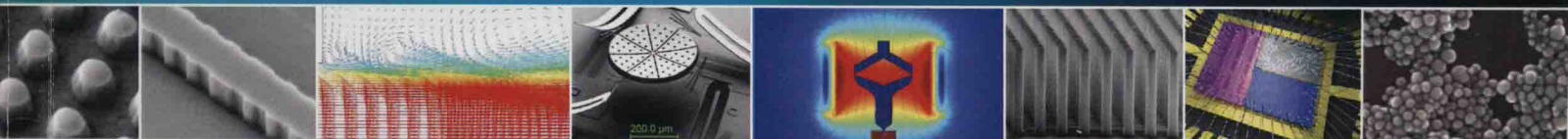




TechConnect Briefs | 2015

Advanced Manufacturing, Electronics and Microsystems



Jointly Published by:


TechConnect



Taylor & Francis Group

TechConnect Briefs 2015

**ADVANCED MANUFACTURING,
ELECTRONICS AND
MICROSYSTEMS**

Edited by

Matthew Laudon Bart Romanowicz





TechConnect
696 San Ramon Valley Blvd., Ste. 423
Danville, CA 94526
U.S.A.

Copyright 2015 by TechConnect.
All rights reserved.

Copyright and reprint permissions: Abstracting is permitted with credit to the source. Other copying, reprint or reproduction requests should be addressed to: Copyrights Manager, TechConnect, Copyright Office, 696 San Ramon Valley Blvd., Ste. 423, Danville, CA 94526, U.S.A.

The papers in this book comprise applied research presented at the 2015 TechConnect World Innovation Conference and Expo and the 2015 Nanotech Conference and Expo, Washington, D.C., June 14-17 2015. They reflect the authors' opinions and, in the interests of timely dissemination, are published as presented and without change. Their inclusion in this publication does not necessarily constitute endorsement by the editors, TechConnect, or the sponsors. Dedicated to our knowledgeable network of willing and forgiving friends.

Advanced Materials: ISBN 978-1-4987-4727-1
Materials for Energy, Efficiency and Sustainability: ISBN 978-1-4987-4728-8
Biotech, Biomaterials and Biomedical: ISBN 978-1-4987-4729-5
Advanced Manufacturing, Electronics and Microsystems: ISBN 978-1-4987-4730-1
TechConnect Briefs 2015 (Four Volumes Set): ISBN 978-1-4987-4731-8

Additional copies may be ordered from:



CRC Press
Taylor & Francis Group
an informa business
www.taylorandfrancisgroup.com

6000 Broken Sound Parkway, NW
Suite 300, Boca Raton, FL 33487
270 Madison Avenue
New York, NY 10016
2 Park Square, Milton Park
Abingdon, Oxon OX14 4RN, UK

Printed in the United States of America

CHAPTER EDITORS - 2015 TechConnect Briefs

VOLUME EDITORS

Matthew Laudon, *TechConnect, USA*
Bart Romanowicz, *TechConnect, USA*
Fiona Case, *TechConnect, USA*

TOPICAL EDITORS

ADVANCED MANUFACTURING

Advanced Manufacturing

Fiona Case, *NSTI, USA*

Sustainable Manufacturing

Michael Meador, *NASA Glenn Research, USA*
James Alexander Liddle, *NIST, USA*
Derek Schorzman, *Liquidia Technologies, Inc., USA*

Nanoscale Materials Characterization

Greg Haugstad, *University of Minnesota, USA*
Pierre Panine, *Xenocs SA, FR*
Dalia Yablon, *Exxon, USA*

Informatics, Modeling, and Simulation

Michael Makowski, *PPG Industries R&D, USA*
Philip J Skinner, *PerkinElmer, USA*
Fiona Case, *NSTI, USA*

NanoFab: Manufacturing & Instrumentation

Guy A. DeRose, *California Institute of Technology, USA*
Aaron Stein, *Brookhaven National Laboratory, USA*
Ahmed Busnaina, *Northeastern University, USA*

ADVANCED MATERIALS

Advanced Materials for Engineering Applications

Brent Segal, *Lockheed Martin, USA*
Thomas J. McKrell, *Massachusetts Institute of Technology, USA*

Materials for Green Building

Elena Enache-Pommer, *Dow Building Solutions R&D, USA*

Materials for Sustainability and Efficiency

Ron Buckhalt, *U.S. Department of Agriculture, USA*
Joyce C. Yang, *U.S. Department of Energy, USA*

Composite Materials

Thomas E. Twardowski, *Integra Life Sciences Corporation, USA*

Soft Matter and Colloids

Patrick Spicer, *Univ. of New South Wales, AU*

Polymers

YuanQiao Rao, *Dow Chemical Company, USA*
Fiona Case, *NSTI, USA*
Rahul Sharma, *The Dow Chemical Company, USA*

Coatings Surfaces and Membranes

Kock-Yee Law, *Xerox, USA*

Graphene

David Burton, *Angstrom Materials, USA*
Lance Criscuolo, *Zyvex Technologies, USA*

Carbon Nano Structures and Devices

Wolfgang S. Bacsa, *University of Toulouse, FR*

Nanoparticle Synthesis and Application

Larry Mann, *Shoei Electronic Materials, Inc., USA*
Sotiris E. Pratsinis, *Swiss Federal Institute of Technology, CH*

Nanomaterials for Catalysis

Phillippe Serp, *CNRS Institute National Polytechnique de Toulouse, FR*

Polymer Nanotechnology

YuanQiao Rao, *Dow Chemical Company, USA*
Fiona Case, *NSTI, USA*

BIOTECH, MEDICAL & PHARMA

Materials for Drug & Gene Delivery

Steven Zullo, *NIBIB/NIH, USA*

Cancer Nanotechnology

Mansoor M. Amiji, *Northeastern University, USA*
Anil Patri, *NIH, USA*

Biomaterials

Thomas Twardowski, *Integra Life Sciences Corporation, USA*

Biosensing, Diagnostics & Imaging

Srinivas Iyer, *Los Alamos National Laboratory, USA*

Biofuels & Bioproducts

Scott Twary, *Los Alamos National Laboratory, USA*

Srinivas Iyer, *Los Alamos National Laboratory, USA*

ELECTRONICS & MICROSYSTEMS

MEMS & NEMS Devices and Applications

William (Cy) Wilson, *NASA Langley Research Center, USA*

Flexible Electronics

Mandakini Kanungo, *Xerox Innovation Group, USA*

Photonic Materials & Devices

Loucas Tsakalakos, *GE Global Research, USA*

Nano Electronics for 2020 and Beyond

Aaron D. Franklin, *Duke University, USA*

Gernot Pomrenke,
USAF/AFOSR/Optoelectronics and Photonics, USA

Curt Richter, *NIST, USA*

Charles Ying, *NSF, USA*

Micro, Nano & Bio Fluidics

Edward Furlani, *University at Buffalo SUNY, USA*

Kwang Oh, *University at Buffalo SUNY, USA*

Inkjet Design Materials and Fabrication

Chris Menzel, *Fujifilm Dimatix, Inc., USA*

ENERGY & SUSTAINABILITY

Energy Storage

Imre Gyuk, *U.S. Department of Energy, USA*

Water Technologies

Armin Volkel, *Palo Alto Research Center, USA*

Advanced Materials for Oil & Gas

Willard C. (Bill) Capdevielle, *Oil Patch Engineering, PLLC, USA*

Rushan Sakhibgareev, *Chevron, USA*

Solar Power Technologies

Brian Korgel, *University of Texas at Austin, USA*

Heath Naquin, *University of Texas at Austin, USA*

NanoNuclear Materials, Fuels & Applications

Brent Segal, *Lockheed Martin, USA*

Thomas McKrell, *MIT, USA*

Steven Winston, *Steven Winston & Assoc., USA*

Carbon Capture

Robert Quinn, *Air Products and Chemicals (retired), USA*

Elizabeth Burton, *Lawrence Berkeley National Laboratory, USA*

Materials for Green Building

Elena Enache-Pommer, *Dow Building Solutions R&D, USA*

Key Elements for Successful Commercialization: Safety and Sustainability

Charles Geraci, Jr., *NIOSH, USA*

Phillip Demokritou, *Harvard University, USA*

Sally Tinkle, *Science and Technology Policy Management, USA*

PERSONAL & HOME CARE, COSMETICS & FOOD

Food Materials

Pat Spicer, *University of New South Wales, AU*

Krassimir Velikov, *Unilever R&D, NE*

Materials for Personal and Home Care

Fiona Case, *Nano Science and Technology Institute, USA*

PREFACE

TechConnect provides a multi-disciplinary and multi-sector forum focused on accelerating applied research and early-stage innovation towards commercialization. The technologies described in the TechConnect Briefs are provided by innovators working in industry, academic and government laboratories around the world. A review committee comprising more than 300 internationally recognized experts reviewed the research and innovations described and selected them for inclusion in this volume, and for presentation at the 10th annual TechConnect World Innovation Conference & Expo, held jointly with the 18th annual Nanotech Conference & Expo, and the 2015 National SBIR/STTR Conference, June 14-17, 2015 Washington DC.

Through TechConnect prospecting programs, transformational innovations are identified in Advanced Materials, Advanced Manufacturing, Materials for Energy & Sustainability, Electronics & Microsystems, Biotech, Medical & Pharma, Personal & Home Care, Cosmetics, and Food industries. The 2015 TechConnect Briefs are also aligned with the National Nanotechnology Initiative and the National Security Technology Accelerator interest areas.

This volume (one of 4) is focused on research and innovations in the Advanced Manufacturing, Electronics and Microsystems track, including industrially viable new materials that will transform industry and new platform technologies that enable their discovery and development. The following chapters are included:

- Advanced Manufacturing
- Sustainable Nanomanufacturing
- NanoFab: Manufacturing & Instrumentation
- Flexible Electronics
- Photonic Materials & Devices
- Nanoelectronics, Materials & Devices
- Modeling & Simulation of Microsystems
- MEMS & NEMS Devices & Applications
- Micro, Nano & Bio Fluidics
- Inkjet Design, Materials & Fabrication

It is our distinct honor to edit the 18th annual TechConnect publication of applied research technologies at the forefront of innovation change for industry and society. The TechConnect Program Committees make every effort to provide a scientifically and commercially relevant publication. The grassroots review and ranking process is a source of pride for these joint committees, and provides a yearly evaluation and technical validation of emerging technologies addressing our world's most pressing needs. We would like to take this opportunity to thank the many individuals who have worked so hard to make this annual publication possible. We hope that you enjoy these TechConnect Briefs, and we hope that the presented technologies are significant steps towards addressing large global challenges.

Matthew Laudon
Austin, Texas

Bart Romanowicz
Austin, Texas

Fiona Case
San Diego, California

Program Review Committee

Wade Adams, *Rice University, USA*
Susan Addo Ntim, *U.S. Food & Drug Administration, USA*
I. Yucel Akkutlu, *Texas A&M University, USA*
Evangelyn Alocilja, *Michigan State University, USA*
Jay Amarasekera, *Sabic, USA*
Mansoor Amiji, *Northeastern University, USA*
Thomas Anchordoquy, *University of Colorado, USA*
Mohamed Ansari, *Universiti Tenaga Nasional Kajang, Malaysia*
Sivaram Arepalli, *Sungkyunkwan University, Korea*
Wolfgang Bacsá, *University of Toulouse, France*
Stephen Bart, *Analog Devices, Inc., USA*
S Rahima Benhabbour, *University of North Carolina at Chapel Hill, USA*
Gary Bernstein, *University of Notre Dame, USA*
Jean Berthier, *CEA Grenoble, France*
Mousumi Mani Biswas, *Western Digital, USA*
Gregory R. Bogart, *Sandia National Laboratories, USA*
Philip Bradford, *North Carolina State University, USA*
Jakob Bredsguard, *Biosynthetic Technologies, USA*
Elizabeth Burton, *Lawrence Berkeley National Laboratory, USA*
Ahmed Busnaina, *Northeastern University, USA*
Willard C. (Bill) Capdevielle, *Oil Patch Engineering, PLLC, USA*
Fiona Case, *Case Scientific, USA*
Martin Case, *Janssen, Pharmaceutical Companies of Johnson & Johnson, USA*
Mansun Chan, *Hong Kong University of Science & Technology, China*
Alessandro Chiolerio, *Politecnico di Torino, Italy*
Bum-Kyoo Choi, *Sogang University, Korea*
Schuyler Corry, *Life Technologies, USA*
Lance Criscuolo, *Zyvex Technologies, USA*
Jaime Jose Cubillo Capuz, *Acciona, Spain*
Zheng Cui, *Suzhou Institute of Nanotech, Chinese Academy of Sciences, China*
Phil Demokritou, *Harvard University, USA*
Guy DeRose, *California Institute of Technology, USA*
George Elvin, *Green Technology Forum, USA*
Dorothy Farrell, *NCI Alliance for Nanotechnology in Cancer, USA*
Aaron Franklin, *Duke University, USA*
Nicolas Feltin, *Laboratoire national de métrologie et d'essais, France*
Thomas Fengyuan Li, *Freescale Semiconductor, USA*
Lisa Friedersdorf, *National Nanotechnology Coordination Office, USA*
Ian Fuller, *Nanotek Instruments, USA*
Edward Furlani, *University at Buffalo SUNY, USA*
Charles Geraci, Jr., *NIOSH, USA*
Harris Goldberg, *InMat, Inc., USA*
Imre Gyuk, *U.S. Department of Energy, USA*
Greg Haugstad, *University of Minnesota, USA*
Tim Hebrink, *3M Corporate Research Process Laboratory, USA*
Michael Helmus, *Consultant / Synogen, Inc., USA*
Andreas Hieke, *Stanford University, USA*
Bin Hu, *University of Tennessee, USA*
Zhaohua Huang, *University of California, San Francisco, USA*
Kiki Ikossi, *Defense Threat Reduction Agency, USA*
Srinivas Iyer, *Los Alamos National Laboratory, USA*
Mark Jack, *Florida A&M University, USA*
Oana Jurchescu, *Wake Forest University, USA*
Mandakini Kanungo, *Xerox, USA*
Barbara Karn, *National Science Foundation, USA*
Brian Korgel, *University of Texas at Austin, USA*

Jana Kukutschova, *Technical University Ostrava, Czech Republic*
 James Lamb III, *Brewer Science, USA*
 William A Lambert, *ExxonMobil, USA*
 David Lashmore, *Nanocomp Technologies, Inc., USA*
 Matthew Laudon, *TechConnect, USA*
 Kock-Yee Law, *Research and Innovative Solutions, USA*
 Stephen Lehrman, *National Nanotechnology Coordination Office, USA*
 James Alexander Liddle, *National Institute of Standards & Technology, USA*
 Igor Linkov, *U.S. Army Engineer Research and Development Center, USA*
 Yuri Lyubchenko, *University of Nebraska, USA*
 Katrin Mackenzie, *Helmholtz Centre for Environmental Research - UFZ, Germany*
 Michael Makowski, *PPG Industries R&D, USA*
 Stuart Maloy, *Los Alamos National Laboratory, USA*
 Anil Mane, *Argonne National Laboratory, USA*
 Larry Mann, *Shoei Electronic Materials, Inc., USA*
 Thomas McKrell, *Massachusetts Institute of Technology, USA*
 Scott McNeil, *National Cancer Institute, USA*
 Joey Mead, *University of Massachusetts Lowell, USA*
 Michael Meador, *NASA Glenn Research, USA*
 Chris Menzel, *Dimatix, Inc., USA*
 Meyya Meyyappan, *NASA Ames Research, USA*
 Stephen Miller, *Northwestern University Medical School, USA*
 Moein Moghimi, *University of Copenhagen, Denmark*
 Ron Munson, *Global CCS Institute, Australia*
 Chang-Yong Nam, *Brookhaven National Laboratory, USA*
 Andrzej Napieralski, *Technical University of Lodz, Poland*
 Heath Naquin, *University of Texas at Austin, USA*
 Tinh Nguyen, *National Institute of Standards & Technology, USA*
 Patricia Nieva, *University of Waterloo, CA*
 Greg Nordin, *Brigham Young University, USA*
 Kwang Oh, *University at Buffalo SUNY, USA*
 Pierre Panine, *Xenocs SA, France*
 Hyung Gyu Park, *ETH Zurich, Switzerland*
 Anil Patri, *National Institutes of Health, USA*
 Joachim Piprek, *NUSOD Institute, USA*
 Elena Polyakova, *Graphene 3D Lab, USA*
 Gernot Pomrenke, *U.S. Air Force, USA*
 Sotiris Pratsinis, *Swiss Federal Institute of Technology, Switzerland*
 Serge Prudhomme, *University of Texas at Austin, USA*
 Robert Quinn, *Air Products and Chemicals, USA*
 YuanQiao Rao, *The Dow Chemical Company, USA*
 Robin Ras, *Aalto University School of Science, Finland*
 Somilkumar Rathi, *Intel Corporation, USA*
 Mark Reed, *Yale University, USA*
 Erik Reimhult, *Universität für Bodenkultur Wien, Austria*
 Curt Richter, *National Institute of Standards & Technology, USA*
 Bart Romanowicz, *TechConnect, USA*
 Robert Rudd, *Lawrence Livermore National Laboratory, USA*
 Richard Sadus, *Swinburne University of Technology, Australia*
 Rushan Sakhibgareev, *Chevron, USA*
 Robert Savinell, *Case Western Reserve University, USA*
 Derek Schorzman, *Liquidia Technologies, Inc., USA*
 David Schut, *Shoei Electronic Materials, Inc., USA*
 Keana Scott, *National Institute of Standards and Technology, USA*
 Brent Segal, *Lockheed Martin, USA*
 Philippe Serp, *Institute National Polytechnique de Toulouse, France*
 Neeraj Sharma, *3M, USA*
 Emilie Siocchi, *NASA Langley Research Center, USA*

Patrick Spicer, *University of New South Wales, Australia*
Samuel Stavis, *National Institute of Standards and Technology, USA*
Aaron Stein, *Brookhaven National Laboratory, USA*
Li Piin Sung, *National Institute of Standards & Technology, USA*
Clayton Teague, *National Nanotechnology Coordination Office (retired), USA*
Trey Thomas, *U.S. Consumer Product Safety Commission, USA*
Sally Tinkle, *Science and Technology Policy Institute, USA*
Loucas Tsakalakos, *GE Global Research, USA*
Andy Tsou, *ExxonMobil Chemical Company, USA*
Thomas Twardowski, *Integra Life Sciences Corporation, USA*
Scott Twary, *Los Alamos National Laboratory, USA*
Krassimir Velikov, *Unilever R&D, Netherlands*
Paul Vogt, *Momentive Performance Materials, USA*
Armin Völkel, *Palo Alto Research Center, USA*
William (Cy) Wilson, *NASA Langley Research, USA*
Steven Winston, *Steven Winston & Assoc., USA*
Ken Wong, *The University of Hong Kong, Hong Kong*
Dalia Yablon, *SurfaceChar LLC, USA*
Charles Ying, *National Science Foundation, USA*
Alex Zaks, *Akermin, Inc., USA*
Zhun Zhao, *Rice University, USA*
Steven Zullo, *NIBIB/NIH, USA*

CONFERENCE OPERATIONS MANAGER

Sarah Wenning, *NSTI & TechConnect, USA*

TechConnect Briefs 2015 Volumes

ADVANCED MATERIALS:

TechConnect Briefs 2015, Vol. 1, ISBN: 978-1-4987-4727-1:

1. Nanoscale Materials Characterization
2. Informatics, Modeling & Simulation
3. Carbon Nano Structures & Devices
4. Graphene
5. Nanoparticle Synthesis & Applications
6. Nanocomposite Materials
7. Advanced Materials for Engineering Applications
8. Coatings, Surfaces & Membranes
9. Polymers
10. Soft Matter & Colloids
11. Nanotech Commercialization: Safety & Sustainability

MATERIALS FOR ENERGY, EFFICIENCY AND SUSTAINABILITY:

TechConnect Briefs 2015, Vol. 2, ISBN: 978-1-4987-4728-8:

1. Energy Storage
2. Fuel Cells & Hydrogen
3. Nanomaterials for Catalysis
4. Materials for Oil, Gas & Biofuels
5. Carbon Capture & Utilization
6. Solar Power Technologies
7. Materials for Green Building
8. Water Technologies
9. Materials for Sustainability & Efficiency

BIOTECH, BIOMATERIALS AND BIOMEDICAL:

TechConnect Briefs 2015, Vol. 3, ISBN: 978-1-4987-4729-5:

1. Materials for Drug & Gene Delivery
2. Cancer Nanotechnology
3. Sensors, Diagnostics & Imaging
4. Micro, Nano & Bio Fluidics
5. Biomaterials
6. Materials for Personal/Home Care & Cosmetics
7. Soft Matter & Colloids
8. Food Materials

ADVANCED MANUFACTURING, ELECTRONICS AND MICROSYSTEMS:

TechConnect Briefs 2015, Vol. 3, ISBN: 978-1-4987-4730-1:

1. Advanced Manufacturing
2. Sustainable Nanomanufacturing
3. NanoFab: Manufacturing & Instrumentation
4. Flexible Electronics
5. Photonic Materials & Devices
6. Nanoelectronics, Materials & Devices
7. Modeling & Simulation of Microsystems
8. MEMS & NEMS Devices & Applications
9. Micro, Nano & Bio Fluidics
10. Inkjet Design, Materials & Fabrication

TECHCONNECT BRIEFS 2015: FOUR VOLUME SET

ISBN: 978-1-4987-4731-8 (hardcopy)

TECHCONNECT BRIEFS 2015: FOUR VOLUME SET

ISBN: 978-1-4987-4733-2 (DVD)

TABLE OF CONTENTS

Preface.....	ix
Program Review Committee	x
TechConnect Briefs 2015 Vol. 1-4 Topics	xiii
Advanced Manufacturing	
Sonic Electrospinning - Turning Nanofibre into Products	1
I. Hosie	
Compact Superconducting Radio-frequency Accelerators and Innovative RF Systems	5
S. Chattopadhyay, R. Kephart	
nPort™ Platform Nanotechnology for Liposome Manufacturing:from 20 to 200nm and from Micrograms to Kilograms	9
D.M. Zhu, G.Q. Chen	
Industrial Accelerators – Beyond Transformers and Cyclotrons, More Power	13
T.K. Kroc, R.D. Kephart	
FE Simulation of material removal and surface properties for EDM during single and multiple spark occurrences	17
H.J. Lim, J.P. Domblesky, N. Kim, S.Y. Hwang	
Bearing life prediction on the basis of run-out using accelerated life testing coupled with numerical analysis	21
N.R. Lee, S.Y. Hwang, N. Kim	
Flexible Printed Thermoelectric Textiles for Low Temperature Waste Heat Energy Harvesting Systems	25
K. Ankireddy, B. Iezzi, M.D. Losego, J.S. Jur	
Manufacturing of a Continuous CNT Rollstock	29
E.M. Chan	
Advanced Manufacturing Process for Producing Carbon Nanofiber Yarns.....	31
A.W. Carpenter, C. Gause, L. Zhang, J.M. Kennedy, C. Hopper, Q. Mao, A. Kelkar	
Multilayer co-extrusion processing of PS/TPV/CNTs nanocomposites.....	35
R. Jian, A. Panwar, C. Barry, J. Mead	
Precision Abrasive-Waterjet Machining of Most Materials from Macro to Micro Scales	39
P.H.-T. Liu	
Customized Manufacture of Protective Headgear for Primary Prevention of Fall Related Traumatic Brain Injuries	43
J. Ferguson, V. Caccese, S. Castle	
A family of MAV drives investigation	47
R.T. Dalewski, K. Gumowski, T. Barczak, J. Godek	
Intense Pulsed Light Sintering and Reduction of Facile Copper Hydroxide Synthesis towards Printable Copper Contacts	51
T. Druffel, R. Dharmadasa, G. Draper	
Synthesis of conductive elastic film and conductive fabric based on crosslinked carboxymethyl starch- AgNPs composite	55
M.A. El-Sheikh	
Rapid Printed Tooling for High-rate Production of Microstructured Surfaces	60
M. De Jesus Vega, J. Shearer, J. Mead, C. Barry	
Design process to minimize roof surface defect using flexural function computed by finite element method	65
S.Y. Hwang, H.S. Jeong, N.S. kim	
Active Air Bearing Technology for Compensating Multi-DOF Motion Errors of Ultra-Precision Motion Units	69
S.-K. Ro, G. Khim, J.-K. Park	
High-rate Manufacturing of 3D Products with Nanostructured Surfaces.....	73
C. Barry, M. De Jesus Vega, J. Mead	
The benefits and challenges of Industry-Start Up-University collaboration for product development.....	77
R. Silveston-Keith	

Advanced large scale colloidal lithography for sub-100 nm direct and indirect nanostructuring: application to silicon and metals	81
H. Kadiri, M. Faustini, D. Turover, D. Grosso, A. Gokarna, G. Lerondel	
NETZSCH Nanotechnology Advancements and Applications	85
S. Miranda, R. Smith	
Sustainable Nanomanufacturing	
Scalable Polymer Patterning (SP2)	89
J. Mead, C. Barry	
Near Infrared Sintering of a cost effective Roll to Roll water purification coating	93
I. Mabbett, D. Brennan, N.P. Lavery, C.M.E. Charbonneau, K. Khan, R. Woods, A.B. Pursglove, D.T. Bryant, T.M. Watson, D.A. Worsley	
Key Elements of a Responsible Development Plan for Nanomanufacturing	97
L.L. Hodson, C.L. Geraci	
DNA Double-Write Photolithography: A Synergy for Top-Down and Bottom-Up Nanofabrication	101
M.J. Heller, Y. Song	
NanoFab: Manufacturing & Instrumentation	
Fabrication of highly ordered vertical GaAs nanowires by inductively coupled plasma etching and their modal analysis	105
N. Dhindsa, A. Chia, J. Boulanger, I. Khodadad, R. LaPierre, J. Walia, S. Saini	
Wafer-Scale Planarization using Location Specific Gas Cluster Ion Beam (GCIB) in Advanced CMOS Logic Technology	108
Y. Moon, L. Qin, D. Koli, C. Snow	
Design and Evaluation of a Highly Stretchable and Conductive Thin Film for Tactile Sensors	112
Y. Sun, D. Zhou, J. Bai, H. Wang, and J. Cao	
Flexible Electronics	
Engineering nanoinks and photonic manufacturing for printable electronics	116
A. Hu	
Room-temperature printing of thin-film devices for flexible electronics	120
T. Minari, M. Kanehara	
Wearable and flexible electronic devices: Market forecasts 2015-2025	124
H. Zervos	
Transparent, Scalable, and Flexible Piezoelectric Pressure Sensors	128
S. Vishniakou	
3D laser writing in-line process for the rapid fabrication of flexible electronic devices	131
G. Dubourg, S. Marjanović, C. Zlebic, J. Matovic and V. Crnojević Bengin	
Photonic Materials & Devices	
230 fold fluorescence enhancement by 3D Rhodamine B coated polystyrene photonic crystals	135
E. Eftekhari, X. Li, I.S. Cole, Q. Li	
Effective Multistep Exciton Delivery Through DNA-based Photonic Wires	139
C.M. Spillmann, S. Buckhout-White, M.G. Ancona, P.D. Cunningham, J.S. Melinger, E.R. Goldman, I.L. Medintz	
Plasmonic Structural Colors For Plastic Consumer Products	143
E. Højlund-Nielsen, J. Clausen, L.H. Thamdrup, M. Zalkovskij, T. Nielsen, T. Mäkelä, J. Ahopelto, N.A. Mortensen, A. Kristensen	
Highly Tunable Surface Plasmons Resonance Using Metal/metal Oxide Hybrid Nanostructures	147
A.A. Khosroabadi, P. Gangopadhyay, R.A. Norwood	
Energy Efficient Transmission Scheme Alternative to M-PAM for Short Range Data Communication	150
M.A. Elsherif, A. Malekmohammadi	
Fabrication and Characterization of On-Chip Integrated Silicon Photonic Bragg Grating and Photonic Crystal Cavity Thermometers	154
N.N. Klimov, T. Purdy, Z. Ahmed	
Silicon Photonic Temperature Sensors	157
Z. Ahmed	

Wafer-scale photonic and plasmonic crystal sensors.....	160
M.C. George, J.-N. Liu, A. Farhang, B. Williamson, M. Black, T. Wangenstein, J. Fraser, R. Petrova, and B.T. Cunningham	
Structural and Luminescent properties of Europium benzene-1,3,5-tricarboxylate	163
B.Y. Alejandro-Zuniga, E. Ortiz, H. Solis, S. Loera-Serna, D.Y. Medina-Velazquez	
Glass-Ceramic Scintillators for High-Resolution Medical Imaging	166
M.B. Beckert, J.H. Nadler, Z. Kang, B.K. Wagner	
The effects of confining cup-like and hill-like parabolic electric potentials on the photoionization cross section in a spheroidal quantum dot	170
M. Tshipa	
Effect of circular dichroism in chiral photonic crystal liquid with enclosed defect layer inside	174
A.H. Gevorgyan, A.N. Kocharian, G.A. Vardanyan	
Nanoelectronics, Materials & Devices	
Arsenene Substrates Enable a New Era of High-Performance Semiconductors	178
D. Zavitz, J. Kubricky	
TCAD AC analysis of Gate Electrode Workfunction Engineering Silicon Nanowire MOSFET for High Frequency Applications.....	181
N. Gupta, A. Kumar, R. Chaujar	
TCAD Analysis of Frequency Dependent Intrinsic and Extrinsic Parameters of GEWE-SiNW MOSFET	185
N. Gupta, A. Kumar, R. Chaujar	
TCAD Analysis of Small Signal Parameters and RF Performance of Heterogeneous Gate Dielectric-Gate All Around Tunnel FET	189
J. Madan, R.S. Gupta, R. Chaujar	
Analysis of Small Signal Behaviour of Transparent Gate Recessed Channel (TGRC) MOSFET for High Frequency/RF Applications.....	193
A. Kumar, N. Gupta, R. Chaujar	
Memristor fabrication and characterization based on TiO ₂	196
M.V. Diamanti, R. Pisoni, A. Cologni, F. Corinto, M.P. Pedferri	
Nanobiomimetic Memcapacitor Memory Devices Identify Circadian Rhythm Dysfunction and Predict Early Signs of “Epilepsy” Using Reentrant Energy-Sensory Images	200
E.T. Chen, J. Thornton, C. Mulchi Jr.	
Fabrication and characterization of quantum dots with carbon nanotube-molecule heterojunctions.....	204
A. Hida, K. Ishibashi	
Impact of Gate Oxide Thickness and Channel Thickness on DC Performance of Carbon Nanotube Tunnel FET	206
K.S. Bhosale, A.V. Jawake, S.R. Aher, H.S. Borse, S.R. Patil, G.C. Patil	
Optimized FFT QCA Implementation using Five-input Majority Gate	210
R. Akeela	
A Novel GaAs-on-Si MOSFET for Analog Integrated Circuits	214
A.V. Jawake, S.R. Aher, H.S. Borse, K.S. Bhosale, S.R. Patil, G.C. Patil	
A Novel Dual-K Spacer Double Gate Junctionless Transistor for Digital Integrated Circuits	218
S.R. Patil, G.C. Patil, H.S. Borse, K.S. Bhosale, A.V. Jawake, S.R. Aher	
Impact of High-k gate oxide on intrinsic device Performance of Junctionless Transistor (JLT)	222
H.S. Borse, A.V. Jawake, S.R. Aher, K.S. Bhosale, S.R. Patil, G.C. Patil, D.S. Bormane	
Acetylcholine Repairs the Amyloid-beta Damage on Brain Circuitry and Memory Loss From a “Mutated Biomimetic Acetylcholinesterase” Neuronal Memcapacitor During Slow-Wave Sleeping	226
J. Thornton, C. Mulchi Jr., P.T. Kissinger, E.T. Chen	
Nanoelectronic Structural Information with Scanning Probe Microscopes	230
J. Kopanski, L. You, J-J Ahn, Y. Obeng	
Modeling of Electromagnetic Phenomena Inside Modern Integrated Semiconductor Structures.....	234
M. Zubert, M. Jankowski, P. S. Nowak, T. Raszkowski, A. Samson, A. Napieralski	
Modeling & Simulation of Microsystems	
Application of Dual-Phase-Lag Model for Thermal Analyses of Electronic Nanostructures	238
M. Janicki, M. Zubert, A. Samson, A. Napieralski	
Novel Nanoelectromechanical Switches for VLSI Power Integrity Improvement	242
R. Zhang, D. Saab, M. Masoo	

Modeling the effect of the increase in the actuation voltage on the dynamic behavior of a RF MEMS switch	246
M. Jamshidzadeh, J. Casals	
The Heat transfer in Fin-FET transistor	250
M. Zubert, M. Janicki, T. Raszkowski, A. Samson, A. Napieralski	
Threshold Voltage Model of Hetero Gate Dielectric-Dual Material Gate-GAA-Tunnel FET	254
J. Madan, R.S. Gupta, R. Chaujar	
High-voltage Edge-rounded Adjustable Trapezoidal Waveform Generators	258
M. Jankowski, A. Napieralski	
Time-Domain Monte-Carlo and Noise Analysis of MAPS Sensors	262
M. Jankowski, A. Napieralski	
Simulation of High-k Passivation-Layer Effects on Breakdown Voltage in AlGaIn/GaN HEMTs	266
H. Hanawa, Y. Satoh, K. Horio	
Simulation of Current Slump Removal in Field-Plate GaAs MESFETs	270
A. Nomoto, Y. Satoh, K. Horio	
Simulation of Lags and Current Collapse in Field-Plate AlGaIn/GaN HEMTs with Deep Acceptors in a Buffer Layer	274
N. Noda, K. Horio	
Simulation of Phonon Thermalization in a Single-photon Detector on the Basis of CeB6 Thermoelectric Sensor	278
A.S. Kuzanyan V.R. Nikoghosyan, A.A. Kuzanyan	
Evaluation of Garofalo creep model for lead-free solder joints in surface mount components	282
E. Amalu	
Effect of IMC thickness on thermo-mechanical reliability of lead-free solder joints in solar cell assembly	286
M.T. Zarmai, N.N. Ekere, C.F. Oduoza, E.H. Amalu	
MEMS & NEMS Devices & Applications	
MEMS pressure sensor with an AlGaIn/GaN based high electron mobility transistor	290
G. Vanko, J. Dzuba, I. Rýger, M. Vallo, T. Lalinský	
Towards generic platforms for MEMS manufacturing	294
A. Rouzaud, JP. Polizzi, P. Robert, J. Arcamone	
Tip-Tilt-Piston Micromirror with Integrated Large Range Variable Focus for Smart Lighting Systems	300
J. Morrison, M. Imboden, T.D.C. Little, D.J. Bishop	
Modeling the effect of the increase in the actuation voltage	304
M. Jamshidzade, J. Cassles	
Embedded fiber optic sensors for battery performance monitoring in Lithium ion battery cells	308
H. Alemohammad, A. Ghannoum, L. Zdravkova, K. Iyer, P. Nieva, A. Yu, A. Khajepour, P. Nieva, A. Yu, A. Khajepour	
An Economical Lightweight Field Deployable PiezoElectric Gravimeter (PEG)	312
S. Jensen	
Advanced Packaging for Next Generation Imaging and Sensor Devices	315
J. Kulick	
Wireless, One-way, Sensor to Base Station Monitoring System for Explosive and Non-hazardous Environments	319
S.L. Jensen	
Micro, Nano & Bio Fluidics	
Recent advances in capillary microflows for point-of-care and home-care devices	323
J. Berthier, D. Gosselin, M. Huet, M. Cubizolles, G. Delapierre	
The Automation of Protein Crystal Presentation for X Ray Diffraction Experiments using Standing Acoustic Waves in a Microfluidic Chip Environment	327
C. Burton, P. Docker, M. Prince, M. Leaper, J. Kay, D. Stuart, G. Evans	
The application of 3D printing to study microfluidic architecture for 'on chip' mixing systems for SRCD and UV spectroscopy	331
M. Prince, P. Docker, C. Burton, R. Hussain, J. Kay, G. Silgardi	
A Simple Method for Fabrication of Microarrays and Microfluidic Device Using PDMS Stamp	335
H. Lee, D. Koh, K.W. Oh	

Negative Dielectrophoretic Force based High Efficiency and High Throughput Cell Sorting System Harnessing Paired Electrode Arrays and a Meso Size Channel	339
D. Lee, B. Hwang, B. Kim	
The Development of an Automated Nano Sampling Handling System for Nanometre Protein Crystallography Experiments	343
P. Docker, D. Axford, M. Prince, B. Cordovez, J. Kay, D. Stuart, G. Evans	
Design, development and testing of apparatus to study gas diffusion in nanochannels	347
S. Karakitsiou, S.D. Eder, B. Holst, A.C. Hoffmann	
On the dynamic contact angle in spontaneous capillary flow	351
J. Berthier, D. Gosselin, G. Delapierre	
Microfluidics for multiplexing of core needle biopsies	355
W.D. Mojica, K.W. Oh, H. Lee, X. Xue, E.P. Furlani	
Bottom-up Nanofabrication of Crystalline Structures of Magnetic Nanoparticles	359
X. Xue, E.P. Furlani	
Low-cost spin-coatable, Transferable, and High-k Ion Gel Dielectric for Flexible Eletrowetting	363
V. Narasimhan, V. Sanjairaj, S-Y Park	
An Integrated Biometric Platform for Evaluation of Targeted Drug Delivery	367
Y. Liu, A. Thomas, C. Uhl, S. Wang, R. He	
Guidelines for choosing an appropriate turbulence model when simulating blood flows in cardiovascular devices	371
B.A.F. Simpson, G.D. Tansley	
Plasmonic Nanocages as Photothermal Transducers for Laser Induced Heating and Bubble Generation	375
I.H. Karamelas, F. Alali, E.P. Furlani	
Inkjet Design, Materials & Fabrication	
Magnetohydrodynamic Liquid Metal Jet Printing	379
S. Vader, Z. Vader, I.H. Karamelas, E.P. Furlani	
Characterization of Inkjet-printed Explosive Materials	382
M.E. Farrell, E.L. Holthoff, L.S. Marcus, P.M. Pellegrino	
Depositing Explosives and Chemical Materials on Relevant Surfaces using Inkjet Technology for Calibration Test Standards	388
R.P. Moon, A.W. Fountain III, J.A. Guicheteau, S.D. Christesen, N. Green, K. Hung, A. Tripathi	
Investigating an Inkjet Printer for Standardized Sample Preparation	392
E.L. Holthoff, M.E. Farrell, L.S. Marcus, P.M. Pellegrino	
Effect of Charge Accumulation and Dielectric Polarization on EHD Patterning on Non-Conductive Substrates	396
S. Haque, S. Lee, S. Son	
Index of Authors	401
Index of Keywords	405

