PROCEEDINGS OF SPIE

SPIDigitalLibrary.org/conference-proceedings-of-spie

Front Matter: Volume 8725

, "Front Matter: Volume 8725," Proc. SPIE 8725, Micro- and Nanotechnology Sensors, Systems, and Applications V, 872501 (11 June 2013); doi: 10.1117/12.2031937

SPIE.

Event: SPIE Defense, Security, and Sensing, 2013, Baltimore, Maryland, United States

PROCEEDINGS OF SPIE

Micro- and Nanotechnology Sensors, Systems, and Applications V

**Thomas George
M. Saif Islam
Achyut K. Dutta**
Editors

**29 April–3 May 2013
Baltimore, Maryland, United States**

Sponsored and Published by
SPIE

Volume 8725

Proceedings of SPIE 0277-786X, V. 8725

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

Micro- and Nanotechnology Sensors, Systems, and Applications V, edited by Thomas George,
M. Saif Islam, Achyut K. Dutta, Proc. of SPIE Vol. 8725, 872501 · © 2013 SPIE
CCC code: 0277-786X/13/\$18 · doi: 10.1117/12.2031937

Proc. of SPIE Vol. 8725 872501-1

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 *Micro- and Nanotechnology Sensors, Systems, and Applications V*, edited by Thomas George, M. Saif Islam, Achyut K. Dutta, Proceedings of SPIE Vol. 8725 (SPIE, Bellingham, WA, 2013) Article CID Number.

ISSN: 0277-786X

ISBN: 9780819495167

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 © 2013, 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/13/\$18.00.

Printed in the United States of America.

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

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

xi	Conference Committee
xv	Introduction

SESSION 1 FRONTIERS IN NANOELECTRONICS RESEARCH

8725 02	Nano-electro-mechanical-systems (NEMS) and energy-efficient electronics and the emergence of two-dimensional layered materials beyond graphene (Keynote Paper) [8725-1] A. B. Kaul, National Science Foundation (United States)
8725 03	Fabrication of large-area twisted bilayer graphene for high-speed ultra-sensitive tunable photodetectors (Invited Paper) [8725-2] J. Bao, S. Xing, Y. Wang, W. Wu, F. Robles-Hernandez, S. Pei, Univ. of Houston (United States)
8725 04	Graphene-Si heterogeneous nanotechnology (Invited Paper) [8725-3] D. Akinwande, L. Tao, The Univ. of Texas at Austin (United States)
8725 05	Photodetection with heterojunctions of graphene and silicon (Invited Paper) [8725-4] F. Liu, X. An, S. Kar, Northeastern Univ. (United States)
8725 06	Band gap and correlated phenomena in bilayer and trilayer graphene (Invited Paper) [8725-5] Y. Lee, K. Myhro, D. Tran, N. Gilgren, J. Velasco Jr., W. Bao, M. Deo, C. N. Lau, Univ. of California, Riverside (United States)
8725 07	New generation transistor technologies enabled by 2D crystals (Invited Paper) [8725-6] D. Jena, Univ. of Notre Dame (United States)

SESSION 2 MULTIFUNCTIONAL AND ADAPTIVE STRUCTURAL MATERIALS I

8725 09	Surface confined assemblies and polymers for sensing and molecular logic (Invited Paper) [8725-106] G. de Ruiter, M. Altman, L. Motiei, M. Lahav, M. E. van der Boom, Weizmann Institute of Science (Israel)
8725 0A	Active frequency selective surfaces (Invited Paper) [8725-8] W. R. Buchwald, Univ. of Massachusetts, Boston (United States) and Solid State Scientific Corp. (United States); J. Hendrickson, J. W. Cleary, Air Force Research Lab. (United States); J. Guo, The Univ. of Alabama in Huntsville (United States)
8725 0B	Adaptive multifunctional composites (Invited Paper) [8725-9] Y. Wang, D. J. Inman, Univ. of Michigan (United States)

SESSION 3 MULTIFUNCTIONAL AND ADAPTIVE STRUCTURAL MATERIALS II

- 8725 0D **Charge redistribution in adaptable quantum-dot and quantum-well nanomaterials for infrared sensing (Invited Paper)** [8725-11]
V. Mitin, J. K. Choi, G. Thomain, Univ. at Buffalo (United States); K. Sablon, U.S. Army Research Lab. (United States); S. Oktyabrysky, Univ. at Albany (United States); N. Vagidov, Optoelectronic Nanodevices LLC (United States); A. Sergeev, Univ. at Buffalo (United States)
- 8725 0E **Functional supramolecular nanomaterials: robust yet adaptive (Invited Paper)** [8725-12]
B. Rybtchinski, Weizmann Institute of Science (Israel)
- 8725 0F **Emission and detection of terahertz radiation using two dimensional plasmons in semiconductor nano-heterostructures for nondestructive evaluations (Invited Paper)** [8725-13]
T. Otsuji, T. Watanabe, S. A. Boubanga Tombet, A. Satou, V. Ryzhii, Tohoku Univ. (Japan); V. Popov, Institute of Radio Engineering and Electronics (Russian Federation); W. Knap, LC2 Labs., CNRS, Univ. Montpellier 2 (France)
- 8725 0G **Graphene-based integrated electronic, photonic and spintronic circuit (Invited Paper)** [8725-14]
P. Potasz, National Research Council Canada (Canada) and Wroclaw Univ. of Technology (Poland); A. D. Güçlü, National Research Council Canada (Canada) and Izmir Institute of Technology (Turkey); I. Ozfidan, National Research Council Canada (Canada) and Univ. of Ottawa (Canada); M. Korkusinski, National Research Council Canada (Canada); P. Hawrylak, National Research Council Canada (Canada) and Univ. of Ottawa (Canada)

SESSION 4 MICRO-/NANOSENSING FOR HARSH ENVIRONMENT ENERGY APPLICATIONS AND ENVIRONMENTAL CONTROL

- 8725 0H **Harsh environment sensor development for advanced energy systems (Keynote Paper)** [8725-15]
R. R. Romanosky, S. M. Maley, National Energy Technology Lab. (United States)
- 8725 0I **Chemical sensor systems for environmental and emission control (Invited Paper)** [8725-16]
A. Lloyd Spetz, Linköping Univ. (Sweden) and Univ. of Oulu (Finland); Z. Darmastuti, Linköping Univ. (Sweden); C. Bur, Linköping Univ. (Sweden) and Univ. des Saarlandes (Germany); J. Huotari, Univ. of Oulu (Finland); R. Bjorklund, Linköping Univ. (Sweden); N. Lindqvist, Alstom Power AB (Sweden); J. Lappalainen, H. Jantunen, Univ. of Oulu (Finland); A. Schütze, Univ. des Saarlandes (Germany); M. Andersson, Linköping Univ. (Sweden) and Univ. of Oulu (Finland)
- 8725 0J **Miniaturized resonant sensors for harsh environments (Invited Paper)** [8725-17]
S. Schmidtchen, D. Richter, J. Sauerwald, H. Fritze, Technische Univ. Clausthal (Germany)
- 8725 0K **III-nitride nanostructures for optical gas detection and pH sensing (Invited Paper)** [8725-18]
S. Paul, K. Maier, EADS Innovation Works (Germany); A. Das, Commissariat à l'Énergie Atomique (France); F. Furtmayr, Justus-Liebig-Univ. Giessen (Germany); A. Helwig, EADS Innovation Works (Germany); J. Teubert, Justus-Liebig-Univ. Giessen (Germany); E. Monroy, Commissariat à l'Énergie Atomique (France); G. Müller, EADS Innovation Works (Germany); M. Eickhoff, Justus-Liebig-Univ. Giessen (Germany)

- 8725 OL **Metal oxide nanowire gas sensors for indoor and outdoor environmental monitoring (Invited Paper)** [8725-19]
 A. Köck, E. Brunet, AIT Austrian Institute of Technology GmbH (Austria); O. Freudenberg, Siemens AG (Germany); C. Gamauf, Univ. of Applied Sciences Wiener Neustadt (Austria); J. Kraft, austriamicrosystems AG (Austria); G. C. Mutinati, T. Maier, AIT Austrian Institute of Technology GmbH (Austria); A. Nemecek, Univ. of Applied Sciences Wiener Neustadt (Austria); F. Schrank, M. Schrems, austriamicrosystems AG (Austria); M. Siegele, Univ. of Applied Sciences Wiener Neustadt (Austria); J. Siegert, austriamicrosystems AG (Austria); S. Steinhauer, AIT Austrian Institute of Technology GmbH (Austria); J. Teva, austriamicrosystems AG (Austria)

SESSION 5 SCANNING PROBE-BASED NANOPATTERNING AND DIP-PEN NANOLITHOGRAPHY: JOINT SESSION WITH CONFERENCES 8725 AND 8729

- 8725 OP **Nano-electro-mechanical systems fabricated using tip-based nanofabrication (Invited Paper)** [8725-23]
 H. Hu, P. K. Mohseni, M. A. Shannon, X. Li, W. P. King, Univ. of Illinois at Urbana-Champaign (United States)

SESSION 6 NOVEL ADAPTIVE OPTICS TECHNIQUES AND APPLICATIONS

- 8725 OS **How adaptive optics may have won the Cold War (Keynote Paper)** [8725-26]
 R. K. Tyson, The Univ. of North Carolina at Charlotte (United States)
- 8725 OU **Adaptive optics for fiber-fed interferometers (Invited Paper)** [8725-28]
 M. Hart, T. Stalcup, O. Durney, N. Emerson, Univ. of Arizona (United States); K. Powell, MMT Observatory (United States); M. Ward, Univ. of Arizona (United States); G. Feller, R. Kendrick, J. Mason, M. Bold, L. Dewell, T. Kubo, Lockheed Martin Space Systems Co. (United States)
- 8725 OV **High-actuator-count MEMS deformable mirrors (Invited Paper)** [8725-30]
 M. A. Helmbrecht, M. He, C. J. Kempf, Iris AO, Inc. (United States)
- 8725 OW **Large-aperture active optical carbon fiber reinforced polymer mirror** [8725-105]
 M. E. L. Jungwirth, Sandia National Labs. (United States) and Honeywell ACS (United States); C. C. Wilcox, U.S. Naval Research Lab. (United States); D. V. Wick, M. S. Baker, C. G. Hobart, J. J. Milinazzo, Sandia National Labs. (United States); J. Robichaud, L-3 Communications IOS-SSG (United States); R. C. Romeo, R. N. Martin, Composite Mirror Applications, Inc. (United States); J. Ballesta, Imagine Optic Inc. (United States); E. Lavergne, Imagine Optic SA (France); E. L. Dereniak, College of Optical Sciences, The Univ. of Arizona (United States)

SESSION 7 NANO-/MICROSTRUCTURED MATERIALS FOR PHOTOVOLTAIC AND PHOTOELECTROCHEMICAL ENERGY HARVESTING: JOINT SESSION WITH CONFERENCES 8725 AND 8728

- 8725 OZ **Towards low-cost high-efficiency GaAs photovoltaics and photoelectrodes grown via vapor transport from a solid source (Invited Paper)** [8725-34]
 J. W. Boucher, A. J. Ritenour, S. W. Boettcher, Univ. of Oregon (United States)

- 8725 10 **Direct-bandgap nanopillar photovoltaics based on patterned catalyst-free epitaxy (Invited Paper)** [8725-35]

G. Mariani, D. L. Huffaker, Univ. of California, Los Angeles (United States)

SESSION 8 MICRO- AND NANOTECHNOLOGY FOR HEALTH CARE: JOINT SESSION WITH CONFERENCES 8725 AND 8719

- 8725 12 **Microscale technologies for imaging endogenous gene expression in individual cells within 3D tissues (Invited Paper)** [8725-38]

T. Ye, Z. Luo, Univ. of California, Davis (United States); Y. Ma, H. S. Gill, N. Nitin, Texas Tech Univ. (United States)

SESSION 9 INTERACTION OF SEMICONDUCTORS AND HIGH-ENERGY PARTICLES

- 8725 14 **Present status and prospects of R&D of radiation-resistant semiconductor devices at JAEA (Keynote Paper)** [8725-41]

H. Itoh, Japan Atomic Energy Agency (Japan)

- 8725 15 **Radiation effects in solar cells (Invited Paper)** [8725-43]

M. Imaizumi, Japan Aerospace Exploration Agency (Japan); T. Ohshima, Japan Atomic Energy Agency (Japan)

- 8725 16 **Radiation tolerance of silicon and diamond detectors exposed to MeV ion beams: characterization using IBIC technique (Invited Paper)** [8725-44]

M. Jakšić, V. Grilj, N. Skukan, Institut Ruder Boškovic (Croatia); M. Pomorski, CEA-Ctr. de Saclay (France); W. Kada, T. Kamiya, Japan Atomic Energy Agency (Japan)

- 8725 17 **Radiation-tolerant microprocessors in Japanese scientific space vehicles: how to maximize the benefits of commercial SOI technologies (Invited Paper)** [8725-45]

D. Kobayashi, K. Hirose, H. Saito, Institute of Space and Astronautical Science (Japan) and The Univ. of Tokyo (Japan)

- 8725 19 **Error-rate prediction for programmable circuits: methodology, tools and studied cases (Invited Paper)** [8725-47]

R. Velazco, TIMA Lab., CNRS (France)

- 8725 1A **Ion beam induced charge analysis of radiation damage in silicon photodiodes (Invited Paper)** [8725-48]

Ž. Pastuović, Australian Nuclear Science and Technology Organisation (Australia); M. Jakšić, Institut Ruder Boškovic (Croatia); E. Vittone, Univ. degli Studi di Torino (Italy)

SESSION 10 MAST: SOFTWARE: JOINT SESSION WITH CONFERENCES 8725 AND 8741

- 8725 1B **Reduction and identification for hybrid dynamical models of terrestrial locomotion (Invited Paper)** [8725-49]

S. A. Burden, S. S. Sastry, Univ. of California, Berkeley (United States)

- 8725 1D **Stochastic receding horizon control: application to an octopedal robot (Invited Paper)** [8725-51]
S. K. Shah, H. G. Tanner, Univ. of Delaware (United States)
- 8725 1F **Bio-inspired multi-mode optic flow sensors for micro air vehicles (Invited Paper)** [8725-53]
S. Park, J. Choi, J. Cho, E. Yoon, Univ. of Michigan (United States)
- 8725 1G **Structure from motion in computationally constrained systems (Invited Paper)** [8725-54]
J. Conroy, U.S. Army Research Lab. (United States); J. S. Humbert, Univ. of Maryland, College Park (United States)
- 8725 1H **Mixed-signal odometry for mobile robotics (Invited Paper)** [8725-55]
M. J. Kuhlman, T.-H. Lee, P. A. Abshire, Univ. of Maryland, College Park (United States)

SESSION 11 FLEXIBLE AND WEARABLE ELECTRONICS FOR DEFENSE APPLICATIONS: JOINT SESSION WITH CONFERENCES 8725 AND 8730

- 8725 1I **Bio-integrated electronics and sensor systems (Invited Paper)** [8725-58]
W.-H. Yeo, R. C. Webb, W. Lee, Univ. of Illinois at Urbana-Champaign (United States); S. Jung, Pohang Univ. of Science and Technology (Korea, Republic of); J. A. Rogers, Univ. of Illinois at Urbana-Champaign (United States)
- 8725 1J **Carbon nanotube macroelectronics: toward system-on-plastic (Invited Paper)** [8725-59]
C. Wang, K. Takei, T. Takahashi, A. Javey, Univ. of California, Berkeley (United States)
- 8725 1M **Mechanically flexible optically transparent silicon fabric with high thermal budget devices from bulk silicon (100) (Invited Paper)** [8725-62]
M. M. Hussain, J. P. Rojas, G. A. Torres Sevilla, King Abdullah Univ. of Science and Technology (Saudi Arabia)

SESSION 12 NOVEL TRANSPARENT CONDUCTORS AND CARBON-BASED TECHNOLOGIES

- 8725 1S **Aligned arrays of single walled carbon nanotubes for transparent electronics (Invited Paper)** [8725-68]
F. Du, J. A. Rogers, Univ. of Illinois at Urbana-Champaign (United States)
- 8725 1V **Graphene-carbon nanotube hybrid transparent conductive films (Invited Paper)** [8725-72]
I. N. Kholmanov, The Univ. of Texas at Austin (United States) and Istituto di Acustica e Sensoristica, Univ. di Brescia, CNR (Italy); T. Y. Kim, The Univ. of Texas at Austin (United States); S. H. Domingues, The Univ. of Texas at Austin (United States) and Univ. Federal do Parana (Brazil); J.-Y. Kim, C. Tan, C. W. Magnuson, H. Li, R. Piner, R. S. Ruoff, The Univ. of Texas at Austin (United States)

SESSION 13	NOVEL MICRO/NANO APPROACHES TO THE CBRNE DETECTION PROBLEM: JOINT SESSION WITH CONFERENCES 8725 AND 8710
8725 1Y	Luminescence enhancement in LaPO₄:Ce/CdTe nanocomposite scintillators (Invited Paper) [8725-76] J. Wang, R. Hall, L. Ma, W. Chen, The Univ. of Texas at Arlington (United States); R. Feng, Canadian Light Source Inc. (Canada); R. Sammynaiken, Univ. of Saskatchewan (Canada); Y. Wang, D. He, Beijing Jiaotong Univ. (China)
SESSION 14	MICRO- AND NANOTECHNOLOGIES FOR STANDOFF DETECTION I: JOINT SESSION WITH CONFERENCES 8725 AND 8710
8725 20	Non-intrusive telemetry applications in the oilsands: from visible light and x-ray video to acoustic imaging and spectroscopy (Keynote Paper) [8725-78] J. M. Shaw, Univ. of Alberta (Canada)
8725 22	Chemical sensing and imaging in microfluidic pore network structures relevant to natural carbon cycling and industrial carbon sequestration (Invited Paper) [8725-80] J. W. Grate, C. Zhang, M. Wilkins, M. G. Warner, N. C. Anheier, J. Suter, R. Kelly, M. Oostrom, Pacific Northwest National Lab. (United States)
SESSION 15	MICRO- AND NANOTECHNOLOGIES FOR STANDOFF DETECTION II: JOINT SESSION WITH CONFERENCES 8725 AND 8710
8725 24	Micro and nano devices in passive millimetre wave imaging systems (Keynote Paper) [8725-82] R. Appleby, Queen's Univ. Belfast (Ireland)
8725 25	Towards airborne nanoparticle mass spectrometry with nanomechanical string resonators (Invited Paper) [8725-83] S. Schmid, M. Kurek, A. Boisen, Technical Univ. of Denmark (Denmark)
8725 26	Antenna coupled detectors for 2D staring focal plane arrays (Invited Paper) [8725-84] M. Gritz, B. Kolasa, Raytheon Co. (United States); B. Lail, Florida Institute of Technology (United States); R. Burkholder, L. Chen, Raytheon Co. (United States)
8725 27	Diffraction limit investigation with sub-wavelength pixels (Invited Paper) [8725-85] A. Bergeron, M. Terroux, L. Marchese, D. Dufour, L. Le Noc, C. Chevalier, INO (Canada)
SESSION 16	MICRO- AND NANOTECHNOLOGIES FOR STANDOFF DETECTION III: JOINT SESSION WITH CONFERENCES 8725 AND 8710
8725 28	Raman and photothermal spectroscopies for explosive detection (Invited Paper) [8725-87] E. Finot, T. Brulé, P. Rai, A. Griffart, A. Bouhélier, Lab. Interdisciplinaire Carnot de Bourgogne, CNRS (France); T. Thundat, Univ. of Alberta (Canada)

- 8725 2A **Data analysis of multi-laser standoff spectral identification of chemical and biological compounds (Invited Paper)** [8725-89]
R. Farahi, Oak Ridge National Lab. (United States) and Univ. of Tennessee (United States); V. Zaharov, Univ. Politécnica de Puerto Rico (United States); L. Tetard, Oak Ridge National Lab. (United States); T. Thundat, Univ. of Alberta (Canada); A. Passian, Oak Ridge National Lab. (United States) and Univ. of Tennessee (United States)

POSTER SESSION

- 8725 2C **Ion irradiation effects on electric properties of hydrogenated amorphous silicon thin films** [8725-91]
S. Sato, T. Ohshima, Japan Atomic Energy Agency (Japan)
- 8725 2D **Effects of x-ray and gamma-ray irradiation on the optical properties of quantum dots immobilized in porous silicon** [8725-92]
G. Gaur, D. Koktysh, D. M. Fleetwood, R. A. Reed, R. A. Weller, S. M. Weiss, Vanderbilt Univ. (United States)
- 8725 2E **Nonlinear-optical up and down frequency-converting backward-wave metasensors and metamirrors** [8725-93]
A. K. Popov, Univ. of Wisconsin-Stevens Point (United States); I. S. Nefedov, Aalto Univ. (Finland); S. A. Myslivets, Kirensky Institute of Physics (Russian Federation); M. I. Shalaev, V. V. Slabko, Siberian Federal Univ. (Russian Federation)
- 8725 2G **Effects of radiation-induced defects on the charge collection efficiency of a silicon carbide particle detector** [8725-96]
N. Iwamoto, S. Onoda, T. Makino, T. Ohshima, Japan Atomic Energy Agency (Japan); K. Kojima, National Institute of Advanced Industrial Science and Technology (Japan); S. Nozaki, The Univ. of Electro-Communications (Japan)
- 8725 2H **Subwavelength resonant nanostructured films for sensing** [8725-97]
K. J. Alvine, B. E. Bernacki, J. D. Suter, W. D. Bennett, D. J. Edwards, A. Mendoza, Pacific Northwest National Lab. (United States)
- 8725 2K **Development of a versatile lab-on-a-chip enzyme assay platform for pathogen detection in CBRNE scenarios** [8725-101]
R. Klemm, S. Schattschneider, T. Jahn, N. Hlawatsch, microfluidic ChipShop GmbH (Germany); S. Julich, Friedrich-Loeffler-Institut (Germany); H. Becker, C. Gärtner, microfluidic ChipShop GmbH (Germany)
- 8725 2L **Radiation detection with CdTe quantum dots in sol-gel glass and polymer nanocomposites** [8725-102]
K. Manickaraj, B. K. Wagner, Georgia Tech Research Institute (United States); Z. Kang, Georgia Tech Research Institute (United States) and Georgia Institute of Technology (United States)

- 8725 2N **Solution-based photodetectors for monolithically integrated low-cost short-wave infrared focal plane arrays** [8725-104]
E. Heves, H. Kayahan, Y. Gurbuz, Sabanci Univ. (Turkey)

Author Index

Conference Committee

Symposium Chair

Kenneth R. Israel, Major General (USAF Retired) (United States)

Symposium Cochair

David A. Whelan, Boeing Defense, Space, and Security (United States)

Conference Chairs

Thomas George, Zyomed Corporation (United States)

M. Saif Islam, University of California, Davis (United States)

Achyut K. Dutta, Banpil Photonics, Inc. (United States)

Conference Program Committee

Debjyoti Banerjee, Texas A&M University (United States)

Scott D. Collins, University of Maine (United States)

Nibir K. Dhar, Defense Advanced Research Projects Agency
(United States)

Ronald G. Dixon, National Institute of Standards and Technology
(United States)

Ernest J. Garcia, Sandia National Laboratories (United States)

Joan A. Hoffmann, Johns Hopkins University Applied Physics
Laboratory (United States)

Muhammad M. Hussain, King Abdullah University of Science and
Technology (Saudi Arabia)

Christopher M. Kroninger, U.S. Army Research Laboratory
(United States)

William D. Nothwang, U.S. Army Research Laboratory (United States)

Shinji Nozaki, University of Electro-Communication (Japan)

Takeshi Ohshima, Japan Atomic Energy Research Institute (Japan)

Stergios J. Papadakis, Johns Hopkins University Applied Physics
Laboratory (United States)

Gernot S. Pomrenke, Air Force Office of Scientific Research
(United States)

Michael T. Postek, National Institute of Standards and Technology
(United States)

Michael K. Rafailov, The Reger Group (United States)

Bilge Saruhan-Brings, Deutsches Zentrum für Luft- und Raumfahrt
(Germany)

Noriko Satake M.D., UC Davis Medical Center (United States)

Andre U. Sokolnikov, Visual Solutions and Applications (United States)
Kyung-Ah Son, HRL Laboratories, LLC (United States)
Thomas G. Thundat, University of Alberta (Canada)
Christopher C. Wilcox, U.S. Naval Research Laboratory (United States)
Jongseung Yoon, The University of Southern California (United States)

Session Chairs

- 1 Frontiers in Nanoelectronics Research
Thomas George, Zyomed Corporation (United States)
- 2 Multifunctional and Adaptive Structural Materials I
Andre U. Sokolnikov, Visual Solutions and Applications (United States)
- 3 Multifunctional and Adaptive Structural Materials II
Andre U. Sokolnikov, Visual Solutions and Applications (United States)
- 4 Micro-/Nanosensing for Harsh Environment Energy Applications and Environmental Control
Bilge Saruhan-Brings, Deutsches Zentrum für Luft- und Raumfahrt e.V. (Germany)
- 5 Scanning Probe-Based Nanopatterning and Dip-Pen Nanolithography: Joint Session with Conferences 8725 and 8729
Ronald G. Dixon, National Institute of Standards and Technology (United States)
Debjyoti Banerjee, Texas A&M University (United States)
- 6 Novel Adaptive Optics Techniques and Applications
Christopher C. Wilcox, U.S. Naval Research Laboratory (United States)
- 7 Nano-/Microstructured Materials for Photovoltaic and Photoelectrochemical Energy Harvesting: Joint Session with Conferences 8725 and 8728
Jongseung Yoon, The University of Southern California (United States)
- 8 Micro- and Nanotechnology for Health Care: Joint Session with Conferences 8725 and 8719
Brian M. Cullum, University of Maryland, Baltimore County (United States)
Eric S. McLamore, University of Florida (United States)
Noriko Satake, UC Davis Medical Center (United States)
Scott D. Collins, University of Maine (United States)
Thomas George, Zyomed Corporation (United States)

- 9 Interaction of Semiconductors and High-Energy Particles
Takeshi Ohshima, Japan Atomic Energy Research Institute (Japan)
Shinji Nozaki, The University of Electro-Communications (Japan)

- 10 MAST: Software: Joint Session with Conferences 8725 and 8741
Christopher M. Kroninger, U.S. Army Research Laboratory
(United States)
William D. Nothwang, U.S. Army Research Laboratory (United States)
Paul D. Samuel, Daedalus Flight Systems, LLC (United States)

- 11 Flexible and Wearable Electronics for Defense Applications: Joint
Session with Conferences 8725 and 8730
Muhammad M. Hussain, King Abdullah University of Science and
Technology (Saudi Arabia)
Ali Javey, University of California, Berkeley (United States)

- 12 Novel Transparent Conductors and Carbon-based Technologies
Kyung-Ah Son, HRL Laboratories, LLC (United States)

- 13 Novel Micro/Nano Approaches to the CBRNE Detection Problem:
Joint Session with Conferences 8725 and 8710
Joan A. Hoffmann, Johns Hopkins University Applied Physics
Laboratory (United States)
Stergios J. Papadakis, Johns Hopkins University Applied Physics
Laboratory (United States)

- 14 Micro- and Nanotechnologies for Standoff Detection I: Joint Session
with Conferences 8725 and 8710
Michael K. Rafailov, University of Alberta (Canada)
Thomas G. Thundat, University of Alberta (Canada)

- 15 Micro- and Nanotechnologies for Standoff Detection II: Joint Session
with Conferences 8725 and 8710
Michael K. Rafailov, University of Alberta (Canada)
Thomas G. Thundat, University of Alberta (Canada)

- 16 Micro- and Nanotechnologies for Standoff Detection III: Joint Session
with Conferences 8725 and 8710
Michael K. Rafailov, University of Alberta (Canada)
Thomas G. Thundat, University of Alberta (Canada)

Introduction

The 2013 Micro- and Nanotechnology Sensors, Systems, and Applications V Conference continued its trailblazing approach to showcasing a diverse range of MEMS and Nanotechnology topics that are a testament to the practically limitless applications of these exciting technologies. The sheer breadth of potential MEMS and Nanotechnology applications was also strongly validated by the synergy we were able to establish between our conference and other, equally diverse, and broad set of conferences within the DSS symposium. Successful joint sessions were conducted with the Scanning Microscopies (8729), Energy Harvesting and Storage (8728), Smart Biomedical and Physiological Sensor Technology (8719), Unmanned Systems Technology (8741), Flexible Electronics (8730), Chemical, Biological, Radiological, Nuclear, and Explosives (CBRNE) Sensing (8710) and the Passive and Active Millimeter-Wave Imaging (8715) Conferences. Exciting new sessions that were introduced in 2013 were sessions on Frontiers in Nanoelectronics Research (showcasing Dr. Anupama Kaul's program at the NSF), Multifunctional and Adaptive Structural Materials, Flexible and Wearable Electronics for Defense Applications, Novel Transparent Conductors and Carbon-based Technologies, Devices, Nano-/Microstructured Materials for Photovoltaic and Photoelectrochemical Energy Harvesting, and Interaction of Semiconductors and High-Energy Particles.

As in previous years, each session was designed by the session chairs to address three “cornerstones” of our conference philosophy namely, describing programmatic investments that set the overall context for the cutting-edge research and development being presented, and the challenges involved in transitioning these exciting concepts to applications in defense, homeland security and space. A wide variety of advanced micro and nanoscale research being conducted by the Defense Advanced Research Projects Agency, Air Force Office of Scientific Research, National Institutes of Health, Department of Energy, Office of Naval Research and the Naval Research Laboratory, Army Research Laboratory, NASA, and the Japanese Atomic Energy Agency was presented.

Thanks to our distinguished contributors, in this proceedings volume, you will find papers covering a breathtaking range of topics from “How adaptive optics may have won the cold war” to “Nano-electro-mechanical-systems (NEMS) and Energy-efficient Electronics and The Emergence of Two-dimensional Layered Materials Beyond Graphene.” Enjoy!

Thomas George
M. Saif Islam
Achyut K. Dutta