PROCEEDINGS OF SPIE

Oxide-based Materials and Devices III

Ferechteh H. Teherani
David C. Look
David J. Rogers
Editors

22–25 January 2012
San Francisco, California, United States

Sponsored and Published by
SPIE

Volume 8263

Proceedings of SPIE, 0277-786X, v. 8263

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 *Oxide-based Materials and Devices III*, edited by Ferechteh H. Teherani, David C. Look, David J. Rogers, Proceedings of SPIE Vol. 8263 (SPIE, Bellingham, WA, 2012) Article CID Number.

ISSN 0277-786X
ISBN 9780819489067

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 © 2012, 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/12/$18.00.

Printed in the United States of America.

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

SPIE Digital Library

SPIEDigitalLibrary.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

ix *Conference Committee*

xiii *Spinoptics: Spin degeneracy removal in nanostructures (Plenary Paper) [8269-100]*
V. Kleiner, N. Shitrit, E. Hasman, Technion-Israel Institute of Technology (Israel)

SESSION 1 HIGHLY CONDUCTING TRANSPARENT OXIDES I

8263 02 **Making highly conductive ZnO: creating donors and destroying acceptors** [8263-01]
D. C. Look, Wright State Univ. (United States) and Wyle Labs., Inc. (United States); K. D. Leedy, Air Force Research Lab. (United States)

8263 03 **Optical characterization of high mobility polycrystalline ZnO:Al films (Invited Paper)** [8263-02]
F. Ruske, M. Wimmer, G. Köppel, Helmholtz-Zentrum Berlin für Materialien und Energie GmbH (Germany); A. Pflug, Fraunhofer-Institut für Schicht- und Oberflächentechnik (Germany); B. Rech, Helmholtz-Zentrum Berlin für Materialien und Energie GmbH (Germany)

8263 05 **Hydrothermal growth and characterization of bulk Ga-doped and Ga/N-codoped ZnO crystals (Invited Paper)** [8263-04]
B. Wang, Solid State Scientific Corp. (United States); M. Mann, M. Snure, Air Force Research Lab. (United States); M. J. Callahan, Solid State Scientific Corp. (United States); D. C. Look, Wright State Univ. (United States) and Wyle Labs., Inc. (United States)

8263 06 **Novel fabrication method for ZnO films via nitrogen-mediated crystallization (Invited Paper)** [8263-05]
N. Itagaki, Kyushu Univ. (Japan) and PRESTO, Japan Science and Technology Agency (Japan); K. Kuwahara, K. Matsushima, K. Oshikawa, Kyushu Univ. (Japan)

SESSION 2 HIGHLY CONDUCTING TRANSPARENT OXIDES II

8263 08 **Properties of TCO anodes deposited by atmospheric pressure chemical vapor deposition and their application to OLED lighting (Invited Paper)** [8263-07]
R. Y. Korotkov, Arkema Inc. (United States)

8263 09 **Real-structure effects: absorption edge of $Mg_x Zn_{1-x}O$, $Cd_xZn_{1-x}O$, and *n*-type ZnO from *ab-initio* calculations (Invited Paper)** [8263-08]
A. Schleife, Lawrence Livermore National Lab. (United States); F. Bechstedt, Friedrich-Schiller-Univ. Jena (Germany) and European Theoretical Spectroscopy Facility (Germany)

SESSION 3 DOPING AND BAND STRUCTURE STUDIES

8263 0A **Thermal process induced change of conductivity in As-doped ZnO (Invited Paper)** [8263-09]
S. C. Su, J. C. Fan, C. C. Ling, The Univ. of Hong Kong (Hong Kong, China)

8263 0B **Doped gallium oxide nanowires for photonics (Invited Paper)** [8263-10]
E. Nogales, I. López, B. Méndez, J. Piqueras, Univ. Complutense de Madrid (Spain); K. Lorenz, E. Alves, Instituto Tecnológico e Nuclear (Portugal); J. A. García, Univ. del País Vasco (Spain)

SESSION 4 MATERIAL GROWTH

8263 0E **Growth and characterization of large-diameter, lithium-free ZnO single crystals (Invited Paper)** [8263-13]
S. Wang, A. Kopec, A. G. Timmerman, Fairfield Crystal Technology, LLC (United States)

SESSION 5 LIGHT EMITTERS I

8263 0K **White-light lasing in ZnO microspheres fabricated by laser ablation (Invited Paper)** [8263-18]
S. Okamoto, Y. Minowa, M. Ashida, Osaka Univ. (Japan)

8263 0L **White light upconversion emission in Yb^{3+}/ Er^{3+}/ Tm^{3+} codoped oxy-fluoride lithium tungsten tellurite glass ceramics (Invited Paper)** [8263-19]
G. F. Ansari, All Saints' College of Technology (India); S. K. Mahajan, Samrat Ashok Technological Institute (India)

8263 0M **Optimization of photoluminescence and electroluminescence of silicon nanocrystals in a superlattice host (Invited Paper)** [8263-20]
M. Roman, D. W. Prather, Univ. of Delaware (United States)

SESSION 6 LIGHT EMITTERS II

8263 0N **Metal oxide nanostructures and white light emission (Invited Paper)** [8263-21]
A. Zainelabdin, O. Nur, G. Amin, S. Zaman, M. Willander, Linköping Univ. (Sweden)

8263 0O **ZnO nanowires for tunable near-UV/blue LED (Invited Paper)** [8263-22]
T. Pauporté, O. Lupan, LECIME, CNRS, Ecole Nationale Supérieure de Chimie de Paris (France); B. Viana, LCMCP, CNRS, Ecole Nationale Supérieure de Chimie de Paris (France)

8263 0P **Photoresponse comparison of indium oxide (In_2O_3) nanomaterials (Invited Paper)** [8263-23]
D. Shao, L. Qin, S. Sawyer, Rensselaer Polytechnic Institute (United States)

SESSION 7 MATERIAL PROCESSING

8263 0Q **Oxide crystal-fibers grown by micro-pulling-down technique and applications for lasers and scintillators (Invited Paper)** [8263-24]
J. Didierjean, N. Aubry, D. Perrodin, J. M. Fourmigue, I. Martial, A. Aubourg, FiberCryst SAS (France); F. Balembois, X. Delen, D. Sangla, P. Georges, Lab. Charles Fabry, CNRS, Univ. Paris-Sud (France)

8263 0R **Novel process for direct bonding of GaN onto glass substrates using sacrificial ZnO template layers to chemically lift-off GaN from c-sapphire (Invited Paper)** [8263-25]
D. J. Rogers, Nanovation (France); A. Ougazzaden, Georgia Institute of Technology/Georgia Tech-Lorraine, UMI 2958, CNRS, Georgia Tech (France); V. E. Sandana, Nanovation (France) and Ecole Polytechnique (France) and Northwestern Univ. (United States); T. Moudakir, Georgia Institute of Technology/Georgia Tech-Lorraine, CNRS (France); A. Ahaitouf, Georgia Tech-CNRS (France); F. H. Teherani, Nanovation (France); S. Gautier, LMOPS-EA, Univ. de Lorraine et Supélec (France) and UMI 2958, CNRS, Georgia Tech (France); L. Goubert, Nanovation (France) and Ecole Polytechnique (France) and Northwestern Univ. (United States); I. A. Davidson, K. A. Prior, Heriot-Watt Univ., SUPA (United Kingdom); R. P. McClintock, MP Technologies LLC (United States); P. Bove, Nanovation (France); H.-J. Drouhin, Ecole Polytechnique (France); M. Razeghi, Northwestern Univ. (United States)

SESSION 8 BAND GAP ENGINEERING

8263 0U **Ion beams as a tool for the characterization of near-pseudomorphic CdZnO epilayers (Invited Paper)** [8263-28]
A. Redondo-Cubero, Instituto Tecnológico e Nuclear (Portugal) and Univ. Nova de Lisboa (Portugal); M. Brandt, F. Henneberger, Humboldt-Univ. zu Berlin (Germany); E. Alves, K. Lorenz, Instituto Tecnológico e Nuclear (Portugal) and Univ. Nova de Lisboa (Portugal)

SESSION 9 OPTICAL PROPERTIES

8263 0W **Microscopic origins of the surface exciton photoluminescence in ZnO nanostructures (Invited Paper)** [8263-30]
M. Biswas, Dublin City Univ. (Ireland); Y. S. Jung, H. K. Kim, Univ. of Pittsburgh (United States); K. Kumar, G. J. Hughes, Dublin City Univ. (Ireland); S. Newcomb, Glebe Scientific Ltd. (Ireland); M. O. Henry, E. McGlynn, Dublin City Univ. (Ireland)

8263 0X **Excitonic transport in ZnO (Invited Paper)** [8263-31]
M. Noltemeyer, F. Bertram, T. Hempel, B. Bastek, J. Christen, Otto-von-Guericke-Univ. Magdeburg (Germany); M. Brandt, M. Lorenz, M. Grundmann, Univ. Leipzig (Germany)

8263 0Y **Electro-optical properties of barium titanate films epitaxially grown on silicon (Invited Paper)** [8263-32]
S. Abel, D. Caimi, M. Sousa, T. Stöferle, C. Rossel, C. Marchiori, IBM Zürich Research Lab. (Switzerland); A. Chelnokov, CEA-LETI Minatec (France); J. Fompeyrine, IBM Zürich Research Lab. (Switzerland)

8263 10 **Tuning optical properties of complex oxides: examples of 12CaO.7Al$_2$O$_3$ mayenite and LaCrO$_3$ perovskite (Invited Paper)** [8263-34]
P. V. Sushko, Univ. College London (United Kingdom)

SESSION 10 OXIDE-ORGANIC HYBRIDATION

8263 12 **Functionalization of ZnO surfaces with organic molecules (Invited Paper)** [8263-36]
N. H. Moreira, A. Garcia, A. L. Rosa, T. Frauenheim, Univ. Bremen (Germany)

SESSION 11 OXIDE-BASED DEVICES I

8263 14 **Reactive dual magnetron sputtering of Ta_2O_5 and Al_2O_3: optical and structural properties and thin film applications** [8263-38]
S. J. Pearce, H. Esfandiarijahromi, M. D. B. Charlton, Univ. of Southampton (United Kingdom)

8263 15 **P-type oxide-based thin film transistors produced at low temperatures (Invited Paper)** [8263-39]
R. Martins, V. Figueiredo, CENIMAT/13N, and Univ. Nova de Lisboa and CEMOP-UNINOVA (Portugal); R. Barros, CENIMAT/13N, and Univ. Nova de Lisboa and CEMOP-UNINOVA (Portugal) and INNOVNANO (Portugal); P. Barquinha, G. Gonçalves, L. Pereira, I. Ferreira, E. Fortunato, CENIMAT/13N, and Univ. Nova de Lisboa and CEMOP-UNINOVA (Portugal)

8263 16 **Multicomponent dielectrics for oxide TFT (Invited Paper)** [8263-40]
L. Pereira, P. Barquinha, G. Gonçalves, E. Fortunato, R. Martins, CENIMAT/13N, Univ. Nova de Lisboa and CEMOP-UNINOVA (Portugal)

SESSION 12 OXIDE-BASED DEVICES II

8263 17 **Growth and characterization of Ga_2O_3 on sapphire substrates for UV sensor applications (Invited Paper)** [8263-41]
D.-S. Wuu, National Chung Hsing Univ. (Taiwan) and Da-Yeh Univ. (Taiwan); S.-L. Ou, R.-H. Horng, National Chung Hsing Univ. (Taiwan); P. Ravadgar, National Cheng Kung Univ. (Taiwan); T.-Y. Wang, National Chung Hsing Univ. (Taiwan); H.-Y. Lee, National Cheng Kung Univ. (Taiwan)

8263 18 **Trap depth optimization to improve optical properties of diopside-based nanophosphors for medical imaging (Invited Paper)** [8263-42]
T. Maldiney, Unité de Pharmacologie Chimique et Génétique et d'Imagerie, CNRS, Univ. Paris Descartes (France); A. Lecointre, B. Viana, A. Bessière, D. Gourier, Lab. de Chimie de la Matière Condensée de Paris, CNRS, Ecole Supérieure de Chimie de Paris (France); M. Bessodes, C. Richard, D. Scherman, Unité de Pharmacologie Chimique et Génétique et d'Imagerie, CNRS, Univ. Paris Descartes (France)

8263 19 **Development of functional magnetic nanoparticles for biomedical application (Invited Paper)** [8263-43]
Y. Ichiyanagi, Yokohama National Univ. (Japan) and Japan Science and Technology Agency (Japan)

8263 1A **Spectroscopic determination of the flatband potential and carrier density of ZnO nanowire array with/without hydrogen plasma treatment (Invited Paper)** [8263-44]
M. Zhong, The Univ. of Tokyo (Japan); A. Apostoluk, Institut des Nanotechnologies de Lyon, CNRS, Univ. de Lyon (France); E. Maeda, The Univ. of Tokyo (Japan); G. Bremond, Institut des Nanotechnologies de Lyon, CNRS, Univ. de Lyon (France); J.-J. Delaunay, The Univ. of Tokyo (Japan)

SESSION 13 SUPERCONDUCTIVITY

8263 1C **Atomic-layer engineering of oxide superconductors (Invited Paper)** [8263-46]
A. T. Bollinger, Brookhaven National Lab. (United States); J. N. Eckstein, Univ. of Illinois at Urbana-Champaign (United States); G. Dubuis, Brookhaven National Lab. (Switzerland) and Ecole Polytechnique Fédérale de Lausanne (Switzerland); D. Pavuna, Ecole Polytechnique Fédérale de Lausanne (Switzerland); I. Božović, Brookhaven National Lab. (United States)

8263 1F **XAS study of superconducting thin film single crystals without doping (Invited Paper)** [8263-49]
H. Oyanagi, National Institute of Advanced Industrial Science and Technology (Japan); A. Tsukada, NTT Basic Research Labs. (Japan) and Tokyo Univ. of Agriculture and Technology (Japan); M. Naito, Tokyo Univ. of Agriculture and Technology (Japan)

SESSION 14 GROWTH, PROPERTIES, AND APPLICATIONS OF NANOSTRUCTURES

8263 1H **Morphological effects on optical and electrical properties of ZnO nanostructures (Invited Paper)** [8263-52]
S. H. Lee, J. Xu, Oak Ridge National Lab. (United States)

8263 1J **Influence of hydrothermal treatment on morphology and properties of ZnO nanostructures (Invited Paper)** [8263-54]
X. Chen, A. M. C. Ng, A. B. Djurišić, C. C. Ling, W. K. Chan, The Univ. of Hong Kong (Hong Kong, China)

8263 1L **Engineered ZnO nanowire arrays using different nanopatterning techniques (Invited Paper)** [8263-56]
J. Volk, Z. Szabó, Research Institute for Technical Physics and Materials Science (Hungary); R. Erdélyi, Research Institute for Technical Physics and Materials Science (Hungary) and Univ. of Pannonia (Hungary); N. Q. Khánh, Research Institute for Technical Physics and Materials Science (Hungary)

POSTER SESSION

8263 1M **Photoconductivity and photocatalytic activity of ZnO thin films grown via thermal oxidation** [8263-57]
J. C. Moore, R. Louder, L. R. Covington, R. Stansell, Coastal Carolina Univ. (United States)

8263 1O **Analysis of peculiarities of ZnO microfilms luminescence** [8263-59]
M. V. Ryzhkov, S. I. Rumyantsev, V. M. Markushev, C. M. Briskina, A. P. Tarasov, Kotel'nikov Institute of Radio Engineering and Electronics (Russian Federation)

8263 1X **Energy harvesting from millimetric ZnO single wire piezo-generators** [8263-69]
D. J. Rogers, Nanovation (France); C. Carroll, SUPA, Univ. of St. Andrews (United Kingdom); P. Bove, Nanovation (France); V. E. Sandana, L. Goubert, Nanovation (France) and Ecole Polytechnique (France) and Northwestern Univ. (United States); A. Largeteau, Institut de Chimie de la Matière Condensée de Bordeaux, CNRS (France); F. H. Teherani, Nanovation (France); G. Demazeau, Institut de Chimie de la Matière Condensée de Bordeaux, CNRS (France); R. McClintock, MP Technologies (United States); H.-J. Drouhin, Ecole Polytechnique (France); M. Razeghi, Northwestern Univ. (United States)

8263 1Y **ZnO nanorod electrodes for hydrogen evolution and storage** [8263-70]
S. Harinipriya, B. Usmani, Indian Institute of Technology Rajasthan (India); D. J. Rogers, Nanovation (France); V. E. Sandana, Nanovation (France) and GEMAC (France) and Ecole Polytechnique (France); F. H. Teherani, Nanovation (France); A. Lusson, GEMAC (France); P. Bove, Nanovation (France); H.-J. Drouhin, Ecole Polytechnique (France); M. Razeghi, Northwestern Univ. (United States)

Author Index

Conference Committee

Symposium Chair

Klaus P. Streubel, OSRAM GmbH (Germany)

Symposium Cochairs

David L. Andrews, University of East Anglia Norwich (United Kingdom)
Liang-Chy Chien, Kent State University (United States)

Program Track Chair

James G. Grote, Air Force Research Laboratory (United States)

Conference Chairs

Ferechteh H. Teherani, Nanovation (France)
David C. Look, Wright State University (United States)
David J. Rogers, University of St. Andrews (United Kingdom) and Nanovation (France)

Program Committee

Ivan Bozovic, Brookhaven National Laboratory (United States)
Stefan T. Bromley, Universitat de Barcelona (Spain)
Jean-Jacques Delaunay, The University of Tokyo (Japan)
Aleksandra B. Djurisic, The University of Hong Kong (Hong Kong, China)
Rodrigo Ferrão de Paiva Martins, CEMOP/Uninova (Portugal)
Michael D. Gerhold, U.S. Army Research Office (United States)
Hanns-Ulrich Habermeier, Max-Planck-Institut für Festkörperforschung (Germany)
Axel Hoffmann, Technische Universität Berlin (Germany)
Masashi Kawasaki, Tohoku University (Japan)
Katharina Lorenz, Instituto Tecnológico e Nuclear (Portugal)
Andreia Luisa da Rosa, Universität Bremen (Germany)
Tatsuo Okada, Kyushu University (Japan)
Manijeh Razeghi, Northwestern University (United States)
Bruno Viana, Ecole Nationale Supérieure de Chimie de Paris (France)
Takafumi Yao, Tohoku University (Japan)

Session Chairs

1 Highly Conducting Transparent Oxides I
David C. Look, Wright State University (United States)
Axel Hoffmann, Technische Universität Berlin (Germany)

2 Highly Conducting Transparent Oxides II
Axel Hoffmann, Technische Universität Berlin (Germany)
David C. Look, Wright State University (United States)

3 Doping and Band Structure Studies
Andreia Luisa da Rosa, Universität Bremen (Germany)

4 Material Growth
Michael D. Gerhold, U.S. Army Research Office (United States)
Takafumi Yao, Tohoku University (Japan)

5 Light Emitters I
Aleksandra B. Djurisic, The University of Hong Kong (Hong Kong, China)

6 Light Emitters II
Aleksandra B. Djurisic, The University of Hong Kong (Hong Kong, China)

7 Material Processing
Michael D. Gerhold, U.S. Army Research Office (United States)
Aleksandra B. Djurišic, The University of Hong Kong (Hong Kong, China)

8 Band Gap Engineering
Stefan T. Bromley, Universitat de Barcelona (Spain)

9 Optical Properties
Rodrigo Ferrão de Paiva Martins, CEMOP/Uninova (Portugal)
Luis M. Pereira, CEMOP/UNINOVA (Portugal)

10 Oxide-Organic Hybridation
Axel Hoffmann, Technische Universität Berlin (Germany)
Manijeh Razeghi, Northwestern University (United States)

11 Oxide-based Devices I
Bruno Viana, Ecole Nationale Supérieure de Chimie de Paris (France)
Rodrigo Ferrão de Paiva Martins, CEMOP/Uninova (Portugal)

12 Oxide-based Devices II
Rodrigo Ferrão de Paiva Martins, CEMOP/Uninova (Portugal)
Bruno Viana, Ecole Nationale Supérieure de Chimie de Paris (France)

13 Superconductivity
Hanns-Ulrich Habermeier, Max-Planck-Institut für Festkörperforschung (Germany)
Ivan Bozovic, Brookhaven National Laboratory (United States)

14 Growth, Properties, and Applications of Nanostructures
Jean-Jacques Delaunay, The University of Tokyo (Japan)
Tatsuo Okada, Kyushu University (Japan)