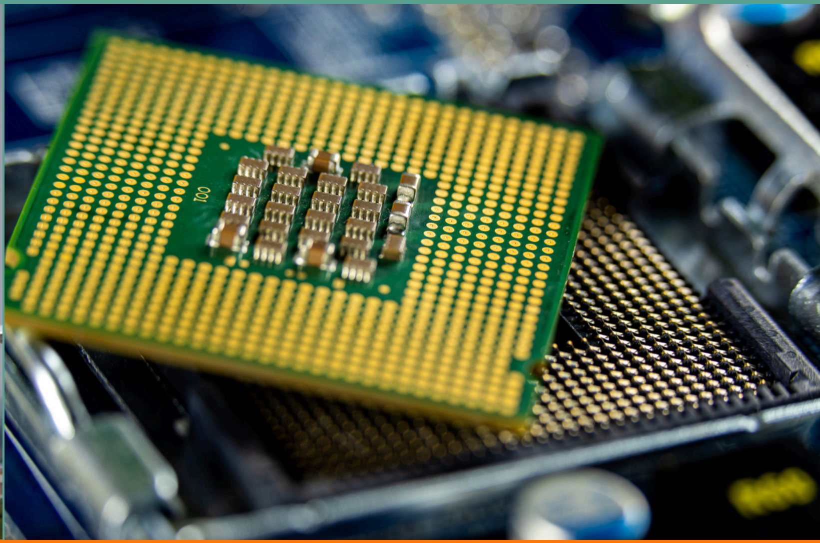
WiPDA 2024

The 11th IEEE Workshop on Wide Bandgap Power Devices & Applications

Technical Program



November 4 - 6, 2024
Dayton, Ohio

Table of Contents

Schedule-At-A-Glance: Monday, November 4, 2024

Time	Tradewinds Room
7:00 - 8:00 AM	Breakfast
Time	**Grand Ballroom**
KEYNOTE PRESENTATION (Chair: Dong Cao)	
8:00 – 8:05 AM	Opening Remarks and Welcome
8:05 – 8:35 AM	Electrification in Aerospace – Trends, Challenges, and Opportunities
TUTORIAL SESSIONS (Chair: Brij Singh)	
8:35 - 9:30 AM	SiC Power MOSFET Design and Overview of Recent Trends
9:30 - 10:25 AM	GaN Power Switching Devices for Energy-Efficient Applications
10:00 - 5:00 PM	Exhibition in Ballroom Foyer
10:25 - 11:20 AM	Development of Semiconductors for Next Generation Power Electronics: From Wide Bandgap GaN to Ultrawide Bandgap Ga2O3, (AlxGa1-x)2O3 and LiGa5O8
11:20 - 12:15 PM	Potential, Progress, and Challenges for Ultra-Wide-Bandgap Semiconductors
Time	**Tradewinds Room**
12:15 - 1:15 PM	Buffet Lunch
Time	**Grand Ballroom**
1:15 - 2:10 PM	(Ultra) Wide Bandgap Material Process and Device TCAD Simulation Methodologies
2:10 - 3:05 PM	10kV SiC MOSFETs based Power Modules and Power Converters
3:05 - 4:00 PM	From Lateral and Vertical GaN Devices to Power ICs and Smart Converters
4:00 - 4:55 PM	WBG for Pushing Wireless Power Transfer Boundaries
4:55 - 5:50 PM	Capacitors and Aircraft Power System Considerations for Higher Temperature Operation and Wide Bandgap Enablement”
5:50 - 6:00 PM	At Marriott Front Door: Bus Transportation to Dayton History Museum
Time	**Dayton History Museum**
6:00 - 9:30 PM	Reception/Social Event
9:30 - 10:30 PM	Bus Transportation at Dayton History Museum back to Marriott

WiPDA 2024

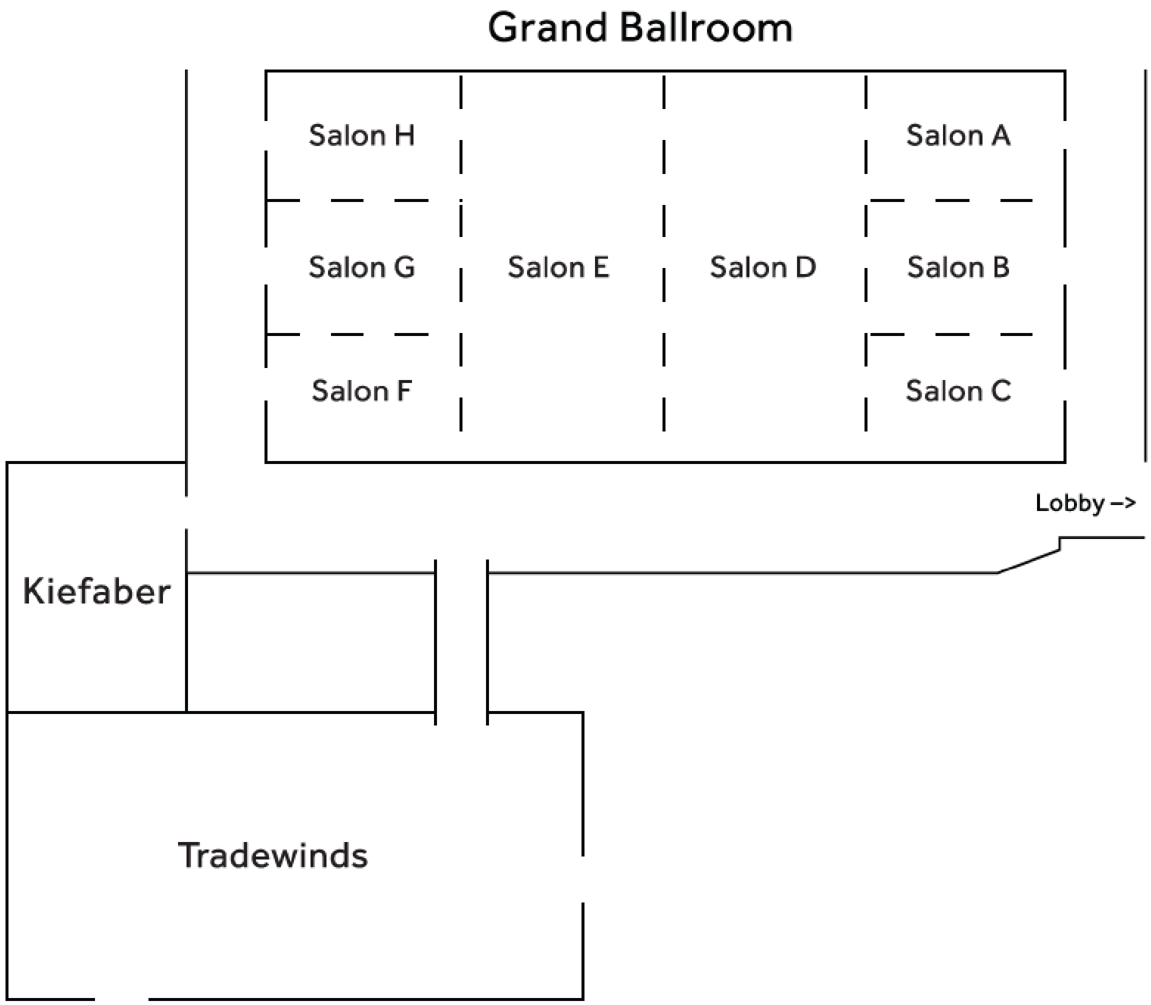
Schedule-At-A-Glance: Tuesday, November 5, 2024

<table>
<tr><th colspan="3">MAIN CONFERENCE, DAY 1 – KEYNOTE PRESENTATIONS</th></tr>
<tr><th>Time</th><th colspan="2">Tradewinds Room</th></tr>
<tr><td>7:00 - 8:30 AM</td><td colspan="2">Breakfast</td></tr>
<tr><th>Time</th><th colspan="2">Kiefaber Room</th></tr>
<tr><td>7:00 - 8:30 AM</td><td colspan="2">WiE Breakfast</td></tr>
<tr><th>Time</th><th colspan="2">Grand Ballroom</th></tr>
<tr><td>8:30 - 9:00 AM</td><td colspan="2">Opening Remarks and Welcome</td></tr>
<tr><td>9:00 - 9:30 AM</td><td colspan="2">Power Electronics for Improved Grid Control, Resilience, and Reliability</td></tr>
<tr><td>9:30 - 10:00 AM</td><td colspan="2">Driving the Industry Trends Towards Integrated GaN Modules</td></tr>
<tr><td>10:00 -10:30 AM</td><td colspan="2">Progress in β-Ga2O3 Materials, Physical Properties, and Device Physics for High Voltage Power Electronics</td></tr>
<tr><td>8:00 - 5:00 PM</td><td colspan="2">Exhibition at Ballroom Foyer</td></tr>
<tr><td>10:30 -10:45 AM</td><td colspan="2">Break at Ballroom Foyer</td></tr>
<tr><td>10:45 - 12:00 PM</td><td colspan="2">Panel 1: The Real Opportunities for Digital Twins, AI, and Digital Transformation</td></tr>
<tr><th>Time</th><th colspan="2">Tradewinds Room</th></tr>
<tr><td>12:00 -1:30 PM</td><td colspan="2">Buffet Lunch</td></tr>
<tr><th colspan="3">MAIN CONFERENCE, DAY 1 – TECHNICAL SESSIONS</th></tr>
<tr><th>Time</th><th>Grand Ballroom A-D</th><th>Grand Ballroom E-H</th></tr>
<tr><td>1:30 - 3:10 PM</td><td>SiC Devices</td><td>GaN Applications</td></tr>
<tr><td>3:10 - 3:30 PM</td><td colspan="2">Break</td></tr>
<tr><td>3:40 - 5:20 PM</td><td>GaN Devices</td><td>SiC Applications</td></tr>
<tr><th>Time</th><th colspan="2">Grand Ballroom</th></tr>
<tr><td>6:00 - 7:00 PM</td><td colspan="2">Poster Session</td></tr>
<tr><td>7:00 - 9:00 PM</td><td colspan="2">Banquet</td></tr>
</table>

Schedule-At-A-Glance: Wednesday, November 6, 2024

MAIN CONFERENCE, DAY 2 – KEYNOTE PRESENTATIONS		
Time	**Tradewinds Room**	
7:00 -8:15 AM	Breakfast	
Time	**Grand Ballroom**	
8:15 – 8:30 AM	Welcome and Keynote Introduction	
8:30 - 9:00 AM	WBG-Based Traction Drives for Passenger and Commercial Electric Vehicles – NEXT-DRIVE	
9:00 - 9:30 AM	Towards SiC 2.0 - SiC Is Already Here	
9:30 - 9:45 AM	Break at Ballroom Foyer	
9:45 -10:15 AM	Will GaN Replace SiC Above a Kilovolt?	
10:00 - 12:00 PM	Exhibition	
10:15 -10:45 AM	Updated Analysis of Vertical GaN Power Device Technology	
10:45 - 12:00 PM	Panel 2: Devices & Applications in Aerospace and Terrestrial Mobility Power	
Time	**Tradewinds Room**	
12:00 -1:30 PM	Buffet Lunch	
MAIN CONFERENCE, DAY 2 – TECHNICAL SESSIONS		
Time	**Grand Ballroom A-D**	**Grand Ballroom E-H**
1:30 - 3:10 PM	SiC Devices 2	GaN Device Characterization, Modeling, and Driving
3:10 - 3:30 PM	Break	
3:40 - 5:20 PM	GaN and Ultrawide Bandgap Devices	SiC Switching Reliability
Time	**Kettering Conference Room**	
6:00 - 9:00 PM	JEDEC 70 Meeting (Invite Only)	

Conference Floor Plan



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WiPDA 2024

Welcome From the General Chair

Dear WiPDA Participants, Esteemed Colleagues, and Industry Leaders,

It is my great pleasure to warmly welcome you to the 11th Annual IEEE/PSMA Workshop on Wide Bandgap Devices and Applications 2024 (WiPDA 2024) in Dayton, OH. It is an honor to once again convene this distinguished community.

As we mark WiPDA's 11th anniversary, we enter a new decade of applying wide bandgap power electronics devices across diverse applications, from GaN-based laptop adapters and wireless chargers to SiC-powered electric vehicles, solar farms, and electric aircraft. Wide bandgap technology has profoundly impacted our lives, driving the next wave of industrial innovation. WiPDA remains a unique forum that brings together experts across disciplines—from semiconductor crystal growth and power device manufacturing to module packaging and end-user applications. It plays a pivotal role in uniting academia, industry innovators, and government policymakers in a collaborative environment.

WiPDA has emerged as the leading global conference advancing wide bandgap technologies. In addition to WiPDA 2024, regional editions like WiPDA Asia and WiPDA Europe have further strengthened the exchange of knowledge among regional experts. Our commitment to fostering the next generation of professionals remains strong. This year, we are proud to introduce a new IEEE Power Electronics Society (PELS)-sponsored student travel grant program, along with a prize paper award program to motivate and recognize young talent. Additionally, we are excited to launch the Women in Engineering (WIE) breakfast and travel grant program, sponsored by the PELS WIE committee, to support greater inclusivity and diversity at WiPDA by encouraging underrepresented attendees to join our community.

The WiPDA 2024 program has been meticulously curated to showcase cutting-edge advancements, foster thought-provoking discussions, and offer exceptional networking opportunities. The workshop will run from Monday, November 4, to Wednesday, November 6, 2024. On the first day, we feature nine tutorials covering a broad array of topics—from SiC devices to GaN applications, ultrawide bandgap materials to simulation techniques, lateral GaN to 10 kV SiC-enabled systems, and wireless charging to aircraft power systems. The day will conclude with a reception and social event at the Dayton History Museum in Carillon Historic Park, where you can mingle with colleagues and explore Dayton’s rich history of innovation.

Over the following two days, we have planned eight keynote presentations, two panel discussions in the mornings, and eight technical oral sessions in the afternoons. This year, one panel will focus on AI and digital twin technologies, while the other will explore aerospace and terrestrial mobility. A special session on ultrawide bandgap devices is also scheduled. Don’t miss our poster session, held during the banquet, for more in-depth interactions with presenters. Additionally, the conference lobby will host exhibitors showcasing a range of products and services, offering even more opportunities for collaboration and engagement.

On behalf of the organizing committee, I would like to express my deepest appreciation to all participants, sponsors, and contributors whose support has been integral to WiPDA's success. Together, we will continue driving the future of wide bandgap power electronics to new heights.

Welcome to WiPDA 2024, and welcome to Dayton!

Sincerely,

Dong Cao, PhD
General Chair, IEEE/PSMA WiPDA 2024

WiPDA 2024 Organizational Committee

Function	Name	Organization
General Chair	Dong Cao	GE Aerospace/University of Dayton
Vice Chair	Xiaoqing Song	University of Arkansas
Local Chair	Dan Schweickart	University of Dayton Research Institute/AFRL
Local Chair	Yu Zou	GE Aerospace
Technical Program Chairs		
GaN Devices Chair	Zhikai Tang	Texas Instruments
SiC Devices Chair	Woongje Sung	University at Albany
GaN Apps Chair	Stefan Moench	University of Stuttgart
SiC Apps Chair	Jun Wang	University of Nebraska-Lincoln
SiC Apps Chair	Mark Scott	Miami University
Ultrawide Bandgap Chair	Xiu Yao	University at Buffalo
Device Switching Reliability	Don Gajewski	Wolfspeed
Conference Component Chairs		
Publications Chair	Soma Essakiappan	Trane Technologies
Tutorials Chair	Brij Singh	John Deere
Tutorials Chair	Yuhao Zhang	Virginia Tech
Plenary Sessions Chair	Victor Veliadis	PowerAmerica
Plenary Session Chair	Jin Wang	Ohio State University
Panel Discussions Chair	Xiaochuan Jia	GE Aerospace
Panel Discussions Chair	Joe Weimer	Air Force Research Laboratory
Panel Discussions Chair	Alain Charles	ABCsWorld Consulting
Panel Discussions Chair	Stephanie Butler	Wattsbulter
Publicity Chair	Renee Yawger	EPC
Website Chair	Lincoln Xue	Tianjin University
Website co-Chair	Kevin Hobbs	University of Dayton/GE Aerospace

Treasurer	Namwon Kim	Oak Ridge National Laboratory
Registration Chair	Xin Zan	University of Maryland
Program Book Chair	Xin Zan	University of Maryland
PSMA Representative	Tim McDonald	Infineon
Student Activity Chair	Matt Woongkul Lee	Purdue University
Student Activity Chair	Jinyeong Moon	Florida State University
Women in Engineering Chair	Xiu Yao	University at Buffalo
Women in Engineering Chair	Sneha Narasimhan	North Carolina State University

Reviewer List

GaN Devices

Track Chair: Zhikai Tang, Texas Instruments

Name	Organization
Martin Kuball	University of Bristol
Matteo Meneghini	University of Padova
Elison Matioli	Swiss Federal Institute of Technology Lausanne
Jin Wei	Peking University
Yuhao Zhang	Virginia Tech
Geetak Gupta	Transphorm
Mengyuan Hua	Southern University of Science & Technology
Peter Moens	ON Semiconductor
King-Yuen Wong	National Tsing Hua University
Jan Sonsky	Innoscience
Towhid Razzak	Texas Instruments
Masakazu Kanechika	Nagoya University

GaN Applications

Track Chair: Stefan Mönch, University of Stuttgart

Name	Organization
Anthony Popovski	GE Vernova
Beatrix Weiss	Siemens Energy
Dominik Koch	University of Stuttgart
Martin Wattenberg	Infineon
Bob White	Embedded Power Labs
Tanzila Akter	University of Arkansas
Yucheng He	Florida State University

Device Switching Reliability

Track Chair: Don Gajewski, Wolfspeed

Name	Organization
Paul Salmen	Infineon
Alejandro Pozo	Efficient Power Conversion
Dilip Risbud	Renesas

SiC Devices

Track Chair: Woongje Sung, University at Albany

Name	Organization
Akin Akturk	CoolCAD Electronics, Inc.
Tsunenobu Kimoto	Kyoto University
Kevin Matocha	Not Affiliated
Sei-Hyung Ryu	Wolfspeed
Vamsi Mulpuri	Navitas Semiconductor
Pete Losee	Qorvo
Sid Sundaresan	Navitas Semiconductor

SiC Applications

Track Chair: Jun Wang, University of Nebraska–Lincoln
Mark Scott, Miami University

Name	Organization
Sudip Mazumder	University of Illinois at Chicago
Hua Bai	University of Tenessee, Knoxville
Lakshmi Ravi	ABB corporate research
Chen Chen	University of Texas, Austin
Mafu Zhang	University of Texas, Austin
Xiang Lin	Tesla
Zhicheng Guo	Arizona State University
Jason Neely	Sandia National Laboratory
Brandon Grainger	University of Pittsburg
Sabrina Helbig	University of Pittsburg
Cong Li	General Electric
Sanket Parashar	General Electric

Ultrawide Bandgap Devices

Track Chair: Xiu Yao, University at Buffalo

Name	Organization
Ke Zeng	University of North Carolina at Charlotte
Robert Kaplar	Sandia National Laboratory
Yuan Qin	Virginia Tech
Sudipto Saha	University at Buffalo
Arindam Sircar	University at Buffalo

Detailed Schedule: Monday, November 4, 2024

Agenda Overview

Time	Tradewinds Room
7:00 - 8:00 AM	Breakfast
Time	**Grand Ballroom**
KEYNOTE PRESENTATION (Chair: Dong Cao)	
8:00 – 8:05 AM	Opening Remarks and Welcome
8:05 – 8:35 AM	**Electrification in Aerospace – Trends, Challenges, and Opportunities** Manish Dalal – GE Aerospace
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8:35 - 9:30 AM	**SiC Power MOSFET Design and Overview of Recent Trends** Woongje Sung - University of Albany
9:30 - 10:25 AM	**GaN Power Switching Devices for Energy-Efficient Applications** Zhikai Tang - Texas Instruments
10:00 - 5:00 PM	Exhibition in Ballroom Foyer
10:25 - 11:20AM	**Development of Semiconductors for Next Generation Power Electronics: From Wide Bandgap GaN to Ultrawide Bandgap Ga2O3, (AlxGa1-x)2O3 and LiGa5O8** Hongping Zhao - The Ohio State University
11:20 - 12:15 PM	**Potential, Progress, and Challenges for Ultra-Wide-Bandgap Semiconductors** Robert Kaplar & Andrew Binder - Sandia National Laboratories
Time	**Tradewinds Room**
12:15 - 1:15 PM	Buffet Lunch
Time	**Grand Ballroom**
1:15 - 2:10 PM	**(Ultra) Wide Bandgap Material Process and Device TCAD Simulation Methodologies** Hiu Yung Wong - San Jose State University
2:10 - 3:05 PM	**10kV SiC MOSFETs based Power Modules and Power Converters** Stig Munk-Nielsen - Aalborg University

3:05 - 4:00 PM	**From Lateral and Vertical GaN Devices to Power ICs and Smart Converters** Stefan Mönch & Sibylle Dieckerhoff - University of Stuttgart & TU Berlin
4:00 - 4:55 PM	**WBG for Pushing Wireless Power Transfer Boundaries** Shajjad Chowdhury, Mostak Mohammad, Vandana Rallabandi - Oak Ridge National Laboratory
4:55 - 5:50 PM	**Capacitors and Aircraft Power System Considerations for Higher Temperature Operation and Wide Bandgap Enablement** Roger Brewer - Lockheed Martin
5:50 - 6:00 PM	At Marriott Front Door: Bus Transportation to Dayton History Museum
Time	**Dayton History Museum**
6:00 - 9:30 PM	Reception/Social Event
9:30 - 10:30 PM	Bus Transportation at Dayton History Museum back to Marriott

Keynote Presentation

Title: **Electrification in Aerospace – Trends, Challenges and Opportunities**

Time: 8:05 – 8:35 AM

Abstract: Electrification in aerospace has been gaining momentum for more than a decade starting with more electric aircraft, moving from pneumatic and hydraulic system to electric system and most recently with hybrid electric or all electric propulsion. The benefits and motivation for the aerospace electrification ranges from economical, environmental, performance and bringing new capabilities that would not be possible with conventional gas turbine propulsion alone such as VTOL or distributed propulsion without significant weight penalty. The discussion will be focused on trends, challenges and opportunities that come with electrification in aerospace.

Speaker Bio: Manish is Vice President for Electrical Power Systems for GE Aerospace Electrical Power business in US and UK. In this role Manish leads the advanced technology team, chief engineers' office, growth pursuits, technology and product roadmaps, systems integration capability and state-of-art power systems integration lab "EPISCenter" located in Dayton, OH. Manish has 30 years of experience in aerospace electrical power domain and expertise in areas of power electronics, controls, electric machine, power systems architecture, hybrid electric systems and integration. Manish has Master of Science degree in electrical engineering and MBA degree in Marketing.

Tutorial Sessions

Title: **SiC Power MOSFET Design and Overview of Recent Trends**

Time: 8:35 – 9:30 AM

Abstract: In recent years, SiC power devices have been widely adopted in various applications, including electric vehicles, on-board/off-board chargers, motor control and drives, switched-mode power supplies, and more. The immediate advantage of

using SiC power devices is the boost in efficiency of power electronics systems, attributed to their lower on-resistance and fast switching capabilities. As SiC MOSFETs are increasingly utilized across different fields, ensuring reliable operation and device ruggedness has become increasingly important. Additionally, the cost of SiC power chips is a critical factor in their manufacture.

This tutorial will address these key considerations and will cover the following topics: In Part I, we will explore SiC MOSFET design, focusing on drift layer design, edge termination techniques, cell design optimization, and layout approaches featuring 3-D simulation. Part II will discuss recent trends in SiC device technology, including rugged MOSFETs with Deep Pwell, novel device architectures and layouts, advancements in JBS diode integrated MOSFETs, bi-directional switches, and high voltage devices rated at 3.3kV and above.

Speaker Bio: Dr. Woongje Sung is an associate professor at the University at Albany, State University of New York, Albany, NY. With extensive experience across various industrial settings, he has worked at a startup company (NoMIS Power), a semiconductor foundry (Dongbu HiTek), and a multinational company (Samsung Advanced Institute of Technology). As a founding member of the DOE-funded PowerAmerica Institute, Dr. Sung has been instrumental in establishing the baseline process for SiC MOSFETs and diodes at X-Fab. Dr. Sung's research focuses on the design, fabrication, and characterization of high-voltage SiC power devices, including 1.2kV, 3.3kV, 6.5kV, 10kV, and 15kV devices. His research group has also been advancing the performance of JBS diode integrated MOSFETs and working on Power ICs on SiC, with an emphasis on cost, performance, and reliability. They have collaborated with various foundries, including X-FAB, Clas-SiC, SiCamore, and private companies. His work is supported by PowerAmerica/DoE, VTO & AMO/DoE, Sandia National Laboratory, and the Army Research Laboratory & Office of Naval Research/DoD. Additionally, Dr. Sung's group has recently developed a reliability assessment setup to ensure the reliable use of SiC power devices, reflecting the increasing focus on device reliability.

Title: **GaN Power Switching Devices for Energy-Efficient Applications**

Time: 9:30 – 10:25 AM

Abstract: Since the first demonstration of gallium nitride high electron mobility transistor (GaN HEMT) in a university research lab three decades ago, the GaN device field has witnessed tremendous performance and reliability improvement through enhanced device physics understanding and technology innovation. Today the GaN power switching device technology has become mature and competitive to be adopted in a multitude of critical power electronics applications that would have a great impact to a green sustainable future. In this tutorial, we will take a close look at what has enabled GaN as a major commercialized power device technology in mass production today with remarkably rapid market penetration and growth. This includes the excellent wide bandgap material properties of GaN, cost-effective substrates, unique device physics, novel device architectures and fab process techniques that are designed and developed for ubiquitous power management applications where simultaneous realization of high energy efficiency and high power density is indispensable. Key GaN-specific reliability aspects at both device and application levels focused upon during device technology development will also be presented.

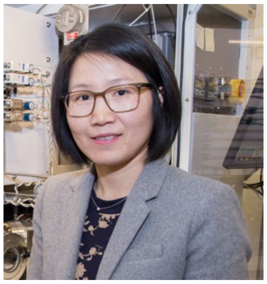
Speaker Bio: Zhikai Tang is currently the GaN Technology Lead Engineer and Senior Member Technical Staff in the Kilby Labs at Texas Instruments (TI) focusing on GaN power technology research and development. Prior to TI, he was leading the next-generation power GaN product development as the Director, Device Engineering and Member of the Technical Staff at Efficient Power Conversion (EPC) from 2014 to 2022. In the technical community, Dr. Tang is currently serving on the technical committees of IEEE IEDM and WiPDA, and is also a JEDEC JC-70 committee member and co-chair on Standards for GaN Device Test & Characterization Methods. He is an editor of Japanese Journal of Applied Physics and Applied Physics Express, and reviewer for multiple technical journals. He is an IEEE Senior Member, EDS Compound Semiconductor Devices and Circuits Committee Member, and Member of Japan Society of Applied Physics. Dr. Tang has co-authored over 50 technical publications, about 30 US patents, and 1 book chapter in the field of GaN power device and IC technologies. He received the B.S. degree in Microelectronics from the University of Electronic Science and Technology of China and the Ph.D. degree in Electronic and Computer Engineering from the Hong Kong University of Science and Technology in 2010 and 2014, respectively.

Title: Development of Semiconductors for Next Generation Power Electronics: From Wide Bandgap GaN to Ultrawide Bandgap Ga_2O_3, $(Al_xGa_{1-x})_2O_3$ and $LiGa_5O_8$

Time: 10:25 – 11:20 AM

Abstract: Wide bandgap gallium nitride (GaN) with a bandgap energy of 3.4 eV and a high electron mobility (phonon limited mobility >2000 cm^2/Vs), possesses Baliga figure-of-merit nearly 1000 times better than Si, enabling substantial reduction in conduction and switching losses in power electronics. Compared to lateral device configurations, vertical GaN devices are at a relatively less mature stage. Achieving high quality thick GaN drift layer with controllable doping level at low-10^{15} cm^{-3} and low defects determines vertical power device performance and reliability. In this tutorial, novel epitaxy techniques such as laser-assisted metalorganic chemical vapor deposition (MOCVD) development of GaN-on-GaN for high performance vertical PN diodes will be discussed. Record breakdown voltage exceeding 11 kV of vertical GaN PN diodes with on resistance of 10 mΩ.cm^2 was demonstrated recently. UWBG gallium oxide (Ga_2O_3) represents an emerging semiconductor material promising for power electronics applications. With a bandgap energy of 4.8 eV, β-Ga_2O_3 is predicted to have a critical field strength of 8 MV/cm, enabling power switching devices with much lower conduction losses. Tremendous progresses have been made in the past decade on developing high quality Ga_2O_3 substrates, thin film epitaxy, defects and doping control, and device demonstrations. This tutorial will discuss MOCVD developments of Ga_2O_3, doping, alloys, phase stabilization and heterostructures. MOCVD growth of (010) β-Ga_2O_3 results in high purity material with low compensation concentration, high electron mobility and wide range of n-type doping. Challenges and opportunities for developing $(Al_xGa_{1-x})_2O_3$ on Ga_2O_3 substrates with different crystal orientations ((010), (100), (-201), (001)) will be discussed. MOCVD growth of metastable α-phase $(Al_xGa_{1-x})_2O_3$ with Al composition from 0-100% and exploration of MOCVD growth window of κ-phase Ga_2O_3 will also be covered. Most recently, a new p-type

ultrawide bandgap $LiGa_5O_8$ was discovered - promises the advancement of future power electronics based on ultrawide bandgap Ga_2O_3 and related semiconductor material systems.



Speaker Bio: Hongping Zhao is a professor in the Department of Electrical and Computer Engineering, and the Department of Materials Science and Engineering at The Ohio State University (Columbus, Ohio, USA). She earned her PhD in Electrical Engineering from Lehigh University (Bethlehem, Pennsylvania, USA) in 2011. Prof. Zhao's research expertise is centered in wide bandgap and ultra-wide bandgap semiconductor materials and devices. Her current research focuses on the material synthesis and device physics of III-nitrides, II-IV-nitrides, Ga_2O_3, etc. She currently serves as an Associate Editor for the journal Applied Physics Letters, and Journal of Crystal Growth. She is also serving as the technical program committee for the ICMOVPE XXI, IWGO 2024, EMC 2024, and IEDM 2024. Prof. Zhao serves as the general conference chair for GOX 2024.

Title: Potential, Progress, and Challenges for Ultra-Wide-Bandgap Semiconductors

Time: 11:20 – 12:15 PM

Abstract: The wide-bandgap semiconductors SiC and GaN have enabled significant improvements in the efficiency and the power density of power conversion systems, ranging from low-power applications such as cell phone and laptop chargers to higher-power applications such as electric vehicle drivetrains and grid applications. In the simplest analysis, this stems from the fundamental relationship between specific on- resistance $R_{on,sp}$ and breakdown voltage V_B for a one-dimensional drift region, i.e. the unipolar figure of merit, where the ratio $V_B^2/R_{on,sp}$ scales as the cube of the critical breakdown electric field. Thus, semiconductors with ultra-wide bandgaps exceeding those of SiC and GaN, such as AlGaN/AlN, Ga_2O_3, diamond, and cubic BN, are expected to further extend this advantage. However, numerous real-world complexities exist that must be addressed before this promise can be fully realized. This tutorial will present a more nuanced analysis of the motivation for using UWBG semiconductors in power conversion applications. The key challenges associated with the growth and processing of these materials will be discussed, such as the size and quality of suitable substrates, achieving effective doping by impurities or other means, the fabrication of low-resistance ohmic contacts, the synthesis of low-defect-density semiconductor-dielectric interfaces with sufficient band offsets, bulk and interfacial electronic and thermal transport, and the tradeoffs inherent between various practical device structures. Progress to date on the primary UWBG semiconductors will be reviewed, and remaining challenges will be presented. The key programs under which UWBG semiconductor research is being conducted will also be highlighted, and a brief overview of potential applications will be included. Sandia National Laboratories is managed and operated by NTESS under DOE NNSA contract DE-NA0003525.

Speaker Bio: The tutorial will be presented by Robert Kaplar, who is the Manager of the Semiconductor Material and Device Sciences Department at Sandia National Laboratories in Albuquerque, NM. His research over the last decade has focused primarily on WBG/UWBG power electronics. He is a co-author on numerous journal articles, conference presentations, and other documents in this field, including several key reviews and roadmaps on UWBG semiconductors. He received a B.S. degree in Physics from Case Western Reserve University and M.S. and Ph.D. degrees in Electrical Engineering from Ohio State University.

Speaker Bio: Substantial tutorial content will be contributed by Andrew Binder, who is a Senior Member of Technical Staff at Sandia National Laboratories. His research is focused on the development of kilovolt-class power semiconductor devices. At Sandia, Andrew leads a multidisciplinary team developing WBG and UWBG devices and has contributed to several key roadmaps on these topics. He received B.S. and Ph.D. degrees in Electrical Engineering from University of Arkansas and University of Central Florida.

Title: **(Ultra) Wide Bandgap Material Process and Device TCAD Simulation Methodologies**

Time: 1:15 – 2:10 PM

Abstract: Wide Bandgap and Ultra-Wide Bandgap (WBG/UWBG) materials (such as SiC, GaN, Ga2O3, NiO, and Diamond) and their devices are revolutionizing the power electronics industry. Due to the wider bandgap and sometimes better carrier mobilities and thermal conductivities, higher voltage ratings and efficiency are made possible. However, WBG/UWBG materials are relatively novel and thus, are more expensive and difficult to fabricate. Therefore, TCAD simulation provides a very cost-effective way to explore the design space of WBG/UWBG material and novel devices. Knowhow is required to have successful TCAD simulations of WBG/UWBG devices due to the wider bandgap and novel physics. In this lecture, we will discuss 1. The methodologies to improve the numerical convergence and their limitations, 2. modeling of critical physics in each material and the corresponding devices, 3. calibration of critical parameters, 4. modeling of defects and reliabilities, and 5. machine learning-assisted WBG modeling and simulation. TCAD Sentaurus will be used in the examples.

Speaker Bio: Hiu Yung Wong is an Associate Professor at San Jose State University. He received his Ph.D. degree in Electrical Engineering and Computer Science from the University of California, Berkeley in 2006. From 2006 to 2009, he worked as a Technology Integration Engineer at Spansion. From 2009 to 2018, he was a TCAD Senior Staff Application Engineer at Synopsys. In Synopsys, he was one of the main creators of WBG examples in the early phase of WBG simulations. He has published more than 40 papers and patents on (U)WBG simulation.

He received the Industry Sponsored Research Award and ERFA RSCA Award in 2024, the AMDT Endowed Chair Award, the Curtis W. McGraw Research Award from ASEE Engineering Research Council in 2022, the NSF CAREER award and the Newnan Brothers Award for Faculty Excellence in 2021, and Synopsys Excellence Award in 2010. He is the author of the book, "Introduction to Quantum Computing: From a Layperson to a Programmer in 30 Steps". He is one of the founding faculties of the

Master of Science in Quantum Technology at San Jose State University.

His research interests include wide bandgap device simulations, the application of machine learning in simulation and manufacturing, cryogenic electronics, and quantum computing. His works have produced 1 book, 1 book chapter, about 120 papers, and 10 patents.

Title: **10kV SiC MOSFETs based Power Modules and Power Converters**

Time: 2:10 – 3:05 PM

Abstract: AAU team has worked since 2013 to develop 10kV power modules and 4160V power converters. In 2017 the power module laboratory was inaugurated and a rotational machine setup for 500kVA has been under construction for 5 years. This tutorial presents the challenges related with working at higher voltages and the experienced significance of the capacitive parasitics on the power module losses distribution and DC voltage operating range. Also, it includes results of switching 10kV chip at 50A/7.2kV in multichip power modules are shown.

1. Short historical overview. Challenges due to higher level of parasitic capacitive energy (displacement currents)
2. Half-bridge MOSFETs loss distribution affected by parasitic capacitance
3. Conductive baseplate capacitance impact on switching oscillations
4. Reducing the parasitic capacitance by ceramic baseplate and low capacitance gate power supply
5. Examples of 10kV Power Modules switching behavior at 200A/7.2kV and Power Converter operation of 4.16kV induction machine
6. Discussion based on experiences with high voltage parasitic capacitance energy levels challenges and next step applying 10kV MOSFETs

Speaker Bio: Stig Munk-Nielsen is currently Professor at the Energy Department, Aalborg University, Denmark. In 2013 we secured funding for a die packaging team and laboratory facilities for 10 kV SiC devices and later we did numerous application designs with GaN, Si and other SiC devices. The packaging facilities is a key enabler for reaching the goal of extending the team experience with digital design framework, where the team include the L, C parasitic of power module layouts. The application interest includes medium voltage RF converters, wind turbine converters and low voltage, high current electrolysis systems technology.

Title: From Lateral and Vertical GaN Devices to Power ICs and Smart Converters

Speakers: Stefan Mönch, University of Stuttgart

Time: 3:05 – 4:00 PM

Abstract: Lateral GaN devices enable monolithic integration of large-area power transistors with gate drivers, temperature, voltage and current sensors, and logic. Vertical GaN enables area-efficient higher voltage power transistors. Combining both will enable high-voltage high-current vertical GaN devices with integrated drivers, sensors and control or protection logic. Lateral and vertical GaN power ICs thus will enable smart power converter applications. This tutorial will present the key challenges and recent achievements in the design and operation of lateral, vertical, and lateral/vertical co-integrated GaN power ICs. First, the intrinsic device design, including semiconductor technology and epitaxy is discussed. Advanced devices (e.g., with reverse diodes, bidirectional blocking HEMTs) and converter topologies (e.g., half-bridges, three-phase inverters) are addressed. Effects from monolithic integration are discussed, such as dynamic capacitive substrate coupling or static backgating. Countermeasures such as low-cost large-area isolating substrates (e.g. GaN-on-Sapphir) are addressed. Integration aspects of closed-loop converters using only n-channel devices are presented for the example of a voltage-mode buck converter with integrated drivers, PWM and feedback. To address higher voltages beyond 800V for electromobility and renewable energy conversion, the status and recent progress of lateral and vertical GaN is reviewed, and the monolithic design of a large-area vertical GaN power transistor with a lateral gate driver and current sensor shown. The tutorial will be presented by Stefan Mönch (University of Stuttgart) and Sibylle Dieckerhoff (TU Berlin), with substantial contributions by Richard Reiner and Michael Basler (Fraunhofer IAF).

Speaker Bio: Stefan Mönch has a junior professorship on smart converters for emission-free future mobility at the University of Stuttgart, Germany, since 2023, and is a researcher and project leader at the Fraunhofer Institute for Applied Solid State Physics (IAF), Freiburg, Germany, since 2017. He has a M.Sc. ('14) and Ph.D. ('21) degree in Electrical Engineering with a focus on highly-efficient and integrated wide-bandgap power electronics for electromobility and renewable energy conversion.

Speaker Bio: Sibylle Dieckerhoff received the Dipl.-Ing. and Dr.-Ing. degrees in electrical engineering from RWTH Aachen University, Aachen, Germany, in 1997 and 2004, respectively. From 1997 to 2002, she was a Research Associate with the Institute for Power Electronics and Electrical Drives, RWTH Aachen, and Daimler-Chrysler Research and Technology, Berlin, Germany. In 2003, she joined Siemens AG, Krefeld, Germany, as a Development Engineer, followed by positions as a Senior Researcher with the Technical University of Berlin (TU Berlin), Berlin, and as a Professor with the Beuth University of Applied Sciences Berlin. Since 2010, she has been a Professor of power electronics with TU Berlin. Her research interests include wide bandgap power devices and their application, grid converters and their control in electric grids, and multilevel converters. Dr. Dieckerhoff was a member of the Administrative Committee of the IEEE Power Electronics Society from 2017 to 2019 and has served as the Vice-Chairperson of the German ETG/VDE Steering Committee from 2013 to 2016. She is also a member of the International Scientific Committee of the European Power Electronics and Drives Association (EPE).

Title: **WBG for Pushing Wireless Power Transfer Boundaries**

Time: 4:00 – 4:55 PM

Abstract: Recent advances in wide bandgap (WBG) semiconductor materials are enabling disruptive technologies that were impossible to realize with Silicon. Among the WBG devices, silicon carbide (SiC) and gallium nitride (GaN) are recognized as outstanding semiconductor devices due to their superior thermal and electrical properties. A key application enabled by these devices is inductive wireless charging for electrified transportation. These systems operate at high frequencies (several 10s of kHz to several MHz) to simultaneously minimize the size of the inductive coils, improve efficiency, and maximize the power transfer distance. Furthermore, the transferred power can range from a few kilowatts to a few hundred kilowatts. Operation at such high power and high frequencies is enabled by the improved efficiency and power density of WBG devices. However, there are many challenges associated with the development of WBG device- based wireless charging systems which require bespoke technological solutions.

This tutorial reviews the state-of-the-art wide bandgap semiconductor devices and the advantages they bring to high-frequency operation, especially for wireless charging. A detailed design methodology for a high-power and long-distance wireless charging system will be presented. Finally, the speakers will discuss the practical challenges and the adopted solutions from their experience

Speaker Bios:

Shajjad Chowdhury (Senior Member, IEEE) received an M.Sc. degree in power and control engineering from Liverpool John Moores University, Liverpool, U.K., in 2011, and a Ph.D. degree in electrical and electronics engineering from the University of Nottingham, Nottingham, U.K., in 2016. In January 2017, he joined the Power Electronics, Machines and Control Group, University of Nottingham, Nottingham, UK, as a Research Fellow. In 2018, he joined Oak Ridge National Laboratory, Oak Ridge, TN, USA. His research interests include multilevel converters, modulation schemes, high-frequency converters, and high-performance ac drives.

Vandana Rallabandi (Senior Member, IEEE) has been a Staff Member at Oak Ridge National Laboratory since 2022. Previously, she was a lead engineer with the GE Research Center in Niskayuna, New York. She has also held positions as a postdoctoral researcher with the SPARK Lab, University of Kentucky, Lexington, and as a research engineer at GE Research, Bangalore, India. She received her M.Tech. and Ph.D. degrees from the Indian Institute of Technology Bombay, Mumbai, India. She has over 10 years of experience in motors and magnetics.

Mostak Mohammad (Senior Member, IEEE) received a B.Sc. degree in electrical and electronics engineering from the Bangladesh University of Engineering and Technology (BUET), Dhaka, Bangladesh, in 2009, and the Ph.D. degree in electrical engineering from The University of Akron, Akron, OH, USA, in 2019., From 2009 to 2014, he worked on radio network planning with Robi Axiata Ltd., Dhaka, where he developed RF propagation models for cellular networks. He is currently a Research and Development Staff with the National Transportation Research Center, Oak Ridge National Laboratory, Knoxville, TN, USA. He has been working on 11–500-kW single-phase, poly-phase, stationary, and dynamic wireless charging systems. His research interests include high-fidelity multiphysics modeling and optimization, high-power wireless charging for electric vehicles, magnetic design, electromagnetic shielding, electric machine design and optimization, and the development of magnetic materials.

Title: **Capacitors and Aircraft Power System Considerations for Higher Temperature Operation and Wide Bandgap Enablement**

Time: 4:55 – 5:50 PM

Abstract: The evolving and challenging demands placed on electronics when installed on a modern military Aircraft, driven largely by environment (high ambient heating, vibration, etc.) could not be any timelier for focused attention. To serve as an introduction on this topic, an overview of a modern aircraft (very generalized)

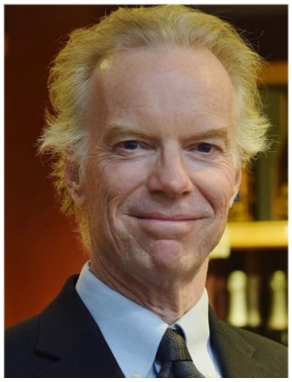
power system that might leverage a high-power density Wide Bandgap-based supply and the associated electrical usage needs that, in turn, drive thermal management challenges on electronics will set the opening stage.

Following the introduction there will be more in-depth discussion regarding what limits upper temperature operating range for many existing capacitor technologies (ultracapacitors, film capacitors and ceramic capacitors) which are a key bottleneck in expanded temperature range for many power electronics and avionics systems within an aircraft. Mechanical fatiguing effects and material limitations within capacitor cells will be illustrated and shown to contribute to these component limitations. The equation for capacitance will be utilized to draw attention into how capacitor cell structure (distance "d" between plates and area "A" of plates) attributes impact attainable capacity and power (irrespective of temperature considerations) prior to turning attention to the next part of the talk.

The core of the talk will next turn to addressing the Technology Readiness Level (TRL) of specific film capacitor variations in stages of development. Film capacitors, often used in power conditioning and filtering systems associated with power generation AC sources (in the 10kW and above range and above 50V to the power bus) of advanced aircraft, have critical advantages which will be addressed. Less mature capacitor concepts utilizing the Ultrawide Band Gap (UWBG) class of materials as a dielectric medium to further enhance performance in passive component devices (create very high voltage standoff capable energy storage) will next be briefly highlighted. A focus will next aim to address a key theme regarding how a theoretical, UWBG-based capacitor "core cell" needs a robust packaging scheme (lead to electrode, e.g. "beyond the cell" level) to achieve greater temperature range and improved reliability (e.g. robustness for high vibration environments). The relevance of packaging form-factor (cylindrical, surface mount) in limiting temperature range envelope of capacitors will also be addressed based on a combination of mechanical and electrical stressing (potentially high ripple typical of WBG supplies) events, i.e.:

"It's not just about the cell level improvements in making robust capacitors for aircraft"

A noteworthy conclusion will emphasize how various performance benefits achieved in a given capacitor type (large Farads per in^3) may sacrifice other needed performance benefits (temperature range). With all these various factors throughout the talk provided, a holistic technology roadmap for future, higher temperature capable capacitor technology development will be provided to form a conclusion and serve the notion that peripheral devices to accompany a WBG-based supply are ripe for innovation.



Speaker Bio: With 35 years of experience at Lockheed Martin, Roger Brewer has been involved in developing electrical power systems and battery programs across multiple LM Business Units. He also contributes to corporate engineering and enterprise strategies centered around batteries, capacitors and power systems and has delivered several presentations across industry aimed at enhancing power system performance for both existing and future platforms. His recent focus has been centered on the wide-ranging benefits of high-temperature-enabled electronics for military and aerospace sectors. He was inducted as an AIAA Associate Fellow in 2022 and currently holds the position of Technical Fellow at Lockheed Martin with both Bachelor and Master's Degrees in Electrical Engineering.

Detailed Schedule: Tuesday, November 5, 2024

Agenda Overview

MAIN CONFERENCE, DAY 1 – KEYNOTES & PANEL DISCUSSION	
Time	**Tradewinds Room**
7:00 - 8:30 AM	Breakfast
Time	**Kiefaber Room**
7:00 - 8:30 AM	WiE Breakfast
Time	**Grand Ballroom**
8:30 - 9:00 AM	Opening Remarks and Welcome
9:00 - 9:30 AM	**Power Electronics for Improved Grid Control, Resilience, and Reliability"** Olga Blum Spahn – DOE ARPA-E
9:30 - 10:00 AM	**Driving the Industry Trends Towards Integrated GaN Modules** Nathan Schemm - Texas Instruments
10:00 -10:30 AM	**Progress in β-Ga2O3 Materials, Physical Properties, and Device Physics for High Voltage Power Electronics** Jim Speck - University of California Santa Barbara
8:00 - 5:00 PM	Exhibition at Ballroom Foyer
10:30 -10:45 AM	Break at Ballroom Foyer
10:45 - 12:00 PM	**Panel 1: The Real Opportunities for Digital Twins, AI, and Digital Transformation** **Moderators:** Stephanie Watts Butler, WattsButler LLC Alain Charles, ABCsWorld Consulting **Panelists:** Syed Hossain, GE EPISCenter, GE Aerospace Kevin Hermanns, PE-Systems GmbH Burak Ozpineci, National Transportation Research Center, Oak Ridge National Laboratory Members of the Audience & Select WiPDA Presenters
Time	**Tradewinds Room**
12:00 -1:30 PM	Buffet Lunch

MAIN CONFERENCE, DAY 1 – TECHNICAL SESSIONS		
Time	**Grand Ballroom A-D**	**Grand Ballroom E-H**
1:30 - 3:10 PM	SiC Devices	GaN Applications
3:10 - 3:30 PM	Break	
3:40 - 5:20 PM	GaN Devices	SiC Applications
Time	**Grand Ballroom**	
6:00 - 7:00 PM	Poster Session	
7:00 - 9:00 PM	Banquet	

Keynote Sessions

Title: **Power Electronics for Improved Grid Control, Resilience, and Reliability**

Time: 9:00 – 9:30 AM

Abstract: The electrical grid is being transformed by an increasing share of renewable energy sources and growth of electrical loads due to decarbonization needs. This drives the need for better control, performance and expansion of the grid. Next generation power electronics with improved power handling and dynamic performance are required to support these advancements. Our most recent program, *Unlocking Lasting Transformative Resiliency Advances by Faster Actuation of power Semiconductor Technologies* (ULTRAFAST) seeks to advance the performance limits of silicon, wide bandgap, and ultrawide bandgap semiconductor devices and significantly improve their actuation methods to support a more capable, resilient, and reliable future grid. ARPA-E has a long history of power electronics programs that support mission goals to improve resilience, reliability, and security of energy infrastructure; improve energy efficiency; reduce greenhouse gas emissions; reduce reliance on energy imports; and maintain U.S. leadership in energy technologies.

Speaker Bio: Dr. Olga Spahn currently serves as a Program Director at the Advanced Research Projects Agency-Energy (ARPA-E). Her focus at ARPA-E is on grid resiliency, power management and distribution, aviation and instrumentation for harsh environments leveraging optical and semiconductor device technologies. Before joining ARPA-E, Dr. Spahn managed Advanced and Exploratory Systems at Sandia National Laboratories where she oversaw new system development and technology maturation activities for Nuclear Deterrence applications. Prior to that, she managed the Semiconductor Material and Device Sciences department where she focused on advancement of wide- and ultrawide-bandgap semiconductor devices and applications, which earned an R&D 100 Award. Her experience as a principal investigator spans technology development for nuclear non-proliferation, photonics and optoelectronics, optical MEMS, and laser material processing.

Dr. Spahn holds her B.S. in Electrical Engineering from University of Illinois Urbana-Champaign, M.S. and Ph.D. in Electrical Engineering from University of California, Berkeley. She has published more than 90 publications, holds 3 patents, and is a co-author of several book chapters.

Title: **Driving the Industry Trends Towards Integrated GaN Modules**

Time: 9:30 – 10:00 AM

Abstract: GaN enables higher switching frequency, lower losses, and smaller power supplies. This is accompanied, however, by a more challenging gate driver design. In recent years, the industry has been moving towards integrating the gate driver which can make using GaN simpler, lower loss, and provide valuable additional features. This presentation will focus on the challenges of driving GaN and how to solve them, as well as showing the benefits and limitations of advanced features such as current sensing, over-current protection, de-sat detection, temperature reporting, thermal shut down, and zero-voltage and zero-current detection that integration can provide.

Speaker Bio: Nathan Schemm is the design manager for TI's integrated high voltage GaN product line. He holds a Ph.D in electrical engineering from University of Nebraska-Lincoln and has been working at TI for 14 years. He is a founding member of TI's GaN product line where he has been an industry pioneer in integrated GaN products over multiple product generations. He has designed multiple industry-first integrated GaN reporting and protection features such as GaN die temperature sensing and reporting, zero-voltage detection, and zero-current detection.

He is an industry expert, and has presented multiple papers at IEEE conferences including receiving a best paper award. He has also written many highly-rated whitepapers (available on TI.com), and presented at numerous TI conferences on all aspects of driving GaN from thermal design to gate driver parasitic inductances. He holds 8 patents with 9 more pending.

Title: Progress in β-Ga_2O_3 Materials, Physical Properties, and Device Physics for High Voltage Power Electronics

Time: 10:00 – 10:30 AM

Abstract: β-Ga_2O_3 is the one of the very few wide bandgap or ultrawide bandgap semiconductors that can be grown directly from the melt (something not offered by SiC, GaN, AlN, or diamond). The system offers easy of doping via group IV donors on the Ga sites. Acceptor doping for semi-insulating behavior can be realized via Mg, Fe, or N doping. Epitaxial growth can be realized by molecular beam epitaxy (MBE), metalorganic chemical vapor deposition (MOCVD) and hydride vapor phase epitaxy (HVPE). In the highest quality MOCVD growth, controlled donor doping in the low to mid 10^{15} cm^{-3} has been demonstrated by several groups with compensating acceptor concentration as low as ~10^{14} cm^{-3}. Outstanding Schottky and ohmic contacts have been demonstrated. The system offers wet etching via hot phosphoric acid. In this talk we survey the materials progress for vertical diodes and transistors with 10 kV blocking voltage. The primary support for this work has been the AFOSR GAME MURI.

Speaker Bio: James S. Speck is a Distinguished Professor in the Materials Department at the University of California Santa Barbara. He received as Bachelors of Science and Metallurgical Engineering in 1983 and his S.M. and Sc.D. from the Massachusetts Institute of Technology in 1985 and 1989, respectively. He joined UCSB in 1990 as an Asst. Professor. Speck's early work focused on epitaxial oxide films on semiconductors, ferroelectric thin films, and strain relaxation in highly misfitting epitaxial systems. He has worked extensively on the materials science of GaN and related alloys. Major aspects of his work on nitrides include elucidating basic growth modes and defect generation, the development of MBE growth of GaN, and the development of nonpolar and semipolar GaN, revealing the nonradiative

Panel Discussion

The Real Opportunities for Digital Twins, AI, and Digital Transformation

Come join our panel as we examine what are the real opportunities for digital twins, artificial intelligence, and other digital transformation tools upon power semiconductors and power electronics. Engage with experts who have been at the forefront of the transformation, as well as those who are just beginning their digital journey.

Moderators:

- Stephanie Watts Butler, WattsButler LLC
- Alain Charles, ABCsWorld Consulting

Panelists:

- Syed Hossain, GE EPISCenter, GE Aerospace, Dayton, Ohio
- Kevin Hermanns, PE-Systems GmbH, Darmstadt, Germany
- Burak Ozpineci, National Transportation Research Center, Oak Ridge National Laboratory
- Members of the Audience & Select WiPDA Presenters

Panelist Bios:

Syed Hossain has a BSEE and MSEE in Electrical Engineering from Bangladesh University of Engineering and Technology, and PhD in Electrical Engineering from the University of Akron, Ohio. He has 25 years+ of experience in electric energy conversion and control working for Delphi Automotive, MI, Globe Motors, OH, University of Dayton Research Institute, OH and his present position of Engineering manager – controls at the GE EPISCenter in Dayton, OH. Dr. Hossain has provided technical leadership in real-time modeling and simulation of aircraft electrical power system (EPS), trade studies for numerous electric power and control programs, and validation/verification of EPS products with emulated systems. He manages a team for controls development of EPS products, and mentors the direct reports for delivering products with quality and cost goals.

Kevin Hermanns is founder and managing director of PE-Systems GmbH. PE-Systems offers solutions in the field of design automation for power electronics including automated characterization and device modelling. Before becoming an entrepreneur, Kevin started his professional career at Siemens in the project office of large-scale railway automation projects. Afterwards, he worked as a research associate at the Technical University of Darmstadt in the Power Electronics Department. During this time, his research interests focused mainly on the distortions of high-power converters. He actively contributed to Cigre working group B4.67, which resulted in the technical brochure "AC side harmonics and appropriate limits for VSC HVDC". He is also an active participant in national and international standardization committees (e.g. IEC and CENELEC). The past years Kevin was the founding chair of the newly formed IEEE Power Electronics Society Technical Committee on Design Methodologies. As such, he sees his role as promoting the use of novel design methodologies. In particular, he focuses on the interaction between design tools and test and measurement techniques.

Burak Ozpineci earned his B.S. degree in electrical engineering from Orta Dogu Technical University, Ankara, Turkey, in 1994. He then completed his M.S. and Ph.D. degrees in electrical engineering at the University of Tennessee, Knoxville, in 1998 and 2002, respectively. Since 2001, he has been with Oak Ridge National Laboratory, where he began as a student and has held positions as a researcher, founding group leader of the Power and Energy Systems Group, group leader of the Power Electronics and Electric Machinery Group. He currently serves as a Corporate Fellow and the Section Head of the Vehicle and Mobility Systems Research Section. Additionally, he has a joint faculty appointment with The University of Tennessee. Dr. Ozpineci is a Fellow of IEEE.

Technical Sessions

MAIN CONFERENCE, DAY 1 – TECHNICAL SESSIONS		
Time	**Location and Topic**	
	Grand Ballroom A - D	Grand Ballroom E - H
1:30 PM – 3:10 PM	SiC Devices 1	GaN Applications
3:10 PM – 3:40 PM	Break	
3:40 PM – 5:20 PM	GaN Devices	SiC Applications
6:00 PM – 9:00 PM	Poster Session and Reception	

Time: 1:30 PM – 3:10 PM

Session Name: **SiC Devices 1 (Track 3: SiC Devices)**

Location: Grand Ballroom A - D

Session Chair: Robert Kaplar (Sandia National Laboratories)

Time	Topic
1:30 – 1:55 PM	**Optimization of JFET Region for 1.2kV SiC HEXFETs with 3D TCAD Simulations** (Paper ID 5036) Authors: Skylar Deboer, Seung Yup Jang, Adam Morgan, Woongje Sung
1:55 – 2:20 PM	**Threshold Voltage Adjustment of Commercial SiC MOSFETs During Gate Oxide Screening by Low Field Pulse** (Paper ID 5047) Authors: Michael Jin, Monikuntala Bhattacharya, Limeng Shi, Jiashu Qian, Shiva Houshmand, Hengyu Yu, Atsushi Shimbori, Marvin White, Anant Agarwal

2:20 – 2:45 PM	**Comparative Analysis of the Static Performance of Various HEXFET Layout Approaches for 1.2 kV SiC MOSFETs** (Paper ID 5050) Authors: Justin Lynch, Skylar Deboer, Seung Yup Jang, Adam Morgan, Woongje Sung
2:45 – 3:10 PM	**Methodology for Determining Critical Screening Voltage in SiC MOSFETs Through Gate Leakage Current Hysteresis** (Paper ID 5056) Authors: Nikhil Bhardwaj, Shiva Houshmand, Hengyu Hu, Monikuntala Bhattacharya, Michael Jin, Limeng Shi, Jiashu Qian, Sandeep Anand, Anant Agarwal

Session Name: GaN Applications (Track 2: GaN Applications)

Location: Grand Ballroom E - H

Session Chair: Sibylle Dieckerhoff (TU Berlin)

Time	Topic
1:30 – 1:55 PM	**Bidirectional GaN Based Semiconductor Galvanic Isolation (SGI) Converter for Energy Storage Application** (Paper ID 5063) Authors: Zhining Zhang, Yifan Shi, Pengyu Fu, Jin Wang, Jacob Mueller, Luciano Andres Garcia Rodriguez
1:55 – 2:20 PM	**A Highly Efficient GaN and SiC Hybrid Active Neutral Point Clamped (ANPC) Inverter for High Speed Electric Traction Applications** (Paper ID 5055) Authors: Ankit Vivek Deshpande, Shaozhe Wang, Erick Pool-Mazun, Enrique Garza-Arias, Rolando Sandoval, Prasad Enjeti

2:20 – 2:45 PM	**From Two to Seven Level GaN π Type Converter Operation for Increased Efficiency of Capacitive Load Charging** (Paper ID 5033) Authors: Stefan Mönch, Michael Basler, Daniel Grieshaber, Richard Reiner, Adrian Söllner, Ines Ben Nour, Rüdiger Quay, Kilian Bartholomé
2:45 PM – 3:10 PM	**Study of Using 24V to Replace 12V Intermediate Bus for VRM** (Paper ID 5031) Authors: Abhishek Bose, Peiwen Jiang, Jason Auduong, Michelle Atkinson, Kobe Knisley, Ethan Buerck, Qingyun Huang

Time: 3:40 PM – 5:20 PM

Session Name: GaN Devices (Track 1: GaN Devices)

Location: Grand Ballroom A - D

Session Chair: Zhikai Tang (Texas Instruments)

Time	Topic
3:40 – 4:05 PM	**RON Degradation Mechanisms of On-Wafer 100-V p-GaN HEMTs Emulating Monolithically Integrated Half-Bridge Circuits** (Paper ID 5023) Authors: Nicolò Zagni, Lorenzo Modica, Marcello Cioni, Giacomo Cappellini, Maria Eloisa Castagna, Giovanni Giorgino, Ferdinando Iucolano, Giovanni Verzellesi, Alessandro Chini
4:05 – 4:30 PM	**Common Wear-Out Mechanism of pGaN Gate in GaN HEMTs Under DC and Inductive Switching Test Methods** (Paper ID 5004) Authors: Angel Espinoza, Ricardo Garcia, Siddhesh Gajare, Shengke Zhang

4:30 – 4:55 PM	**Analysis of Inverter Architectures in a GaN-IC Technology** (Paper ID 5015) Authors: Adarsh Datta, Thibault Cosnier, Iacopo Morelli, Olga Syshchyk, Urmimala Chatterjee, Matteo Borga, Benoit Bakeroot, Stefaan Decoutere
4:55 – 5:20 PM	**A Novel Split-Gate GaN Reverse Conduction FinFET Device with Lower Dead-Time Power Losses** (Paper ID 5014) Authors: Peng Wu, Wen Yang, Chuan Song, Huaxing Jiang, Bin Li

Session Name: SiC Applications (Track 4: SiC Applications)

Location: Grand Ballroom E - H

Session Chair: Qingyun Huang (University of Missouri)

Time	Topic
3:40 – 4:05 PM	**SiO2/Si3N4 Electret Incorporated AlN Substrates for Partial Discharge Free WBG Power Electronics Operating at Low Pressures** (Paper ID 5018) Authors: Asif Muhammad Juberi, Chanyeop Park
4:05 – 4:30 PM	**Active Common Mode Voltage Cancellation in SiC-Based NPL.H Inverter with Imbalanced Load** (Paper ID 5030) Authors: Mikayla Benson, Kangbeen Lee, Jinyeong Moon, Woongkul Lee
4:30 – 4:55 PM	**3.6 MVA Fuel-Cell Electrical Aircraft Powertrain Inverter Design Using 1700V SiC MOSFETs** (Paper ID 5037) Authors: Haoran Meng, Vafa Marzang, Xiaoyan Liu, Zhongshu Sun, Maohang Qiu, Dong Cao

4:55 – 5:20 PM	**Multi-Level-Resistance Gate Driver for SiC Motor Drives to Control Slew Rate and Reduce Switching Loss** (Paper ID 5054) Authors: Abhishek Bose, Peiwen Jiang, Hayden Higgins, Qingyun Huang

Poster Session

Time: 6:00 PM – 7:00 PM

Session Chair: Xiaoqing Song (University of Arkansas)

GaN Devices
Characterization and Modeling Protocol for GaN-on-Si Power Transistors (Paper ID 5005) Authors: Salim Dahmani, Adama Seck Elhadji, Cyril Buttay, Bruno Allard, Hassan Maher, Ali Soltani
Electromagnetic Investigation of Substrate Coupling in Power Integrated Circuits in GaN-on-Si Technology (Paper ID 5012) Authors: Rui Yao, Miao Cui, Zhao Wang, Sang Lam, Stephen Taylor
GaN Applications
Effect of Switching Frequency on Efficiency in Wide Bandgap Based Drive Systems (Paper ID 5021) Authors: Matthew Cooke, Dan Rogers
GaN-Based, Buck-LLC Resonant Design and Maximum Efficiency Point Tracking Regulation for Space Power Systems (Paper ID 5008) Authors: Thomas Cook, Brandon Grainger
Magnetoresistance-Based Current Sensor for Wide Bandgap Power Converter Integration Applications (Paper ID 5029) Authors: Hossein Niakan, Alireza Omidi, Babak Parkhideh
Zener Diode Controlled GaN FET Gate Drive Circuit (Paper ID 5061) Authors: Yousef Zahid and Roy McCann

SiC Devices
Investigation of the Single-Pulse Avalanche Capability of Commercial 1.2kV SiC MOSFETs with Different Structures (Paper ID 5022) Authors: Ge Yue, Na Ren, Kuang Sheng
Robustness Across Initial Estimates of Optimization Algorithms for Power Semiconductor Model Parameter Extraction (Paper ID 5062) Authors: Magnus Haitz, Martin Richter, Ingmar Kallfass
On the Need for Accurate Experimental Determination of the Impact Ionization Coefficients Along <11$\bar{2}$0> Direction in 4H-SiC (Paper ID 5052) Authors: Bhargav P. N. S., Vijaya Kumar Gurugubelli
New Figure of Merit to Evaluate Volumetric and Gravimetric Power Density of 1700V SiC Power Module Semiconductors (Paper ID 5011) Authors: Vafa Marzang, Haoran Meng, Xiaoyan Liu, Maohang Qiu, Kevin Hobs, Zhongshu Sun, Dong Cao
SiC MOSFET Structure at the Die Level with AFM sMIM Mode (Paper ID 5034) Authors: Rosine Coq Germanicus, Mahima Chaudhary, Kimmo Niskanen, Xavier Larose, Vanessa Chazal, Guillaume Bascoul
SiC Applications
Symmetric Dual-Buck Front-End Current-Source Converter with Low Common-Mode EMI (Paper ID 5025) Authors: Hang Dai, Kum-Kang Huh, Cong Li, Thomas Jahns, Bulent Sarlioglu, John Yagielski
Thermal and Bonding Strength Evaluation of Die Attach Materials for Power Module Packaging (Paper ID 5043) Authors: Mohammad Dehan Rahman, Xiaoling Li, H. Alan Mantooth, Xiaoqing Song
Improving Fault Current Interruption Capability of Contactors in EV Battery Packs with SiC MOSFET Commutation Circuit (Paper ID 5016) Authors: Yanjun Feng, Z. John Shen

Ultrawide Bandgap Devices
Design of a Low Parasitic Inductance Paralleled Module for 8.56 kV β−Ga_2O_3 MOSFET (Paper ID 5032) Authors: Wei Liu, Ge Yang, Xiu Yao
Evaluation of the Bonding Strength of Die Attachment Techniques for Gallium Oxide Power Devices (Paper ID 5041) Authors: Tanzila Akter, Mohammad Dehan Rahman, Yuyang Wang, Yuxiang Chen, H. Alan Mantooth, Xiaoqing Song

Detailed Schedule: Wednesday, November 6, 2024

Agenda Overview

MAIN CONFERENCE, DAY 2 – KEYNOTES & PANEL DISCUSSION	
Time	**Tradewinds Room**
7:00 - 8:15 AM	Breakfast
Time	**Grand Ballroom**
8:15 – 8:30 AM	Welcome and Keynote Introduction
8:30 - 9:00 AM	**WBG-Based Traction Drives for Passenger and Commercial Electric Vehicles – NEXT-DRIVE** Burak Ozpineci - Oak Ridge National Laboratory
9:00 - 9:30 AM	**Towards SiC 2.0 - SiC Is Already here** Shiori Idaka - Mitsubishi Electric
9:30 - 9:45 AM	Break at Ballroom Foyer
9:45 -10:15 AM	**Will GaN Replace SiC Above a Kilovolt?** David Chen - Power Integrations
10:00 AM - 12:00 PM	Exhibition
10:15 -10:45 AM	**Updated Analysis of Vertical GaN Power Device Technology** Bob Kaplar and Andrew Binder – Sandia National Laboratories
10:45 - 12:00 PM	**Panel 2: Devices & Applications in Aerospace and Terrestrial Mobility Power** **Moderator:** Joseph A. Weimer, Air Force Research Laboratory **Panelists:** Neil Merrett, Air Force Research Laboratory Bruce Geil, Army Research Laboratory Rodger Dyson, NASA Glenn Research Center LJ Petersen, Office of Naval Research
Time	**Tradewinds Room**
12:00 -1:30 PM	Buffet Lunch

MAIN CONFERENCE, DAY 2 – TECHNICAL SESSIONS		
Time	Grand Ballroom A-D	Grand Ballroom E-H
1:30 - 3:10 PM	SiC Devices 2	GaN Device Characterization, Modeling, and Driving
3:10 - 3:30 PM	Break	
3:40 - 5:20 PM	GaN and Ultrawide Bandgap Devices	SiC Switching Reliability
Time	Kettering Conference Room	
6:00 - 9:00 PM	JEDEC 70 Meeting (Invite Only)	

Keynote Sessions

Title: WBG-Based Traction Drives for Passenger and Commercial Electric Vehicles – NEXT-DRIVE

Time: 8:30 – 9:00 AM

Abstract: For over 20 years, ORNL has been researching wide bandgap (WBG) semiconductor applications in transportation, primarily focusing on electric traction drive systems and both wired and wireless charging technologies. Recent work has advanced integrated power modules as part of the Electric Drive Technologies Consortium, exploring innovative substrate technologies and their potential in power modules. By integrating substrates with heat sinks optimized using genetic algorithms, the power density of traction inverters has increased more than eightfold since 2015. While much of ORNL's efforts have historically centered on passenger vehicles, the NEXT-DRIVE project marks a shift toward commercial vehicle applications. This project aims to enhance asset utilization, efficiency, and power density while reducing costs, leveraging high-fidelity modeling and artificial intelligence. This presentation will discuss the challenges of applying WBG technology to electric traction drives and charging in both passenger and commercial vehicles, as well as key areas for future research to address these challenges.

Speaker Bio: Burak Ozpineci earned his B.S. degree in electrical engineering from Orta Dogu Technical University, Ankara, Turkey, in 1994. He then completed his M.S. and Ph.D. degrees in electrical engineering at the University of Tennessee, Knoxville, in 1998 and 2002, respectively. Since 2001, he has been with Oak Ridge National Laboratory, where he began as a student and has held positions as a researcher, founding group leader of the Power and Energy Systems Group, group leader of the Power Electronics and Electric Machinery Group. He currently serves as a Corporate Fellow and the Section Head of the Vehicle and Mobility Systems Research Section. Additionally, he has a joint faculty appointment with The University of Tennessee. Dr. Ozpineci is a Fellow of IEEE.

Title: Towards SiC 2.0 - SiC Is Already Here

Time: 9:00 – 9:30 AM

Abstract: It has been about 15 years since SiC module products were introduced to the world and about 10 years since the mass production of MOSFETs products. Based on field experience, expectations for the potential application of SiC modules are increasing. At the same time, the unique behaviour of SiC has been highlighted and development has been pushed forward to overcome their particularities. Thanks to these efforts, SiC module has reached the stage where it can be used. Here we will share some of the recent technological developments that have made “SiC available”.

Speaker Bio: Shiori Idaka joined Mitsubishi Electric's Advanced Technology R&D Centre in 2002. There, she was involved in the development of various semiconductor packages, including LSIs, MEMS sensors, high-frequency and optical devices, power devices. In December 2016, she moved to the German branch of Mitsubishi Electric Europe B.V. and launched the European Research Cooperation Centre in 2017, where she is responsible for the coordinating of research and development projects on power electronics. She is also a member of the Department of Electrical Engineering at Nagoya University since 2014.

Title: **Will GaN Replace SiC Above a Kilovolt?**

Time: 9:45 – 10:15 AM

Abstract: Initially adopted in the rapid charging market for high-efficiency adapters, GaN-based switchers are breaking out now to more applications. GaN, unlike silicon, doesn't suffer so much from switching-loss penalties when moving to higher voltages. Efficiency and excellent robustness make them ideal for HV automotive, industrial and appliance products making the shift-to-green. Voltage limits are the next hurdle to overcome as we all invent new ways for GaN to disrupt traditional markets. Remaining questions are how high GaN can go in voltage and how competitive it can be versus SiC in HV applications.

Speaker Bio: Mr. David Chen serves as Sr. Director of Applications Engineering for Power Integrations, which he joined in 2015. He leads a power electronics team of nearly a hundred engineers across three laboratories worldwide.
As an energy efficiency advocate from the power semiconductor industry, David loves the interplay between technologies and regulations to better the world. Contributing actively as an industry stakeholder in workgroups, David collaborates with standards bodies on energy efficiency, safety, and compliance, providing technical guidance on standards and regulations from the California Energy Commission, U.S. Department of Energy, Environmental Protection Agency (ENERGY STAR®), European Commission (energy label and ecodesign), and China Quality Certification Center.

For five years, David has served as co-chair for the Power Sources Manufacturers Association (PSMA) Energy Management Committee and provides support for the PSMA Safety and Compliance Committee. In 2024, he also began his term as Vice President for the PSMA. He is a member of the International Energy Agency 4E Electronic Devices and Networks Annex and Power Electronic Conversion and Technology Annex, the IEC TC47/SC47E committee for semiconductor devices and TC59/MT9 committee for standby power measurement, and JEDEC's JC-70 Wide Bandgap Power Electronic Conversion Semiconductors Committee.

With thirty years of experience in power system design and applications, David has held senior management positions at both publicly traded and privately held companies, including Volterra (acquired by Maxim), Akros Silicon, and Jade Sky Technologies, an LED driver start-up which he co-founded. David received both his B.S. degree in Electrical Engineering and M.S. degree in Mechanical Engineering from MIT and is the author of two patents.

Title: **Updated Analysis of Vertical GaN Power Device Technology**

Time: 10:15 – 10:45 AM

Abstract: Vertical GaN power devices present an alternative device topology compared to the much more established lateral GaN HEMT structure. Indeed, a cross-section of a vertical GaN device superficially resembles that of a Si or SiC power device and is similarly fabricated on a native substrate. This talk will present the state of vertical GaN power device technology as we best understand it today, and will compare this to other WBG device technologies and will extrapolate to plausible future scenarios. Historically, predications of vertical GaN device performance have been based largely on the unipolar figure of merit, which in turn was based on the best available knowledge of the breakdown electric field of a GaN drift region. However, recent experimental measurements of the GaN impact ionization coefficients have revised this view, and further, the drift region is just one part of the device and may not dominate its performance especially for lower voltage classes. For example, recent success in the development of high-k gate dielectrics have modified the value proposition for vertical GaN MOSFETs relative to other technologies. However, the specifics of the device architecture (e.g. TMOS vs. DMOS) as well as the maturity of the manufacturing process (e.g. cell pitch) significantly impact the analysis. The prospects for vertical GaN MOSFETs will be discussed compared to present and expected future SiC MOSFETs. Additionally, GaN HEMTs are expanding beyond the 650 V node with 1200 V devices demonstrated, and such devices may also make effective use of multiple heterostructure-based channels, and are another device class that must be considered when evaluating the merits of vertical GaN. Finally, some past and present commercial efforts to develop vertical GaN will be reviewed in an effort to provide perspective on this analysis.

Speaker Bio:

Bob Kaplar is the Manager of the Semiconductor Material and Device Sciences Department at Sandia National Laboratories in Albuquerque, NM. His group's research over the last decade has focused primarily on WBG/UWBG power electronics. He is a co-author on numerous journal articles, conference presentations, and other documents in this field, including many publications on vertical GaN devices. He received a B.S. degree in Physics from Case Western Reserve University and M.S. and Ph.D. degrees in Electrical Engineering from Ohio State University.

Substantial content for this keynote talk will be contributed by Andrew Binder, who is a Senior Member of Technical Staff at Sandia National Laboratories. His research is focused on the development of kilovolt-class power semiconductor devices. At Sandia, Andrew leads a multidisciplinary team developing WBG and UWBG devices, and he is a co-author on numerous journal articles and conference presentations covering key developments in vertical GaN. He received B.S. and Ph.D. degrees in Electrical Engineering from University of Arkansas and University of Central Florida.

Panel Discussion

Devices & Applications in Aerospace & Terrestrial Mobility Power

Join us in this panel focusing on the wide bandgap devices and their applications for aerospace and terrestrial mobility power.

Moderator:
Joseph A. Weimer, Technical Advisor of Electrical Systems Branch, Air Force Research Laboratory

Panelists:

- Neil Merrett, Senior Research Physicist, Air Force Research Laboratory
- Bruce Geil, Chief of the Power Integration and Architecture branch, Army Research Laboratory

- Rodger Dyson, Chief of the Thermal Energy Conversion Branch, NASA Glenn Research Center
- LJ Petersen, CAPT USN (ret.), Office of Naval Research

Moderator and Panelist Bios:

Joseph A. Weimer has over 47 years of experience in electrical power and power electronics engineering. Upon graduating from the University of Dayton in 1977, with a degree in electrical engineering, he joined the Dayton Power and Light Company where he worked in the Electrical Distribution Engineering Department. In 1981, Mr. Weimer joined the Aerospace Power Division as project engineer, where he was responsible for the research and development of electrical machines and motor drives, fault tolerant electrical distribution systems and components, power semiconductor devices and passive power electronic components. Mr. Weimer received his MSEE degree in electrical engineering from the University of Dayton in 1985. He holds 4 patents related to power electronics and electrical machines. He is a registered Professional Engineer in the State of Ohio. Mr. Weimer has been Technical Advisor/Chief of the Power Division's Electrical Systems Branch since 1989.

Neil Merrett is a Senior Research Physicist with the Power and Controls Division of the Air Force Research Laboratory. He manages programs developing SiC materials, devices, modules, and components in addition to performing research in SiC, GaN, diamond, and Ga_2O_3 device technology as well as novel generator designs. He is on over 10 US patents related to semiconductor devices and 29 publications. Before joining AFRL he worked at SemiSouth Laboratories designing SiC devices and process flows. He received his PhD in Physics from Auburn University in 2002.

Bruce Geil is the chief of the Power Integration and Architecture branch in the Energy Sciences division at the Army Research Laboratory. The branch specializes in Army relevant performance of electrical power conversion and distribution systems through research in power electronics packaging, thermal management with a focus on high conductivity phase change materials, power switching, and control for system electrification at the tactical level. The branch has been a leading proponent for wide band gap SiC device development and is currently working with industry, academia, and other government agencies on advancing high voltage (>15kV) devices. Mr. Geil has over 41 years of experience at the Army Research Laboratory with a primary concentration on the design, fabrication and packaging of semiconductor devices. He holds degrees in mechanical engineering from UMBC and electrical engineering from the University of Maryland College Park.

Dr. Rodger Dyson is Chief of the Thermal Energy Conversion Branch at NASA Glenn Research Center where he has worked for over 34 years in power, propulsion, and thermal technologies supporting both aeronautics and space missions. He currently serves as a power and propulsion technical lead developing megawatt scale electric aircraft propulsion, fault management, Mars nuclear electric propulsion, and lunar surface power. He is the author of more than 12 licensed patents in power generation technologies. He is the recipient of NASA's Outstanding Leadership and Exceptional Engineering Achievement Medals, AIAA Aviation EATS Best Paper Award for Systems in 2023, and NASA Power Division Best Paper Award in 2024.

LJ Petersen graduated from the United States Naval Academy, Annapolis, MD with a BS in Mathematics in 1986 and commissioned an Ensign in the US Navy. Selected as an Engineering Duty Officer, he received a MS in Mechanical Engineering from the Naval Postgraduate School, 1994. Following Active Duty, he was an Electrical Engineer at NSWC, Carderock Division, Annapolis, MD. Hired by ONR in May 2006, he served as S&T rep to the Electric Ships Office (ESO), PMS 320. Recalled to Active Duty, in 2008, with assignment as the Deputy Director, PMS 320, from 2008-2012. Promoted to Captain in 2009, he retired from the Navy in 2016 following 30 years of service.

From 2012-2014, he was the Navy's Director for Systems Engineering, assigned in Deputy Assistant Secretary of the Navy for Research, Development, Test and Evaluation (DASN RDT&E.) Mr. Petersen returned to ONR in 2014 and leads basic research in power electronics, electromagnetism, and adaptive controls and applied research in machinery controls, wide bandgap (WBG) semiconductor applications, Medium Voltage Direct Current (MVDC) power distribution systems, and Power Electronic Power Distribution Systems (PEPDS) in the Sea Warfare and Weapons Department, ONR 33.

Married to Alena, they have two adult children. Senior member of IEEE, member of ASNE and the MRS. He and Alena are active in their church and singing.

Technical Sessions

MAIN CONFERENCE, DAY 3 – TECHNICAL SESSIONS		
Time	Location and Topic	
	Grand Ballroom A - D	Grand Ballroom E - H
1:30 PM – 3:10 PM	SiC Devices 2	GaN Device Characterization, Modeling and Driving
3:10 PM – 3:40 PM	**Break**	
3:40 PM – 5:20 PM	GaN and Ultrawide Bandgap devices	SiC Switching Reliability

Time: 1:30 – 3:10 PM

Session Name: **SiC Device 2 (Track 3: SiC Devices)**

Location: Grand Ballroom A - D

Session Chairs: Aivars Lelis (Army Research Laboratory)

Time	Topic
1:30 – 1:55 PM	**Demonstration of 7.2 kV / 200 a Switching Performance for a 10 kV SiC MOSFET Half-Bridge Power Module** (Paper ID 5042) Authors: Gao Liu, Zhixing Yan, Jannick Kjær Jørgensen, Morten Rahr Nielsen, Benjamin Futtrup Kjærsgaard, Nianzun Qi, Thore Stig Aunsborg, Bjørn Rannestad, Asger Bjørn Jørgense, Hongbo Zhao, Michael Møller Bech, Stig Munk-Nielsen
1:55 – 2:20 PM	**Comparative Study on Single and Multiple JTE Ion Implantations in 1.2kV 4H-SiC Pin Diodes and MOSFETs** (Paper ID 5058) Authors: Dinuth Chamila Yapa Yapa Mudiyanselage, Skylar Deboer, Justin Lynch, Seung Yup Jang, Adam Morgan, Woongje Sung

2:20 – 2:45 PM	**A Non-Destructive Short Circuit Withstand Time Screening Methodology for Commercially Available SiC Power MOSFET** (Paper ID 5053) Authors: Monikuntala Bhattacharya, Michael Jin, Jiashu Qian, Limeng Shi, Shiva Houshmand, Hengyu Yu, Marvin White, Atsushi Shimbori, Anant Agarwal
2:45 – 3:10 PM	**Investigation on Design Approaches for 4H-SiC Bi-Directional Field Effect Transistors (BiDFETs)** (Paper ID 5048) Authors: Stephen Mancini, Seung Yup Jang, Andrew Binder, Richard Floyd, Robert Kaplar, Jack Flicker, Stan Atcitty, Adam Morgan, Woongje Sung

Session Name: **GaN Device Characterization, Modeling and Driving (Track 2: GaN Applications)**

Location: Grand Ballroom E - H

Session Chairs: Zhikai Tang (Texas Instruments)

Time	Topic
1:30 – 1:55 PM	**Design of a 650V Full Bridge GaN Module with Integrated Gate Driver and Decoupling Capacitors** (Paper ID 5040) Authors: Subhransu Satpathy, Partha Pratim Das, Subhashish Bhattacharya, Rayna Alizadeh, Richard Eddins
1:55 – 2:20 PM	**High Temperature Characterization and Degradation Test of a Cascode Gallium Nitride Field Effect Transistor** (Paper ID 5046) Authors: Mohammad Dehan Rahman, Abu Shahir Md Khalid Hasan, H. Alan Mantooth, Xiaoqing Song

2:20 – 2:45 PM	**Evaluation and Characterization of 650-V Bidirectional GaN Devices** (Paper ID 5064) Authors: Zhining Zhang, Yizhou Cong, Junchong Fan, Pengyu Fu, Jin Wang, Jacob Mueller, Luciano Andres Garcia Rodriguez
2:45 – 3:10 PM	**Soft Switching of GaN Devices: Modeling Based Approach** (Paper ID 5010) Authors: Geetak Gupta, Nihal Singh, Davide Bisi, Yulu Huang, Aditya Raj, Peter Smith, Philip Zuk, Tushar Dhayagude, Rakesh Lal, Primit Parikh

Time: 3:40 – 5:20 PM

Session Name: **GaN and Ultrawide Bandgap devices (Track 1: GaN Devices, Track 5: Ultrawide Bandgap Devices)**

Location: Grand Ballroom A - D

Session Chairs: Geetak Gupta (Transphorm), Robert Kaplar (Sandia National Laboratories)

Time	Topic
3:40 – 4:05 PM	**Modeling of Ion-Implanted Floating Guard Ring in GaN Diode with Experimental Verification** (Paper ID 5007) Authors: Albert Lu, Yifan Wang, Nathan Yee, Yuhao Zhang, Hiu Yung Wong
4:05 – 4:30 PM	**Novel Noncontact Enhanced Throughput Electrical Characterization for AlGaN/GaN HEMT Technology** (Paper ID 5027) Authors: Marshall Wilson, Dmitriy Marinskiy, Carlos Almeida, Ivan Shekerov, Bret Schrayer, Jacek Lagowski

4:30 – 4:55 PM	**Capacitors and Aircraft Power System Considerations for Higher Temperature Operation and Wide Bandgap Enablement** (Paper ID 5006) Authors: Roger Brewer
4:55 – 5:20 PM	**Performance Analysis of a Two-Stage Ga2O3 Voltage Multiplier** (Paper ID 5026) Authors: Arindam Sircar, Sudipto Saha, Uttam Singisetti, Xiu Yao

Session Name: SiC Switching Reliability (Track 6: Device Switching Reliability)

Location: Grand Ballroom E - H

Session Chairs: Don Gajewski (Wolfspeed)

Time	Topic
3:40 – 4:05 PM	**Impact of Gate Switching Instability in SiC MOSFETs Application Performance Degradation During Hard Switching Conversion** (Paper ID 5009) Authors: Andrea Piccioni, Maximilian Feil, Thomas Aichinger
4:05 – 4:30 PM	**Ageing and Degradation Study by Thermal, Electrical and Radiation Stress in SiC-JFET/Si-pMOS Cascode Switches** (Paper ID 5020) Authors: David Marroqui, Ausias Garrigos, Enrique Maset, David Alcaraz, Guillermo Terol, Jose Manuel Blanes, Pablo Casado
4:30 – 4:55 PM	**Evaluation of 1.2-kV Rated SiC Trench MOSFETs Under High-Voltage Switching Impulses** (Paper ID 5035) Authors: Hengyu Yu, Michael Jin, Nikhil Bhardwaj, Limeng Shi, Monikuntala Bhattacharya, Jiashu Qian, Shiva Houshmand, Anant Agarwal

4:55 – 5:20 PM	**Wafer-Level Dynamic On-Resistance Testing and Characterization of GaN HEMTs** (Paper ID 5013) Authors: Muskan Sharma, Robert Strittmatter, Wen-Chia Liao, Alejandro Pozo, Jianjun Cao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Kinetic CnCV: high throughput production monitoring
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