

# THERMINIC<sup>2014</sup>

(( 20th INTERNATIONAL WORKSHOP  
Thermal Investigations of ICs and Systems ))

SEPTEMBER 24 - 26, 2014 @ GREENWICH, LONDON, UK

→ Welcome

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**PROCEEDINGS**

## WELCOME TO THERMINIC 2014!

The THERMINIC Workshop was created in 1994 to disseminate the results of the THERMINIC EU research project. This was one of the first INCO - Copernicus projects that were created to support the EU research cooperation with East European countries. The workshop received major interest from the beginning as the first such workshop in Europe that has aimed to facilitate the discussion of thermal issues at various levels of electronics. The organizers and the participants are indebted to Bernard Courtois who chaired the steering committee for 18 years and assured the high quality of the Workshop and the Proceedings. We also have to mention the name of Vladimir Szekely from BME and Clemens Lasance from Philips Research who were the Program chairs for many years and who guaranteed the broad scope and the scientific excellence of the presented papers.

The first contributors came from the electronics community, but the industrial thermal management research community soon discovered that they can find interesting novel solutions to their problems at THERMINIC. The scope of the Workshop has continuously broadened since then. The focus of last year's Workshop was on automotive and reliability issues while this year Power electronics is the new subject that gets special attention. Related EU research projects were given the opportunity from the beginning to show their project results to the European thermal community. This year the NANOTHERM and the SMARTPOWER Fr7 Integrated projects have the opportunity to introduce you to the results achieved so far.

With this short message I would like to thank the contribution of all researchers who have submitted papers to THERMINIC or came to participate in the discussions, which helped shape THERMINIC into what it is now: a respected scientific event to discuss thermal problems and their potential solutions in electronics.

I hope that this event and that of the following years will further broaden the scope of the Therminic Workshop and increase the value that this endeavor can give to the community of researchers.

### Marta Rencz

General Chair, Chair of the Therminic Workshop Steering Committee

### Welcome to Greenwich

On behalf of the organizers of this year's THERMINIC Workshop I am delighted to welcome you to the World Heritage Site that is Maritime Greenwich. With an excellent technical programme of oral and poster presentations and a celebratory social programme we are sure that you will find this year's workshop both instructive and enjoyable. Our central theme for this year's workshop is power electronics where we have a number of papers addressing this topic supported on Thursday by a panel session where leading UK experts will discuss the thermally related challenges faced by this growing sector.

Please also join us for the social events which include a welcome reception on Wednesday evening and a spectacular dinner cruise and trip around the London Eye on Thursday evening where you will have the opportunity to view the famous sites of London.

I am very grateful to our industry sponsors and exhibitors for helping to make this the 20th Anniversary of the Workshop an event that will be remembered by all. Finally a special thanks to Martina Creutzfeldt at mcc Agentur für Kommunikation and Vania Caldeira and Suzanne Louail at the University of Greenwich for all their help in organizing this event. I look forward to meeting you all here in Greenwich and again at future Therminic workshops.

### Chris Bailey

Programme Chair Therminic 2014



**Márta Rencz**  
General Chair



**Bernhard Wunderle**  
Vice General



**Chris Bailey**  
Programme Chair



**John Parry**  
Publicity Chair

OVERVIEW

Wednesday, September 24, 2014

Registration

🕒 8.00 am – 9.00 am

Welcome

🕒 9.00 am – 9.10 am

**Keynote I:**

An Integrated Approach to Thermal Management of Power Electronic Modules

*Mark Johnson, University of Nottingham*

*Chair: Chris Bailey, University of Greenwich*

🕒 9.10 am – 9.50 am

➔ **Session 1:**  
**Industrial Use of Compact Models**

🕒 9.50 am – 11.10 am

Coffee Break

🕒 11.10 am – 11.40 am

➔ **Session 2:**  
**Thermal Materials**

🕒 11.40 am – 12.40 pm

**Vendors Session**

🕒 12.40 pm – 1.10 pm

Lunch

🕒 1.10 pm – 2.20 pm

➔ **Session 3:**  
**Solid State Lighting**

🕒 2.20 pm – 3.20 pm

Coffee Break

🕒 3.20 pm – 3.50 pm

➔ **Session 4:**  
**Micro-fluidics and Novel Cooling Technologies**

🕒 3.50 pm – 5.10 pm

➔ **Session 5:**  
**Poster Introduction Session**

🕒 5.10 pm – 6.10 pm

Poster Session & Cocktails

🕒 6.30 pm – 7.30 pm

## SESSIONS 1 – 2 VENDORS SESSION

### Session 1: Industrial Use of Compact Models

🕒 9.50 am – 11.10 am

WESTMINSTER

➔ Chair: John Parry, Mentor Graphics

#### 9.50 am Creation and Use Compact Thermal Models for Virtual Prototyping of Electronic Assemblies from a Semiconductor Companies Perspective

John Janssen

*NXP Semiconductors, The Netherlands*

#### 10.10 am Requirements for the Industrial Automation of Compact Thermal Model Creation Using CFD Simulation

Byron Blackmore<sup>1</sup>, John Parry<sup>2</sup>

*Mentor Graphics, Canada; Mentor Graphics, United Kingdom*

#### 10.30 am Electronic Board Modeling by the Means of DELPHI Compact Thermal Model of Components

Eric Monier-Vinard<sup>1</sup>, Cheikh-Tidiane Dia<sup>2</sup>, Valentin Bissuel<sup>1</sup>,

Julien Dufrenne<sup>1</sup>; Olivier Daniel<sup>1</sup>

*<sup>1</sup>Thales Corporate Engineering, France; <sup>2</sup>Laboratoire Thermique Interfaces Environnement (LTIE), France*

#### 10.50 am Thermal Characterization of a Multi-Heatsource Component with and without an External Heatsink

Wendy Luiten

*Philips Research, The Netherlands*

### Session 2: Thermal Materials

🕒 11.40 am – 12.40 pm

WESTMINSTER

➔ Chair: Gabor Farkas, Mentor Graphics MAD MicReD Division

#### 11.40 am Thermal Characterization of Percolating Thermal Underfills: Bulk and Cavity

Brian R. Burg<sup>1</sup>, Manuel Kolly<sup>1</sup>, Kerry Yu<sup>2</sup>, Jonas Zürcher<sup>1</sup>, Gerd

Schlottig<sup>1</sup>, Thomas Brunschwiler<sup>1</sup>

*<sup>1</sup>IBM Research - Zurich, Switzerland; <sup>2</sup>Intrinsiq Materials Ltd, United Kingdom*

#### 12.00 pm In Situ Thermal Conductivity Measurement of Magnetic Nanoparticle Layers in Lab-on-a-Chip Devices

Ferenc Ender, Gusztáv Hantos, András Vitéz, Diána Weiser

*<sup>1</sup>Budapest University of Technology and Economics, Hungary*

#### 12.20 pm Candidate Thermally Enhanced Polymer Composite Materials for Cooling of Electronic Systems

Peter Rodgers, Valerie Eveloy, Loutfi El Sayed

*The Petroleum Institute, United Arab Emirates*

### Vendors Session

🕒 12.40 pm – 1.10 pm

WESTMINSTER

➔ Chair: Chris Bailey, University of Greenwich

SESSIONS 3 – 4

Session 3:  
Solid State Lighting

🕒 2.20 pm – 3.20 pm

WESTMINSTER

➔ Chair: Thomas Zahner, OSRAM Opto Semiconductors GmbH

2.20 pm    **Experimental and Theoretical Considerations on the Offset Correction of Transient Cooling Curves of Light Emitting Diodes Based on JESD51-14**

Franz Xaver Daiminger<sup>1</sup>, Martin Gruber<sup>1</sup>, Christian Dendorfer<sup>1</sup>, Thomas Zahner<sup>2</sup>

<sup>1</sup>Deggendorf Institute of Technology, Germany; <sup>2</sup>Osram Opto Semiconductors, Germany

2.40 pm    **Characterization of Heat-sinks of Socketable LED Modules Using Thermal Transient Testing**

András Poppe<sup>1</sup>, Ernő Kollár<sup>1</sup>, Zoltán Tóth<sup>2</sup>, János Simonovics<sup>2</sup>

<sup>1</sup>Budapest University of Technology and Economics, Hungary; <sup>2</sup>GE Hungary, Budapest, Hungary

3.00 pm    **A Real-Time Approach to Thermal Design, Leveraging Display Performance in a LED TV**

Lieven Penninck, Lieve Lanoye, Benoit Catteau, Hans Van Parys, Luc Peeters<sup>1</sup>

Linköping University, Sweden; <sup>2</sup>Chalmers University of Technology, Gothenburg, Sweden; <sup>3</sup>Southern Methodist University, Dallas, Texas, USA; <sup>4</sup>TMX Scientific, Dallas, Texas, USA; <sup>5</sup>Lawrence Berkeley Innovation Site Europe, TPVision, Belgium

Session 4:  
Micro-fluidics and Novel Cooling Technologies

🕒 3.50 pm – 5.10 pm

WESTMINSTER

➔ Chair: Yogendra Joshi, Georgia Institute of Technology

3.50 pm    **Experimental Investigation on Heat Transfer Enhancements in Laminar Flow with Ferrofluids under Magnetic Field – Application to Power Electronics Cooling**

Wahid Cherief<sup>1,2</sup>, Yvan Avenas<sup>1</sup>, Sebastien Ferrouillat<sup>2</sup>, Afef Lebouc<sup>1</sup>, Mickael Petit<sup>3</sup>, Martin Wu<sup>1</sup>

<sup>1</sup>G2Elab- Grenoble Electrical Engineering laboratory, France; <sup>2</sup>LEGI- Laboratory of Geophysical and Industrial Flows, Grenoble, France; <sup>3</sup>SATIE, ENS Cachan - CNAM - University of Cergy Pontoise, France

4.10 pm    **Optimization of Heaters in a Digital Microfluidic Biochip for the Polymerase Chain Reaction**

Zipeng Li<sup>1</sup>, Tsung-Yi Ho<sup>2</sup>, Krishnendu Chakrabarty<sup>1</sup>

<sup>1</sup>Duke University, United States of America; <sup>2</sup>National Cheng Kung University, Taiwan

4.30 pm    **Characterization of Phase Change Material Systems with a Thermal Test Device**

Xavier Jorda<sup>1</sup>, Jesus Esarte<sup>2</sup>, Xavier Perpiña<sup>1</sup>, Miquel Vellvehi<sup>1</sup>, Gorka Argandoña<sup>2</sup>, Maite Aresti<sup>2</sup>

<sup>1</sup>IMB-CNM(CSIC), Spain; <sup>2</sup>CETENA-CEMITEC Aditech, Spain

4.50 pm    **Ionic Wind Generator on LED Lighting Application**

Marek Knap, Jan Duga

OMS spol s.r.o., Slovak Republic



## POSTER SESSION

### Session 5

#### Poster Introduction Session

🕒 5.10 pm – 6.10 pm

WESTMINSTER

➔ Chair: Marta Rencz, Budapest University of Technology & Economics

### Poster Session & Cocktails

🕒 6.30 pm – 7.30 pm

NELSON

➔ Chair: Marta Rencz, Budapest University of Technology & Economics

- 01      **On the Influence of an Upstream Heat Source on the Thermal Structure Function of a LED**  
Andreas Kloss, Marko Kaening  
*OSRAM GmbH, Germany*
  
- 02      **Multi-Channel and Real-Time Monitoring System for Junction Temperature of Light-Emitting Diodes**  
Byungjin Ma, Jemin Kim, Sungsoon Choi, Kwanhoon Lee  
*Korea Electronics Technology Institute, Republic of South Korea*
  
- 03      **Power Cycling Test of Power Semiconductor Based on Junction Temperature Monitoring**  
SungSoon Choi, WooYoung Lee, Byungjin Ma, Kwan-Hun Lee  
*Korea Electronics Technology Institute, Republic of South Korea*

- 04      **Configurable Heat Generators for FPGAs**  
Pawel Weber<sup>1</sup>, Maciej Zagrabski<sup>1</sup>, Przemysław Musz<sup>1</sup>, Krzysztof Kępa<sup>2</sup>, Maciej Nikodem<sup>1</sup>, Bartosz Wojciechowski<sup>1</sup>  
*<sup>1</sup>Institute of Computer Engineering, Control and Robotics, Wrocław University of Technology, Poland; <sup>2</sup>Bradley Department of Electrical and Computer Engineering, Virginia Tech, Blacksburg, VA, USA*
  
- 05      **Fast Novel Thermal Analysis Simulation Tool for Integrated Circuits (FANTASTIC)**  
Lorenzo Codecasa<sup>1</sup>, Vincenzo d'Alessandro<sup>2</sup>, Alessandro Magnani<sup>2</sup>, Niccolò Rinaldi<sup>2</sup>, Peter J. Zampardi<sup>3</sup>  
*<sup>1</sup>Politecnico di Milano, Italy; <sup>2</sup>Università Federico II, Naples, Italy; <sup>3</sup>RF Micro Devices, USA*
  
- 06      **Green's Function Solution of Hyperbolic Heat Equation Suitable for Thermal Analysis of Electronic Nanostructures**  
Marcin Janicki  
*Lodz University of Technology, Poland*
  
- 07      **Scaling of Thermal-Electronic Logic Circuits**  
János Mizsei<sup>1</sup>, Márton C. Bein<sup>1</sup>, Jyrki Lappalainen<sup>2</sup>, László Juhász<sup>1</sup>  
*<sup>1</sup>Budapest University of Technology and Economics, Hungary; <sup>2</sup>University of Oulu, Finland*

POSTER SESSION

- 08

**Design and Analysis of Heat Dissipation of LED Back Light Module**

C. E. Zheng<sup>1</sup>, Y. L. Peng<sup>1</sup>, M. Y. Tsai<sup>1</sup>, C. H. Chen<sup>2</sup>

<sup>1</sup>Chang Gung University, Taiwan, ROC; <sup>2</sup>Unity Opto Tech. Co., Taiwan, ROC
- 09

**Issues of Thermal Transient Testing on Photovoltaic Modules**

Balázs Plesz, Sándor Ress, Péter Gábor Szabó, Gusztáv Hantos, Dóra Dudola

Budapest University of Technology and Economics, Hungary
- 10

**Orientation Effects on the Performance of Natural Convection Cooled Hybrid Fins**

Kyoung Joon Kim

Pukyong National University, Korea, Republic of (South Korea)
- 11

**Real-Time Coolant Temperature Monitoring in Power Electronics Using Linear Parameter-Varying Models for Variable Coolant Flow Situations**

Manuel Warwel<sup>1,2</sup>, Gerd Wittler<sup>1</sup>, Michèle Hirsch<sup>2</sup>, Hans-Christian Reuss<sup>3</sup>

<sup>1</sup> University of Applied Sciences Esslingen, Germany; <sup>2</sup>Robert Bosch GmbH, Schwieberdingen, Germany; <sup>3</sup>University of Stuttgart, Germany
- 12

**Energy Harvested LED Luminaire**

Ján Duga, Marek Knap

OMS spol. s.r.o., Slovak Republic
- 13

**A Review of the Computer Based Simulation of Electro-Thermal Modelling of Power Electronics Devices**

Mohammad Shahjalal, Hua Lu, Chris Bailey

University of Greenwich, United Kingdom



OVERVIEW

Thursday, September 25, 2014

**Keynote II:**

Reliability of LED-based Products: a Matter of  
Balancing Temperatures  
*Willem van Driel, Philips Lighting*  
*Chair: András Poppe, Budapest University of Technology  
and Economics*  
🕒 8.30 am – 9.10 am

➔ **Session 6:**  
**Power Electronics**

🕒 9.10 am – 10.30 am

Coffee Break  
🕒 10.30 am – 11.00 am

➔ **Session 7:**  
**Thermal Metrology**

🕒 11.00 am – 12.20 pm

Lunch  
🕒 12.20 pm – 1.30 pm

➔ **Session 8:**  
**Design Methodologies and Simulation I**

🕒 1.30 pm – 2.50 pm

Coffee Break  
🕒 2.50 pm – 3.20 pm

➔ **Session 9:**  
**Reliability**

🕒 3.20 pm – 4.40 pm

➔ **Power Electronics Panel Session**

🕒 4.45 pm – 5.45 pm

Boat tour, London Eye  
🕒 7.00 pm – 11.00 pm



SESSIONS 6 – 7

Session 6:  
Power Electronics

🕒 9.10 am – 10.30 am

WESTMINSTER

➔ Chair: Hua Lu, University of Greenwich

- 9.10 am

**Phase Change Based Thermal Buffering of Transient Loads for Power Converter**

Bernhard Wunderle<sup>1</sup>, Martin Springborn<sup>1</sup>, Daniel May<sup>1</sup>, Raul Mrossko<sup>2</sup>, Mohamad Abo Ras<sup>3</sup>, Charles-Alix Manier<sup>4</sup>, Hermann Oppermann<sup>4</sup>, Radoslava Mitova<sup>5</sup>

<sup>1</sup>TU Chemnitz, Germany; <sup>2</sup>Amic Berlin, Germany; <sup>3</sup>Berliner Nanotest und Design GmbH, Germany; <sup>4</sup>Fraunhofer IZM, Germany; <sup>5</sup>Schneider Electric, Grenoble, France
- 9.30 am

**Thermal Transient Measurement of Insulated Gate Devices Using the Thermal Properties of the Channel Resistance and Parasitic Elements**

Gabor Farkas, Tivadar Purak, Gergely Toth

Mentor Graphics MAD MicReD Division, Hungary
- 9.50 am

**Thermal Properties of Interconnects in Power MOSFETs**

Alex Burenkov<sup>1</sup>, Eberhard Baer<sup>1</sup>, Cristian Boianceanu<sup>2</sup>

<sup>1</sup>Fraunhofer IISB, Germany; <sup>2</sup>Infineon Technologies, Romania
- 10.10 am

**A New Approach for the Identification of Reduced Thermal Models**

Jean-Louis Blanchard<sup>1</sup>, Fatma Abid<sup>1</sup>, Gaël Chevallier<sup>2</sup>

<sup>1</sup>VALEO, France; <sup>2</sup>SUPMECA, France

Session 7:  
Thermal Metrology

🕒 11.00 am – 12.20 pm

WESTMINSTER

➔ Chair: Wendy Luiten, Philips

- 11.00 am

**Thermal Characterization of Highly Conductive Die Attach Materials**

Mohamad Abo Ras<sup>1,3</sup>, Daniel May<sup>2</sup>, Sven Rzepka<sup>3</sup>, Thomas Winkler<sup>1</sup>, Bernd Michel<sup>3</sup>, Bernhard Wunderle<sup>2</sup>

<sup>1</sup>Berliner Nanotest und Design GmbH, Germany; <sup>2</sup>TU Chemnitz, Germany; <sup>3</sup>Fraunhofer ENAS, Germany
- 11.20 am

**A Comparison Study on Thermal Characterization of High Power LEDs with Different Ceramic Attach Adhesives for Automotive Lighting Applications**

Anithambigai Permal<sup>1</sup>, Mutharasu Devarajan<sup>1</sup>, Thomas Zahner<sup>2</sup>, Ling Hung Huong<sup>3</sup>, David Lacey<sup>3</sup>

<sup>1</sup>Nano Optoelectronics Research Laboratory, Universiti Sains Malaysia, Malaysia; <sup>2</sup>OSRAM Opto Semiconductors GmbH, Germany; <sup>3</sup>OSRAM Opto Semiconductors Malaysia, Penang, Malaysia
- 11.40 pm

**Evaluation of Thermal Solder Joint Quality and Thermal Performance of PCBs by Using Standard Measurement Equipment**

Sebastian Georg Schlegl<sup>1</sup>, Markus Wicke<sup>2</sup>, Thomas Zahner<sup>2</sup>, Kurt-Jürgen Lang<sup>2</sup>

<sup>1</sup>OTH Regensburg, Germany; <sup>2</sup>Osram Opto Semiconductors GmbH, Germany
- 12.00 pm

**Rational Design of Gold Micro- and Nanowires for High Spatial and Temporal Resolution Thermal Investigations**

Olena Kraieva<sup>1,3</sup>, Carlos Quintero<sup>1</sup>, Christian Bergaud<sup>1</sup>, Gabor Molnar<sup>2</sup>

<sup>1</sup>Laboratoire d'Analyse et d'Architecture des Systèmes (LAAS), France; <sup>2</sup>Laboratoire de Chimie de Coordination (LCC), CNRS, France; <sup>3</sup>Kyiv Polytechnic Institute, NTUU, Ukraine

SESSIONS 8 – 9  
POWER ELECTRONICS  
PANEL SESSION

Session 8:  
Design Methodologies and Simulation I

🕒 1.30 pm – 2.50 pm

WESTMINSTER

➔ Chair: Krishnendu Chakrabarty, Duke University

1.30 pm    Investigation of Effects of Die Thinning on Central TSV Bus Driver Thermal Performance

Samson Melamed<sup>1</sup>, Fumito Imura<sup>1</sup>, Masahiro Aoyagi<sup>1</sup>, Hiroshi Nakagawa<sup>1</sup>, Katsuya Kikuchi<sup>1</sup>, Michiya Hagimoto<sup>2</sup>, Yukoh Matsumoto<sup>2</sup>  
<sup>1</sup>National Institute of Advanced Industrial Science and Technology, Japan; <sup>2</sup>TOPS Systems Corporation, Japan

1.50 pm    Multi-Port Dynamic Compact Thermal Models of Nonlinear Heat Conduction

Lorenzo Codecasa<sup>1</sup>, Vincenzo d'Alessandro<sup>2</sup>, Alessandro Magnani<sup>2</sup>, Niccolò Rinaldi<sup>2</sup>  
<sup>1</sup>Politecnico di Milano, Milan, Italy; <sup>2</sup>Università Federico II, Naples, Italy

2.10 pm    Towards Electro-Thermo-Mechanical Simulation of Integrated Circuits in Standard CAD Environment

Maroua Garci, Jean-Baptiste Kammerer, Luc Hebrard  
Icube, France

2.30 pm    Thermal Improvement of High Speed Processor Cold Plate Used in Military Ruggedized Mission Computer

Ayşe Gözde Ulu Soysal, Serkan Kayili, Tolga Kokturk  
Aselsan A.S., Turkey

Session 9:  
Reliability

🕒 3.20 pm – 4.40 pm

WESTMINSTER

➔ Chair: Bernhard Wunderle, TU Chemnitz

3.20 pm    Separation of Failure Modes in Short Cycle Time Power Cycling Experiments

Zoltan Sarkany, Andras Vass-Varnai, Marta Rencz  
Mentor Graphics, Hungary

3.40 pm    In-Situ Monitoring of Interface Delamination by the 30omega Method

Marcus Schulz<sup>1,2</sup>, Hans Walter<sup>3</sup>, Raul Mroßko<sup>1</sup>, Sergey Sheva<sup>1</sup>, Guanda Yang<sup>2,4</sup>, Jürgen Keller<sup>1</sup>, Bernhard Wunderle<sup>2</sup>  
<sup>1</sup>AMIC Angewandte Micro-Messtechnik GmbH, Germany; <sup>2</sup>TU Chemnitz, Germany; <sup>3</sup>Fraunhofer IZM, Berlin, Germany

4.00 pm    Detection of Solder Joint Cracking of High Power LEDs on Al-IMS during Temperature Shock Test by Transient Thermal Analysis

Gordon Elger<sup>1</sup>, Shri Vishnu Kandasamy<sup>1</sup>, Robert Derix<sup>2</sup>, Fosca Conti<sup>3</sup>  
<sup>1</sup>Technische Hochschule Ingolstadt, Germany; <sup>2</sup>Philips Technology GmbH, Germany; <sup>3</sup>University of Padova, Italy

4.20 pm    Study of Impact of Thermal Refinishing Processes on Reliability of COTS Components

S. Stoyanov<sup>1</sup>, C. Bailey<sup>2</sup>, P. Stewart<sup>2</sup>, P. Tollafeld<sup>3,1</sup>  
<sup>1</sup>University of Greenwich, UK; <sup>2</sup>Selex Galileo, UK; <sup>3</sup>Micross Semiconductors

Power Electronics Panel Session

🕒 4.45 pm – 5.45 pm

WESTMINSTER

OVERVIEW

Friday, September 26, 2014

Keynote III:

On-Chip Temperature and Leakage Power  
Measurement and Comparison between Air Cooling  
and Microfluidic Cooling  
*Yogendra Joshi, Georgia University of Technology*  
*Chair: Peter Rodgers, The Petroleum Institute*  
🕒 9.00 am – 9.40 am

- ➔ **Session 10:**  
**Thermal Management Concepts I**  
🕒 9.40 am – 10.40 am

Coffee Break  
🕒 10.40 am – 11.10 pm

- ➔ **Session 11:**  
**Design Methodologies and Simulation II**  
🕒 11.10 am – 12.30 pm

Lunch  
🕒 12.30 pm – 1.40 pm

- ➔ **Session 12:**  
**Thermal Management Concepts II**  
🕒 1.40 pm – 2.40 pm

Closing Remarks and Best Paper and Poster Awards

- ➔ **Special Session 1:**  
**Nanotherm I**  
🕒 9.40 am – 10.40 am

- ➔ **Special Session 2:**  
**Nanotherm II**  
🕒 11.10 am – 12.30 pm

- ➔ **Workshop:**  
**Smart Power**  
🕒 1.40 pm – 2.40 pm

SESSION 10  
SPECIAL SESSION 1

Session 10:  
Thermal Management Concepts I

🕒 9.40 am – 10.40 am

WESTMINSTER

➔ Chair: Vadim Tsoi, Huawei Technologies Sweden AB

9.40 am    **A Study of the Maximum Theoretical Power Dissipation of Tablets under Natural Convection Conditions**

Guy Robert Wagner  
*Electronic Cooling Solutions, United States of America*

10.00 am    **Assessment of a Heat Spreading Solution for Hot Spots Cooling in Compact Packages**

Rafael Prieto<sup>1,2,3</sup>, Guillaume Belly<sup>2</sup>, Perceval Coudrain<sup>1</sup>, Jean-Philippe Colonna<sup>2</sup>, François de Crecy<sup>2</sup>, Severine Cheramy<sup>2</sup>, Yvan Avenas<sup>3</sup>  
<sup>1</sup>ST Microelectronics, France; <sup>2</sup>CEA, LETI, MINATEC Campus, France;  
<sup>3</sup>Univ. Grenoble Alpes, France

10.20 am    **Hardware Microprocessor Thermal Emulation Using Synthetic Heat Sources and Temperature Sensors in FPGA**

Bartosz Wojciechowski<sup>1</sup>, Maciej Nikodem<sup>1</sup>, Paweł Weber<sup>1</sup>, Maciej Zagrabski<sup>1</sup>, Krzysztof Kępa<sup>2</sup>  
<sup>1</sup>Institute of Computer Engineering, Control and Robotics, Wrocław University of Technology, Poland; <sup>2</sup>Bradley Department of Electrical and Computer Engineering, Virginia Tech, Blacksburg, VA, USA

Special Session 1:  
Nanotherm I

🕒 9.40 am – 10.40 am

NELSON

➔ Chair: Afshin Ziaei, Thales Research & Technology

9.40 am    **In Situ Thermal Reliability Testing Methodology for Novel Thermal Interface Materials**

Gusztáv Hantos<sup>1</sup>, Márta Rencz<sup>1</sup>, László Juhász<sup>2</sup>  
<sup>1</sup>Budapest University of Technology and Economics, Hungary; <sup>2</sup>BME VIKING Nonprofit Plc., Hungary

10.00 am    **Modeling of the Effective Thermal Conductivity of Sintered Porous Pastes**

Jose Ordonez-Miranda<sup>2</sup>, Ivan Nikitin<sup>3</sup>, Varvara G. Kouznetsova<sup>4</sup>, Marrit Hermens<sup>4</sup>, Sebastian Volz<sup>1</sup>  
<sup>1</sup>CNRS, France; <sup>2</sup>Ecole Centrale Paris, France; <sup>3</sup>Infineon Technologies AG, Germany;  
<sup>4</sup>Eindhoven University of Technology, The Netherlands

10.20 am    **Electrically Conductive Thermal Interface Materials Based on Vertically Aligned Carbon Nanotubes Mats**

Joffrey Daon<sup>1</sup>, Gérard Cibien<sup>1</sup>, Elodie Leveugle<sup>1</sup>, Christophe Galindo<sup>1</sup>, Afshin Ziaei<sup>1</sup>, Shuangxi Sun<sup>4</sup>, Wei Mu<sup>4</sup>, Lilei Ye<sup>3</sup>, Yifeng Fu<sup>3</sup>, Jinbo Bai<sup>2</sup>, Johan Liu<sup>4</sup>  
<sup>1</sup>THALES Research and Technology, France; <sup>2</sup>Ecole Centrale Paris, France; <sup>3</sup>SHT, Göteborg, Sweden; <sup>4</sup>Chalmers University of Technology, Göteborg, Sweden



SESSION 11  
SPECIAL SESSION 2

Session 11:  
Design Methodologies and Simulation II

🕒 11.10 am – 12.30 pm

WESTMINSTER

➔ Chair: Andrzej Napieralski, Technical University of Lodz

11.10 am Using a Monte-Carlo Model to Identify Best Filler Arrangement in Thermally Conductive Materials

Pierre Leon Descamps, Sandrine Teixeira, Guy Beaucarne  
*Dow Corning S.A., Belgium*

11.30 am Parametric Compact Thermal Models by Moment Matching for Variable Geometry

Lorenzo Codecasa<sup>1</sup>, Vincenzo d'Alessandro<sup>2</sup>, Alessandro Magnani<sup>2</sup>, Niccolò Rinaldi<sup>2</sup>  
*<sup>1</sup>Politecnico di Milano, Milan, Italy; <sup>2</sup>Università Federico II, Naples, Italy*

11.50 am Calculation Limits of the Homogeneous Effective Thermal Conductivity Approach in Modeling of Printed Circuit Board

Eric Monier-Vinard<sup>1</sup>, Najib Laraqi<sup>2</sup>, Cheikh Tidiane Dia<sup>1,2</sup>, Minh-Nhat Nguyen<sup>2</sup>, Valentin Bissuel<sup>1</sup>  
*<sup>1</sup>Thales Global Service, France; <sup>2</sup>Laboratory LTIE - University of Paris-West Nanterre, France*

12.10 am An Assessment of CFD Simulations and Appropriate Simplifications Used for the Development of LED Luminaires

James Robert Pryde<sup>1,2</sup>, David Whalley<sup>2</sup>, Weeratunge Malalasekera<sup>2</sup>  
*<sup>1</sup>Tamlite lighting, United Kingdom; <sup>2</sup>Loughborough University, United Kingdom*

Special Session 2:  
Nanotherm II

🕒 11.10 am – 12.10 pm

NELSON

➔ Chair: Afshin Ziaei, Thales Research & Technology

11.10 am A Novel Contactless Technique for Thermal Conductivity Determination: Two-Laser Raman Thermometry

J. Sebastian Reparaz<sup>1</sup>, Emigdio Chavez-Angel<sup>1,2</sup>, Markus R. Wagner<sup>1</sup>, Bartłomiej Graczykowski<sup>1</sup>,  
Jordi Gomis-Bresco<sup>1</sup>, Francesc Alzina<sup>1</sup>, Clivia M. Sotomayor-Torres<sup>1,3</sup>  
*<sup>1</sup>Catalan Institute of Nanoscience and Nanotechnology (ICN2), Spain; <sup>2</sup>Dept. of Physics, Spain; <sup>3</sup>ICREA, Spain*

11.30 am Mechanical Properties of Porous Silver Material Depended on Sintering Parameters

Ivan Nikitin, Klaus Pressel  
*Infineon Technology AG, Germany*

11.50 am Enhanced Heat Spreader Based on Few-layer Graphene Intercalated with Silane-functionalization Molecules

Haoxue Han<sup>1,2</sup>, Yuriy A. Kosevich<sup>1,2,3</sup>, Yong Zhang<sup>4</sup>, Johan Liu<sup>4</sup>, Yifeng Fu<sup>5</sup>, Lilei Ye<sup>5</sup>, Sebastian Volz<sup>1,2</sup>  
*<sup>1</sup>CNRS, France; <sup>2</sup>Ecole Centrale Paris, France; <sup>3</sup>Russian Academy of Sciences, Moscow, Russia; <sup>4</sup>Chalmers University of Technology, Sweden; <sup>5</sup>SHT Smart High-Tech AB, Sweden*

SESSION 12  
CLOSING

Session 12:  
Thermal Management Concepts II

🕒 1.40 pm – 2.40 pm

WESTMINSTER

➔ Chair: John Janssen, NXP Semiconductors

- 1.40 pm

**Advancing the Thermal Stability of 3D-IC's Using Logi-thermal Simulation**  
Gergely Nagy, Péter Horváth, László Pohl, András Poppe  
*Budapest University of Technology and Economics, Hungary*
- 2.00 am

**Optimizing Temperature Distribution in Modern Processors through Efficient Floorplanning**  
Piotr Zajac, Melvin Galicia, Cezary Maj, Andrzej Napieralski  
*Lodz University of Technology, Poland*
- 2.20 am

**Intake Fan Implementation to Allow High Ambient Temperatures**  
Guy Diemunsch  
*Electronic Cooling Solutions, France*

Closing Remarks

🕒 2.40 pm – 2.50 pm

**Best Paper Award**

sponsored by Huawei

**Best Poster Award**

sponsored by University of Greenwich

Workshop:  
Smart Power

🕒 1.40 pm – 2.40 pm

NELSON

➔ Chair: Mohamad Abo Ras, Berliner Nanotest und Design GmbH

- 1.40 pm

**Thermal Characterization of High Power AlGaIn/GaN HEMT Using IR Microscopy and Thermoreflectance**  
Lény Baczkowski<sup>1</sup>, Dominique Carisetti<sup>2</sup>, Jean-Claude Jacquet<sup>1</sup>, Dustin Kendig<sup>3</sup>, Franck Vouzeaud<sup>4</sup>, Christophe Gaquiere<sup>5</sup>  
*<sup>1</sup>III-V Lab, France; <sup>2</sup>Thales Research and Technology, USA; <sup>3</sup>Microsanj, USA; <sup>4</sup>Thales Airborne Systems, France; <sup>5</sup>IEMN, France*
- 2.00 am

**Extracting Model Parameters from Thermal Transient Measurements for Thermal Stress Simulation**  
Zoltan Sarkany, Marta Rencz  
*Budapest University of Technology and Economics, Hungary*
- 2.20 am

**Accelerated Reliability Testing and Modeling of Subsystems Based on Sintered Silver Thermal Interface Materials**  
Jens Heilmann<sup>1</sup>, Ivan Nikitin<sup>2</sup>, Daniel May<sup>1</sup>, Klaus Pressel<sup>2</sup>, Bernhard Wunderle<sup>1,3</sup>  
*<sup>1</sup>Chemnitz University of Technology, Chemnitz, Germany; <sup>2</sup>Infineon Technologies, Regensburg, Germany; <sup>3</sup>Fraunhofer ENAS, Chemnitz, Germany*

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