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2ND ANNUAL INTERNATIONAL CONFERENCE

ADVANCED POWER ELECTRONICS FOR EV/HEV

10-12 SEPTEMBER 2019 | MUNICH, GERMANY

• UPDATES ON WIDE BAND GAP, PACKAGING, RELIABILITY AND COOLING IN POWERTRAIN AND CHARGING APPLICATIONS •

Dr. Martin Rittner
Senior Expert Power Electronics Assembly and Interconnection Technologies
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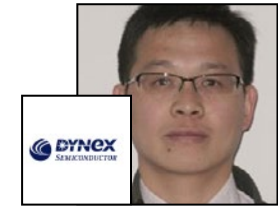

Dr. Yangang Wang
Vice Director RDC
Dynex Semiconductor, UK

Prof. Dr. Eckart Hoene
Chief Expert Power Electronics
Fraunhofer IZM, Germany

WITH THE CONTRIBUTION OF

THE CONFERENCE WILL PROVIDE YOU WITH A PLATFORM TO:

Hear the latest developments in wide band gap semiconductors such as SiC and GaN and how to **lower cost and decrease defect density**

Learn the perspective of system and infrastructure suppliers in the areas of **powertrain and chargers (on and off board)** and their requirements for power electronics

Discover the newest solutions in the areas of **packaging and cooling** of power modules and components for **increased efficiently, reliability and robustness**

Find out how to efficiently **test reliability** on system and device level

Discuss the best strategies for **inverter integration**

INTERACTIVE SESSIONS

Speed Networking | Maximise your networking outcome at this event by participating in these fast-paced 1-to-1 meetings. Get to know the other attendees and exchange your business cards.

Panel Discussion | Steer this interactive panel discussion with your questions to our panel of experts and use the opportunity for further discussion.

Round Table Discussions | Choose your main discussion topic and deepen your knowledge in close dialogue with experts by pointed questions.

Evening Get-Together | Join our evening Get-Together and take this opportunity to network and make new business contacts. Or just to relax and round off your first conference day.

SPEAKERS 2018

Dr. Martin Rittner
Senior Expert Power Electronics Assembly and Interconnection Technologies
Robert Bosch GmbH, Germany

Dr. Maximilian Hofmann
Group manager "Drive Inverters and Mechatronics", Deputy Head of the department "Vehicle Power Electronics"
Fraunhofer IISB, Germany

Andre Kleyner
PhD, Global Reliability Leader
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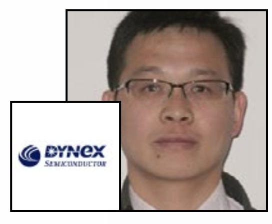

Dr. Yangang Wang
Vice Director RDC
Dynex Semiconductor, UK

Pradip Chatterjee
Senior Staff Engineer
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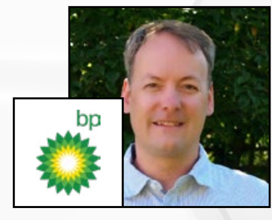


Dr. Jon Salkeld
Technology Director, Advanced Mobility Unit
BP, UK

Aly Mashaly
Deputy Director
ROHM Semiconductor Europe, Germany

Chris White
Engineering Manager, Power Device Division
Hitachi Europe, UK

Dr. Chao Ji
Power Electronics Research Engineer
Protean Electric, UK

Dr. Simon Hart
CTO (Controllers and Power Electronics)
YASA, UK

Ralf Bayer
Deputy manager, Green Car Team
Mobis Parts Europe, Germany

Prof. Dr. Eckart Hoene
Chief Expert Power Electronics
Fraunhofer IZM, Germany

Dr.-Ing. Philip Brockerhoff
Systems Engineer, Technology&Innovation
Continental, Germany

Nikolas Bauer
Predevelopment EV
BMW Group, Germany

Dr. Peter Barrass
Engineering Director
BorgWarner Power Drive Systems, UK

CONFERENCE DAY ONE | 10 SEPTEMBER 2019

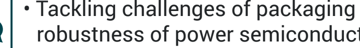
08:00 Registration and welcome coffee

Who is Who | Discover who else is participating in the conference. The matchmaking picture wall will help you identify who you want to meet at the conference. In cooperation with FUJIFILM

08:50 Opening Remarks by the chairman of the day
Prof. Dr. Eckart Hoene, Fraunhofer IZM

ADVANCES IN WIDE BAND GAP POWER ELECTRONICS FOR EV/HEV

09:00 **Opportunities for power electronics by packaging and integration**
Continuing improvement in power electronics requires faster switching and increased pulse frequencies. Designing for high frequency, the packaging technologies given the required design freedom and heterogeneous integration are the enablers for significant volume reduction, manufacturing in big production lots and cost reduction
• Heterogeneous Integration technologies for power electronics
• High speed switching and high pulse frequencies
• Electrical and packaging co-design
Prof. Dr. Eckart Hoene, Chief Expert Power Electronics, **Fraunhofer IZM**



09:40 **Panel discussion | Power electronics as the key element of EV/HEV efficiency**
• Tackling challenges of packaging and thermal management for efficiency, reliability and robustness of power semiconductors
• The potential of wide band gap devices and existing hurdles in mass production and cost
• Market insights and business disruptions
Prof. Dr. Eckart Hoene, Chief Expert Power Electronics, **Fraunhofer IZM**

10:30 Speed Networking

11:00 Coffee break and networking

11:30 **Supermini to Super Car - Optimizing Cost-Performance for EV Traction Systems**
Optimizing the cost-performance tradeoff for a portfolio of EV Power Trains is key to achieving competitive solutions. A targeted range of power modules with common mechanical outline covering a wide range of power and performance is a key enabler and this is what Hitachi's expanded Suijin Series of high performance power modules delivers.
• Suijin Series - From supermini to super car performance in a common housing
• Latest advances in technology and product development for optimum cost and performance
• Future developments for EV/HEV semiconductors
HITACHI **Chris White**, Engineering Manager, Power Device Division, **Hitachi Europe Ltd.**

12:10 **The advantages and pitfalls of Silicon Carbide power semiconductors in vehicle applications**
The talk will examine how SiC power semiconductors can benefit power converters and bring system level benefits to vehicle applications. It will also look at some of the disadvantages and pitfalls when trying to bring this new technology to market.
• Advantages of SiC power semiconductors
• Disadvantages and pitfalls of SiC power semiconductors
• Power converter and system level considerations
Dr. Peter Barrass, Engineering Director, **BorgWarner Power Drive Systems**

12:50 Networking Luncheon

UPDATES FOR GaN

14:20 **Power modules for fast switching GaN – new results from the EU public funded project 'InRel-NPower'**
Fast hard switching GaN power semiconductors under highest di/dt slopes with lowest voltage overshoots demand for new low-inductive power module designs.
• The lateral GaN HEMT device need adjusted module concepts in comparison to vertical devices
• A double sided AMB-LTCC power module design and an AMB-polymer hybrid module design enable the performance of lateral GaN HEMTs
• A 30 kW power stage will show up the GaN HEMT potential in drive inverter applications
Dr. Martin Rittner, Senior Expert Power Electronics Assembly and Interconnection Technologies,
BOSCH **Robert Bosch GmbH**

15:00 **Miniaturization of EV Power Electronics using GaN Devices**
• Simulative Optimization using Verilog-A
• Role of dead time adaptation
• GaN commutation cell design aspects

Nikolas Bauer, Predevelopment EV, **BMW Group**

15:40 Coffee break and networking

POWER ELECTRONICS IN CHARGING APPLICATIONS

16:10 **Tackling the challenges of electric vehicle fast charging**
• Understanding the system level requirements and trends of off board fast FV charger.
• Trends in device technologies and power conversion systems.
• Top level topologies for charger for different power level
infineon **Pradip Chatterjee,** Senior Staff Engineer, **Infineon Technologies**

16:50 **Bi-directional on board chargers: architecture and business models**
• An overview of common OBC architectures and relevant Mobis products
• Resulting possible business models for OEMs
HYUNDAI MOBIS **Ralf Bayer,** Deputy manager, Green Car Team, **Mobis Parts Europe**

17:30 Closing remarks by the chairman of the day,
Prof. Dr. Eckart Hoene, Fraunhofer IZM

17:40 End of the conference day one

18:30 **Evening Get-Together** | Join our evening Get-Together and take this opportunity to network and make new business contacts. Or just to relax and round off your first conference day.

CONFERENCE DAY TWO | 11 SEPTEMBER 2019

08:30 Registration and morning coffee

09:00 Opening Remarks by the chairman of the day
Dr. Martin Rittner, Robert Bosch GmbH

SYSTEM LEVEL APPLICATIONS

09:10 **Automotive wide-band-gap applications – impact on system and integration**
- SiC- and GaN-based power electronic systems for automotive application (drive-inverters, charger, DC/DC-converter)
- Characteristics of SiC/GaN semiconductors, impact on system behavior
- Potentials of mechatronic integration

Dr. Maximilian Hofmann, Group manager "Drive Inverters and Mechatronics", Deputy Head of the department "Vehicle Power Electronics", **Fraunhofer IISB**

09:50 **Solutions for high-efficiency HV inverter**
- The talk will evaluate different options to improve efficiency in power HV electronics for electric vehicles.
- IGBT Inverter
- Alternative inverter circuits
- Alternative semiconductor materials

Dr.-Ing. Philip Brockerhoff, Systems Engineer, Technology&Innovation, **Continental**

10:30 Coffee break and networking

11:00 **Design and development of SiC drive for in-wheel motor applications**
- In-wheel motor & ProteanDrive inverter system
- Benefits of using SiC technology & design considerations of SiC inverters
- Testing validations and experimental results of a SiC laboratory demonstrator

Dr. Chao Ji, Power Electronics Research Engineer, **Protean Electric**

11:40 **ROUND TABLE SESSIONS** | Choose your main discussion topic and deepen your knowledge in close dialogue with experts by pointed questions.

Table A | New cost efficient power module cooling methods
Dr. Simon Hart, CTO (Controllers and Power Electronics), **YASA**

Table B | New materials and interconnection technologies for high temperature resistant power packaging

Table C | Moving to 800V

12:30 Discussion of the round table results and Q&A

13:00 Networking luncheon

DEVELOPMENTS IN RELIABILITY AND THERMAL MANAGEMENT

14:30 **Temperature cycling test for power electronics units subject to a very large number of power cycles in the field**
- Effects of temperature rise during cycles on durability and fatigue life
- How to account for the effect of both environmental and power cycles triggered temperature changes
- Developing an adequate temperature cycling validation test

Andre Kleyner, PhD, Global Reliability Leader, **Aptiv/Delphi Technologies**

15:10 **All sintered double side cooled power semiconductor module for EV/HEV**
- Planar and compact packaging with double side cooling EV/HEV power module is developed.
- Ag sintering is applied for joining and interconnection with significant improvement of reliability.
- The module is characterized and being qualified by automotive standard.

Dr. Yangang Wang, Vice Director RDC, **Dynex Semiconductor**

15:50 Coffee break and networking

16:20 **SiC MOSFETs technology and device reliability**
The core of the presentation will be centered in reliability and robustness test results of SiC MOSFET device. For a discrete device operating at temperatures up to 175°C this comprises:
- Lifetime estimations in blocking state and of gate oxide
- Gate-Source threshold voltage shift (High temperature gate bias test for positive and negative VGS values)
- Body-diode reliability (DC and pulse test)
- High-humidity, high-temperature reverse bias test
- Avalanche ruggedness and typical breakdown voltage
- Short circuit withstand time

Aly Mashaly, Deputy Director Power Systems, **ROHM Semiconductor Europe**

17:00 Closing remarks by the chairman of the day
Dr. Martin Rittner, Robert Bosch GmbH

17:10 End of the main conference and registration for Workshop A

A INNOVATIVE PACKAGING SOLUTIONS FOR WBG POWER ELECTRONICS

17:45 - 20:15

Until recently, optimizing the efficiency of semiconductor power devices was the focus of the industry. However, in the recent times the main factor contributing to relability, durability and life of power electronics is the packaging. Because of such requirements as high power densities and dealing with increasing heat dissipation, packaging becomes quite expensive. One of the main challenges is currently to bring the cost down, while keeping the high demands fulfilled. In this workshop together with the moderator, you will be able to discuss and brainstorm possible developments in packaging, touching on some of the most important questions:

- What will be the final cost of packaging in mass production ?
- Best ways for power dice embedding for SiC and GaN
- New materials (organics for HV, laminates etc.), new interconnection techniques
- Packaging for higher temperature (220-230 deg.)

Dr. Martin Rittner, Senior Expert Power Electronics Assembly and Interconnection Technologies, **Robert Bosch GmbH**

08:00 Registration

B

08:30 - 11:00

RELIABILITY TESTING FOR HV POWER ELECTRONICS

Reliability of power electronics (and electronics in general) is one of the main factors for making electric vehicles a mass market reality. A lot of research has been carried out to improve this aspect. Yet, how does one test reliability and make conclusions about how reliable a power electronic unit is? In this workshop we will explore different test methods and experimental results for this question. Some of the points discussed will be:

- Temperature cycling and high temperature operating life testing
- Other accelerated stress tests
- Tests result in long-term degradation or immediate catastrophic failures
- Perspective from system supplier and a power electronics manufacturer
- Challenges of power electronics testing compared to the 'conventional' automotive electronics, such as liquid cooling, different loading profiles and different operating requirements

Dr. Andre Kleyner, Global Reliability Engineering Leader, **Aptiv/Delphi**
Aly Mashaly, Deputy Director, **ROHM Semiconductor Europe**

11:00 Morning coffee break

C

11:30 - 14:00

POWER ELECTRONICS FOR HIGH POWER FAST CHARGING APPLICATIONS

One of the main requirements for electric vehicles to enter the mass market is widespread deployment of high power charging infrastructure. Industries are beginning to invest in deploying such networks, but to be commercially viable we need a step change in charger cost, efficiency and reliability. Power electronics, such as inverters and DC/DC converter, play an important role in delivering this both on the forecourt and the vehicle. Yet, many challenges still remain, with a sense we are hitting the limits of silicon IGBTs and must look to wide bandgap devices as the way forward. In this workshop we will discuss the basics of charging station and on board charger power electronics and dig into some of the important aspects of future technology:

- Requirements on power electronics in a 350 kW fast charging context
- Cooling of battery and power electronics during the UFC activity
- Efficient energy management
- The prospects for WBG semiconductors for charging applications
- Wide output voltage range

Pradip Chatterjee, Senior Staff Engineer, **Infineon Technologies**
Jon Salkeld, Technology Director - Advanced Mobility Unit, **BP**

14:00 Networking luncheon

D

15:00 - 17:30

ADVANCES IN MECHATRONIC INVERTER INTEGRATION

With the strict requirements or space usage and increasing power density, integration of traction inverter becomes a challenging task. The rise of wide band gap power electronics puts an even higher demand on these requirements. On top of that, the high temperatures and vibration cause additional difficulties to the integrated system. In this workshop we will introduce innovative mechatronic integration techniques and discuss with the audience possible new approaches focusing on:

- 3D integration for SiC inverters
- Device, interconnection and cooling techniques for increase robustness and lower cost of power electronics
- Dealing with high vibrational loads
- Testing and practical experience

Dr. Maximilian Hofmann, Group manager "Drive Inverters and Mechatronics", Deputy Head of the department "Vehicle Power Electronics", **Fraunhofer IISB**

17:30 End of the workshop day

Our power semiconductor products deliver high reliability based upon decades of market experience, using advanced proprietary technologies, adopted globally by customers leading their application fields. Continuous development of new products and solutions, including MOS SiC and best in class Silicon semiconductors, contributing to our social innovation business. Building on this long history in producing power modules for Electric and Hybrid-Electric vehicles our SUIJIN series provides a range of high power, high performance power modules to meet specifications for automotive applications from 600V to 1200V. To assist with initial evaluation and design activities Hitachi can supply a comprehensive evaluation kit to support our SUIJIN product line.

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Business Development Manager
T: +49 (0)30 20 913-212
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HOW CAN YOU MEET YOUR MARKETING AND BUSINESS DEVELOPMENT OBJECTIVES?

NETWORKING | Ensure that you have the opportunity to engage with the key decision makers within your industry. We can create a platform for you to effectively interact with your top customers and prospects in the environment of your choice. This can range from formalized private meetings / workshops right through to less structured networking events such as sponsored drinks receptions, coffee breaks or lunches. Ultimately whatever you decide is the right forum; we will support you in your quest to advance relationships with the key people who can influence the future of your business.

BRANDING | Your company can be elevated to a position where they are seen as a market leader. In a fiercely competitive market you need to ensure that your brand is differentiated from the competition. Failure to create a clear identity will see your organization fade into the background. We ensure that we do everything we can to effectively lift your brand before, during and after the event. Not only do we create a fully integrated marketing campaign, which your company can be part of, but we also offer high impact premium branding opportunities for example on bags, water bottles, pens lanyards etc.

THOUGHT LEADERSHIP | If you think that you should be viewed as a true industry leader then your need to demonstrate your market knowledge and expertise through a thought leadership opportunity, such as speaking or chairing. This is a highly unique opportunity for your company to educate the market, and as long as you are credible enough to fit into a high level event program, we can position your organization alongside top customers and prospects in our speaker faculty. As part of this speaker faculty your company will be set apart from other industry attendees giving you the competitive edge required to make further strides in the market.

To learn more about the opportunities available contact:
Saklyen Golam | saklyen.golam@iqpc.de | +49 (0)30 20 91 3 - 212

8 REASONS WHY THIS CONFERENCE CAN BENEFIT YOU.

1. Generate new sales leads: Our event will bring together the industry's key-decision makers, all of whom have strong business reasons for attending the event. By exhibiting and presenting, you can impact on these buyers. By the very nature of the high quality of delegate attendance, the contacts generated will lead to very high conversion rates.
2. Launch new products or services: Use the event as a launch pad to promote your latest products or system. With the most senior figures from the industry in attendance, plus carefully selected media partners at the event, innovative new technology will always generate a buzz.
3. Demonstrate thought leadership: Speaking on the program will allow you to demonstrate your market knowledge and expertise to an audience of high level decision makers.
4. Enter new markets: Sponsorship is one of the most effective ways to enter new markets. It is a great opportunity to research and network whilst gaining exposure to a new qualified database.
5. Building customer loyalty: Face-to-face contact at conferences, and showing continued support of the market, helps develop client loyalty as well as cementing your position as an industry player.
6. Positioning your company brand: Being part of this highly influential industry event establishes your company as a strong brand and highlights your company's abilities and strengths. Commitment to this event also demonstrates your capability as a global player.
7. Building relations with the media: We have researched the market in order to find the most influential media partners. We understand that opportunities for editorial coverage and developing better relations can be integral to your companies' success, so our media partnerships offer additional benefit above and beyond the standard sponsorship package.
8. Brokering new business partnerships: Currently there are huge opportunities to partner with OEM suppliers actively looking to adjust their supply chains.

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All Prices + VAT	Book & pay until 07. June 2019	Book & pay until 12. July 2019	Book & pay until 16. August 2019	Standard Pricing
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The delegate fee includes the following services:
Access to the purchased conference packages, Catering during the entire conference, Conference documentation + Evening Get-Together

Please indicate your choice on our conference workshops:

☐ **Workshop A** | Innovative Packaging Solutions for WBG Power Electronics
☐ **Workshop B** | Reliability Testing for HV Power Electronics
☐ **Workshop C** | Power Electronics for High Power Fast Charging Applications
☐ **Workshop D** | Advances in Mechatronic Inverter Integration

Only one discount applicable per person.

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Venue and Accommodation

To be announced soon

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