> crystals in air**

Paper 7584-40

Author(s): Szabolcs Beke, Koji Sugioka, RIKEN (Japan); Joern Bonse, Federal Institute for Materials Research and Testing (Germany); Katsumi Midorikawa, RIKEN (Japan)

[Show Abstract](#)

**Design of micron-scale universal optical logic gates**

Paper 7584-41

Author(s): Akbar Rahmani Nejad, Islamic Azad Univ. (Iran, Islamic Republic of) and Iran Airports Co. (Iran, Islamic Republic of)

[Show Abstract](#)

**MOPA fiber laser with controlled pulse length and peak power for optimizing micromachining applications**

Paper 7584-42

Author(s): Sami T. Hendow, Multiwave Photonics (United States); João M. Sousa, Multiwave Photonics, S.A. (Portugal)

[Show Abstract](#)

**Ronchi test with equivalent wavelength**

Paper 7584-43

Author(s): Anmi Garcia Arellano, Fermin-Solomon Granados-Agustin, Instituto Nacional de Astrofisica, Óptica y Electrónica (Mexico)

[Show Abstract](#)

**Applicability of drilling with laser to deal with shally formations in Iranian oilfields: a case study**

Paper 7584-44

Author(s): Saeed Ghadami, Mohammad Nabaei, Abbas Roohi, Ali Moazeni, Islamic Azad Univ. (Iran, Islamic Republic of)

[Show Abstract](#)

**Wednesday 27 January**

**Session 9: Biological and Biomimetic Applications**

Date: **Wednesday 27 January**

Time: **8:40 AM - 10:00 AM**

*Session Chair:* **Hiroyuki Niino**, National Institute of Advanced Industrial Science and Technology (Japan)

**Optical protein patterning and microfabrication for cellular biology research** (*Invited Paper*)

Paper 7584-23

Author(s): Santiago Costantino, Univ. de Montréal (Canada)

[Show Abstract](#)

**Optical far- and near-field femtosecond laser micro/nanostructuring and applications** (*Invited Paper*)

Paper 7584-24

Author(s): Vassilia Zorba, Lawrence Berkeley National Lab. (United States)

[Show Abstract](#)

**Nano-aquarium fabrication with cut-off filters for mechanism study of Phormidium assemblage**

Paper 7584-25

Author(s): Yasutaka Hanada, Koji Sugioka, Ikuko Ishikawa, Hiroyuki Kawano, Atsushi Miyawaki M.D., Katsumi Midorikawa, RIKEN (Japan)

[Show Abstract](#)

**LASE Best Student Paper Prize**

Date: **Wednesday 27 January**  
Time: **10:20 AM - 10:30 AM**

Students! Are you a primary author in the LASE conference? SPIE will present awards to the best 3 student papers on the science and application of lasers at the LASE plenary.

Cash awards of \$1500, \$1000, and \$500 are available.

Respond to the student author email survey or contact Jen Murphy [jenm@spie.org] by 2 November to participate.

## LASE Plenary Session

Date: **Wednesday 27 January**  
Time: **10:30 AM - 12:30 PM**

### Attosecond-Angstrom Science *(Plenary)*

Paper 7589-101

Author(s): Paul B. Corkum, Univ. of Ottawa (Canada) and Lab. for Attosecond Science, National Research Council Canada (Canada)

[Show Abstract](#)

### Ultrafast Fiber Laser Technology: Status and Prospects *(Plenary)*

Paper 7579-102

Author(s): Andreas Tünnermann, Friedrich-Schiller-Univ. Jena (Germany) and Fraunhofer Institute for Applied Optics and Precision Engineering (Germany)

[Show Abstract](#)

### Challenges and Prospects of Ultrafast Lasers in Ophthalmology *(Plenary)*

Paper 7589-103

Author(s): Holger Lubatschowski, Laser Zentrum Hannover e.V. (Germany)

[Show Abstract](#)

**Lunch/Exhibition Break 12:30 PM - 2:00 PM**

## Session 10: Laser Texturing and Machining I

Date: **Wednesday 27 January**  
Time: **2:00 PM - 3:30 PM**

*Session Chair:* **Koji Sugioka**, RIKEN (Japan)

### Processing of metals and dielectric materials with ps-laserpulses: Results, strategies, limitations and needs *(Invited Paper)*

Paper 7584-26

Author(s): Beat Neuenschwander, Guido F. Bucher, Christian Nussbaum, Benjamin Joss, Martin Muralt, Urs W. Hunziker, Peter Schuetz, Berner Fachhochschule (Switzerland)

[Show Abstract](#)

### Laser texturing of doped borosilicate glasses

Paper 7584-27

Author(s): Alexander M. Streltsov, James E. Dickinson, Jr., Richard R. Grzybowski, Daniel Harvey, Stephan L. Logunov, Alper Ozturk, Marcel Potuzak, James S. Sutherland, Corning Inc. (United States)

[Show Abstract](#)

### Lasers in the manufacturing of LEDs from JPSA

Paper 7584-28

Author(s): Marco Mendes, Jeffrey P. Sercel, Jie Fu, Xiangyang Song, Christian Porneala, Joshua Stearns, JPSA (United States)

No abstract available

### Recent advancements in technology of compact laser plasma EUV sources

Paper 7584-29

Author(s): Henryk Fiedorowicz, Andrzej S. Bartnik, Military Univ. of Technology (Poland); Torsten Feigl, Fraunhofer-Institut für Angewandte Optik und Feinmechanik (Germany); Roman Jarocki, Jerzy Kostecki, Military Univ. of Technology (Poland); Ladislav Pina, Czech Technical Univ. in Prague (Czech Republic); Miroslaw Szczurek, Przemyslaw W. Wachulak, Military Univ. of Technology (Poland)

[Show Abstract](#)

## Session 11: Laser Texturing and Machining II

Date: **Wednesday 27 January**  
Time: **4:00 PM - 5:40 PM**

*Session Chair:* **Beat Neuenschwander**, Berner Fachhochschule (Switzerland)

### Femtosecond laser direct writing of volume Fresnel zone plates

Paper 7584-30

Author(s): Pornsak Srisungsitthisunti, Okan K. Ersoy, Xianfan Xu, Purdue Univ. (United States)

[Show Abstract](#)

**High-quality percussion drilling of silicon with a CW fiber laser**

Paper 7584-31  
 Author(s): Joe X. Z. Yu, Paul J. L. Webster, James M. Fraser, Queen's Univ. (Canada)

[Show Abstract](#)

**MOPA based Yb fibre laser: a new low cost tool for micromachining**

Paper 7584-32  
 Author(s): Kun Li, William O'Neill, Univ. of Cambridge (United Kingdom)

[Show Abstract](#)

**Laser micromachining of metallic glasses: investigation of the material response to machining with micro-second and pico-second lasers**

Paper 7584-33  
 Author(s): Iban Quintana, Tekniker (Spain); Todor Dobrev, Cardiff Univ. (United Kingdom); Ana Aranzabe, Tekniker (Spain)

[Show Abstract](#)

**355nm DPSS UV laser micro-processing for semiconductor and electronics industry**

Paper 7584-34  
 Author(s): Fei Zhang, Jun Duan, Xiaoyan Zeng, Xiangyou Li, Wuhan National Lab. for Optoelectronics (China)

[Show Abstract](#)

**Thursday 28 January**

**Session 12: Photovoltaics: Joint Session with Conference 7585**

Date: **Thursday 28 January**  
 Time: **1:50 PM - 5:00 PM**

Session Chair: **Wilhelm Pfleging**, Karlsruhe Institute of Technology (Germany)

**Structuring of thin film solar cells (Invited Paper)**

Paper 7585-24  
 Author(s): Gabriele Eberhardt, Uwe Wagner, JENOPTIK Automatisierungstechnik GmbH (Germany); Thomas Peschel, Fraunhofer-Institut für Angewandte Optik und Feinmechanik (Germany)

[Show Abstract](#)

**'Green processing' of thin film with top-hat lasers and applications in photovoltaic**

Paper 7585-25  
 Author(s): Keming Du, EdgeWave GmbH (Germany)

[Show Abstract](#)

**Productivity and flexibility, the key factors for laser processing in photovoltaic manufacturing**

Paper 7585-26  
 Author(s): Michael Moody, InnoLas, Inc. (United States)

[Show Abstract](#)

**Microstructuring and wafering of silicon with laser chemical processing (Invited Paper)**

Paper 7585-27  
 Author(s): Sybille Hopman, Andreas Fell, Kuno Mayer, Filip Granek, Fraunhofer-Institut für Solare Energiesysteme (Germany)

[Show Abstract](#)

**Advanced laser techniques from semiconductor manufacturing transition to solar PV production**

Paper 7585-28  
 Author(s): Marco Mendes, Rick Slagle, Jie Fu, Xiangyang Song, Christian Porneala, Mathew Hannon, Jeffrey P. Sercel, JPSA (United States)

[Show Abstract](#)

**Investigation on production of highly textured Sb doped polycrystalline silicon using solid state Nd:YAG laser for photovoltaic application**

Paper 7584-35  
 Author(s): Palani A. Iyemperumal, Indian Institute of Technology Madras (India); Nilesh J. Vasa, Indian Institute of Technology Madras (India) and Kyushu Univ. (Japan); Singaperumal Makaram, Indian Institute of Technology Madras (India); Okada Tatsuo, Kyushu Univ. (Japan)

[Show Abstract](#)

**Monolithic interconnection of CIGS solar cells by picosecond laser structuring**

Paper 7585-32  
 Author(s): Heinz P. Huber, Christian Hellwig, Gerhard Heise, Thomas Kuznicki, Sebastian Sarrach, Christian Menhard, Hochschule München (Germany); Andreas Heiss, Helmut Vogt, Joerg Palm, Franz Karg, AVANCIS GmbH & Co KG (Germany)

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