

PROCEEDINGS OF SPIE

# ***Wide Bandgap Power and Energy Devices and Applications III***

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

**20–21 August 2018**  
**San Diego, California, United States**

*Sponsored and Published by SPIE*

**Volume 10754**

Proceedings of SPIE 0277-786X, V. 10754

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

Wide Bandgap Power and Energy Devices and Applications III, edited by Mohammad Matin,  
Srabanti Chowdhury, Achyut K. Dutta, Proc. of SPIE Vol. 10754, 1075401 · © 2018  
SPIE · CCC code: 0277-786X/18/\$18 · doi: 10.1117/12.2514605

Proc. of SPIE Vol. 10754 1075401-1

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](http://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 and Energy Devices and Applications III*, edited by Mohammad Matin, Srabanti Chowdhury, Achyut K. Dutta, Proceedings of SPIE Vol. 10754 (SPIE, Bellingham, WA, 2018) Seven-digit Article CID Number.

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

ISBN: 9781510620797  
ISBN: 9781510620803 (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](http://SPIE.org)

Copyright © 2018, 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](http://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/18/\$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](http://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	<i>Authors</i>
vii	<i>Conference Committee</i>

---

## ADVANCED WIDE BANDGAP MATERIALS TECHNOLOGIES

---

10754 02	<b>Investigation of interfacial impurities in m-plane GaN regrown p-n junctions for high-power vertical electronic devices (Invited Paper) [10754-1]</b>
----------	--

---

## ADVANCED WIDE BANDGAP DEVICES

---

10754 08	<b>Comparative study of Heatsink materials for Gallium Nitride HEMT modules using thermal modelling [10754-7]</b>
----------	---

---

## ADVANCED DEVICES AND APPLICATIONS II

---

10754 0F	<b>IGBT module loss calculation and thermal resistance estimation for a grid-connected multilevel converter [10754-14]</b>
----------	--

---

## POSTER SESSION

---

10754 0H	<b>Impact of cascode GaN power devices on a bidirectional DC-DC buck/boost converter in DC Microgrids [10754-17]</b>
10754 0I	<b>Design and performance study of a DC-DC ZETA converter with wide bandgap power devices [10754-18]</b>
10754 0J	<b>Calcium lead titanate thin films for pyroelectric detector application [10754-19]</b>
10754 0K	<b>Investigation of an interleaved high-gain DC-DC converter with GaN power semiconductor devices for DC-distributed renewable energy systems [10754-20]</b>
10754 0L	<b>Review of optical properties of two-dimensional transition metal dichalcogenides (Invited Paper) [10754-21]</b>



## 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.

Alatawi, Khaled, 08  
Al-bayati, Ali M. S., 0H, 0I, 0K  
Alharbi, Salah S., 0H, 0I, 0K  
Alharbi, Saleh S., 0H, 0I, 0K  
Allerman, Andrew, 02  
Almasoudi, Fahad, 08  
Aragon, Andrew, 02  
Armstrong, Andrew, 02  
Braithwaite, Keesean, 0J  
Chaloo, Rajab, 0F  
Crawford, Mary, 02  
Feezell, Daniel, 02  
Fu, Xingang, 0F  
Hadi, Abdullah Al, 0F  
Mafi, Elham, 0J  
Manandhar, Mahesh B., 08  
Matin, Mohammad A., 08, 0H, 0I, 0K  
Monavarian, Morteza, 02  
Patel, Jessica, 0J  
Pickrell, Greg, 02  
Rana, Mukti, 0J, 0L  
Stricklin, Isaac, 02  
Terrones, Mauricio, 0L  
Tesema, Yehuwalashet A., 0H, 0K  
Voshell, Andrew, 0L



# Conference Committee

## *Program Track Chair*

**Ruyan Guo**, The University of Texas at San Antonio (United States)

## *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)

## *Conference Program Committee*

**Mowafak M. Al-Jassim**, National Renewable Energy Laboratory  
(United States)

**Abdul A. S. Awwal**, Lawrence Livermore National Laboratory  
(United States)

**Daniel F. Feezell**, The University of New Mexico (United States)

**David Wenzhong Gao**, University of Denver (United States)

**M. Saif Islam**, University of California, Davis (United States)

**Andrew P. Lange**, Lawrence Livermore National Laboratory  
(United States)

**Hidenori Mimura**, Shizuoka University (Japan)

**Rebecca J. Nikolic**, Lawrence Livermore National Laboratory  
(United States)

**Madan Niraula**, Nagoya Institute of Technology (Japan)

**Nezih Pala**, Florida International University (United States)

**Xiaolong Qiang**, Northeastern University (China)

## *Session Chairs*

- 1 Advanced Wide Bandgap Materials Technologies  
**Andrew P. Lange**, Lawrence Livermore National Laboratory  
(United States)  
**Achyut K. Dutta**, Banpil Photonics, Inc. (United States)
- 2 Advanced Wide Bandgap Devices  
**Mohammad A. Matin**, University of Denver (United States)  
**Andrew P. Lange**, Lawrence Livermore National Laboratory  
(United States)
- 3 Advanced Devices and Applications I  
**Girija Gaur**, Kramer Levin Naftalis & Frankel LLP (United States)  
**Amrita Sahu**, Altria Group, Inc. (United States)

- 4 Advanced Devices and Applications II  
**Srabanti Chowdhury**, University of California, Davis (United States)  
**Mohammad A. Matin**, University of Denver (United States)