

# Table of Content

## Session 1: Power Electronic Systems

Chairmen: J. D. van Wyck, University of Johannesburg, South Africa; E. Wolfgang, ECPE e. V., Germany

- 1.1 **Keynote: Performance, Trends and Limitations of Power Electronics Systems** ..... 17  
J. W. Kolar, ETH Zurich, Switzerland
- 1.2 **Integrated Gate Driver Solutions (Invited paper)** ..... 37  
R. Herzer, Semikron Elektronik GmbH & Co. KG, Nuremberg, Germany

## Session 2: System Integration

Chairmen: B. Allard, Ampere-Lab, Villeurbanne, France; J. A. Ferreira, Delft University of Technology, The Netherlands

- 2.1 **High Density System Integration for Medium Power Applications (Invited paper)** ..... 47  
D. Boroyevich, Z. Chen, F. Luo, K. Ngo, P. Ning, R. Wang, Di Zhang, Center for Power Electronics Systems, Virginia Tech, Blacksburg; F. Wang, University of Tennessee, Knoxville; R. Burgos, ABB U.S. Corporate Research Center, Raleigh; R. Lai, GE Global Research Center, Niskayuna; S. Wang, GE Aviation Systems, Vandalia, United States
- 2.2 **A Formal Approach to System Integration** ..... 57  
J. M. Gutierrez-Alcaraz, S. W. H. de Haan, J. A. Ferreira, Delft University of Technology, The Netherlands
- 2.3 **Design for Fault Tolerance and Predictive Failures** ..... 63  
J. Wolmarans, J. A. Ferreira, H. Polinder, I. Josifovic, Delft University of Technology; D. Clarenbach, Aeronamic BV Almelo, The Netherlands
- 2.4 **Modular Concept for Power Electronics in Electric Cars** ..... 69  
W. Wondrak, A. Dehbi, A. Willikens, Daimler AG, Boeblingen, Germany
- 2.5 **Power Module with Solid State Circuit Breakers for Fault-Tolerant Applications** ..... 73  
K. Kriegel, A. Melkonyan, M. Galek, Siemens Corporate Technology, Munich; J. Rackles, Munich University of Applied Sciences, Munich, Germany

## Session 3: Reliability

Chairmen: G. Coquery, INRETS, Versailles, France; U. Scheuermann, Semikron Elektronik GmbH & Co. KG, Nuremberg, Germany

- 3.1 **Railway Traction Reliability (Invited paper)** ..... 79  
M. Mermet-Guyennet, M. Piton, ALSTOM Transport, Semeac, France
- 3.2 **First Power Cycling Results of Improved Packaging Technologies for Hybrid Electrical Vehicle Applications** ..... 85  
A. Hensler, J. Lutz, Chemnitz University of Technology; M. Thoben, K. Guth, Infineon Technologies AG, Warstein, Germany

## Session 6: Power Electronics Applications

Chairmen: D. Boroyevich, CPES, USA; J.-H. Fabian, ABB Switzerland Ltd., Baden-Daettwil, Switzerland

- 6.1 **Power Electronics System Integration for Electric and Hybrid Vehicles (Invited paper) .....** 227  
M. März, A. Schletz, B. Eckardt, S. Egelkraut, H. Rauh, Fraunhofer Institute of Integrated Systems and Devices, Erlangen, Germany
- 6.2 **Solar Power Inverters (Invited paper) .....** 237  
R. Mallwitz, B. Engel, SMA Solar Technology AG, Niestetal, Germany
- 6.3 **Fault Tolerant Drives for Aerospace Applications (Invited paper) .....** 245  
G. J. Atkinson, J.W. Bennet, B.C. Mecrow, D.J. Atkinson, A.G. Jack, V. Pickert, University of Newcastle, United Kingdom

## Session 7: Power Modules

Chairman: M. Bakran, Siemens AG, Nuremberg, Germany

- 7.1 **Dynamic Paralleling Problems in IGBT Module Construction and Application .....** 253  
U. Schlapbach, ABB Switzerland Ltd. Semiconductor, Lenzburg, Switzerland
- 7.2 **Non Destructive SOA Testing of Power Modules (Invited paper) .....** 261  
G. Busatto, C. Abbate, F. Iannuzzo, University of Cassino, Italy
- 7.3 **Active Reduction of Common Mode Current in Power Modules .....** 267  
J.-L. Schanen, T. De Oliveira, J.-M. Guichon, G2Elab, Grenoble;  
S. Mandray, A. Bouzourene, Thales AES, Paris, France
- 7.4 **Power Module with Additional Low Inductive Current Path .....** 273  
M. Frisch, Vincotech GmbH, Unterhaching, Germany; T. Ernö, Vincotech Kft, Bicske, Hungary
- 7.5 **Power Circuit Design for Clean Switching .....** 279  
R. Bayerer, D. Domes, Infineon Technologies AG, Warstein, Germany

## Session 8: Power Electronics

Chairman: M. Meinhardt, SMA, Niestetal, Germany

- 8.1 **Development of a Mid-Power Core (35 kW) Dedicated to Inverters for Aerospace Applications .....** 285  
R. De Maglie, G. Osvald, A. Mashaly, S. Liebig, J. Engstler, A. Engler, Liebherr Elektronik GmbH, Lindau, Germany
- 8.2 **Evaluation of Power Density of a Reduced Switch Count Five-Level Three-Phase PWM Rectifier for Aircraft Applications .....** 291  
J. Itoh, Y. Noge, Nagaoka University of Technology, Nagaoka, Niigata, Japan
- 8.3 **Development of a Highly Compact and Efficient Solar Inverter with Silicon Carbide Transistors .....** 297  
C. Wilhelm, D. Kranzer, B. Burger, Fraunhofer Institute for Solar Energy System, Freiburg, Germany
- 8.4 **Mixed Switched Mode and Linear Lithium Ion Battery Tester for High Power and Large Bandwidth .....** 303  
M. Fischnaller, J. Melbert, Ruhr-Universität Bochum, Germany

<b>8.5</b>	<b>A Linear 10 kV Power Amplifier for Piezo Actuators .....</b>	<b>309</b>
	T. Horn, J. Melbert, Ruhr-Universität Bochum, Germany	

### Session 9: DC/DC Converters

Chairmen: J. A. Cobos, UPM, Spain; A. Mertens, Technical University of Hannover, Germany

<b>9.1</b>	<b>Three-Stage DC-DC Converter Solutions for SMPS Applications in Comparison .....</b>	<b>315</b>
	U. Schwalbe, M. Scherf, T. Reimann, ISLE GmbH, Ilmenau, Germany	
<b>9.2</b>	<b>Fast Control Technique for High Frequency (5MHz) DC/DC Integrated Converter .....</b>	<b>321</b>
	M. del Viejo, P. Alou, J. A. Oliver, O. García, J. A. Cobos, Universidad Politécnica de Madrid, Spain	

### Session 10: Packaging

Chairmen: F. P. McCluskey, University of Maryland, College Park, United States; D. Silber, University Bremen, Germany

<b>10.1</b>	<b>Low Temperature Sinter Technology Die Attachment for Power Electronic Applications ....</b>	<b>327</b>
	C. Göbl, J. Faltenbacher, Semikron Elektronik GmbH Co. KG, Nuremberg, Germany	
<b>10.2</b>	<b>Pure Low Temperature Joining Technique Power Module for Automotive Production Needs .....</b>	<b>333</b>
	E. Schulze, C. Mertens, Volkswagen AG, Wolfsburg; A. Lindemann, Otto-von-Guericke-Universität, Magdeburg, Germany	
<b>10.3</b>	<b>Power Semiconductor Joining through Sintering of Silver Nanoparticles: Evaluation of Influence of Parameters Time, Temperature and Pressure on Density, Strength and Reliability .....</b>	<b>339</b>
	M. Knoerr, A. Schletz, Fraunhofer Institute for Integrated Systems and Devices Technology (IISB), Nuremberg, Germany	
<b>10.4</b>	<b>Sintering Technology Used for Interconnection of Large Areas: Potential and Limitation for Power Modules .....</b>	<b>345</b>
	T. Licht, R. Speckels, M. Thoben, Infineon Technologies AG, Warstein, Germany	
<b>10.5</b>	<b>Novel Silver Contact Paste; Lead Free Solution for Die Attach .....</b>	<b>351</b>
	W. Schmitt, W. C. Heraeus GmbH, Hanau, Germany	

### Session 11: Materials

Chairmen: D. L. Saums, DS & A LLC, USA; M. Schneider-Ramelow, Fraunhofer Institute IZM, Berlin, Germany

<b>11.1</b>	<b>Direct Bonded Aluminum on Aluminum Nitride Substrates via a Transient Liquid Phase and its Application .....</b>	<b>357</b>
	Y. Kuromitsu, Y. Nagatomo, H. Tonomura, K. Akiyama, Mitsubishi Materials Corp., Naka, Ibaraki; C. M. Montesa. N. Shibata, Y. Ikuhara, The University of Tokyo, Japan	
<b>11.2</b>	<b>Evaluation of Insulation Material in Advanced High Power IGBT Modules with Extended Operation Temperature .....</b>	<b>363</b>
	L. Feller, S. Hartmann, D. Schneider, ABB Semiconductors, Lenzburg; D. Granata, Swiss Federal Institute of Technology, Zurich; B. Behzadi, ABB Forschungszentrum Daettwil, Switzerland	