
State-of-the-Art Program on Compound Semiconductors 53 (SOTAPOCS 53)

Editors:

M. E. Overberg

Sandia National Laboratory
Albuquerque, New Mexico, USA

J. LaRoche

Raytheon Company
Waltham, Massachusetts, USA

K. Mishra

Osram Sylvania Central Research Thin Film Technologies
Beverly, Massachusetts, USA

W. Johnson

Kopin Corporation
Westboro, Massachusetts, USA

Sponsoring Divisions:



Electronics and Photonics



Luminescence and Display Materials



Published by

The Electrochemical Society

65 South Main Street, Building D
Pennington, NJ 08534-2839, USA

tel 609 737 1902

fax 609 737 2743

www.electrochem.org

ecstransactions™

Vol. 41, No. 6

Copyright 2011 by The Electrochemical Society.
All rights reserved.

This book has been registered with Copyright Clearance Center.
For further information, please contact the Copyright Clearance Center,
Salem, Massachusetts.

Published by:

The Electrochemical Society
65 South Main Street
Pennington, New Jersey 08534-2839, USA

Telephone 609.737.1902
Fax 609.737.2743
e-mail: ecs@electrochem.org
Web: www.electrochem.org

ISSN 1938-6737 (online)
ISSN 1938-5862 (print)
ISSN 2151-2051 (cd-rom)

ISBN 978-1-56677-906-7 (Hardcover)
ISBN 978-1-60768-260-8 (PDF)

Printed in the United States of America.

ECS Transactions, Volume 41, Issue 6
State-of-the-Art Program on Compound Semiconductors 53 (SOTAPoCS 53)

Table of Contents

Preface *iii*

**Chapter 1
Heterostructures 1**

Nitride Semiconductors: Why they Work in Optoelectronic Devices *3*
T. D. Moustakas

The Thermal Response of Gallium Nitride HFET Devices Grown on Silicon and SiC
Substrates *13*
F. N. Donmezer, W. James, and S. Graham

**Chapter 2
Nanowires**

Space Charge Limited Current and Polarization in AlGaN/GaN Nanowires *33*
M. Mastro, H. Kim, J. Ahn, J. Kim, J. Hite, and C. Eddy Jr.

**Chapter 3
HEMTs**

Effect of the Source Field Plate on AlGaN/GaN High Electron Mobility Transistors *41*
during Off-State Stress

*L. Liu, T. Kang, D. A. Cullen, L. Zhou, J. Kim, C. Chang, E. Douglas, S. Jang,
D. Smith, S. Pearton, W. Johnson, and F. Ren*

Reliability Issues in AlGaN/GaN High Electron Mobility Transistors *51*
E. Douglas, L. Liu, C. Lo, B. Gila, F. Ren, and S. Pearton

Improved Off-State Stress Critical Voltage on AlGaN/GaN High Electron Mobility
Transistors Utilizing Pt/Ti/Au Based Gate Metallization *63*
*C. Lo, L. Liu, T. Kang, R. Davies, B. Gila, S. Pearton, I. Kravchenko, O. Laboutin,
Y. Cao, W. Johnson, and F. Ren*

Chapter 4 Heterostructures 2

Plasmon-Enhanced Near-Green Light Emission from InGaN/GaN Quantum Wells <i>R. Paiella, J. Henson, J. DiMaria, E. Dimakis, R. Li, S. Minissale, L. Dal Negro, and T. D. Moustakas</i>	73
Effect of Interface Polarization Charge on GaN/SiC Separate Absorption and Multiplication Avalanche Photodiodes <i>P. H. Shen, A. V. Sampath, Q. Zhou, J. Campbell, and M. Wraback</i>	81
Electric Field Driven Degradation of AlGaN/GaN High Electron Mobility Transistors during Off-State Stress <i>C. Chang, E. Douglas, J. Kim, L. Liu, C. Lo, B. Chu, D. Cheney, B. Gila, F. Ren, G. Via, D. A. Cullen, L. Zhou, D. Smith, S. Jang, and S. Pearton</i>	89
Electrical Performance of Chlorine-Treated AlGaN MOS Diodes with i-ZnO Insulator <i>Y. Chiou, C. Lee, H. Lee, K. Chang, J. Lin, and H. Chuang</i>	101
Circular and Rectangular Via Holes Formed in SiC via Using ArF Based UV Excimer Laser <i>L. Liu, C. Chang, W. Wu, S. Pearton, and F. Ren</i>	107
Fabrication and Characterization of Self-Aligned InAlAs/InGaAsSb/InGaAs Double Heterojunction Bipolar Transistors <i>C. Lo, C. Chang, S. Chen, C. Chang, S. Wang, J. Chyi, I. Kravchenko, S. Pearton, and F. Ren</i>	117
Thermal Simulation of 193 nm UV-Laser Lift-Off AlGaN/GaN High Electron Mobility Transistors Mounted on AlN Substrates <i>T. Kang, C. Lo, L. Liu, R. Finch, F. Ren, X. Wang, E. Douglas, S. Pearton, S. Hung, and C. Chang</i>	129

Chapter 5 Heterostructures 3

Lattice-Matched and Strain-Compensated Materials for Mid-Wave and Long-Wave Infrared Quantum Cascade Lasers <i>C. A. Wang, D. R. Calawa, A. Goyal, S. Menzel, and F. Capasso</i>	139
Probing the Radiative Limits of III-V Quantum Wells <i>R. E. Welser, O. Laboutin, and W. Johnson</i>	151

Chapter 6

Poster Session

Evaluation of the High Temperatures Influence on High Frequency C-V Curves of MOS Capacitor	163
<i>A. Borges Ziliotto and M. Bellodi</i>	

The Reliability Study and Device Modeling for p-HEMT Microwave Power Transistors	175
<i>S. Liu, H. Chang, T. Chang, H. Kao, C. Cheng, and A. Chin</i>	

Investigation of Electrodeposited and Solution Grown ZnO Nanorod Based UV Photodetector	189
<i>S. Dalui</i>	

Chapter 7

Semiconductors and Plasmonics: Active Nanostructures for Photonic Devices and Systems

Plasmon Resonant Enhancement of Photocatalytic Solar Fuel Production	197
<i>W. Hou, Z. Liu, W. Hsuan, P. Pavaskar, and S. B. Cronin</i>	

Enhanced Photoelectrochemical Properties of CdS/ZnO Supported on Carbon Nanotube Films	207
<i>L. Dong, J. Malone, L. Yu, H. Dong, and J. Yu</i>	

Combination of the Opposing Effects of Silver Nanoparticles and Peptide Nucleic Acids on Dye-Sensitized Solar Cells to Enhance their Respective Positive Influence	211
<i>N. Loew, S. Ikenouchi, and M. Ihara</i>	

Indium Tin Oxide Nanofibers and their Applications for Dye-Sensitized Solar Cells	223
<i>S. Chuangchote, T. Sagawa, and S. Yoshikawa</i>	

Adding New Capabilities to Silicon CMOS Integrated Circuits via Deterministic Assembly	231
<i>J. Kim, T. Morrow, L. Lin, C. Keating, J. Mayer, and T. S. Mayer</i>	

Chapter 8 Graphene Processing and Devices

Graphene Formation on 4H-SiC(0001) Surface Flattened by Catalyst-Assisted Chemical Etching in HF Solution <i>K. Nishitani, H. Sakane, A. Hattori, T. Okamoto, K. Kawai, J. Uchikoshi, Y. Sano, K. Yamauchi, M. Morita, and K. Arima</i>	241
Graphene/SiC/Si FETs with SiCN Gate Stack <i>T. Suemitsu, M. Kubo, H. Handa, R. Takahashi, H. Fukidome, M. Suemitsu, and T. Otsuji</i>	249
Hydrogen Detection Using Chemical Vapor Deposited Graphene Coated with Platinum <i>B. Chu, J. Nicolosi, C. Lo, W. Strupinski, S. Pearton, and F. Ren</i>	255

Chapter 9 Sol Gel TFTs

Effects of Post-Deposition Annealing Atmosphere and Duration on Sol-Gel Derived Amorphous Indium-Zinc-Oxide Thin-Film Transistors <i>W. Chung, T. Chang, H. Li, T. Tseng, and Y. Tai</i>	265
The Impact of Active Layer Pre-Treatment on Bias Stress Stability of Sol-Gel Derived Amorphous Indium-Gallium-Zinc-Oxide Thin Film Transistor <i>W. Chung, T. Chang, H. Li, Y. Chen, I. Li, T. Tseng, and Y. Tai</i>	273
Author Index	283