WIDE BANDGAP DEVICES & APPLICATIONS

PowerAmerica

VIRTUAL SHORT COURSE
November 12-14, 2024

Participants will receive an IEEE PDH or IEEE CoP certificate

COURSE BENEFITS

Attendees will gain comprehensive insight into power SiC and GaN materials, devices, and insertion of these technologies into power electronics systems.

COURSE OBJECTIVES

Provide fundamentals of SiC and GaN material, device, and power electronics technology. Participants will gain proficiency through instruction on WBG fundamentals and application-specific case studies.

WHO SHOULD ATTEND

- POWER ELECTRONICS APPLICATIONS ENGINEERS
- POWER DEVICE ENGINEERS
- SiC & GaN TECHNICAL MARKETING PROFESSIONALS
- POWER ELECTRONICS BUSINESS & PRODUCT LINE MANAGERS

INSTRUCTORS

Anant Agarwal, PhD
Ohio State University

Sandeep Bahl, PhD
Distinguished Member of Technical Staff, Texas Instruments

Juan Carlos Balda, PhD
University of Arkansas

Elif Balkas, PhD
R&D Manager-Materials, Wolfspeed

Tushar H. Dhayagude
Sr. Director, Transphorm, a Renesas Company

Peter Friedrichs, PhD
Vice President, SiC, Infineon

David Levett, PhD
Consultant

Fang Luo, PhD
Stony Brook University

Michael MacMillan, PhD
Consultant

Matteo Meneghini, PhD
University of Padova

Dallas Morisette, PhD
Purdue University

Brij Singh, PhD
Electrification R&D Manager, JohnDeere

Victor Veliadis, PhD
Executive Director and CTO, PowerAmerica

For questions, email *poweramerica@ncsu.edu.*

COURSE FEE

$50 Student
$500 PowerAmerica member
$1000 PowerAmerica non-member

LOCATION

Link to join the live course will be sent to registered attendees.

REGISTRATION ONLINE AT:
PowerAmericaInstitute.org/shortcourse

WIDE BANDGAP DEVICES & APPLICATIONS VIRTUAL SHORT COURSE

COURSE OUTLINE

How SiC Power Devices Shape the Future

- Power electronics in the energy grid for 2050
- E-mobility and wide band gap technologies
- Benefits of SiC devices in today's applications
- New solutions and innovation enabled by SiC devices

Applications of Power Electronics in Power Distribution

- Characteristics of high-voltage SiC MOSFETs
- Potential applications in medium-voltage distribution systems
- Static compensator for unbalanced currents
- Solid-state power substations, and cascaded H-bridge converters

SiC Substrate: Advantages, Challenges, and Solutions

- Motivation for SiC
- SiC advantages in power electronics
- SiC substrate technologies and processing
- SiC defects, surface quality, and flatness

Electrical Screening of Commercial SiC Power Devices

- Extrinsic defects
- TDDB measurements on commercial MOSFETs from various vendors
- Wafer level electrical screen
- Package level burn-in

SiC Fabrication in a Silicon Fab

- Introduction to SiC material properties and key applications
- SiC process technology: Etch, metallization and ohmic contact formation, doping, gate oxide, edge termination
- SiC fab infrastructure
- Last barriers to mass commercialization

GaN Power Devices: Technology and Reliability-limiting Processes

- Overview of GaN technology and advantages
- Charge trapping phenomena in GaN devices
- Advanced methodology for stability investigations of GaN FETs

SiC Traction Inverters

- Off-road vehicle requirements
- WBG tech innovations
- Demonstration in off-road vehicles
- Off-road vehicle electrification roadmap

Silicon Carbide Epitaxy Technology

- SiC epitaxy – basics of growth
- Substrates and growth parameters
- SiC epitaxy tools
- Next-generation tools and techniques
- Characterization techniques and requirements for commercial epitaxy
- Thickness and doping accuracy and uniformity
- Defect types and control

Optimizing SiC MOSFET Chip and Packaging Design to Match Specific Application Requirements

- Review of 5 different real world applications for SiC
- What are the technical challenges?
- What are the engineering design solutions?
- How to ensure a good design fit?
- Applications: Chargers/energy storage, traction drives, aviation, servo drives and automotive drive trains.

Fundamentals of SiC Power MOSFET Design

- Physics of avalanche breakdown
- Relationship between breakdown voltage and on-resistance
- SiC MOSFET design optimization
- Unique aspects of SiC power device design and fabrication compared with silicon
- Planar and trench devices
- Edge termination
- Layout considerations

Reliable GaN FETs for Power Supply Applications

- Motivation for the GaN FET
- The meaning of traditional qualification—what does and does not carry over from Si reliability
- Intrinsic reliability of the GaN FET—dynamic Ron, TDDB & hot-carrier wearout
- Achieving application-reliable GaN: a mission profile approach and JEDEC JEP180
- Surge robustness without avalanche

Topologies for High Voltage GaN Applications

- GaN advancements and new applications in the past 5 years
- Applications in the 45W to 10kW range
- Approaches and topologies for each power segment and market needs
- Power levels and topologies and the pros and cons of
- GaN, SiC and Si MOSFETs in various applications.

SCHEDULE (based on EST Daylight Time)

Tues., Nov.12, 10:50AM– 5:35PM
Wed., Nov.13, 11:00AM– 5:35PM
Thurs., Nov.14, 11:00AM– 5:35PM

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