

PROCEEDINGS OF SPIE

Wide Bandgap Power Devices and Applications II

**Mohammad Matin
Srabanti Chowdhury
Achyut K. Dutta**
Editors

**7–8 August 2017
San Diego, California, United States**

Sponsored and Published by
SPIE

Volume 10381

Proceedings of SPIE 0277-786X, V. 10381

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

Wide Bandgap Power Devices and Applications II, edited by Mohammad Matin,
Srabanti Chowdhury, Achyut K. Dutta, Proc. of SPIE Vol. 10381, 1038101
© 2017 SPIE · CCC code: 0277-786X/17/\$18 · doi: 10.1117/12.2296669

Proc. of SPIE Vol. 10381 1038101-1

The papers 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. Additional papers and presentation recordings may be available online in the SPIE Digital Library at SPIDigitalLibrary.org.

The papers 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 these proceedings:

Author(s), "Title of Paper," in *Wide Bandgap Power Devices and Applications II*, edited by Mohammad Matin, Srabanti Chowdhury, Achyut K. Dutta, Proceedings of SPIE Vol. 10381 (SPIE, Bellingham, WA, 2017) Seven-digit Article CID Number.

ISSN: 0277-786X
ISSN: 1996-756X (electronic)

ISBN: 9781510612198
ISBN: 9781510612204 (electronic)

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 © 2017, 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/17/\$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

SPIDigitalLibrary.org

Paper Numbering: *Proceedings of SPIE* follow an e-First publication model. A unique citation identifier (CID) number is assigned to each article at the time of 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 and print versions of the publication. SPIE uses a seven-digit CID article numbering system structured as follows:

- The first five 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.

Contents

v *Authors*
vii *Conference Committee*

SESSION 1	WIDE BANDGAP MATERIALS AND DEVICES I
10381 03	A study of the effect of surface pretreatment on atomic layer deposited Al₂O₃ interface with GaN [10381-2]
10381 04	3D analysis of thermal and electrical performance of wide bandgap VDMOSFETs [10381-3]
SESSION 2	WIDE BANDGAP MATERIALS AND DEVICES II
10381 06	Development of an efficient DC-DC SEPIC converter using wide bandgap power devices for high step-up applications [10381-6]
SESSION 3	WIDE BANDGAP MATERIALS AND DEVICES III
10381 07	Defect-induced optical breakdown in aluminum nitride and gallium nitride epitaxial films (Invited Paper) [10381-7]
10381 08	Comparative study of CAVET with dielectric and p-GaN gate and Mg ion-implanted current blocking layer [10381-8]
10381 09	Highly efficient GaN HEMTs transformer-less single-phase inverter for grid-tied fuel cell [10381-9]
SESSION 4	WIDE BANDGAP MATERIALS AND DEVICES IV
10381 0B	Oxidation of GaAs substrates to enable β-Ga₂O₃ films for sensors and optoelectronic devices (Invited Paper) [10381-11]
10381 0C	Simulation and performance comparison of Si and SiC-based interleaved boost converter [10381-12]
10381 0D	High efficiency H₆ single-phase transformerless grid-tied PV inverter with proposed modulation for reactive power generation [10381-13]
10381 0E	Low-crosstalk optimization in 2D segmented waveguide crossings by evolutionary algorithms (Invited Paper) [10381-14]

POSTER SESSION

- 10381 0G **Modeling and simulation of GaN step-up power switched capacitor converter [10381-16]**
- 10381 0H **Design and performance study of a DC-DC flyback converter based on wide bandgap power devices for photovoltaic applications [10381-18]**
- 10381 0I **Design of a high-performance cascaded boost converter with SiC power devices for photovoltaic applications [10381-19]**
- 10381 0J **Properties of reactively sputtered Al_xN_y thin films for pyroelectric detectors [10381-20]**

Authors

Numbers in the index correspond to the last two digits of the seven-digit citation identifier (CID) article numbering system used in Proceedings of SPIE. The first five digits reflect the volume number. Base 36 numbering is employed for the last two digits and indicates the order of articles within the volume. Numbers start with 00, 01, 02, 03, 04, 05, 06, 07, 08, 09, 0A, 0B...0Z, followed by 10-1Z, 20-2Z, etc.

Agarwal, Anchal, 08
Ahmadi, Elaheh, 08
Alatawi, Khaled S., 09, 0D
Alateeq, Ayoob S., 0C, 0G
Al-bayati, Ali M. S., 06, 0H, 0I
Alhalaili, Badriyah, 0B
Alharbi, Salah S., 06, 0H, 0I
Alharbi, Saleh S., 06, 0H, 0I
Almalaq, Yasser A., 0C, 0G
Almasoudi, Fahad M., 09, 0D
Braithwaite, Keesean, 0J
Calvano, Nicholas, 0J
Chowdhury, Srabanti, 03, 08
Chrostoski, Philip, 0J
Dourado-Sisnando, A., 0E
Dryden, Daniel M., 0B
Elhadj, Selim, 07
Gao, Jianyi, 03
Islam, M. Saif, 0B
Kaya, Ahmet, 0B
Keller, Stacia, 08
Lange, Andrew P., 07
Laurent, Matthew A., 08
Li, Wenwen, 03
Mahadeva Bhat, K., 08
Manandhar, Mahesh B., 04
Mandal, Saptarshi, 03, 08
Mao, Howard, 0B
Matin, Mohammad A., 04, 06, 09, 0C,
0D, 0G, 0H, 0I
Rana, Mukti, 0J
Rodríguez-Esquerre, V. F., 0E
Rubio-Mercedes, C. E., 0E
Souza-Alcântara, M., 0E
Voshell, Andrew, 0J
Woodall, Jerry M., 0B
Yoo, Jae-Hyuck, 07

Conference Committee

Conference Chairs

Mohammad Matin, University of Denver (United States)
Srabanti Chowdhury, University of California, Davis (United States)
Achyut K. Dutta, Banpil Photonics, Inc. (United States)

Program Track Chairs

Shizhuo Yin, The Pennsylvania State University (United States)
Ruyan Guo, The University of Texas at San Antonio (United States)

Conference Program Committee

Mowafak M. Al-Jassim, National Renewable Energy Laboratory
(United States)
Abdul A. S. Awwal, Lawrence Livermore National Laboratory
(United States)
M. Saif Islam, University of California, Davis (United States)
Hidenori Mimura, Shizuoka University (Japan)
Rebecca J. Nikolic, Lawrence Livermore National Laboratory
(United States)
Madan Niraula, Nagoya Institute of Technology (Japan)
Bart Van Zegbroeck, University of Colorado at Boulder
(United States)

Session Chairs

- 1 Wide Bandgap Materials and Devices I
Achyut K. Dutta, Banpil Photonics, Inc. (United States)
- 2 Wide Bandgap Materials and Devices II
M. Saif Islam, University of California, Davis (United States)
Achyut K. Dutta, Banpil Photonics, Inc. (United States)
- 3 Wide Bandgap Materials and Devices III
Mohammad A. Matin, University of Denver (United States)
- 4 Wide Bandgap Materials and Devices IV
Mohammad A. Matin, University of Denver (United States)

