PROCEEDINGS OF SPIE

Nanosensors, Biosensors, and Info-Tech Sensors and Systems 2010

Vijay K. Varadan *Editor*

8–11 March 2010 San Diego, California, United States

Sponsored by SPIE

Cosponsored by American Society of Mechanical Engineers (United States)

Cooperating Organizations Intelligent Materials Forum (Japan) Jet Propulsion Laboratory (United States) National Science Foundation (United States)

Published by SPIE

Volume 7646

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 Nanosensors, Biosensors, and Info-Tech Sensors and Systems 2010, edited by Vijay K. Varadan, Proceedings of SPIE Vol. 7646 (SPIE, Bellingham, WA, 2010) Article CID Number.

ISSN 0277-786X ISBN 9780819480613

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 © 2010, 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/10/\$18.00.

Printed in the United States of America.

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



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 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

ix	Conference Committee	
	KEYNOTE SESSION	
7646 02	Exploratory procedures with carbon nanotube-based sensors for propellant degradation determinations (Keynote Paper) [7646-01] P. B. Ruffin, E. Edwards, C. Brantley, B. McDonald, U.S. Army Research (United States)	
7646 05	Eco green flexible hybrid photovoltaic-thermoelectric solar cells with nanoimprint technology and roll-to-roll manufacturing (Keynote Paper) [7646-15] V. K. Varadan, Univ. of Arkansas (United States); S. H. Choi, NASA Langley Research Ctr. (United States)	
	NANOWIRE, NANOTUBE, AND NANOSTRUCTURES I	
7646 07	Photoreduction of Au(III) to form Au(0) nanoparticles using ferritin as a photocatalyst [7646-03] R. J. Hilton, J. D. Keyes, R. K. Watt, Brigham Young Univ. (United States)	
7646 08	Comparison of the phase transformation rate for TiO ₂ thin film and TiO ₂ nanorods [7646-04] Y. Chen, K. S. Kang, J. Nayak, J. Kim, Inha Univ. (Korea, Republic of)	
	NANOWIRE, NANOTUBE, AND NANOSTRUCTURES II	
7646 OA	A systems engineering approach to wireless integration, design, modeling, and analysis of nanosensors, networks, and systems [7646-07] S. Mohan, H. M. Al-Rizzo, R. Babiceanu, T. Elwi, R. Ghimire, G. Huang, H. Khalil, D. Rucker, C. Singh, Univ. of Arkansas at Little Rock (United States); V. Varadan, Univ. of Arkansas at Fayetteville (United States); K. Yoshigoe, R. Zhu, Univ. of Arkansas at Little Rock (United States)	
	NANO DEVICES AND SENSORS I	
7646 OC	Environmental sensing in composite oxide semiconductor films [7646-09] A. K. Pradhan, R. Mundle, G. Kogo, R. B. Konda, O. Bamiduro, O. Yasar, K. Zhang, M. Bahoura, F. Williams, K. Song, Norfolk State Univ. (United States)	
7646 OE	Investigation of sodium-potassium niobate (Na _{0.5} K _{0.5} NbO ₃) thin film fabrication for piezoelectric sensor application [7646-11] SD. Jang, Inha Univ. (Korea, Republic of); JH. Koh, Kwangwoon Univ. (Korea, Republic of JH. Kim, Chosun Univ. (Korea, Republic of); J. Kim, Inha Univ. (Korea, Republic of)	

7646 OF	OF Growth and properties of PZT: based perovskite multilayers for sensor applications [7646] A. K. Pradhan, O. Yasar, R. B. Konda, R. Mundle, M. Bahoura, F. Williams, K. Song, Norfolk State Univ. (United States); D. R. Sahu, Univ. of Witwatersrand (South Africa)					
7646 OG	Carbon nanocomposite-based contact mode interdigitated center of pressure sensor					
	[7646-13] TB. Xu, National Institute of Aerospace (United States); C. Park, National Institute of Aerospace (United States) and Univ. of Virginia, Charlottesville (United States); N. Guerreiro, National Institute of Aerospace (United States) and Univ. of Maryland (United States); J. H. Kang, National Institute of Aerospace (United States); J. E. Hubbard, Jr., National Institute of Aerospace (United States) and Univ. of Maryland (United States)					
	NANO DEVICES AND SENSORS II					
7646 OJ	Maximizing the efficiency of ferritin as a photocatalyst for applications in an artificial photosynthesis system [7646-66]					
	R. J. Hilton, J. D. Keyes, R. K. Watt, Brigham Young Univ. (United States)					
7646 OK	Homeland security monitoring sensors and early warning relay and diagnostic system [7646-18]					
	V. K. Varadan, Univ. of Arkansas (United States); P. B. Ruffin, C. Brantley, E. Edwards, U.S. Army Research (United States)					
7646 OM	Low voltage pentacene OTFT integration for smart sensor control circuits [7646-67] P. S. Kumar, P. Rai, G. N. Mathur, V. K. Varadan, Univ. of Arkansas (United States)					
7646 ON	Flexible strain sensor based on carbon nanotube rubber composites [7646-20] JH. Kim, Pukyong National Univ. (Korea, Republic of); YJ. Kim, Korea Institute of Geoscience and Mineral Resources (Korea, Republic of); W. K. Baek, K. T. Lim, I. Kang, Pukyong National Univ. (Korea, Republic of)					
	SMART ELECTRONICS					
7646 00	A digital logic nanowire for reliability enhancement [7646-21] S. C. Lee, Univ. of Oklahoma (United States)					
7646 OP	A programmable second order oversampling CMOS sigma-delta analog-to-digital converter for low-power sensor interface electronics [7646-22] R. Soundararajan, A. Srivastava, Y. Xu, Louisiana State Univ. (United States)					
7646 0Q	Probabilistic behavior and information measures of sequential nanolCs [7646-23] S. C. Lee, Univ. of Oklahoma (United States)					
7646 OR	7646 OR Quantum state transition diagram: a bridge from classical computing to quantum computing [7646-24] L. R. Hook IV, S. C. Lee, Univ. of Oklahoma (United States)					

	WIRELESS SENSOR SYSTEMS				
7646 OS	Power beaming to a micro aerial vehicle using an active phased array [7646-25] H. Sawahara, A. Oda, D. Alseny, K. Komurasaki, Y. Arakawa, The Univ. of Tokyo (Japan)				
7646 OU	Rectennas performance based on substrates for bio-medical applications [7646-27] H. Yoon, F. Williams, K. D. Song, Norfolk State Univ. (United States); S. Y. Yang, J. H. Kim, Inhouniv. (Korea, Republic of); K. Lee, Federal Highway Administration (United States); S. H. Ch. NASA Langley Research Ctr. (United States)				
7646 OV	Reliability considerations in switchable PLL frequency synthesizers for wireless sensor networks [7646-28] Y. Liu, A. Srivastava, Louisiana State Univ. (United States)				
7646 OW	Application of wireless sensor system on security network [7646-29] S. Oh, H. Kwon, Univ. of Arkansas (United States); H. Yoon, Norfolk State Univ. (United State V. K. Varadan, Univ. of Arkansas (United States)				
7646 OX	Software structure for broadband wireless sensor network system [7646-30] H. Kwon, S. Oh, H. Yoon, V. K. Varadan, Univ. of Arkansas (United States)				
	NANO SENSORS AND ACTUATORS				
7646 OY	Multi-walled carbon nanotubes covalently bonded cellulose composite for chemical vapor sensor [7646-31] S. Yun, S. Y. Yang, J. Kim, Inha Univ. (Korea, Republic of)				
7646 OZ	Integration of OLEDs in biomedical sensor systems: design and feasibility analysis [7646-32 P. Rai, P. S. Kumar, V. K. Varadan, Univ. of Arkansas (United States)				
7646 10	Cellulose polypyrrole-ionic liquid (CPIL) nanocomposite for durable, biomimetic electro-active paper actuator [7646-33] S. K. Mahadeva, JH. Kim, J. Kim, Inha Univ. (Korea, Republic of)				
	APPLICATIONS I				
7646 11	Photoresponsive hydrogel microvalve activated by bacteriorhodopsin proton pumps [7646-34] K. Al-Aribe, G. K. Knopf, The Univ. of Western Ontario (Canada)				
7646 13	Versatile smart optical material characterizer system [7646-36] Y. Park, National Institute of Aerospace (United States); S. Park, Kyungwon Univ. (Korea, Republic of); U. Lee, Gachon Univ. Gil Medical Ctr. (Korea, Republic of); K. Lee, Federal Highway Administration (United States); S. Choi, NASA Langley Research Ctr. (United States)				
7646 14	Bioelectronic photosensing array for non-planar imaging [7646-37] G. K. Knopf, The Univ. of Western Ontario (Canada)				

	APPLICATIONS II					
7646 16	Reliability of PEDOT-PSS strain gauge on foam structure [7646-39] CL. Chang, K. Fix, WC. Wang, Univ. of Washington (United States)					
7646 17	Organic electronics based pressure sensor towards intracranial pressure monitoring [7646-40] P. Rai, V. K. Varadan, Univ. of Arkansas (United States)					
7646 18	A bio-inspired flow sensor [7646-41] X. Yu, J. Tao, J. Berilla, Case Western Reserve Univ. (United States)					
	MODELING AND CHARACTERIZATION					
7646 1A	Wave propagation and structural dynamics in graphene nanoribbons [7646-43] F. Scarpa, Univ. of Bristol (United Kingdom); M. Ruzzene, Georgia Institute of Technology (United States); S. Adhikari, R. Chowdhury, Swansea Univ. (United Kingdom)					
7646 1B	Thickness effect on Schottky diode characteristics of ZnO thin film (Invited Paper) [7646-44 J. Nayak, Y. Chen, K. S. Kang, J. Kim, Inha Univ. (Korea, Republic of)					
7646 1C	C Characterization of micro-scale surface features using partial differential equations [7646-45] G. González Castro, R. Spares, H. Ugail, B. R. Whiteside, J. Sweeney, Univ. of Bradford (Un Kingdom)					
7646 1E	Mathematical modeling for the design of porous coronary stents: nano- and microporous stents v. macroporous stents [7646-47] A. K. Habib, A. V. Finn, Emory Univ. (United States)					
	APPLICATIONS III					
7646 1F	Comprehensive design and process flow configuration for micro and nano tech devices [7646-48]					
	K. Hahn, T. Schmidt, M. Mielke, Univ. Siegen (Germany); D. Ortloff, J. Popp, Process Relations GmbH (Germany); R. Brück, Univ. Siegen (Germany)					
7646 1G	Smart energy management system [7646-49] A. Desai, J. Singh, La Trobe Univ. (Australia)					
	APPLICATIONS IV					
7646 11	A very high Q-factor inductor using MEMS technology [7646-51] N. Khalid, K. Shah, J. Singh, H. P. Le, J. Devlin, La Trobe Univ. (Australia); Z. Sauli, Univ. Malaysi Perlis (Malaysia)					
7646 1J High crystalline GaN nanoparticle and GaN thin film fabrication (Invited Paper) [7646-5 Y. Chen, K. S. Kang, J. Noyak, J. Kim, Inha Univ. (Korea, Republic of)						

7646 1K Thermal indicating paints for ammunition health monitoring [7646-53]
J. L. Zunino III, U.S. Army Armament Research, Development and Engineering Ctr. (United States); Z. Iqbal, New Jersey Institute of Technology (United States)

7646 1L Fabrication of UV-micro-patternable permanent micro magnets for lab on a chip and MEMS [7646-54]

A. Khosla, J. L. Korčok, B. L. Gray, D. B. Leznoff, Simon Fraser Univ. (Canada); J. Herchenroeder, Magnequench International Inc. (United States); D. Miller, Z. Chen, Magnequench Tech Ctr. (Singapore)

Nanowire-organic thin film transistor integration and scale up towards developing sensor array for biomedical sensing applications [7646-55]

P. S. Kumar, P. T. Hankins, P. Rai, V. K. Varadan, Univ. of Arkansas (United States)

POSTERS

7646 10 Design of a microelectronic circuit to amplify and modulate the signal of a micro-electro-mechanical systems arterial pressure sensor [7646-57]

E. Vela-Peóa, I. Quiñones-Urióstegui, Instituto Nacional de Rehabilitación (Mexico); F. Martínez-Piñon, J. A. Álvarez-Chávez, Ctr. de Investigación e Innovación Tecnológica, IPN (Mexico)

7646 1P Synthesis and characterization of composite of gold nanoparticles attached ZnO nanorods [7646-58]

K. Zhang, R. Konda, T. Holloway, Norfolk State Univ. (United States); W. Cao, Old Dominion Univ. (United States); A. K. Pradhan, Norfolk State Univ. (United States)

- 7646 1Q Simple theoretical analysis of the thermoelectric power under strong magnetic quantization in superlattices of non-parabolic semiconductors with graded interfaces [7646-61] S. R. Singharoy, JIS College of Engineering (India)
- 7646 1R Dynamic behavior of double-walled carbon nanotubes conveying viscous fluid based on nonlocal elastic theory [7646-62]
 Y. Zhen, B. Fang, L. Wang, Harbin Institute of Technology (China)

Analysis of the effect of both specimen size and grain size on the tensile strength of the polycrystalline metallic materials [7646-63]

B.-B. Jung, Pohang Univ. of Science and Technology (Korea, Republic of); H. K. Lee, POSCO Technical Research Laboratories (Korea, Republic of); H.-C. Park, Pohang Univ. of Science and Technology (Korea, Republic of)

7646 1U Thermal sensors based on nano porous silicon [7646-65]

J.-C. Lin, St. John's Univ. (Taiwan); W.-C. Tsai, National Cheng Kung Univ. (Taiwan); M.-K. Hsu, St John's Univ. (Taiwan); H.-T. Hou, Tamkang Univ. (Taiwan); Y.-H. Chen, Chinese Culture Univ. (Taiwan)

Author Index

Conference Committee

Symposium Chairs

Donald J. Leo, Virginia Polytechnic Institute and State University (United States)

Kara J. Peters, North Carolina State University (United States)

Symposium Cochairs

Norbert G. Meyendorf, Fraunhofer-Institut für Zerstörungsfreie Prüfverfahren (Germany)

Norman M. Wereley, University of Maryland, College Park (United States)

Conference Chair

Vijay K. Varadan, University of Arkansas (United States)

Cochairs

Jaehwan Kim, Inha University (Korea, Republic of)
Kyo D. Song, Norfolk State University (United States)
Sang H. Choi, NASA Langley Research Center (United States)

Program Committee

Pratul K. Ajmera, Louisiana State University (United States)

William C. Edwards, NASA Langley Research Center (United States)

Sean Jones, National Science Foundation (United States)

Ravindra P. Joshi, Old Dominion University (United States)

Kimiya Komurasaki, The University of Tokyo (Japan)

Kunik Lee, Federal Highway Administration (United States)

Uhn Lee, Gachon University Gil Medical Center (Korea, Republic of)

Xinxin Li, Shanghai Institute of Microsystem and Information Technology (China)

N. Manoharan, Sathyabama Deemed University (India)

Seshadri X. Mohan, University of Arkansas at Little Rock (United States)

Yeonjoon Park, NASA Langley Research Center (United States)

Aswini K. Pradhan, Norfolk State University (United States)

Yongrae Roh, Kyungpook National University (Korea, Republic of)

Paul B. Ruffin, U.S. Army Aviation and Missile Research, Development and Engineering Center (United States)

Ashok Srivastava, Louisiana State University (United States)

Malathi Srivatsan, Arkansas State University (United States)

Richard K. Watt, Brigham Young University (United States)
Frances Williams, Norfolk State University (United States)
Tian-Bing Xu, National Institute of Aerospace (United States)
T. C. Yih, Oakland University (United States)
Ming Zhou, Suzhou Institute of Nano-Tech and Nano-Bionics (China)

Session Chairs

Keynote Session

Vijay K. Varadan, University of Arkansas (United States)

Sang H. Choi, NASA Langley Research Center (United States)

Vijay K. Varadan, University of Arkansas (United States)

Nanowire, Nanotube, and Nanostructures I **Kwang Sun Kang**, Inha University (Korea, Republic of)

Nanowire, Nanotube, and Nanostructures II

Sang H. Choi, NASA Langley Research Center (United States)

Nano Devices and Sensors I

Aswini K. Pradhan, Norfolk State University (United States)

Nano Devices and Sensors II

Christina L. Brantley, U.S. Army Research, Development and Engineering Command (United States)

Smart Electronics

Ashok Srivastava, Louisiana State University (United States)

Wireless Sensor Systems

Frances Williams, Norfolk State University (United States)

Eugene Edwards, U.S. Army Aviation and Missile Research,

Development and Engineering Center (United States)

Nano Sensors and Actuators

Jaehwan Kim, Inha University (Korea, Republic of)

Applications II

Pratyush Rai, University of Arkansas (United States)

Modeling and Characterization

Linfeng Chen, University of Arkansas (United States)

Applications III

Pratyush Rai, University of Arkansas (United States)

Applications IV

Pratyush Rai, University of Arkansas (United States)