THERMINIC 2013

((19th INTERNATIONAL WORKSHOP
Thermal Investigations of ICs and Systems))

SEPTEMBER 25 – 27, 2013 @ FRAUNHOFER FORUM BERLIN

PROGRAMME

2013

THERMINIC

Programme

Organized by:

Fraunhofer ENAS

b-tu Brandenburg University of Technology

TECHNISCHE UNIVERSITÄT CHEMNITZ

AMIC

Sponsored by:

IEEE

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THALES

InfraTec

NANOTEST Berliner Nanotest und Design GmbH

IBM

Mentor Graphics Mechanical Analysis

NXP

CONTENT

WELCOME TO THERMINIC 2013!

Organised yearly since 1995, the THERMINIC Workshop series has become the premier venue for academics and industry to present and discuss the latest developments in essential and emerging thermal questions and best practices in the field of microelectronics. Just like its highly successful predecessor events in Grenoble (1995), Budapest (1996), Cannes (1997 and 1998), Rome (1999), Budapest (2000), Paris (2001), Madrid (2002), Aix-en-Provence (2003), Sophia Antipolis (2004), Belgirate (2005), Nice (2006), Budapest (2007), Rome (2008), Leuven (2009), Barcelona (2010), Paris (2011), and Budapest (2012), Therminic 2013 will again feature a powerful technical program, with 54 oral and 23 poster presentations in 14 sessions. Well over 100 conference delegates from 20 countries are joining us this year.

This program has been designed as a navigator for your conference participation. It includes not just all the sessions, presentations and evening events, but also the venue floor plan, timetable and crucial information to help make the most of your stay in Berlin. Note that the days have been color-coded for easier handling.

Each day kicks off with a keynote by a global player from industry. Thomas Brunschwiler (IBM Research), Berthold Hellenthal (AUDI AG) and Theo Treurniet (Philips Lighting) will share their insights on thermal challenges for microprocessor and high performance computing, for automotive electronics, and for solid state lighting, respectively.

Wednesday morning through to Friday afternoon are dedicated to technological sessions, which have been organized into 12 main thermal topics. The Friday, for the first time, offers a parallel session on the Smartpower and Nanotherm projects.

Don't forget the conference's evening program. The cocktail reception on Wednesday evening in the Fraunhofer Forum's exhibition area will be a first opportunity to mingle with old and new contacts and the concurrent poster session should be a great chance to discover new potential and exciting young projects. Then rev up your conference spirit at THERMINIC's Thursday night guided boat tour on the river Spree.

Apart from the opportunity to participate in what we believe will be some truly inspiring research presentations, on a personal level we also hope THERMINIC 2013 will be a chance for us to meet new colleagues and reconnect with trusted partners. Please bring your ideas, comments and suggestions – anything at all that you feel will help us provide a better service to you.

We look forward to spending a perfect late summer conference with you at THERMINIC 2013 in Berlin.

Peter E. Raad
General Chair

Márta Rencz
Vice General

Bernhard Wunderle
Programme Chair

András Poppe
Programme Vice Chair

THERMINIC 2013 SCIENTIFIC COMMITTEE

General Chair: Peter Raad, Southern Methodist University, Dallas, USA
Vice General Chair: Marta Rencz, Budapest University of Technology & Economics, Hungary
Programme Chair: Bernhard Wunderle, Chemnitz University of Technology, Germany
Vice Programme Chair: Andras Poppe, Budapest University of Technology & Economics, Hungary

Steering Committee:

M. Rencz, Budapest University of Technology & Economics, Hungary (chair)
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J. Janssen, NXP Semiconductors, Nijmegen, The Netherlands
A. Napieralski, TU Lodz, Poland
J. Parry, Mentor Graphics, UK
P. Raad, Southern Methodist University, Atlanta, USA
A. Rubio, U. Politècnica de Catalunya, Spain
B. Wunderle, Chemnitz University of Technology, Germany

Programme Committee:

Name	Company
J . Altet	U. Politècnica de Catalunya, Spain
M. Abo Ras	Berliner Nanotest und Design GmbH, Germany
T. Baba	National Metrology Institute Tsukuba, Japan
I. Barsony	Institute for Technical Physics and Materials Science (MFA)
S. Bouwstra	MEMS Technical Consultancy, Amsterdam, The Netherlands
K. Chakrabarty	Duke University, Durham, USA
O. Chapuis	CIN2-CSIC, Barcelona, Spain
L. Codecasa	Politecnico di Milano, Italy
A. Daniel	Intel, USA
R. Egawa	Tohoku University, Japan
V. Eveloy	The Petroleum Inst., UAE
S. Garimella	Purdue University, West Lafayette, USA
Y. C. Gerstenmaier	Siemens, Germany
A. Glezer	The Georgia Institute of Technology, USA
A. Gupta	Freescale Semiconductor Inc., Austin, USA
J. Janssen	NXP Semiconductors, Nijmegen, The Netherlands
X. Jorda	Centro Nacional de Microelectronica, Spain
J. Keller	AMIC Angewandte Micro-Messtechnik GmbH, Germany
W. Luiten	Philips Applied Technologies, Eindhoven, The Netherlands
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B. Michel	IBM Zurich, Rueschlikon, Switzerland
A. Napieralski	TU Lodz, Poland
H. Oppermann	Fraunhofer Institute for Reliability and Microintegration IZM, Germany
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P. Rodgers	The Petroleum Inst., UAE
A. Rubio	U. Politècnica de Catalunya, Spain
S. Sapatnekar	University of Minnesota, USA
R. Schacht	Brandenburg University of Technology, Cottbus-Senftenberg, Germany
D. Schweitzer	Infineon Technologies AG, Germany
Y. Scudeller	E.Polytech. U. Nantes, France
A. Shakouri	Purdue University, USA
E. Suhir	UC Santa Cruz, USA
A. Tay	NUS, Singapore
V. Tsoi	Huawei Technologies, Sweden
B. Vandevelde	IMEC, Belgium
S. Volz	Ecole Centrale Paris, France
G. Wachutka	TU München, Germany
J. Yu	Philips Research, The Netherlands
T. Zahner	OSRAM, Germany

GENERAL INFORMATION

CONFERENCE VENUE

The Conference will be held at the Fraunhofer-Forum Berlin, right in the center of the city.

FRAUNHOFER-FORUM BERLIN

Anna-Louisa-Karsch-Straße 2, 10178 Berlin, Germany
www.forum.fraunhofer.de

HOW TO FIND YOUR WAY AROUND

We have booked the Fraunhofer-Forum's entire ground floor for the Therminic 2013 Workshop. The floor plan on page 10 and the session overviews are designed to help you find your way around. Coffee break and lunchtime catering will be offered on the ground floor in the exhibition and poster area.

WARDROBE AND BAGGAGE CHECK

Wardrobe and baggage check are available on the ground floor, next to the registration desk.

CONFERENCE REGISTRATION

The conference registration fee includes admission to all conference sessions and the poster session. The conference package includes a printed copy of the proceedings, a list of registered conference participants and authors, lunch and refreshments during breaks. Regular participants have free admission to the gala dinner. For accompanying persons extra tickets can be purchased for this event.

THE REGISTRATION DESK IS OPEN

Wednesday, September 25, 2013	08.00 am – 06.30 pm
Thursday, September 26, 2013	08.30 am – 06.30 pm
Friday, September 27, 2013	08.30 am – 03.00 pm

DOOR REGISTRATION FEES

Regular Workshop Participation: 750 EUR
IEEE or Committee Member Workshop Participation: 690 EUR
One-day Participation Special Sessions September 27, 2013: 290 EUR
Gala Dinner // Spree River Cruise: 70 EUR

PAYMENT

The registration fee must be credited towards the conference account no later than September 20, 2013. All transfer charges must by covered by the participant's bank. If we have not received your payment September 20, 2013 you will have to pay at the conference.

CONTACT INFORMATION AND ASSISTANCE DURING THE CONFERENCE

Don't hesitate to approach us at the registration desk if you have any questions or requests. Our aim is to help you make the most of your conference participation.

DIETARY REQUIREMENTS

The rich buffet lunch is designed to cater for all dietary requirements and all tastes. When in doubt, please consult one of the chefs serving the food, they will be able to give you detailed information.

INTERNET ACCESS

The Fraunhofer-Forum kindly provides all conference delegates with wireless Internet access throughout the conference. Login-information is available at the registration counter.

Please remember to log out when not using the Internet in order to avoid jammed lines.

CONFERENCE LANGUAGE AND PROCEEDINGS

The official language of all presentations is English. The conference proceedings will be handed out at the registration desk upon check-in.

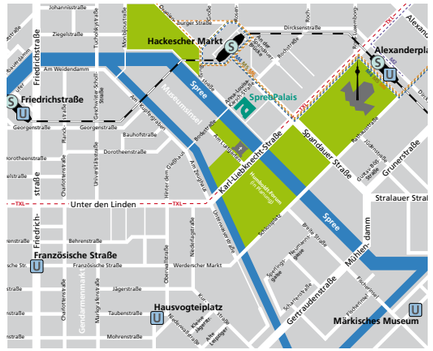
CONFERENCE VENUE

FRAUNHOFER-FORUM BERLIN @ SPREEPALAIS

Anna-Louisa-Karsch-Straße 2, 10178
Berlin, Germany
www.forum.fraunhofer.de

PUBLIC TRANSPORT

S-Bahn lines S 5, S 7, S 75, S 9 all stop at Hackescher Markt, a 2-minute-walk from the Fraunhofer Forum.



GROUND FLOOR

SPEKTRUM
Sessions 1-12

FOYER
Poster Area, Lunch and Coffee Break

1ST FLOOR

AUDITORIUM
Special Sessions

VENDOR COMPANIES

The organizers would like to express their thanks to the following companies for their support.

MENTOR GRAPHICS

The Mechanical Analysis Division has led the market in electronics thermal design with software solutions for more than two decades and has the largest installed base of any tool provider. Mentor Graphics' FloTHERM®, and FloEFD™ suites of thermal simulation tools predict airflow, temperature and heat transfer in components, boards and complete systems, across all industries. These software solutions are complemented by a range of thermal characterization hardware that can measure the thermal resistances and capacitances in the heat flow path from the die junction to the ambient, identifying material properties and interfacial resistances to allow full thermal model verification.

CONTACT:
Mentor Graphics MicReD Division | Dr. Gabor Farkas
Gabor Denes utca 2. fszt 1/ (Infopark D) | Budapest, Hungary H-1117
Phone: +36 30 280 3752 | Gabor_Farkas@mentor.com

INFRATEC GMBH

The Dresden-based company InfraTec GmbH Infrarotsensorik und Messtechnik is a specialist for products and services in the field of infrared technology. The business sector of infrared measuring technology operates in all areas of thermographic applications, with its scope of performance ranging from sales of thermographic cameras to the self-developed and manufactured high-end thermal camera series ImageIR®. Extensive detailed images of electrical assemblies and components with a pixel size of up to 2 µm can be generated with the aid of the 8-times microscope.

CONTACT:
InfraTec GmbH | Infrarotsensorik und Messtechnik
Gostritzer Str. 61 – 63 | 01217 Dresden, Germany
Phone: +49 351 871-8620 | thermo@InfraTec.de | www.InfraTec.de

NANOTEST

The Berlin-based Nanotest und Design GmbH serves as a full-scale provider of engineering and testing services for reliability evaluation in microsystem technologies and nanotechnology. One main area of expertise is thermal characterization of materials, interfaces and components in microelectronics.

At THERMINIC 2013 Nanotest presents the TIMA Tester, a universal platform providing various modules for precise and reproducible thermal characterization (based on steady-state technique). All types of TIMs, substrates, isolation or high conductive die attach materials etc. can be investigated. Properties from thermal conductivity, thermal interface resistance etc. up to aging behavior can be analyzed.

CONTACT:
Berliner Nanotest und Design GmbH | Mohamad Abo Ras
Volmerstr. 9 B | 12489 Berlin, Germany
Phone: +49 30 6392 3880 | aboras@nanotest.org | www.nanotest.org

Wednesday, September 25, 2013

Registration
8.00 am – 9.00 am

Welcome
9.00 am – 9.10 am

Keynote I:
Thermal Challenges for Microprocessors and High Performance Computing
Thomas Brunschwiler, IBM Research
Chair: Peter E. Raad, SMU
9.10 am – 9.50 am

→ **Session 1:**
Thermal Phenomena on the Nano Scale
9.50 am – 11.10 am

Coffee Break
11.10 am – 11.40 am

→ **Session 2:**
Design and Simulation I
11.40 am – 12.40 pm

Lunch
12.40 pm – 2.10 pm

→ **Session 3:**
Characterization
2.10 pm – 3.10 pm

Coffee Break
3.10 pm – 3.40 pm

→ **Session 4:**
Thermal (Interface) Materials
3.40 pm – 4.40 pm

Coffee Break
4.40 pm – 5.10 pm

Poster Introduction Session
5.10 pm – 6.30 pm

Poster Session & Cocktails
6.30 pm – 8.00 pm

Session 1:
Thermal Phenomena on the Nano Scale

9.50 am – 11.10 am

SPEKTRUM

➔ *Chairs: P-Olivier Chapuis, Lorenzo Codecasa*

9.50 am **Nanoscale Thermal Transport And Phonon Dynamics In Ultra-Thin Si Based Nanostructures**
Markus R. Wagner[1], Emigdio Chávez-Ángel[1,2], Jordi Gomis-Bresco[1], Juan Sebastian Reparaz[1], Andrey Shchepetov[3], Mika Prunnila[3], Jouni Ahopelto[3], Francesc Alzina[1], Clivia M. Sotomayor-Torres[1,2,4]
[1]Institute of Nanotechnology (ICN), Campus UAB, Barcelona, Spain; [2]Dept. of Physics, Campus UAB, Barcelona, Spain; [3]VTT Technical Research Centre of Finland, Espoo, Finland; [4]Catalan Institution for Research and Advanced Studies (ICREA), Barcelona, Spain

10.10 am **Investigation of High Gigahertz Acoustic Phonon Lifetimes in Thin Silicon Membranes**
Martin Schubert, Martin Grossmann, Matthias Klingele, Oliver Ristow, Mike Hettich, Thomas Dekorsy
Department of Physics, University of Konstanz, Germany

10.30 am **Investigation of the Thermal Behavior of Thin Crystalline Silcon Solar Cells**
Balázs Plesz, Sándor Ress
Budapest University of Technology and Economics, Hungary

10.50 am **The Nondestructive Thermoacoustic Method of Determination of the Air-Tightness of Metal Packagings of Transistors**
Maciej Kubicki, Mirosław Maliński
Koszalin University of Technology, Poland

Session 2:
Design and Simulation I

11.40 am – 12.40 pm

SPEKTRUM

➔ *Chairs: Gerhard Wachutka, John David Parry*

11.40 am **Multiphysics Modelling for Power Electronics Modules – Current Status and Future Challenges**
Chris John Bailey
University of Greenwich, United Kingdom

12.00 pm **Stochastic Thermal Modeling by Polynomial Chaos Expansion**
Lorenzo Codecasa, Luca Di Rienzo
Politecnico di Milano, Italy

12.20 pm **Electro-Thermal Co-Design of Chip-Package-Board-Systems**
Christoph Sohrmann, Andy Heinig, Michael Dittrich, Roland Jancke, Peter Schneider
Fraunhofer IIS/EAS, Dresden, Germany

Session 3:
Characterization

2.10 pm – 3.10 pm

SPEKTRUM

➔ *Chairs: Peter Gabor Szabo, Carl Zandén*

2.10 pm **Toolset for Measuring Thermal Behavior of FPGA Devices**
Paweł Weber[1], Maciej Zagrabski[1], Bartosz Wojciechowski[1], Krzysztof S. Berezowski[1], Maciej Nikodem[1], Krzysztof Kępa[2]
[1]Wroclaw University of Technology, Poland; [2]Virginia Tech, Blacksburg, Virginia, USA

2.30 pm **Thermal Conductivity Measurements with the 3omega Method and Scanning Thermal Microscopy**
Wassim Jaber, Ali Assy, Stéphane Lefèvre, Séverine Gomès, P-Olivier Chapuis
Centre for Thermal Sciences (CETHIL), CNRS - INSA Lyon, France

2.50 pm **Thermal Conductivity of Isotopically Enriched Silicon Carbide**
Björn Lundqvist[1], Peter E. Raad[3,4], Milan Yazdanfar[1], Pontus Stenberg[1], Rickard Liljedahl[1], Pavel L. Komarov[4], Niklas Rorsmann[2], Joel Ager III[5], Olle Kordina[1], Ivan Ivanov[1], Erik Janzén[1]
[1]Linköping University, Sweden; [2]Chalmers University of Technology, Gothenburg, Sweden; [3]Southern Methodist University, Dallas, Texas, USA; [4]TMX Scientific, Dallas, Texas, USA; [5]Lawrence Berkeley National Labs, Berkeley, California, USA

Session 4:
Thermal (Interface) Materials

3.40 pm – 4.40 pm

SPEKTRUM

➔ *Chairs: Anna Ellett, Daniel May*

3.40 pm **Polymers in Power Electronics – Performance of Thermal Interface Materials**
André Zimmermann, Klaus-Volker Schuett
Robert Bosch GmbH, Germany

4.00 pm **Development and Fabrication of Thin Film Thermo Test Chips and its Integration into a Test System for Thermal Interface Characterization**
Mohamad Abo Ras[1,2], Gunter Engelmann[3], Daniel May[5], Mario Rothermund[3], Ralph Schacht[2,4], Bernhard Wunderle[2,5], Thomas Winkler[1], Bernd Michel[2], Hermann Oppermann[3]
[1]Berliner Nanotest und Design GmbH, Berlin, Germany; [2]Fraunhofer ENAS, Chemnitz, Germany; [3]Fraunhofer IZM, Berlin, Germany; [4]Brandenburg University of Technology, Cottbus-Senftenberg, Germany; [5]Chemnitz University of Technology, Germany

4.20 pm **Effect of Nanostructuration on the Thermal Conductivity of Thermoelectric Materials**
Stéphane Grauby[1], Etienne Puyoo[2], Miguel Munoz Rojo[3], Marisol Martin Gonzalez[3], Wilfrid Claeys[1], Stefan Dilhaire[1]
[1]Université Bordeaux 1, France; [2]INSA, Lyon, France; [3]IMM-CSIC, Madrid, Spain

Poster Introduction Session

5.10 pm – 6.30 pm

SPEKTRUM

→ *Chairs: Marta Rencz, András Poppe*

01 The Effect of Heat Treatment on Spin-On Oxide Glasses in Solar Cell Application
Enikő Bándy, Árpád Földváry, Márta Dr. Rencz
Budapest University of Technology and Economics, Hungary

02 Thermal Model Generalization of Infrared Radiation Sensors
György Bognár, Péter Gábor Szabó
Budapest University of Technology and Economics, Hungary

03 Self-Heating Effects in Nano-Scale SOI MOSFETs: TCAD and Molecular Dynamics Simulations
Alex Burenkov[1], Viktor Belko[2], Juergen Lorenz[1]
[1]Fraunhofer IISB, Erlangen, Germany; [2]Belarussian State University, Minsk, Belarus

04 Compact Electro-Thermal Models of Interconnects
Lorenzo Codecasa
Politecnico di Milano, Italy

05 Investigation of DELPHI Compact Thermal Model Style for Modeling Surface-Mounted Soft Magnetic Composite Inductor
Cheikh Tidiane Dia[1,2], Eric Monier-Vinard[1], Najib Laraqi[2], Valentin Bissuel[1]
[1]Thales Global Services, Meudon-La-Foret, France; [2]Université Paris Ouest, Laboratoire Thermique Interfaces Environnement, France

06 Thermal Characterization of Multichip Structures
Ferenc Ender[1], Gusztav Hantos[1], Dirk Schweitzer[2], Peter Gabor Szabo[1]
[1]Budapest University of Technology and Econimics, Hungary; [2]Infineon Technologies AG, Neubiberg, Germany

07 The Compact Thermal Model of the Pulse Transformer
Krzysztof Górecki, Małgorzata Rogalska
Gdynia Maritime University, Poland

08 Heat Flux Sensor for Power Loss Measurements of Switching Devices
Demetrio Iero[1], Francesco G. Della Corte[1], Giuseppe Fiorentino[2], Pasqualina M. Sarro[2], Bruno Morana[2]
[1]Università Mediterranea Reggio Calabria, Italy; [2]Delft University of Technology, The Netherlands

09 Empirical Feasibility Assessment of Energy Scavenging Opportunity in Compact Mobile Computers
Muhammad Azhar Ali Khan, Ali Muhtaroğlu
Middle East Technical University - Northern Cyprus Campus, Turkey

10 Non-linear Thermal Simulations of Semiconductor Devices on System Level
Vladimír Košel[1], Monica Schipani[2], Ehrenfried Seebacher[1]
[1]ams AG, Unterpremstaetten, Austria; [2]ams Italy Srl, Navacchio, Italy

POSTER SESSION

11 Proposal of New Thermal Resistance for Light-Emitting Diodes

Byungjin Ma[1], Kwanhoon Lee[2]

[1]Korea Electronics Technology Institute, Seongnam, Korea, Republic of (South Korea); [2]Kwangwoon University, Seoul, Korea, Republic of (South Korea)

12 Combined Method for Thermal Characterization of High Power Semiconductors

Enrico Merten[1], Mohamad Abo Ras[1], Tobias von Essen[1], Ralph Schacht[2], Daniel May[3], Thomas Winkler[1], Bernd Michel[4]

[1]Berliner Nanotest & Design GmbH, Berlin, Germany; [2]Brandenburg University of Technology, Cottbus-Senftenberg, Germany; [3]Chemnitz University of Technology, Germany; [4]Fraunhofer ENAS, Chemnitz, Germany

13 Thermal-Electronic Integrated Logic

János Mizsei[1], Jyrki Lappalainen[2], Márton C. Bein[1]

[1]Budapest University of Technology and Economics, Hungary; [2]University of Oulu, Finland

14 Approach For Reliability of Thermal Interface Materials In Battery Cell Sensors

Torsten Nowak[1], Matthias Müller[1], Felix Wüst[1], Michael Krüger[1], Ole Hölck[1], Hans Walter[1], Olaf Wittler[1], Klaus-Dieter Lang[1,2]

[1]Fraunhofer IZM, Berlin, Germany; [2]Technical University Berlin, Germany

15 Low Voltage Fully Integrated DC-DC Converter for Self-Powered Temperature Sensors

Manula Randhika Pathirana, Ali Muhtaroğlu

Middle East Technical University Northern Cyprus Campus, Turkey

16 Single Kernel Electro-Thermal IC Simulator

Philippe Raynaud

Mentor Graphics, Montbonnot Saint Martin, France

17 SrTiO3 Thin Films as Highly Efficient Thermoelectric Materials

Juan Sebastian Reparaz[1], Sweta Bhansali[1], Worawut Khunsin[1], Markus R. Wagner[1,4], Jaume Roqueta[2], Jose Santiso[2], Begona Abad Mayor[3], Pablo Diaz-Chao[3], Marisol Martin-Gonzalez[3], Clivia M. Sotomayor Torres[1]

[1]Catalan Institute of Nanotechnology, Barcelona, Spain; [2]Centre d'Investigació en Nanociencia i nanotecnología (CIN2), Barcelona, Spain; [3]Instituto de Microelectronica de Madrid, Spain; [4]Catalan Institute for Research and Advanced Studies ICREA, Spain

18 Electronics Cooling By Extended Surface: Refractive Index Changes Flow Visualization of the Natural Convection Heat Transfer

Carmine Sapia, G. Sozio

University Roma TRE, Italy

19 Parametric Transient Thermo-Electrical PSPICE-Model for a Power Cable

Ralph Schacht[1,2,3], Sven Rzepka[2,3], Bernd Michel[2,3]

[1]Brandenburg University of Technology, Cottbus-Senftenberg,, Germany; [2]Fraunhofer ENAS, Chemnitz, Germany; [3]Joint Lab Berlin – Technical Safety, Germany

20 Characterization and Kinetic Monitoring of the Reactions between TixAly Phases in Ti-Al based Ohmic Contacts on n-type GaN by Differential Scanning Calorimetry

Nicolas Thierry-Jebali[1,2], Rodica Chiriac[1], Christian Brylinski[1]

[1]Université de Lyon,Laboratoire des Multimatériaux et Interfaces, Villeurbanne, France; [2]INSA de Lyon, Laboratoire Ampère, Villeurbanne, France

Wednesday, September 25, 2013
6.30 pm – 8.00 pm

21 **Logi-Thermal Simulation Using High-Resolution Temperature Dependent Delay Models**
Andras Timar, Marta Rencz
Budapest University of Technology and Economics, Hungary

22 **In-Situ Measurements of Material Thermal Parameters for Accurate LED Lamp Thermal Modelling**
Miquel Vellvehi[1], Xavier Perpinyà[1], Xavier Jordà[1], Robert J Verkhoven[2], Jos M. G. Kunen[2], Jiri Jakovenko[3], Peter Bancken[4], Pieter J. Bolt[2]
[1]Institut de Microelectrònica de Barcelona (IMB-CNM,CSIC), Spain; [2]TNO, Eindhoven, the Netherlands; [3]Czech Technical University in Prague, Czech Republic; [4]Philips Lighting, Eindhoven, The Netherlands

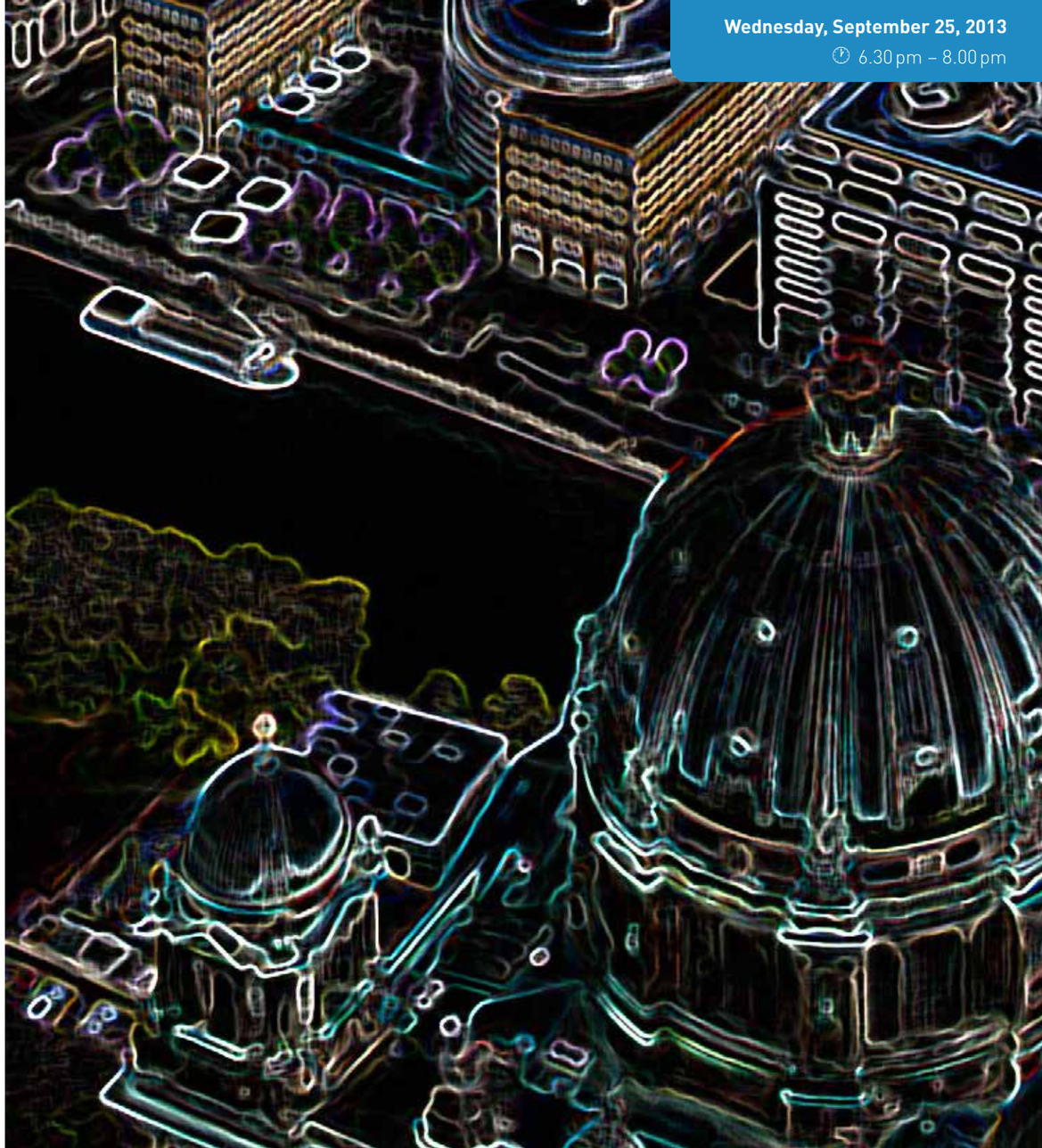
23 **Analysis of Effectiveness of Core Swapping in Modern Multicore Processors**
Piotr Zajac, Michal Szermer, Marcin Janicki, Cezary Maj, Piotr Pietrzak, Andrzej Napieralski
Lodz University of Technology, Poland

Poster Session & Cocktails

6.30 pm – 8.00 pm

FOYER

➔ *Chairs: Marta Rencz, András Poppe*



Thursday, September 26, 2013

Keynote II:
Thermal Challenges for Automotive Electronics
Berthold Hellenthal, AUDI AG
Chair: Bernhard Wunderle, TU Chemnitz
9.00 am – 9.40 am

→ **Session 6:**
Thermal Metrology
9.40 am – 11.00 am

Coffee Break
11.00 am – 11.30 am

→ **Session 7:**
Reliability
11.30 am – 1.10 pm

Lunch
1.10 pm – 2.40 pm

→ **Session 8:**
Thermal Management Concepts
2.40 pm – 4.00 pm

Coffee Break
4.00 pm – 4.30 pm

→ **Session 9:**
Design and Simulation II
4.30 pm – 5.30 pm

Vendors' Session
5.30 pm – 6.00 pm

Social Event: Boat Tour
8.00 pm – 11.00 pm

Session 6:
Thermal Metrology
9.40 am – 11.00 am

SPEKTRUM

➔ *Chairs: Mohamad Abo Ras, Torsten Nowak*

09.40 am **Transient Thermal Techniques as Failure Analytical Tool**
Daniel May[1], Bernhard Wunderle[1], Ralph Schacht[2]
[1]Chemnitz University of Technology, Germany; [2]Brandenburg University of Technology, Cottbus-Senftenberg, Germany

10.00 am **Practical Aspects of Thermal Transient Testing in Live Digital Circuits**
Gergely Nagy, Péter Horváth, András Poppe
Budapest University of Technology and Economics, Hungary

10.20 am **Improving the Accuracy of Junction Temperature Measurement with the Square-Root-t Method**
Christian Herold[1], Menia Beier[1], Josef Lutz[1], Alexander Hensler[2]
[1]Chemnitz University of Technology, Germany; [2]SIEMENS AG, Erlangen, Germany

10.40 am **Thermal Conductivity Reduction in Si Free-Standing Membranes Investigated Using Raman Thermometry**
Markus R. Wagner[1], Juan Sebastian Reparaz[1], Emigdio Chávez-Ángel[1,2], Jordi Gomis-Bresco[1], Andrey Shchepetov[3], Mika Prunnila[3], Jouni Ahopelto[3], Francesc Alzina[1], Clivia M. Sotomayor Torres[1,4]
[1]Catalan Institute of Nanotechnology, Barcelona, Spain; [2]Dept. of Physics, UAB, Barcelona, Spain; [3]VTT Technical Research Centre of Finland, Finland; [4]Institució Catalana de Recerca i Estudis Avançats (ICREA), Barcelona, Spain

Session 7:
Reliability
11.30 am – 1.10 pm

SPEKTRUM

➔ *Chairs: Wendy Luiten, Jürgen Keller*

11.30 am **Solder Joint Lifetime of Rapid Cycled LED Components**
Wendy Luiten
Philips Research, Eindhoven, The Netherlands

11.50 am **Mean-Time-to-Crack Model of Microbump Interconnect in FCGBA Package under Thermal Cyclic Test**
Chien-Chang Chen[1], Wei-Chen Wu[2], Ching Yu Chin[2], Hung-Ming Chen[2], Vito Lin[3], Eason Chen[3]
[1]National Chiao Tung University, Taiwan, R.O.C; [2]VLSI Design Automation Laboratory, National Chiao Tung University, HsinChu City, Taiwan, R.O.C.; [3]Siliconware Precision Industries Co., Taiwan, R.O.C.

12.10 pm **Stress Impact of Thermal-Mechanical Loads Measured with the Stress Chip**
Florian Schindler-Saefkow[1,2,4], Florian Rost[1], Alexander Otto[1,4], Jürgen Keller[2], Thomas Winkler[4], Bernhard Wunderle[3,1], Bernd Michel[1], Sven Rzepka[1,4]
[1]Fraunhofer ENAS, Chemnitz, Germany; [2]AMIC Angewandte Micro-Messtechnik GmbH, Berlin, Germany; [3]Chemnitz University of Technology, Germany; [4]Berliner Nanotest and Design GmbH, Berlin, Germany

12.30 pm **Optimisation of Low Dissipation Micro-Hotplates – Thermo-Mechanical Design and Characterisation**
Ferenc Bíró[1,2], Andrea Edit Pap[2], Csaba Dücso[2], István Bársony[2]
[1]Doctoral School of Molecular & Nanotechnologies, University of Pannonia, Veszprém, Hungary; [2]Research Centre of Natural Science, Research Institute for Technical Physics and Materials Science, Budapest, Hungary

12.50 pm **Lifetime of CMOS Circuits Evaluation by Means of Electro-Thermal Simulations**
Maroua Garci, Jean-Baptiste Kammerer, Luc Hébrard
ICube, Strasbourg, France

Session 8:
Thermal Management Concepts

2.40 pm – 4.00 pm

SPEKTRUM

➔ *Chairs: Bernhard Wunderle, Ralph Schacht*

2.40 pm **Double-Sided Cooling and Thermo-Electrical Management of Power Transients for Silicon Chips on DCB-Substrates for Converter Applications: Design, Technology and Test**

Bernhard Wunderle[1], Charles-Alix Manier[2], Mohamad Abo Ras[3], Martin Springborn[1], Daniel May[1], Hermann Oppermann[2], Michael Toepper[2], Raul Mrossko[4], T. Xhonneux[5], Tristan Caroff[6], Wilhelm Maurer[7], Radoslava Mitova[8]

[1]Chemnitz University of Technology, Germany; [2]Fraunhofer IZM, Berlin, Germany; [3]Berliner Nanotest und Design GmbH, Berlin, Germany; [4]AMIC Angewandte Micro-Messtechnik GmbH, Berlin, Germany; [5]5TAIPRO Engineering, Seraing, Belgium; [6]CEA, Grenoble, France; [7]Infineon, Munich, Germany; [8]Schneider Electric, Grenoble, France

3.00 pm **Thermal Management Challenges in the Passive Cooling of Handheld Devices**

Guy Robert Wagner, William Maltz

Electronic Cooling Solutions, Santa Clara, Californa, USA

3.20 pm **Power and Thermal Constraints of Modern System-on-a-Chip Computer**

Efraim Rotem[1,2], Ran Ginosar[2], Uri Weiser[2], Avi Mendelson[2]

[1]Intel Corporation, Haifa, Israel; [2]Technion, Israel Institute of Technology, Israel

3.40 pm **Experimental Investigation of Uninterrupted and Interrupted Microchannel Heat Sinks**

Ayse Gozde Ulu Soysal[1], Cuneyt Sert[2], Almıla Guvenc Yazicioglu[2]

[1]Aselsan A.S., Turkey; [2]Middle East Technical University, Ankara, Turkey

Session 9:
Design and Simulation II

4.30 pm – 5.30 pm

SPEKTRUM

➔ *Chairs: Chris John Bailey, Marcin Janicki*

4.30 pm **Convolution Based Compact Thermal Model for 3D-ICs: Methodology and Accuracy Analysis**

Federica Lidia Teresa Maggioni[1,2], Herman Oprins[1], Eric Beyne[1], Ingrid De Wolf[1,3], Tine Baelmans[2]

[1]IMEC, Leuven, Belgium; [2]KULeuven, Leuven, Belgium; [3]KULeuven, Leuven, Belgium

4.50 pm **Dynamic Sub-Compact Model and Global Compact Model Reduction for Multichip Components**

Cheikh Tidiane Dia[1,2], Eric Monier-Vinard[1], Najib Laraqi[2], Valentin Bissuel[1], Olivier Daniel[1]

[1]Thales Global Services, Meudon La Foret, France; [2]Laboratoire Thermique Interfaces Environnement (LTIE), Paris, France

5.10 pm **Novel Approach to Compact Modeling for Nonlinear Thermal Conduction Problems**

Lorenzo Codecasa

Politecnico di Milano, Italy

Thursday, September 26, 2013
5.30 pm – 11.00 pm

Vendors' Session
5.30 pm – 6.00 pm

SPEKTRUM FOYER

➔ *Chair: Peter E. Raad*

The three exhibiting companies Mentor Graphics, Infratec and Nanotest will each give a ten-minute presentation on their services and equipment.

Social Event: Boat Tour on the MS BELVEDERE
8.00 pm – 11.00 pm

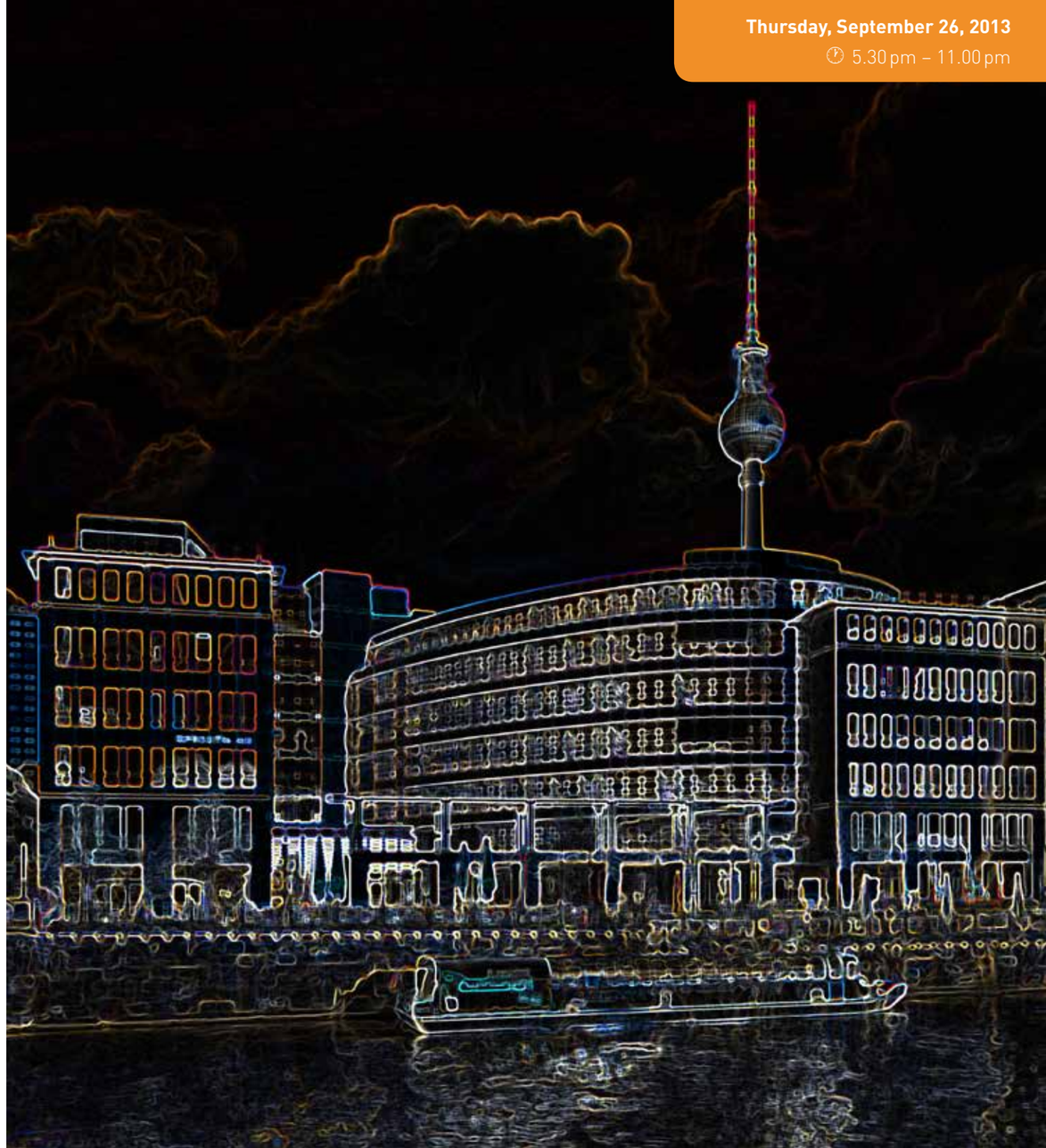
The planned 3-hour-tour links historical and modern Berlin and offers another perspective of the city! On board the ships, a guide explain the well-known and less-known sights of Berlin and make them more familiar with a wealth of intriguing information and anecdotes.

Departure from FFB 7.00 pm
Ship boarding time 7.30 pm
Ship departure time 8.00 pm

Address Märkisches Ufer, 10179 Berlin
Mobile number +49 163 97 28 653

From FFB, the ship jetty can be reached on foot. We will start our short walk (1.5 km, about 20 min.) leaving FFB at 7.00pm sharp. If you want to make your own way to the jetty, we will be happy to provide you with a map at the registration counter.

The Spree trip will take us through the city passing Mühlendammschleuse, Nikolai Quarter, Berlin Cathedral, Museum Island, Friedrichstrasse, Reichstag, Jakob-Kaiser-Haus, Marie-Elisabeth-Lüders-Haus, Paul-Loebe-Haus, Chancellor's Office, House of Cultures of the World, Moabit Werder, Bellevue Castle, the German Federal Ministry of the Interior, Castle Bridge with view of the Charlottenburg Castle and back again.



Friday, September 27, 2013

Keynote III:
Thermal Challenges for Solid State Lighting
Theo Treurniet, Philips Lighting
Chair: Bernard Courtois, CMP
9.00 am – 9.40 am

→ **Session 10:**
Solid State Lighting / LED
9.40 am – 11.20 am

Coffee Break
11.20 am – 11.50 am

→ **Session 11:**
Power Electronics
11.50 am – 1.10 pm

Lunch
1.10 pm – 2.40 pm

→ **Session 12:**
Fluidics
2.40 pm – 3.40 pm

Closing Remarks
3.40 pm – 3.50 pm

→ **Special Session 1:**
Smart Power
9.40 am – 11.20 am

→ **Special Session 2:**
Nanotherm
11.50 am – 1.10 pm

Session 10:
Solid State Lighting / LED

9.40 am – 11.20 am

SPEKTRUM

➔ *Chairs: Thomas Zahner, Joan H. Yu*

9.40 am **Inline Rth Control: Fast Thermal Transient Evaluation for High Power LEDs**
Thomas Dannerbauer, Thomas Zahner
Osram Opto Semiconductors GmbH, Regensburg, Germany

10.00 am **Improving Thermal Conductivity of Polymer Composites in Embedded LEDs Systems**
Joan H. Yu, Giovanni Cennini
Philips Research, Eindhoven, The Netherlands

10.20 am **Study on Thermal Performance of High Power LED Employing Aluminium Filled Epoxy Composite as Thermal Interface Material**
Anithambigai Permal[1], Shanmugan Subramani[1], Mutharasu Devarajan[1], Thomas Zahner[2], David Lacey[3]
[1]Universiti Sains Malaysia, Malaysia; [2]OSRAM Opto Semiconductors GmbH, Germany.; [3]OSRAM Opto Semiconductors (Malaysia) Sdn. Bhd., Malaysia

10.40 am **The Influence of Mutual Thermal Interactions between Power LEDs on their Characteristics**
Krzysztof Górecki
Gdynia Maritime University, Poland

11.00 am **Influence of Different Characterization Parameters on the Accuracy of LED Board Thermal Models for Retrofit Bulbs**
Xavier Jorda[1], Xavier Perpiña[1], Miquel Vellvehi[1], Wim Hertog[2], Mariano Peralvarez[2], Josep Carreras[2]
[1]IMB-CNM(CSIC), Spain; [2]IREC, Spain

Special Session 1:
Smart Power

9.40 am – 11.20 am

AUDITORIUM

➔ *Chairs: Jens Heilmann, Yifeng Fu*

9.40 am **Free Standing Thermal Interface Material based on Vertical Arrays Composites**
Elodie Leveugle, Laurent Divay, Hung Le Khanh, Joffrey Daon, Evelyne Chastaing, Pierre Le Barny, Afshin Ziaei
Thales Research and Technology, Palaiseau, France

10.00 am **Controlling the Density of CNTs by Different Underlayer Materials in PECVD Growth**
Liang Xu[1,2], Di Jiang[1], Yifeng Fu[3], Shantung Tu[2], Johan Liu[1,4]
[1]Chalmers University of Technology, Gothenburg, Sweden; [2]East China University of Science and Technology, China; [3]SHT Smart High Tech AB, Gothenburg, Sweden; [4]Shanghai University, China

10.20 am **Transient Cooling of Power Electronic Devices Using Thermoelectric Coolers Coupled with Phase Change Materials**
Tristan Caroff[1], Radoslava Mitova[2], Julia Simon[1], Bernhard Wunderle[3]
[1]CEA, Grenoble, France; [2]Schneider Electric, Grenoble, France; [3]Chemnitz University of Technology, Germany

10.40 am **Novel High Sensitivity Sensor Structures for Temperature Monitoring of GAN based MMICs**
Alexandru Müller[1], George Konstantinidis[2], Adrian Dinescu[1], Valentin Buiculescu[1], Alexandra Stefanescu[1], Alina Cismaru[1], Ioana Giangu[1], George Stavrinidis[2], Antonis Stavrinidis[2], Afshin Ziaei[3]
[1]IMT Bucharest, Romania; [2]FORTH-IESL-MRG Heraklion, Greece; [3]Thales Research & Technology, France

11.00 am **Failure Prediction of IGBT Modules Based on Power Cycling Tests**
Zoltán Sárkány, András Vass-Várnai, Gusztáv Hantos, Márta Rencz
Budapest University of Technology and Economics, Hungary

Session 11:
Power Electronics

11.50 pm – 1.10 pm

SPEKTRUM

➔ *Chairs: John Janssen, Enrico Merten*

11.50 am **Impact of Nonlinearities in Boundary Conditions on Device Compact Thermal Models**

Marcin Janicki[1], Tomasz Torzewicz[1], Andras Vass-Varnai[2], Andrzej Napieralski[1]

[1]Lodz University of Technology, Poland; [2]Mentor Graphics, Budapest, Hungary

12.10 am **Thermal Design of a High Current Circuit Board for Automotive Applications**

Raúl Mroßko[1], Thomas Hofmann[2], Christoph Neeb[3], Alexander Neimann[4], Jürgen Keller[1]

[1]AMIC Angewandte Micro-Messtechnik GmbH, Germany; [2]Conti Temic Microelectronic GmbH,Nürnberg, Germany; [3]RWTH Aachen University, Germany; [4]Schweizer Electronic AG, Schramberg, Germany

12.30 pm **Fully-Coupled 3D Electro-Thermal Field Simulator for Chip-Level Analysis of Power Devices**

Wim Schoenmaker[1], Olivier Dupuis[1], Bart De Smedt[1], Peter Meuris[1], Jiri Ocenasek[1], Wim Verhaegen[1], Dündar Dumlugöl[1], Martin Pfost[2]

[1]Magwel NV, Leuven, Belgium; [2]Reutlingen University, Germany

12.50 pm **Generation of Electro-Thermal Models of Integrated Power Electronics Modules Using a Novel Synthesis Technique**

Giuseppe Greco[1], Giovanni Vinci[1], Angelo Raciti[2], Davide Cristaldi[2]

[1]STMicroelectronics, Catania, Italy; [2]Department of Electric Electronic and Systems Engineering, University of Catania, Italy

Special Session 2:
Nanotherm

11.50 am – 1.10 pm

AUDITORIUM

➔ *Chairs: Elodie Leveugle, Johan Liu*

11.50 am **Integrating Advanced Interconnect Technologies in a High Power Lighting Application: First Steps**

Sander Noijen[1], Sebastian Fritsche[2], Andreas Steffen Klein[2], Andras Poppe[3], Gerard Kums[1], Olaf van der Sluis[1]

[1]Philips Research, Eindhoven, The Netherlands; [2]Heraeus Materials Technology GmbH & Co. KG, Hanau, Germany; [3]Budapest University of Technology and Economics, Hungary

12.10 pm **Reliability of Advanced Thermal Interface Technologies based on Sintered Die-Attach Materials**

Jens Heilmann[1], Ivan Nikitin[2], Daniel May[1], Klaus Pressel[2], Bernhard Wunderle[1,3]

[1]Chemnitz University of Technology, Germany; [2]Infineon Technologies, Regensburg, Germany; [3]Fraunhofer ENAS, Chemnitz, Germany

12.30 pm **Modelling of Graphene and Few-Layer Graphene Heat Spreaders for Hot-Spot Cooling**

Yuxiang Ni, Jose Ordonez-Miranda, Yann Chalopin, Sebastian Volz

Ecole Centrale Paris, France

12.50 pm **Fabrication and Characterization of a Metal Matrix Polymer Fibre Composite for Thermal Interface Material Applications**

Carl Zandén[1], Xin Luo[1], Lilei Ye[2], Johan Liu[1,3]

[1]Chalmers University of Technology, Gothenburg, Sweden; [2]SHT Smart High-Tech AB, Gothenburg, Sweden; [3]Shanghai University, China

Session 12:
Fluidics

2.40 pm – 3.40 pm

SPEKTRUM

➔ *Chairs: Yogendra Joshi, Ralph Schacht*

2.40 pm **Hybrid Porous Media and Fluid Domain Modeling Strategy to Optimize a Novel Staggered Fin Heat Sink Design**

Ningkang LI[1], Gerd Schlottig[1], Marco De-Fazio[3], Sharma Chander Shekhar[2], Manish Tiwari[2], Roberto Brioschi[3], Thomas Brunschwiler[1]

[1]IBM Research, Zurich, Switzerland; [2]Swiss Federal Institute of Technology in Zurich (ETHz), Switzerland; [3]STMicroelectronics, Agrate, Italy

3.00 pm **Numerical Basis and Validation of CAD-Centric CFD: Honeycomb Heatsink Study**

Travis Mikjaniec, John Parry, Paul Blais

Mentor Graphics Corporation, Wilsonville, OR, USA

3.20 pm **Co-Design of Multicore Architectures and Microfluidic Cooling for 3D Stacked ICs**

Zhimin Wan, He Xiao, Yogendra Joshi, Sudhakar Yalamanchili

Georgia Institute of Technology, Atlanta, USA

Closing Remarks

3.40 pm – 3.50 pm

ABOUT BERLIN

Berlin... a center of (re)invention

November 9th, 1989 marked the beginning of a new chapter in Berlin's history. The eyes of the world watched its residents level the wall that had outraged so many. Shortly afterwards, for the first time in over 28 years, East and West mingled via the Brandenburg Gate, setting the foundation for a new self-understanding. Over the last 20 years, much has changed. Germany's government moved to Berlin in 2001; its institutions, embassies, media, leading corporations, lobby groups and artists, drawn by Berlin's long cultural tradition and its newly emerging hopes and tensions, followed.

A previous no-man's zone that had, along with the wall, epitomized the breach between the two German republics, Potsdamer Platz has been completely rebuilt and rehabilitated to its former position as the city's governmental and commercial center. Many iconic buildings pepper the area, including the »Bundeskanzleramt«, presently home to Chancellor Angela Merkel, and a new central railway station, Europe's largest crossing station. Germany's parliament, the Reichstag, was restored and the inclusion of its famous glass dome, designed by Sir Norman Foster, was considered by some as intended to signal a new era of social and governmental transparency. While the number of new buildings to house political and diplomatic institutions has grown massively, construction is by no means complete. The city remains sprinkled with building sites, and indeed, in this city that has more bridges than Venice, some might argue, always will be.

Germany's »salad bowl«

Over 3.4 million people live in Berlin; the majority in single-person households. Berlin is Germany's, if not melting pot, then salad bowl of cultures, religions and life styles. Berlin counts as its own residents from more than 150 nations, and is home to the largest Turkish community outside Turkey, which has led to the Kreuzberg district's nickname »Little Istanbul«. Each spring, new and old Berliners from around the world celebrate their cultural backgrounds at »Carnival of Cultures«, which is attended by more than half a million merry-makers. Take a walk around the 12 districts to get the size of this multicultural city, or do like the locals and hop on a bicycle – Berlin is arguably second only to Amsterdam as Europe's cycling capital.

All things cultural

Berlin is one of the world's most exciting cities. Opera or performance art, antique sculpture or random street art, traditional or contemporary – the city caters to all tastes. With three opera houses, its Museumsinsel (literally, island of museums; a UNESCO World Heritage Site), tourists are kept on the go. Visit the Jewish Museum for an interesting overview of more than 2000 years of Jewish life or the Museum of Technology for a fascinating look at the history of aeroplanes, ships and computers. For fans of obscuria, Kreuzberg's Museum der Dinge (Museum of Objects) offers a lively, eclectic history of everyday items.

Berlin's inner-city districts of Mitte, Prenzlauer Berg, Friedrichshain, Kreuzberg and north Neukölln are home to the city's young and innovative arts scene. Temporary galleries, start-up boutiques, and all variety of musicians abound. These are also among the city's main party zones, with a large variety of clubs, bars, restaurants open around the clock.

Despite the cutting-edge urban experience Berlin offers, nature is never far away, as forests and lakes surround the city. Take a boat down the Spree river, go canoeing in the Spreewald, hiking in Grünewald, cycle part of the new bike path Mauerweg (wall trail), or take in some history at the beautiful Sanssouci palace and park in Potsdam.

City of science

Berlin has four universities with more than 140,000 students. The city is also home to many other applied and basic research institutes, including the Fraunhofer-Gesellschaft, the Max-Planck-Gesellschaft and two technology parks, making it the perfect location for the Therminic 2013 Workshop!

The Fraunhofer Forum is situated right in the historic center of town, next to the Brandenburg Gate, the boulevard »Unter den Linden«, and the Museumsinsel. Berlin's widely praised public transport system and bike-friendliness ensures longer excursions are easily undertaken.

NOTES

NOTES

CONTACT

THERMINIC 2013

((19th INTERNATIONAL WORKSHOP
Thermal Investigations of ICs and Systems))

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