

PROCEEDINGS OF SPIE

Smart Nano-Micro Materials and Devices

Saulius Juodkazis

Min Gu

Editors

5–7 December 2011

Hawthorn, Australia

Sponsored by

Swinburne University of Technology (Australia)

Published by

SPIE

Volume 8204

Proceedings of SPIE, 0277-786X, v. 8204

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

The papers included in this volume were part of the technical conference cited on the cover and title page. Papers were selected and subject to review by the editors and conference program committee. Some conference presentations may not be available for publication. The papers published in these proceedings reflect the work and thoughts of the authors and are published herein as submitted. The publisher is not responsible for the validity of the information or for any outcomes resulting from reliance thereon.

Please use the following format to cite material from this book:

Author(s), "Title of Paper," in *Smart Nano-Micro Materials and Devices*, edited by Saulius Juodkazis, Min Gu, Proceedings of SPIE Vol. 8204 (SPIE, Bellingham, WA, 2011) Article CID Number.

ISSN 0277-786X
ISBN 9780819488459

Published by

SPIE

P.O. Box 10, Bellingham, Washington 98227-0010 USA
Telephone +1 360 676 3290 (Pacific Time) · Fax +1 360 647 1445
SPIE.org

Copyright © 2011, Society of Photo-Optical Instrumentation Engineers

Copying of material in this book for internal or personal use, or for the internal or personal use of specific clients, beyond the fair use provisions granted by the U.S. Copyright Law is authorized by SPIE subject to payment of copying fees. The Transactional Reporting Service base fee for this volume is \$18.00 per article (or portion thereof), which should be paid directly to the Copyright Clearance Center (CCC), 222 Rosewood Drive, Danvers, MA 01923. Payment may also be made electronically through CCC Online at copyright.com. Other copying for republication, resale, advertising or promotion, or any form of systematic or multiple reproduction of any material in this book is prohibited except with permission in writing from the publisher. The CCC fee code is 0277-786X/11/\$18.00.

Printed in the United States of America.

Publication of record for individual papers is online in the SPIE Digital Library.

The logo for SPIE Digital Library features the word "SPIE" in a bold, sans-serif font above the words "Digital Library" in a smaller, sans-serif font. To the right of the text is a stylized graphic consisting of three vertical bars of increasing height, resembling a bar chart or a signal waveform.

SPIDigitalLibrary.org

Paper Numbering: Proceedings of SPIE follow an e-First publication model, with papers published first online and then in print and on CD-ROM. Papers are published as they are submitted and meet publication criteria. A unique, consistent, permanent citation identifier (CID) number is assigned to each article at the time of the first publication. Utilization of CIDs allows articles to be fully citable as soon as they are published online, and connects the same identifier to all online, print, and electronic versions of the publication. SPIE uses a six-digit CID article numbering system in which:

- The first four digits correspond to the SPIE volume number.
- The last two digits indicate publication order within the volume using a Base 36 numbering system employing both numerals and letters. These two-number sets start with 00, 01, 02, 03, 04, 05, 06, 07, 08, 09, 0A, 0B ... 0Z, followed by 10-1Z, 20-2Z, etc.

The CID number appears on each page of the manuscript. The complete citation is used on the first page, and an abbreviated version on subsequent pages. Numbers in the index correspond to the last two digits of the six-digit CID number.

Contents

xiii	<i>Conference Committee</i>
xvii	<i>Introduction</i>

MODERN CHALLENGES: SOLAR, BIO- AND NANO-PHOTONICS

- 8204 03 **Auto-luminescent genetically encoded ratiometric indicator for real-time Ca²⁺ imaging at the single cell level (Invited Paper)** [8204-01]
K. Saito, K. Kobayashi, Hokkaido Univ. (Japan); T. Nagai, Hokkaido Univ. (Japan) and Japan Science and Technology Agency (Japan)
- 8204 04 **Characterization and applications of plasmon fields in metal nanostructures (Invited Paper)** [8204-02]
A. Kolloch, D. Benner, M. Bädicker, R. Waitz, T. Geldhauser, J. Boneberg, P. Leiderer, E. Scheer, Univ. Konstanz (Germany)
- 8204 05 **Imprint process for optical device with periodic structure (Invited Paper)** [8204-03]
J. Nishii, Hokkaido Univ. (Japan)

LASER FABRICATION I

- 8204 07 **Applications of nonlinear laser nano/microlithography: fabrication from nanophotonic to biomedical components (Invited Paper)** [8204-05]
M. Malinauskas, P. Danilevičius, E. Balčiūnas, S. Rekštytė, Vilnius Univ. (Lithuania); E. Stankevičius, Ctr. for Physical Sciences and Technology (Lithuania); D. Baltrikienė, V. Bukelskienė, Vilnius Univ. (Lithuania); G. Račiukaitis, Ctr. for Physical Sciences and Technology (Lithuania); R. Gadonas, Vilnius Univ. (Lithuania)

LASER FABRICATION II

- 8204 0B **Holographic femtosecond laser processing system with an adaptive control (Invited Paper)** [8204-09]
Y. Hayasaki, S. Hasegawa, Utsunomiya Univ. (Japan)
- 8204 0D **Micro-channel drilling of Ni and Pt films on silicon by using laser beam interference ablation for solid oxide fuel cells** [8204-11]
M. Gedvilas, B. Voisiat, S. Indrišiūnas, M. Maciulevičius, Ctr. for Physical Sciences and Technology (Lithuania); S. Tamulevičius, B. Abakevičienė, V. Grigaliūnas, Kaunas Univ. of Technology (Lithuania); G. Račiukaitis, Ctr. for Physical Sciences and Technology (Lithuania)

MICROFLUIDICS I

- 8204 0G **Dielectrophoresis of micro/nano particles using curved microelectrodes** [8204-15]
K. Khoshmanesh, Deakin Univ. (Australia); F. J. Tovar-Lopez, RMIT Univ. (Australia); S. Baratchi, Monash Univ. (Australia); C. Zhang, Univ. of South Australia (Australia); A. A. Kayani, A. F. Chrimes, RMIT Univ. (Australia); S. Nahavandi, Deakin Univ. (Australia); D. Wlodkowic, Univ. of Auckland (New Zealand); A. Mitchell, K. Kalantar-zadeh, RMIT Univ. (Australia)
- 8204 0H **Influence of flow rate on the droplet generation process in a microfluidic chip** [8204-16]
F. Lapiere, N. Wu, Y. Zhu, Commonwealth Scientific and Industrial Research Organisation (Australia)

MICROFLUIDICS II

- 8204 0I **ADMiER-ing thin but complex fluids** [8204-17]
A. G. McDonnell, P. K. Bhattacharjee, S. Pan, D. Hill, M. K. Danquah, J. R. Friend, L. Y. Yeo, R. Prabhakar, Monash Univ. (Australia)
- 8204 0J **Surface modification of poly(dimethylsiloxane) (PDMS) microchannels with DNA capture-probes for potential use in microfluidic DNA analysis systems** [8204-18]
D. A. Khodakov, L. D. Thredgold, C. E. Lenehan, G. A. Andersson, H. Kobus, A. V. Ellis, Flinders Univ. (Australia)
- 8204 0M **Capillary flow in microfluidic Hele-Shaw cells** [8204-21]
K. Petkovic-Duran, Y. Zhu, Commonwealth Scientific and Industrial Research Organisation (Australia)

SENSING

- 8204 0P **Programmable logic controller optical fibre sensor interface module** [8204-24]
G. Allwood, G. Wild, S. Hinckley, Edith Cowan Univ. (Australia)
- 8204 0Q **Numerical modelling of interrogation systems for optical fibre Bragg grating sensors** [8204-25]
D. Oswald, S. Richardson, G. Wild, Edith Cowan Univ. (Australia)

PLASMONICS I

- 8204 0T **Vertical plasmonic nanowires for 3D nanoparticle trapping** [8204-28]
J. Wu, X. Gan, Swinburne Univ. of Technology (Australia)
- 8204 0U **Enhancement of stimulated Raman scattering in Nd³⁺-doped terrace-microspheres** [8204-29]
H. Uehara, T. Kishi, T. Yano, S. Shibata, Tokyo Institute of Technology (Japan)

SOLAR CELLS I

- 8204 0W **Organic solar cells: evaluation of the stability of P3HT using time-delayed degradation** [8204-31]
C.-H. Poh, Univ. of Newcastle (Australia); C.-K. Poh, Univ. of Wollongong (Australia);
G. Bryant, W. Belcher, P. Dastoor, Univ. of Newcastle (Australia)

SOLAR CELLS II

- 8204 10 **A comparison of silicon and germanium photovoltaic power converters for power-over fibre** [8204-36]
G. Allwood, G. Wild, S. Hinckley, Edith Cowan Univ. (Australia)
- 8204 12 **A comparison between Si and GaAs nanowire-based photovoltaic devices** [8204-142]
S. Abdellatif, The British Univ. in Egypt (Egypt); K. Kirah, The French Univ. of Egypt (Egypt);
H. Ghali, The British Univ. in Egypt (Egypt); W. Anis, Ain Shams Univ. (Egypt)

MODERN CHALLENGES: MATERIALS FOR PHOTONICS

- 8204 14 **Functional optical devices using highly ordered hole array architectures of anodic porous alumina (Invited Paper)** [8204-38]
H. Masuda, Tokyo Metropolitan Univ. (Japan) and Kanagawa Academy of Science and Technology (Japan); T. Kondo, Kanagawa Academy of Science and Technology (Japan);
K. Nishio, Tokyo Metropolitan Univ. (Japan)
- 8204 15 **Discovering new properties and applications of ultrafast laser nanostructuring in transparent materials (Invited Paper)** [8204-39]
M. Beresna, M. Gecevičius, P. G. Kazansky, Univ. of Southampton (United Kingdom)
- 8204 16 **Singular photonics based on liquid crystals topological defects (Invited Paper)** [8204-40]
E. Brasselet, C. Loussert, Lab. Ondes et Matière d'Aquitaine, CNRS, Univ. Bordeaux 1 (France)
- 8204 17 **Tailoring of photonic structures by femtosecond laser lithography (Invited Paper)** [8204-41]
V. Mizeikis, Shizuoka Univ. (Japan); V. Purlys, D. Paipulas, Vilnius Univ. (Lithuania); L. Maigyte, K. Staliunas, Univ. Politecnica de Catalunya (Spain)

LASER FABRICATION IV

- 8204 1D **Non-contact quantification of laser micro-impulse in water by atomic force microscopy and its application for biomechanics (Invited Paper)** [8204-47]
Y. Hosokawa, Nara Institute of Science and Technology (Japan)

MICROFLUIDICS III

- 8204 1G **Microfluidic device for high-yield pairing and fusion of stem cells with somatic cells** [8204-50]
M. Gel, Commonwealth Scientific and Industrial Research Organisation (Australia); K. Hirano, Kyoto Univ. (Japan); H. Oana, Univ. of Tokyo (Japan); H. Kotera, T. Tada, Kyoto Univ. (Japan); M. Washizu, Univ. of Tokyo (Japan)
- 8204 1H **Microfluidic chip containing porous gradient for chemotaxis study** [8204-51]
A. Al-Abboodi, R. Tjeung, P. Doran, L. Yeo, J. Friend, P. Chan, Monash Univ. (Australia)

MICROFLUIDICS IV

- 8204 1J **On-chip surface acoustic-wave driven microfluidic motors** [8204-53]
R. J. Shilton, N. Glass, S. Langelier, P. Chan, L. Y. Yeo, J. R. Friend, Monash Univ. (Australia) and The Melbourne Ctr. for Nanofabrication (Australia)
- 8204 1L **Identification of chemical warfare agents using a portable microchip-based detection device** [8204-56]
K. Petkovic-Duran, A. Swallow, B. A. Sexton, F. Glenn, Y. Zhu, Commonwealth Scientific and Industrial Research Organisation (Australia)

PLASMONICS II

- 8204 1N **Tailoring plasmonic nanoparticles and fractal patterns** [8204-59]
L. Rosa, Swinburne Univ. of Technology (Australia); S. Juodkazis, Swinburne Univ. of Technology (Australia) and Melbourne Ctr. for Nanofabrication (Australia)
- 8204 1O **Sputtering-growth of seeded Au nanoparticles for nanogap-assisted surface-enhanced Raman scattering (SERS) biosensing** [8204-60]
C. Y. Fu, National Univ. of Ireland, Galway (Ireland) and Singapore Bioimaging Consortium (Singapore); D. U.S., S. Rautela, D. W. Goh, Singapore Bioimaging Consortium (Singapore); M. Olivo, National Univ. of Ireland, Galway (Ireland) and Singapore Bioimaging Consortium (Singapore) and Royal College of Surgeons Ireland (Ireland) and National Univ. of Singapore (Singapore)

PLASMONICS III

- 8204 1R **Plasmonic nanofocusing by axicon-shape Kretschmann configuration (Invited Paper)** [8204-62]
A. Ono, Shizuoka Univ. (Japan) and Japan Science and Technology Agency (Japan); H. Sano, Shizuoka Univ. (Japan); W. Inami, Shizuoka Univ. (Japan) and Japan Science and Technology Agency (Japan); K. Kato, Shizuoka Univ. (Japan); Y. Kawata, Japan Science and Technology Agency (Japan) and Shizuoka Univ. (Japan)
- 8204 1U **Generation of surface plasmon vortex power flows** [8204-65]
S. Oh, Seoul National Univ. (Korea, Republic of); H. Kim, Korea Univ. (Korea, Republic of); J. Park, S.-W. Cho, B. Lee, Seoul National Univ. (Korea, Republic of)

MATERIALS

- 8204 1V **Surface-enhanced Raman scattering in three-dimensional ordered Au nanoparticles in anodic porous alumina matrix** [8204-66]
T. Kondo, Kanagawa Academy of Science and Technology (Japan); K. Nishio, H. Masuda, Kanagawa Academy of Science and Technology (Japan) and Tokyo Metropolitan Univ. (Japan)
- 8204 1X **Lithography of porous materials for devices fabrication** [8204-68]
P. Falcaro, Commonwealth Scientific and Industrial Research Organisation (Australia); P. Innocenzi, Univ. degli Studi di Sassari (Italy); A. J. Hill, C. Doherty, Commonwealth Scientific and Industrial Research Organisation (Australia)
- 8204 1Z **Comprehensive study of ZnO nanostructures grown using chemical bath deposition: from growth to application** [8204-70]
Z. N. Urgessa, D. M. Murape, Nelson Mandela Metropolitan Univ. (South Africa); O. S. Oluwafemi, Walter Sisulu Univ. (South Africa); A. Venter, M. Wagner, J. R. Botha, Nelson Mandela Metropolitan Univ. (South Africa)

ODS AND PHC

- 8204 21 **Comparison of photopolymers for optical data storage applications and relief diffractive optical elements recorded onto photopolymers** [8204-72]
S. Gallego, A. Márquez, M. Ortuño, C. Neipp, A. Beléndez, Univ. de Alicante (Spain) and I.U. Física Aplicada A Las Ciencias Y Las Tecnologías (Spain); I. Pascual, I.U. Física Aplicada A Las Ciencias Y Las Tecnologías (Spain) and Univ. de Alicante (Spain)
- 8204 23 **A novel photonic crystal waveguide-based symmetric-Mach-Zehnder-type ultrafast all-optical switch using quantum dot semiconductor optical amplifier** [8204-74]
X. Li, T. Wang, W. Yan, H. Zheng, Wuhan National Lab. for Optoelectronics (China) and Huazhong Univ. of Science and Technology (China)

MODERN CHALLENGES: MECHANISMS

- 8204 25 **Dynamic imaging of surface acoustic waves in phononic crystals (Invited Paper)** [8204-75]
O. B. Wright, Hokkaido Univ. (Japan); I. A. Veres, Research Ctr. for Nondestructive Testing (Austria); D. M. Profunser, O. Matsuda, Hokkaido Univ. (Japan); B. Culshaw, Univ. of Strathclyde (United Kingdom); U. Lang, ETH Zürich (Switzerland)
- 8204 27 **Nanoaquarium: integrated microchips fabricated by ultrafast laser for understanding phenomena and functions of microorganisms (Invited Paper)** [8204-77]
K. Sugioka, Y. Hanada, K. Midorikawa, H. Kawano, I. S. Ishikawa, A. Miyawaki, RIKEN (Japan)
- 8204 28 **Laser microprocessing and nanoengineering of large-area functional micro/nanostructures (Invited Paper)** [8204-78]
M. Tang, National Univ. of Singapore (Singapore); X. Z. Xie, Guangdong Univ. of Technology (China); J. Yang, Z. C. Chen, L. Xu, Y. S. Choo, M. H. Hong, National Univ. of Singapore (Singapore)

ELECTRO-ACTIVE MATERIALS

- 8204 29 **First-principles study on novel lead-free piezoelectric materials** [8204-79]
Y. Uetsuji, Osaka Institute of Technology (Japan); K. Tsuchiya, Tokai Univ. (Japan);
E. Nakamachi, Doshisha Univ. (Japan)
- 8204 2A **Design of biocompatible high-piezoelectric BaTiO₃ with additives** [8204-80]
K. Tsuchiya, Y. Akagawa, Tokai Univ. (Japan); Y. Uetsuji, Osaka Institute of Technology
(Japan); E. Nakamachi, Doshisha Univ. (Japan)
- 8204 2B **Electrochemically switchable surfaces using polymer brush-grafted conducting polymer
films** [8204-81]
Y. Pei, The Univ. of Auckland (New Zealand); J. Travas-Sejdic, D. E. Williams, The Univ. of
Auckland (New Zealand) and MacDiarmid Institute for Advanced Materials and
Nanotechnology (New Zealand)

MEMS

- 8204 2D **Active control of lateral leakage in thin-ridge SOI waveguide structures** [8204-83]
N. Dalvand, T. G. Nguyen, RMIT Univ. (Australia); R. S. Tummidi, T. L. Koch, Lehigh Univ. (United
States); A. Mitchell, RMIT Univ. (Australia)
- 8204 2E **Ten ways to destroy a prototype MEMS device** [8204-84]
S. van der Velden, Defence Science and Technology Organisation (Australia) and La Trobe
Univ. (Australia); I. Powlesland, Defence Science and Technology Organisation (Australia);
J. Singh, La Trobe Univ. (Australia)
- 8204 2G **Modeling and simulation of cantilever beam for optimal placement of piezoelectric
actuators for maximum energy harvesting** [8204-87]
A. Khalatkar, V. K. Gupta, R. Haldkar, PDPM IITDM Jabalpur (India)

MICROFLUIDICS V

- 8204 2J **Integration of microplasma and microfluidic technologies for localised microchannel
surface modification** [8204-91]
E. J. Szili, S. A. Al-Bataineh, C. Priest, P. J. Gruner, P. Ruschitzka, Univ. of South Australia
(Australia); J. W. Bradley, Univ. of Liverpool (United Kingdom); J. Ralston, Univ. of South
Australia (Australia); D. A. Steele, R. D. Short, Univ. of South Australia (Australia)

PLASMONICS IV

- 8204 2M **Effect of nanoholes on the plasmonic properties of star nanostructures** [8204-94]
S. Zhu, A. K. Whittaker, I. Blakey, The Univ. of Queensland (Australia)

FUTURE MATERIALS

- 8204 2O **A review on carbon-based materials as on-chip interconnects** [8204-98]
H. Sadeghi, Univ. Teknologi Malaysia (Malaysia); J.-M. Redouté, Monash Univ. (Australia);
D. T. H. Lai, Victoria Univ. (Australia); M. T. Ahmadi, R. Ismail, Univ. Teknologi Malaysia
(Malaysia)
- 8204 2Q **Optical fibre communications and sensing system experiments for undergraduate
photonics laboratories** [8204-100]
G. Wild, G. I. Swan, Edith Cowan Univ. (Australia)

MICROSCOPY I

- 8204 2R **Thermal imaging of micro-structured polymers with high-speed infrared camera** [8204-101]
J. Morikawa, T. Hashimoto, Tokyo Institute of Technology (Japan)
- 8204 2U **Improvement of speckle noise reduction in lensless Fourier-transform digital holography**
[8204-104]
Y. Zhang, D. Wang, Y. Wang, Z. Zhou, J. Zhao, Beijing Univ. of Technology (China)

MICROSCOPY II

- 8204 2V **Magnetic microscopy/metrology potential of metamaterials using nanosized spherical
particle arrays** [8204-105]
K. Eason, B. Luk'yanchuk, Y. Zhou, A*STAR - Data Storage Institute (Singapore);
A. E. Miroshnichenko, Y. S. Kivshar, The Australian National Univ. (Australia)
- 8204 2X **Simulation of crosstalk and quantum efficiency in high-resolution UV-blue imaging arrays**
[8204-107]
P. V. Jansz, S. Hinckley, Edith Cowan Univ. (Australia)

POSTER SESSION

- 8204 2Z **Development of electric power generation system for bio-MEMS device by using a new
bio-compatible piezoelectric material $MgSiO_3$** [8204-85]
H. Kuribayashi, E. Nakamachi, Y. Morita, Doshisha Univ. (Japan)
- 8204 31 **Compact wideband filter element-based on complementary split-ring resonators** [8204-95]
A. K. Horestani, Z. Shaterian, The Univ. of Adelaide (Australia) and Aerospace Research
Institute (Iran, Islamic Republic of); W. Withayachumnankul, The Univ. of Adelaide (Australia)
and King Mongkut's Institute of Technology Ladkrabang (Thailand); C. Fumeaux,
S. Al-Sarawi, D. Abbott, The Univ. of Adelaide (Australia)
- 8204 32 **Performance improvement of high-thickness photopolymers for holographic data storage
applications** [8204-109]
M. Ortuño, S. Gallego, A. Márquez, C. Neipp, I. Pascual, A. Beléndez, Univ. de Alicante
(Spain)

- 8204 33 **Analysis of optical frequency signal transmission through whispering gallery mode** [8204-110]
M. Fukuhara, Y. L. Yu, T. Aihara, K. Nakagawa, Toyohashi Univ. of Technology (Japan);
K. Yamaguchi, Kagawa Univ. (Japan); M. Fukuda, Toyohashi Univ. of Technology (Japan)
- 8204 34 **Evaporative self-assembly of gold nanorings via a surface acoustic wave atomization** [8204-111]
K. C. Ng, A. Qi, L. Y. Yeo, J. Friend, W. Cheng, Monash Univ. (Australia)
- 8204 35 **Reduction of obtainable resistivity in transparent conducting impurity-doped ZnO thin films prepared with a very thin buffer layer by magnetron sputtering** [8204-112]
T. Minami, T. Miyata, T. Hirano, J. Nomoto, Kanazawa Institute of Technology (Japan)
- 8204 36 **PL and EL characteristics in Bi- and rare earth-co-doped $(La_{1-x}Ga_x)_2O_3$ phosphor thin films prepared by magnetron sputtering** [8204-113]
T. Miyata, Y. Nishi, T. Minami, Kanazawa Institute of Technology (Japan)
- 8204 37 **Strain-resistance relationship in gold conductors for elastomeric-based flexible devices** [8204-114]
B. M. Durnin, C. M. Shah, S. Sriram, M. Bhaskaran, RMIT Univ. (Australia)
- 8204 3C **Reflectometric interference biosensing using nanopores: integration into microfluidics** [8204-119]
T. Kumeria, M. Kurkuri, Univ. of South Australia (Australia); K. Diener, Royal Adelaide Hospital (Australia) and Univ. of South Australia (Australia); C. Zhang, L. Parkinson, D. Losic, Univ. of South Australia (Australia)
- 8204 3G **An extended analytical model to simulate an optical coherence tomography systems with a quasi-stationary optical delay line** [8204-124]
P. Jansz, S. Richardson, G. Wild, S. Hinckley, Edith Cowan Univ. (Australia)
- 8204 3H **Chemical and biomolecule patterning on 2D surfaces using atmospheric pressure microcavity plasma array devices** [8204-125]
S. A. Al-Bataineh, E. J. Szili, G. Desmet, P. Ruschitzka, P. J. Gruner, C. Priest, Univ. of South Australia (Australia); N. H. Voelcker, Flinders Univ. (Australia); D. A. Steele, R. D. Short, H. J. Griesser, Univ. of South Australia (Australia)
- 8204 3I **Immobilization of enzyme (DAAO) on hybrid nanoporous MCF, SBA-15, and MCM-41 materials** [8204-126]
T. Q. Phi, H. G. Le, T. A. Vu, T. T. H. Phan, H. T. Pham, C. D. Dao, P. T. Dang, Vietnam Academy of Science and Technology (Vietnam)
- 8204 3K **Design of modern nanofabrication facilities** [8204-128]
S. Beswick, A. Smith, D. Morrish, D. J. Day, S. Juodkakis, M. Gu, Swinburne Univ. of Technology (Australia)
- 8204 3L **Photonic and plasmonic waveguide sensors** [8204-129]
A. P. Hope, T. G. Nguyen, RMIT Univ. (Australia); A. Mitchell, RMIT Univ. (Australia) and ARC Ctr. of Excellence for Ultrahigh-Bandwidth Devices for Optical Systems (Australia)

- 8204 3N **Morphology and optical study of dye-doped TiO₂-SiO₂ thin films** [8204-131]
A. K. Gathania, N. Dhiman, A. Sharma, National Institute of Technology, Hamirpur (India);
B. P. Singh, Indian Institute of Technology Bombay (India)
- 8204 3Q **Fabry-Pérot sensors: microfluidic channels and transparent membranes** [8204-134]
G. Gervinskas, Swinburne Univ. of Technology (Australia); P. Trocha, Univ. Konstanz
(Germany); R. Buividas, D. J. Day, Swinburne Univ. of Technology (Australia); E. Scheer,
P. Leiderer, Univ. Konstanz (Germany); S. Juodkazis, Swinburne Univ. of Technology
(Australia) and Melbourne Ctr. for Nanofabrication (Australia)
- 8204 3S **Sub-nm-scale precision stage using nonresonant-ultrasonic motor for making of nanodevices** [8204-136]
Y. Soh, Kumamoto Univ. (Japan); K. Kosaka, PMT Corp. (Japan); H. Kubota, Kumamoto Univ.
(Japan)
- 8204 3T **Controlling cell-material interactions using coatings with advanced polymer architectures**
[8204-137]
P. Kogler, Commonwealth Scientific and Industrial Research Organisation (Australia) and
Reutlingen Univ. (Germany); P. Pasic, G. Johnson, P. Bean, Commonwealth Scientific and
Industrial Research Organisation (Australia); G. Lorenz, Reutlingen Univ. (Germany);
L. Meagher, H. Thissen, Commonwealth Scientific and Industrial Research Organisation
(Australia)
- 8204 3U **Combination of a nano-coordinate measuring machine with a low-coherent digital holographic microscopy sensor for large-scale measurements** [8204-138]
S. Stuerwald, Fraunhofer-Institut für Produktionstechnologie (Germany); R. Schmitt,
Fraunhofer-Institut für Produktionstechnologie (Germany) and RWTH Aachen Univ.
(Germany)
- 8204 3V **Waveguide optimization via evolutionary algorithms** [8204-139]
Q. Shi, T. G. Nguyen, A. Mitchell, A. Song, RMIT Univ. (Australia)

Author Index

Conference Committee

Symposium Chairs

Saulius Juodkazis, Swinburne University of Technology (Australia)
Min Gu, Swinburne University of Technology (Australia)

Conference Chairs

Saulius Juodkazis, Swinburne University of Technology (Australia)
Min Gu, Swinburne University of Technology (Australia)

Program Committee

Boris Chichkov, Laser Zentrum Hannover e.V. (Germany)
Timothy J. Davis, Commonwealth Scientific and Industrial Research Organisation (Australia)
Benjamin J. Eggleton, The University of Sydney (Australia)
James R. Friend, Monash University (Australia)
Ewa M. Goldys, Macquarie University (Australia)
Minghui Hong, National University of Singapore (Singapore)
Chennupati Jagadish, The Australian National University (Australia)
Yuri S. Kivshar, The Australian National University (Australia)
ByoungHo Lee, Seoul National University (Korea, Republic of)
Roger A. Lewis, University of Wollongong (Australia)
Boris S. Luk'yanchuk, A*STAR - Data Storage Institute (Singapore)
Arnan Mitchell, RMIT University (Australia)
Razvan Stoian, Laboratoire Hubert Curien (France)
Koji Sugioka, RIKEN (Japan)
Xuehua Wang, Sun Yat-Sen University (China)
Michael J. Withford, Macquarie University (Australia)
Yonggang Zhu, Commonwealth Scientific and Industrial Research Organisation (Australia)

Session Chairs

- 1 Plenary Session on Modern Challenges: Solar, Bio- and Nano-Photonics
Min Gu, Swinburne University of Technology (Australia)
- 2 Modern Challenges: Solar, Bio- and Nano-Photonics
Saulius Juodkazis, Swinburne University of Technology (Australia)
- 3 Laser Fabrication I
Vyngantas Mizeikis, Shizuoka University (Japan)

- 4 Laser Fabrication II
Michael Ventura, Swinburne University of Technology (Australia)
- 5 Microfluidics I
Daniel Day, Swinburne University of Technology (Australia)
- 6 Microfluidics II
Yoichiroh Hosokawa, Nara Institute of Science and Technology (Japan)
- 7 Sensing
Lorenzo Rosa, Swinburne University of Technology (Australia)
- 8 Plasmonics I
Paul Leiderer, Universität Konstanz (Germany)
- 9 Solar Cells I
Junji Nishii, Universität Konstanz (Germany)
- 10 Solar Cells II
Jhantu Saha, Swinburne University of Technology (Australia)
- 11 Plenary Session on Modern Challenges: Materials for Photonics
Saulius Juodkazis, Swinburne University of Technology (Australia)
- 12 Modern Challenges: Materials for Photonics
Razvan Stoian Jean Monnet University and the National Research Centre (France)
- 13 Laser Fabrication III
Elisa Nicole, Swinburne University of Technology (Australia)
- 14 Laser Fabrication IV
Andrei Rode, Australian National University (Australia)
- 15 Microfluidics III
Andrew Clayton, Swinburne University of Technology (Australia)
- 16 Microfluidics IV
Etienne Brasselet, Université Bordeaux 1 (France)
- 17 Plasmonics II
James Chon, Swinburne University of Technology (Australia)
- 18 Plasmonics III
Michael Ventura, Swinburne University of Technology (Australia)

- 19 Materials
Koji Hatanaka, The University of Tokyo (Japan)
- 20 ODS and PhC
Yasuyuki Tsuboi, Hokkaido University (Japan)
- 21 Plenary Session on Modern Challenges: Mechanisms
Minghui Hong, National University of Singapore (Singapore)
- 22 Modern Challenges: Mechanisms
James Friend, Royal Melbourne Institute of Technology (Australia)
- 23 Electro-active Materials
Akira Saito, Osaka University (Japan)
- 24 MEMS
Hongchun Bao, Swinburne University of Technology (Australia)
- 25 Microfluidics V
Peter Kingshott, Swinburne University of Technology (Australia)
- 26 Plasmonics IV
Lorenzo Rosa, Swinburne University of Technology (Australia)
- 27 Future Materials
Scott Wade, Swinburne University of Technology (Australia)
- 28 Microscopy I
Xiaosong Gan, Swinburne University of Technology (Australia)
- 29 Microscopy II
Xiangping Li, Swinburne University of Technology (Australia)

Introduction

The SPIE Smart Nano+Micro Materials and Devices, a multidisciplinary forum focused on the use of micro- and nanofabrication technologies for addressing current global problems on energy sustainability and sensing, was held on 4–7 December at Swinburne University of Technology in Melbourne, Australia.

Synergy between basic research and engineering, i.e., between fundamentals of light-matter interaction and basic laws of thermodynamics with practical solutions and design of devices, is essential for paving the most efficient route to the development of practical solutions for our household and industry applications. A rigorous analysis of the efficiency in energy harvesting of different sorts: light-to-electrical, light-to-chemical, light-to-thermal, mechanical-to-electrical, etc., has to be undertaken based on basic laws of physics and guide practical applications.

Availability, abundance, and cost of materials for future solar energy harvesting are becoming key factors for choosing the right path for practical devices. This is dictated by the scaling laws and large surface area requirements for the energy harvesting solutions by solar cells. A multidisciplinary discussion and collaboration considering the most advanced current fabrication technologies is required due to increasingly complex and usually three-dimensional (3D) designs of promising light harvesting solutions.

Three inspiring plenary talks:

- Nanomaterials in Photovoltaics, by Martin A. Green (University of New South Wales, Australia)
- Photonics Band-Gap Materials: Light Trapping Crystals, by Sajeev John (University of Toronto, Canada)
- Nanophotonics: Thermal and Solar Applications, by Shanhui Fan (Stanford University, United States)

presented practical challenges we are facing and should overcome for realization of the most efficient light and thermal energy harvesting. It is not surprising that some of the light trapping solutions remind us of patterns found in nature. The difference from a bio-mimetic approach is, however, that those designs are driven by the fundamental understanding of science underpinnings of the most efficient light trapping.

Very strong presence of microfluidics on the fundamental science level as well as at the level of practical applications and devices was appreciated by conference participants. Wide field of opto-/acousto-mechanics, bio-reactors, cell particle sorting, etc. applications was covered by presentations. Novel

principles in sensing and control of nano- and micro-materials will be guided by the discussed methods.

Laser-based fabrication methods of complex 3D structures by direct write approach with ultra-short laser pulses had a strong presence at the conference. Demonstrations of new materials, principles of their design, processing and fabrication of micro-/nano-optical elements to control light at micro and nano-scales were highlights of the conference. Use and incorporation of plasmonic nano-particles in optical memory and waveguiding applications are very promising in sensing.

Nearly 150 papers on new research in these topics were presented in the three-day event. All morning sessions were plenary and invited talks in a single stream covering a wide spectrum of the most recent developments in related fields from basics to applications. This strategy was well accepted by conference participants. The afternoon sessions were more specialized and were carried out in four parallel streams. The conference was hosted by Swinburne University: home of strong biophotonics and nanophotonics research centered at the Centre for Micro-Photonics.

We acknowledge support of the conference by SPIE, Faculty of Engineering and Industrial Sciences, Swinburne University, colleagues and students of our Centre for the help in preparation and during the meeting. We are grateful to John Morris Scientific company for establishing the best poster awards.

We thank all the participants — the smart teams behind development of smart materials and devices.

Saulius Juodkazis
Min Gu