

THERMINIC 2022

((28th INTERNATIONAL WORKSHOP
Thermal Investigations of ICs and Systems))

SEPTEMBER 28–30, 2022 | DUBLIN, IRELAND

PROGRAM 2022



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→ PREFACE



Lorenzo Codecasa
General Chair



Bernhard Wunderle
Vice General Chair



John Parry
Publicity Chair

WELCOME TO THERMINIC 2022!

This 28th edition of THERMINIC is again the main European event for academics and industry to share recent advancements in thermal challenges and solutions for electronics and microelectronics, including aspects of nano-scale heat transfer, thermal modelling, simulation of solid-state lighting as well as cooling issues of power electronics.

Following the workshops held in Grenoble (1995), Budapest (1996, 2000, 2007, 2012 and 2016), Cannes (1997 and 1998), Rome (1999), Paris (2001, 2011 and 2015), Madrid (2002), Aix-en-Provence (2003), Sophia Antipolis (2004), Belgirate (2005), Nice (2006), Rome (2008), Leuven (2009), Barcelona (2010), Berlin (2013), Greenwich (2014), Amsterdam (2017), Stockholm (2018), Lecco (2019) and two online workshops (2020, 2021), THERMINIC is taking place in Ireland for the first time. It is exciting to return to a fully in-person workshop after such a challenging time.

The 28th THERMINIC Workshop once again features a strong technical program, with 37 oral and 37 poster presentations organized in 10 oral sessions and 2 poster introduction sessions. More than 130 conference delegates from 23 countries are joining us this year.

This program booklet has been designed as a navigator for your THERMINIC 2022 participation. It includes all the sessions, presentations, and evening events to help make the most of your stay in Dublin. Note that the days have been color-coded for easier handling.

We are delighted to welcome three distinguished representatives from academia and industry as keynote speakers at THERMINIC 2022. John R. Thome (JJ Cooling Innovation Sàrl, formerly EPFL Lausanne), Johannes van Es (Royal Netherlands Aerospace Centre) and Justin A. Weibel (Purdue

University) will showcase current trends and discuss the role of end-to-end thermal fluid design, novel electronics cooling concepts including additive manufacturing, and thermal management for a wide range of applications.

We also have a great evening program planned. The drinks reception on Wednesday evening will be hosted in Trinity College Dublin in the Atrium, adjacent to its historic Dining Hall. This is just a short walk from the venue, through the Trinity College campus. Trinity's president Provost Dr Linda Doyle is looking forward to welcoming you there. The visit and dinner in the Guinness Storehouse on Thursday night promises to be a true highlight of the Workshop.

We are picking up the initiative of turning THERMINIC into a "green" event, not only by reducing our workshop's environmental impact, but also by sponsoring the purchase of an acre of bogland here in Ireland to offset the participants' carbon footprint. Our thanks go to the authors for their presentations and posters, as well as to the members of the scientific committee for soliciting and selecting the right mix of contributions. We are also very grateful to our industry sponsors and exhibitors for their support of THERMINIC 2022.

Last not least, we would like to thank the teams from Trinity College Dublin and mcc Agentur für Kommunikation for all their help in the organisation of THERMINIC 2022.

We look forward to an inspiring three days with you at THERMINIC 2022 in Dublin.

Dr. Tim Persoons
Program Chair



Tim Persoons
Program Chair



Michael Gibbons
Program Co-Chair



Rocco Lupoi
Program Co-Chair



Anthony Robinson
Program Co-Chair

→ THERMINIC 2022 SCIENTIFIC COMMITTEE

General Chair:

Lorenzo Codecasa, Politecnico di Milano, Italy

Vice General Chair:

Bernhard Wunderle, TU Chemnitz / Fraunhofer ENAS, Germany

Program Chair:

Tim Persoons, Trinity College Dublin, Ireland

Program Co-Chairs:

Michael Gibbons, Trinity College Dublin, Ireland

Anthony Robinson, Trinity College Dublin, Ireland

Rocco Lupoi, Trinity College Dublin, Ireland

Publicity Chair:

John Parry, SIEMENS Digital Industry Software, United Kingdom

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Genevieve Martin, Signify, The Netherlands

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András Poppe, Budapest University of Technology and Economics, Hungary

Dirk Schweitzer, Infineon, Germany

Andrew Tay, Singapore University of Technology and Design, Singapore

Vadim Tsoi, Huawei Technologies, Sweden

Bernhard Wunderle, Technical University of Chemnitz, Germany

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Berliner Nanotest und Design GmbH, Germany

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U. Politècnica de Catalunya, Spain

Ch. Bailey

University of Greenwich, United Kingdom

I. Barsony

Center for Energy Research, Institute for Technical Physics and Materials Science, Hungary

Gy. Bognár

Budapest University of Technology and Economics, Hungary

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IMB-CNM, Spain

T. Persoons

Trinity College Dublin, Ireland

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P. Rodgers

The Petroleum Institute, United Arab Emirates

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P.G. Szabó

Budapest University of Technology and Economics, Hungary

A. Tay

Singapore University of Technology and Design, Singapore

V. Tsoi

Huawei Technologies Sweden AB, Sweden

W. van Driel

Signify, The Netherlands

S. Volz

CNRS, Central Supélec, France

W. Wessel

Thales Group, The Netherlands

B. Wunderle

TU Chemnitz, Germany

T. Zahner

OSRAM Opto Semiconductors, Germany

→ GENERAL INFORMATION

WORKSHOP VENUE

This year's THERMINIC Workshop will be hosted at The Alex Hotel in Dublin. The 4-star boutique hotel is located in the heart of Dublin city center. Within a 1-minute walk, you reach the Trinity historic campus and Dublin's Georgian quarter. There you find the national museum, the national library and the national gallery. Within 5 minutes you have a wide range of pubs and other hotels.

ALEX HOTEL, DUBLIN

41-47 Fenian St, Dublin 2, Ireland
E-Mail: info@ocallaghancollection.com
Phone: +353 1 607 3700

HOW TO FIND YOUR WAY AROUND

We have booked the hotel's conference facilities for the THERMINIC 2022 Workshop. The plenary sessions will take place in rooms Orient 1 + 2. Coffee breaks will be offered in the exhibition and poster viewing area (Orient 3 + 4). The buffet lunch is also served in this area.

WORKSHOP REGISTRATION

The workshop registration fee includes admission to all oral and poster sessions. The conference package includes a download link for the electronic proceedings, a list of registered conference participants and authors, lunch and refreshments during breaks. Regular participants have free admission to the conference dinner.

THE REGISTRATION DESK IS OPEN

Wednesday, September 28, 2022	8.00 am – 6.00 pm
Thursday, September 29, 2022	8.30 am – 6.00 pm

DOOR REGISTRATION FEES

Workshop Participation: € 825

PAYMENT

The registration fee must be credited towards the conference account no later than September 26, 2022. All transfer charges must be covered by the participant's bank. If payments are not received by September 26, 2022; you can pay by credit card at the workshop site.

CONTACT INFORMATION AND ASSISTANCE DURING THE CONFERENCE

Do not 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 a wide variety of dietary requirements and 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 hotel kindly provides all conference delegates with free wireless Internet access throughout the conference. The wifi network is 'The Alex Conference' and the password is 'ALEXMEETING'.

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 electronic workshop proceedings will be made available as a download link to participants before the conference.

TAXIS AND PUBLIC TRANSPORTATION IN DUBLIN

A taxi can be hired on the street, at a taxi rank or pre-booked. All taxis in Ireland must accept credit and debit card payments as well as cash. Taxi hailing apps operating in Dublin include FREENOW (www.free-now.com) and LYNK (www.lynk.ie). Dublin city centre public transport buses are operated by Dublin Bus (www.dublinbus.ie) and the city trams are operated by Luas (www.luas.ie). All of these accept Leapcard contactless payments (www.leapcard.ie).

→ VENDOR
PRESENTATIONS

3M
Smart Immersion Heat Transfer Fluid Solutions for Today's Power Electronics
Rudi Van San, 3M, Belgium

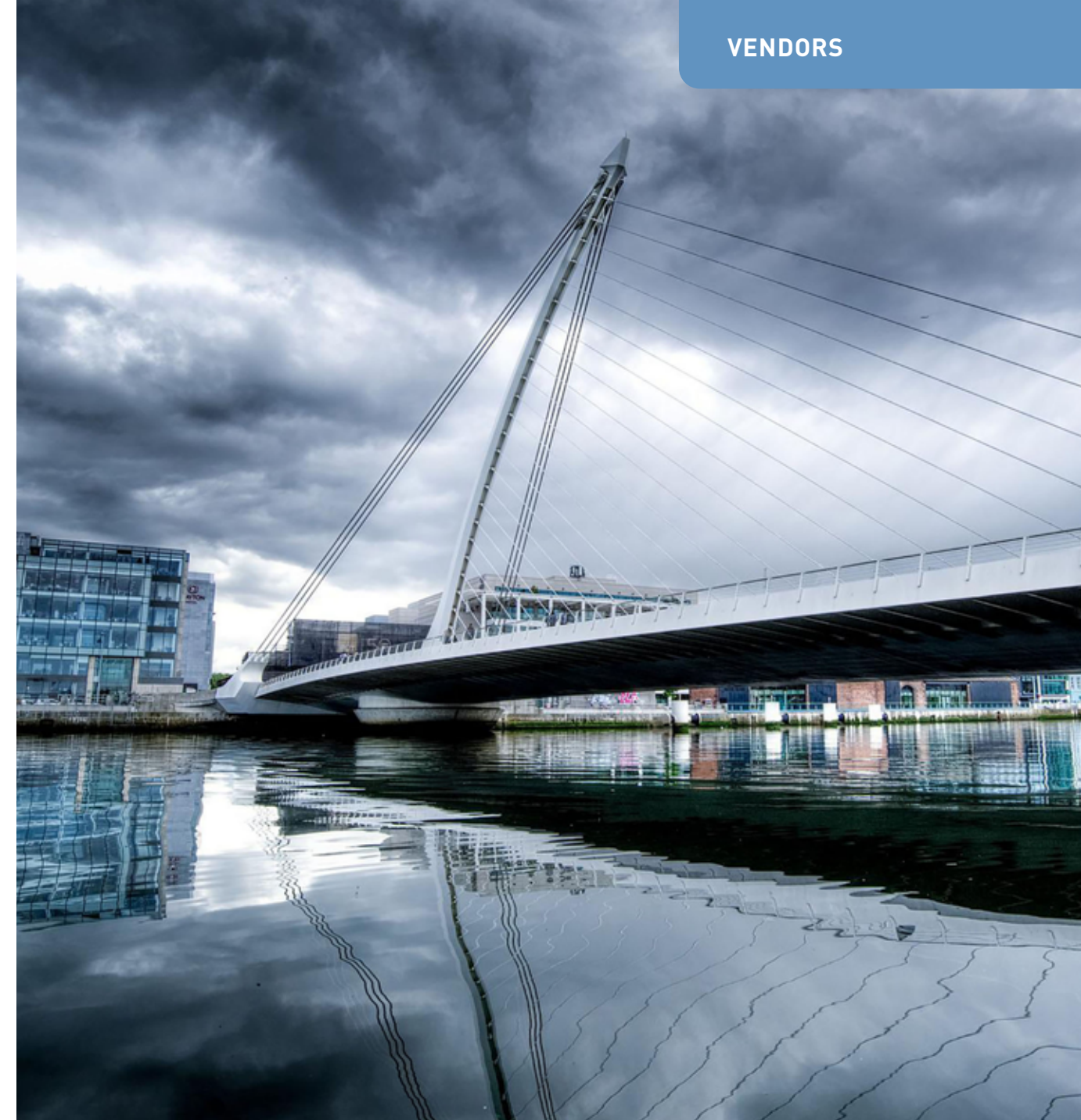
CADENCE
6SigmaET – Thermal Simulation for the Electronics Industry
Tom Gregory, cadence, United Kingdom

HUAWEI
Huawei Vision-Driven Cooling Research
Vadim Tsoi, Huawei Technologies Sweden AB, Sweden

NANOTEST
High-end Equipment for Thermal Characterization and Failure Analysis
Mohamad Abo Ras, Berliner Nanotest und Design GmbH, Germany

SIEMENS
Simcenter Solutions for Power Electronics
Robin Bornoff, SIEMENS Digital Industry Software, United Kingdom

VENDORS



→ SUPPORTERS

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

TRINITY COLLEGE

Located in a beautiful campus in the heart of Dublin's city centre and founded in 1592, **Trinity College Dublin** is Ireland's highest ranked university. It is home to 18,000 undergraduate and postgraduate students across all the major disciplines in the arts and humanities, and in business, law, engineering, science, and health sciences. The **School of Engineering** is a research led multi-disciplinary school widely recognised as a leader in education and research. Founded in 1841, it combines history and tradition with innovation, expertise, and contemporary teaching practices. Academic research is central to what we do. Our academic staff are experts in their fields and collectively have published over 2,000 academic research papers in the past five years. With an annual research income of over €10 million, we are home to approximately 60 academic staff, 50 research staff, and over 110 research students.

<https://www.tcd.ie>

<https://www.tcd.ie/Engineering>

HUAWEI

HUAWEI | Founded in 1987, Huawei is a leading global provider of information and communications technology (ICT) infrastructure and smart devices. We have approximately 197,000 employees and we operate in over 170 countries and regions, serving more than three billion people around the world. Huawei's mission is to bring digital to every person, home and organization for a fully connected, intelligent world. To this end, we will: drive ubiquitous connectivity and promote equal access to networks to lay the foundation for the intelligent world; provide the ultimate computing power to deliver ubiquitous cloud and intelligence; build powerful digital platforms to help all industries and organizations become more agile, efficient, and dynamic; redefine user experience with AI, offering consumers more personalized and intelligent experiences across all scenarios, including home, travel, office, entertainment, and fitness & health.

<https://www.huawei.com>

NANOTEST

NANOTEST | The Berliner Nanotest und Design GmbH is German engineering company with scientific lab that provides services and products for thermal characterization and to measure, improve and maintain reliability. For all facets of the electronics industry, from RF to high power, from automotive to space applications, Nanotest supplies solutions that empower material and system manufacturers to improve their products' quality, performance and reliability. Nanotest products are highly scientific, yet convenient stand-alone systems that offer a wide range of features, from simple single measurements to partly automated series testing, aging investigations and failure analyses. By staying active in research and keeping a close link to various institutes and universities, Nanotest solutions are always up-to-date with latest scientific and methodological developments and offer the edge over other comparable solutions.

<https://nanotest.eu>

SIEMENS

Siemens Digital Industries Software | Our Simulation & Test division leads the market in electronics thermal design software. Our team are at THERMINIC to discuss thermal design, thermal characterization, reliability requirements and production quality testing. We are happy to answer any questions about these topics. More information on Siemens Simcenter products, including Simcenter Flotherm, Simcenter FLOEFD, Simcenter T3STER and a range of Simcenter Powertester solutions for active power cycling of high-current devices like IGBTs and MOSFETs, is available from our booth.

<https://www.siemens.com/simcenter>



→ SUPPORTERS

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

6SIGMAET

6SigmaET | 6SigmaET, now part of Cadence, is a thermal modeling tool that uses advanced computational fluid dynamics (CFD) to create accurate models of electronic equipment. Designed specifically for the electronics industry, our software ushers in unparalleled intelligence, automation and accuracy to help you meet your requirements and to help you overcome thermal design challenges. Thermal simulation is a key element of the engineering design process. Our software enables you to create and solve models quickly, verify electronic designs before manufacturing, and optimize the best thermal performance while reducing your time to market. This level of intelligence and automation enables designers to spend more time on design, and less time on software operations.

<https://www.6sigmaet.info>

AMBER

AMBER | AMBER is the Science Foundation Ireland (SFI) Centre for Advanced Materials and BioEngineering Research. The Centre brings a multidisciplinary partnership between leading academics in Advanced Materials Science, BioEngineering and Industry. Working collaboratively we develop new materials and devices for the ICT, medical devices, energy and sustainable industrial technology sectors. Today society is faced with many technological and environmental challenges from sustainability and reducing their carbon footprint to next-generation personalised healthcare. By partnering with highly specialist Research faculties across Ireland, AMBER brings excellence in advanced research, innovation and knowledge from multiple industry sector projects to our collaborative partners, industry and society at a national and global level. AMBER is hosted at Trinity College Dublin.

<https://ambercentre.ie>

CONNECT

CONNECT | CONNECT is the Science Foundation Ireland (SFI) research centre for Future Networks and Communications, aligned with Priority A of Ireland's national research strategy (Future Networks, Communications and Internet of Things). We innovate, design, and develop networks that can meet the fast-evolving needs of their end-users, while anticipating and enabling a new generation of services with widely varying user experience requirements. CONNECT envisions a future of sustainably deployed, dependable communication networks that foster innovation in services, empower citizens, and improve quality of life. CONNECT is hosted at Trinity College Dublin.

<https://connectcentre.ie>

3M

3M | At 3M, we apply science in collaborative ways to improve lives daily. With corporate operations in 70 countries and sales in 200, we are committed to creating the technology and products that advance every company, enhance every home and improve every life. Our 3M™ Novec™ Engineered Fluids are developed not only to deliver excellent performance in many heat transfer applications, but to do so in a way that doesn't compromise worker safety or environmental sustainability. Novec Engineered Fluids are dielectric and non-flammable, offer a variety of operating temperature ranges and are low-maintenance, low-mess alternatives to traditional cooling fluids such as water, water/glycol or oils used for heat transfer. Their high dielectric strength allows direct contact with electronics and their excellent material compatibility making them ideal for your machinery. Novec fluids work in many applications including cold plate cooling for semiconductors, freeze-drying of pharmaceuticals, immersion cooling of data centres and spray cooling for avionics.

<https://www.3m.co>

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Advancing Materials for Impact

CONNECT
SFI Research Centre for
Future Networks

3M

→ KEYNOTE SPEAKERS

JOHN R. THOME

Professor Emeritus, Swiss Federal Institute of Technology, Lausanne (EPFL), Switzerland & Co-founder, JJ Cooling Innovation Sarl, Switzerland

John R. Thome is Technical Director of JJ Cooling Innovation Sarl in Lausanne, Switzerland, which develops new micro-two-phase cooling technologies for: power electronics, automotive, datacenters, edge computing, aerospace, 5G, batteries, food and beverage industries. These comprise Passive Cooling (gravity/thermosyphons and self-excited/PHPs) and Active Cooling (pumped and compressor driven systems), see (<https://www.jjcooling.com>). He has 45+ years of research experience on two-phase flow and heat transfer, technology development/applications and development of high fidelity thermal-hydraulic simulation codes. JJ Cooling's thermosyphon simulator won the 2020 ITherm Best Paper Award.

He formerly was Professor of Heat Transfer at the EPFL in Lausanne (1998-2018) where he founded and directed the LTCM lab. He is the author of five books and is editor-in-chief of the Encyclopedia of Two-Phase Heat Transfer and Flow (16 volumes). He founded and chairs the Virtual International Research Institute of Two-Phase Flow and Heat Transfer (<http://2phaseflow.org>) that has some 30 participating members. He has written over 250 journal papers with 29'400 citations. He received the 2017 Nusselt-Reynolds Prize, the 2019 IEEE ITherm Award, the 2019 ASME InterPack Medal and the 2010 ASME Heat Transfer Memorial Award, among others.

JOHANNES VAN ES

Senior Research Manager, NLR Energy and Thermal Management Group, Royal Netherlands Aerospace Centre (NLR)

Johannes van Es – Principal Scientist – Head of the NLR Energy and Thermal Management Group of the Royal Netherlands Aerospace Centre (NLR) – has extensive experience in space- and aircraft thermal control. He is responsible for new system and component R&D in satellite and aircraft thermal management and also point of contact for the Dutch Roadmap "Thermal Management and

Cooling Systems" to co-ordinate Dutch developments in S/C thermal management and streamline with ESA and EU developments.

He received the M.S. degree in Engineering Physics (1995) followed by a post-graduate designers degree in Process Engineering (1997) from Twente University in the Netherlands. Since 1997 he works at NLR starting as R&D engineer. In 2001 he became international project manager responsible for the Tracker Thermal Control System (TTCS) for the Alpha Magnetic Spectrometer (AMS02) currently operating on ISS (<https://arc.aiaa.org/doi/10.2514/6.2013-3389>) and lead several developments of Two-Phase MPL's for international customers. He has authored more than 25 papers in the field of thermal engineering. He is since 2011 member of the ICES International Committee and session vice-chair and since 2019 session chair of the Satellite, Payload and Instrument Thermal Control session of the International Conference on Environmental Systems (ICES).

JUSTIN A. WEIBEL

Associate Professor of Mechanical Engineering & Director, Cooling Technologies Research Center, Purdue University, West Lafayette, IN, USA

Justin A. Weibel is an Associate Professor in the School of Mechanical Engineering at Purdue University and Director of the Cooling Technologies Research Center (CTRC), a graduated NSF I/UCRC that addresses research and development needs of its member organizations in the area of high-performance heat removal from compact spaces. Dr. Weibel's research explores methodologies for prediction and control of heat transport to enhance the performance and efficiency of thermal management technologies. He has been a key contributor to the development of transformative cooling technologies supported by DARPA, NAVSEA, ONR, ARPA-E, and SRC programs, in addition to numerous industry sponsored research projects. He recently received the 2020 ASME Electronic & Photonic Packaging Division (EPPD) Young Engineer Award and 2021 ASME K-16 Outstanding Early Faculty Career in Thermal Management Award. Dr. Weibel is on the IEEE ITherm Executive Committee and is Associate Editor of the IEEE Transactions on Components Packaging and Manufacturing Technology.



John R. Thome



Johannes van Es



Justin A. Weibel

Wednesday, September 28, 2022

Welcome

🕒 9.30 am – 9.40 am

Tim Persoons, Trinity College Dublin

Keynote I:

🕒 9.40 am – 10.20 am

Experiences of Applying Passive Micro-Two-Phase Cooling to Electronics (Thermosyphons and Pulsating Heat Pipes)

Prof. (Emeritus) John R. Thome

Chair: Anthony Robinson, Trinity College Dublin

Coffee Break

🕒 10.20 am – 10.40 am

Session 1.1: Power Electronics

🕒 10.40 am – 11.40 am

Poster introductions I

🕒 11.40 am – 12.10 pm

Lunch and Poster Session

🕒 12.10 pm – 1.30 pm

Session 1.2: Convective Single-Phase Cooling

🕒 1.30 pm – 2.50 pm

Vendor session 1

🕒 2.50 pm – 3.20 pm

Coffee Break

🕒 3.20 pm – 3.40 pm

Session 1.3: Packaging

🕒 3.40 pm – 5.00 pm

Walk to Trinity College

🕒 5.10 pm – 5.30 pm

Welcome Reception: The Atrium, Trinity College

🕒 5.30 pm – 7.30 pm

→ SESSION 1.1

Session 1.1: Power Electronics

🕒 10.40 am – 11.40 am

→ Session Chair: *Bernhard Wunderle, TU Chemnitz (DE)*

10.40 am Development of a Realtime Physics Based Digital Twin for Online MOSFET Condition Monitoring in PV Converter Applications

Leander Van Cappellen^{1,3,4}, Martijn Deckers^{2,4}, Omid Alavi^{1,3,4}, Michael Daenen^{1,3,4}, Johan Driesen^{2,4}

¹IMO-IMOMECE, Hasselt University, Diepenbeek, Belgium; ²KU Leuven Electa ESAT/ELECTA, KU Leuven, Heverlee, Belgium; ³imec, Heverlee, Belgium; ⁴EnergyVille, Genk, Belgium

11.00 am Digital Twin Validation and Thermal Control Aspects in a Power Conversion Module

Wendy Luiten
WLC, Netherlands

11.20 pm Reliable Force Field Potential for Thermal Transport in AlN

Simon Christopher Fernbach¹, Elke Kraker¹, Natalia Bedoya-Martínez¹, Egbert Zojer²

¹MCL, Leoben, Austria; ²TU Graz, Graz, Austria



→ POSTER
INTRODUCTIONS I

Poster Introductions I

🕒 11.40 am – 12.10 pm

→ Session Chair: Vadim Tsoi, Huawei Technologies Sweden AB (SE)

01 Thermal Management with Through Glass Vias for Next Generation Photonic Packages

Parnika Gupta
Tyndall National Institute, Cork, Ireland

02 Determining the Contribution of Spatial Sub-Regions to Structure Functions

Lorenzo Codecasa¹, Vincenzo d'Alessandro², Antonio Pio Catalano²,
Ciro Sognamillo², Dario D'Amore¹
¹Politecnico di Milano, Milano, Italy; ²University Federico II, Naples, Italy

03 Thermal Disturb TCAD Simulation of Phase Change Memory Device

Roberto Simola¹, Paul Devoge¹, Philippe Boivin¹, Stephan Niel¹, Roberto
Gonella¹, Andrea Redaelli²
¹STMicroelectronics, France; ²STMicroelectronics, Italy

04 Thermal Performance of Miniature Vapour-Compression Refrigeration System for CPU Thermal Management

Fazeel Mohammed Naduvilakath Mohammed^{1,3}, Michel Lebon², Gerard
Byrne¹, Gemma Murray¹, Sara Battaglioli^{1,3}, Anthony James Robinson^{1,3}
¹Department of Mechanical Engineering, Trinity College Dublin, Ireland;
²Nexalus Ltd, Cork, Ireland; ³CONNECT, Dunlop Oriel House, Trinity College,
Dublin, Ireland

05 An Analysis of the Energy Infrastructure in Generic Data Centres

Younis Osama Abdelsalam¹, Tim Persoons², Sajad Alimohammadi^{1,2}
¹Technological University Dublin - City Campus, Dublin, Ireland; ²Trinity
College Dublin, Dublin, Ireland

06 Accelerating the Thermal Transient Testing by a Novel Temperature Sensitive Parameter Calibration Method Based on I-V Characteristic Measurement

Sándor Ress^{1,2}, Zoltán Sárkány², Gábor Farkas², Márta Rencz^{1,2}
¹Budapest University of Technology and Economics, Budapest, Hungary;
²Siemens DI SW STS, Budapest, Hungary

07 Model Order Reduction of a Nonlinear Model of an Electronic Component: Application to a Microchip Activated by 4 Sources

Fatme Mustapha^{1,2}, Valentin Bissuel¹, Frédéric Joly², Olivier Quéméner²
¹Thales Global Services SAS, Conflans-Sainte-Honorine, France; ²Laboratoire
de Mécanique et d'Energétique d'Evry, Evry, France

08 Additively Manufactured Lattice Structure Heat Sink for Railway Power Electronics Liquid Cooling

Ahmad Batikh¹, Jean-Pierre Fradin¹, Antonio Castro Moreno²
¹ICAM Toulouse, Toulouse, France; ²IRT Saint Exupéry Toulouse, Toulouse,
France

09 Thermal Modeling of Embedded Microscale Channel Structures Realized in Heterogeneous Packaging

György Bognár, Gábor Takács, Péter Gábor Szabó
Budapest University of Technology and Economics, Budapest, Hungary

10 Experimental Study on the Thermohydraulic Performance of Oil-Cooled Heat Sinks for Power Electronics

Jana Rogiers^{1,2}, Ilya T'Jollyn^{1,2}, Thomas Schoonjans^{1,2}, Jasper Nonneman^{1,2},
Michel De Paepe^{1,2}
¹Ghent University, Ghent, Belgium; ²FlandersMake@UGent corelab EEDT-MP,
Ghent, Belgium

→ POSTER
INTRODUCTIONS I

- 11

Acoustic Noise Insulation for Air-cooled Data Centre Hard Disk Drive Enclosures: Effect on Thermal Management

Sahan Wasala¹, Lon Stevens², Raye Sosseh³, Tim Persoons¹

¹*Trinity College Dublin, Dublin, Ireland;* ²*Seagate US LLC, Longmont, USA;* ³*Seagate US LLC, Shakopee, USA*
- 12

Comparison of Different Formulations for The Dual-Phase-Lag Heat Conduction Model

Artur Sobczak, Grzegorz Jablonski, Marcin Janicki

Lodz University of Technology, Lodz, Poland
- 13

SPICE Model Extension to Simulate the Transient Coupled Electro-Thermal Behaviour for Several Power Electronic components on System Level - Modelling Approach and Experimental Validation

Gregor Wiedemann, Ralph Schacht

Brandenburgische Technische Universität Cottbus-Senftenberg, Cottbus, Germany
- 14

Application of Lévêque Analogy to Open Cellular Solids

Sanjeet Kumar, Sripriya Ramamoorthy, Shankar Krishnan

Department of Mechanical Engineering, Indian Institute of Technology, Bombay, India
- 15

Flow-through Porous Finned Heat Sinks with Helmholtz Resonators for Combined Heat Dissipation and Tonal as well as Broadband Noise Reduction

Akshay Wagh, Harshavardhan Ronge, Radhika Choudhary, Shankar Krishnan, Sripriya Ramamoorthy

Department of Mechanical Engineering, Indian Institute of Technology, Bombay, India

- 16

Towards Quieter Air-cooling Systems: Rotor Self-noise Prediction for Axial Cooling Fans

Wenguang Zhao, Sahan Wasala, Tim Persoons

Trinity College Dublin, Dublin, Ireland
- 17

Noise Attenuation Through Optimised Acoustic Metamaterials: A Low Form Factor Design for Targeted Noise Reduction

Oluwaseyi Ayotunde Ogun, John Kennedy

Trinity College Dublin, Dublin, Ireland
- 18

Design and Characterization of a Sealed Hybrid-cooled High Performance Computing Server

Michel Lebon¹, Sara Battaglioli^{1,2,3}, Richard Jenkins¹, Ian Parry⁴, Anthony Robinson^{1,2,3}

¹*Nexalus, Nexalus, Ireland;* ²*Dep. of Mechanical, Manufacturing & Biomedical Engineering, Trinity College Dublin, Dublin, Ireland;* ³*CONNECT Centre, Dunlop Oriel House, Trinity College Dublin, Dublin, Ireland;* ⁴*OCUK Ltd, Newcastle-under-Lyme, UK*

→ SESSION 1.2 – 1.3

Session 1.2: Convective Single-Phase Cooling

🕒 1.30 pm – 2.50 pm

→ Session Chair: Wendy Luiten, WLC (NL)

- 1.30 pm

High Heat Flux Removal by Water Jet Impingement using 3D Printed Nozzles

Ram Gopal Varma Ramaraju¹, Mohammad Passandideh Fard^{1,2},
Sanjeev Chandra¹

¹University of Toronto, Canada; ²Ferdowsi University of Mashhad, Iran
- 1.50 pm

Parametric Investigation of Inlet Pressure and Diffuser Angle Impact on Adjustable Air Amplifier Performance

Eoin Hendrikus Oude Essink^{1,2,3}, Tim Persoons^{2,3}, Sajad Alimohammadi^{1,2,3}

¹Technological University Dublin, Dublin, Ireland; ²Trinity College Dublin, Dublin, Ireland; ³MaREI, SFI Research Centre for Energy, Climate and Marine, Environmental Research Institute, Cork, Ireland
- 2.10 pm

Heat Transfer Enhancement In A Minichannel Due To Asymmetric Sinusoidal Pulsating Flows

Parth S. Kumavat¹, Sajad Alimohammadi², Seamus M. O'Shaughnessy¹

¹University of Dublin, Trinity College, Dublin, Ireland; ²Technological University Dublin, Dublin, Ireland
- 2.30 pm

Experimental Investigation of the Heat Transfer Characteristics Associated with Dual Jet Cooling

Paula Jane Murphy¹, Sajad Alimohammadi², Séamus O'Shaughnessy¹

¹Trinity College Dublin, Dublin, Ireland; ²Technological University Dublin, Dublin, Ireland

Session 1.3: Packaging

🕒 3.40 pm – 5.00 pm

→ Session Chair: Peter Gabor Szabo, Budapest University of Technology and Economics (HU)

- 3.40 pm

Tiny Power Box - Thermal Investigations for Very High Power Density Onboard Chargers

Christian Mentin, Ismail Recepi, Philip Matzick

Silicon Austria Labs, Graz, Austria
- 4.00 pm

Accelerated Stress Testing and Failure Analysis of Thermal Greases

Bernhard Wunderle¹, Daniel May¹, Jörg Arnold¹, Mohamad Abo Ras²

¹TU Chemnitz, Chemnitz, Germany; ²Berliner Nanotest & Design GmbH, Berlin, Germany
- 4.20 pm

A Novel Integrated Cooling Packaging for High Power Density Semiconductors

Amin Salim Obaid Al-Hinaai^{1,2}, Cyril Butty¹, Till Huesgen², Daniela Meyer³, Richard Zeitler³

¹Electronics Integration Laboratory, University of Applied Sciences Kempten, Kempten, Germany; ²: Univ Lyon, CNRS, INSA Lyon, Université Claude Bernard Lyon ¹, Villeurbanne, France; ³: CeramTec GmbH, Plochingen, Germany
- 4.40 pm

Analysis of the Thermal Behavior of a Li-Ion Pouch Battery Cell – Part I: Finite-Element Simulation Including the Entropic Coefficient

Marcello Iasiello¹, Francesco Piccirillo¹, Nicola Bianco¹, Luigi Pio Di Noia², Pierluigi Guerriero²

¹Dept. of Industrial Engineering, University Federico II, Naples, Italy; ²Dept. of Electrical Engineering and Information Technology, University Federico II, Naples, Italy

Thursday, September 29, 2022

Keynote II:

⌚ 8.40 am – 9.20 am

Advances in Two-Phase Cooling of Power Electronics and the Role of 3D-printed Components

Johannes van Es

Session 2.1: Thermal Materials and Reliability

⌚ 9.20 am – 10.20 am

Coffee Break

⌚ 10.20 am – 10.40 am

Session 2.2: Advanced Manufacturing

⌚ 10.40 am – 11.40 am

Poster Introductions II

⌚ 11.40 am – 12.10 pm

Lunch and Poster Session

⌚ 12.10 pm – 1.30 pm

Session 2.3: Thermal Measurements and Characterisation I

⌚ 1.30 pm – 2.50 pm

Vendor Session 2

⌚ 2.50 pm – 3.10 pm

Coffee Break

⌚ 3.10 pm – 3.30 pm

Session 2.4: Thermal Measurements and Characterisation II

⌚ 3.30 pm – 4.50 pm

Coach The Alex -> Guinness

⌚ 6.45 pm – 7.15 pm

Visit and Conference Dinner in Guinness Storehouse

⌚ 7.30 pm – 11.00 pm

Coach Guinness -> The Alex

⌚ 11.00 pm – 11.30 pm

→ SESSION 2.1 – 2.2

Session 2.1: Thermal Materials and Reliability

🕒 9.20 am – 10.20 am

→ Session Chair: Marcin Janicki, Lodz University of Technology (PL)

9.20 am Thermal Conductivity Measurements of Thermal Interface Materials Using the Bidirectional 3-Omega Method

Corinna Grosse-Kockert¹, Mohamad Abo Ras¹, Daniel May^{1,2}, Alexandre Cremieux-Trives¹, Florian Löffler¹, Bernhard Wunderle²

¹Berliner Nanotest und Design GmbH, Berlin, Germany; ²Technische Universität Chemnitz, Chemnitz, Germany

9.40 am Crack Growth Prediction in High-Power LEDs from TTA, SAM and Simulated Data

Joseph Hermann¹, Maximilian Schmid², Gordon Elger¹

¹TU Ingolstadt, Ingolstadt, Germany; ²Fraunhofer IVI, Ingolstadt, Germany

10.00 am Accelerated Stress Testing for High-Cycle Fatigue of thin Al Films on piezo-driven MEMS Cantilever

Nathanael Jöhrmann¹, Chris Stöckel^{1,2}, Bernhard Wunderle^{1,2}

¹TU Chemnitz, Chemnitz, Germany; ²Fraunhofer ENAS, Chemnitz, Germany

Session 2.2: Advanced Manufacturing

🕒 10.40 am – 11.40 am

→ Session Chair: Johannes van Es, Royal Netherlands Aerospace Centre (NL)

10.40 am FEM Analysis of 3D Printable Finned Metal Liquid Cold Plates for Semiconductor Power Modules

Paolo Cova¹, Nicola Delmonte¹, Davide Spaggiari¹, Marco Portesine², Federico Portesine², Roberto Menozzi¹

¹University of Parma, Parma, Italy; ²Poseico S.p.A., Genua, Italy

11.00 am Improving the Performance of Flat Heat Pipes by Exploiting Benefits of Additive Manufacturing

Davoud Jafari, Wessel W. Wits

University of Twente, Enschede, Netherlands

11.20 am Beyond Fourier Thermal Management at the Nanoscale

Paul Desmarchelier¹, Efstratios Nikidis², Joseph Kioseoglou², Anne Tanguy^{3,4}, Konstantinos Termentzidis¹

¹CNRS, CETHIL UMR5008, Université Claude Bernard Lyon, Villeurbanne, France; ²Physics Department, Aristotle University of Thessaloniki, Thessaloniki, Greece; ³Univ Lyon, INSA Lyon, CNRS, France; ⁴ONERA, University Paris-Saclay, Chemin de la Hunière, Palaiseau, France

→ POSTER
INTRODUCTIONS II

Poster Introductions II

🕒 11.40 am – 12.10 pm

→ Session Chair: John Janssen, NXP Semiconductors (NL)

- 01

Enhancement of an Open Compute Project (OCP) Server Thermal Management and Waste Heat Recovery Potential via Hybrid Liquid-cooling

Sara Battaglioli^{1,2,3}, Michel Lebon², Richard Jenkins², Jon Summers⁴, Jeffrey Sarkinen⁴, Anthony J. Robinson^{1,2,3}

¹Dep. of Mechanical, Manufacturing & Biomedical Engineering, Trinity College Dublin, Dublin, Ireland; ²Nexalus Labs, Water St, Loughanalla, Castlepollard, Ireland; ³CONNECT Centre, Dunlop Oriel House, Trinity College Dublin, Dublin, Ireland; ⁴RISE, Research Institutes of Sweden, Luleå, Sweden
- 02

Effects of Wetting Behaviours and Contact Resistance on Thermal and Rheological Characteristics of Thermal Interface Materials

Julia Lucia Mayer^{1,2}, Andreas Griesinger¹, Norbert Willenbacher²

¹DHBW Stuttgart, Stuttgart, Germany; ²Karlsruher Institute of Technology, Karlsruhe, Germany
- 03

Compact SPICE Models of Sub-100 nm FDSOI and FinFET Devices in the Wide Temperature Range (-269°C...+300°C)

Konstantin O. Petrosyants^{1,2}, Mamed R. Ismail-zade¹, Lev M. Sambursky^{1,2}

¹National Research University Higher School of Economics, Moscow Institute of Electronics and Mathematics, Moscow, Russia; ²Institute for Design Problems in Microelectronics of Russian Academy of Sciences, Moscow, Russia
- 04

The Effect of Dimming Frequency on the Aging of Power LEDs

János Hegedüs, Gusztáv Hantos, András Poppe, Máté Lukács, Bence Bodnár

Department of Electron Devices, Faculty of Electrical Engineering and Informatics, Budapest University of Technology and Economics, Budapest, Hungary

- 05

Experimental Investigation of a Novel Direct Rotor Cooling Method for an Interior Permanent Magnet Synchronous Machine

Jasper Nonneman^{1,2}, Ieuan Evans¹, Ilya T'Jollyn^{1,2}, Steven Vanhee^{1,3}, Michel De Paepe^{1,2}

¹Department of Electromechanical, Systems and Metal Engineering, Ghent University, Ghent, Belgium; ²Flanders Make@UGent – Core lab EEDT-MP, Ghent, Belgium; ³Dana Belgium NV, Brugge, Belgium
- 06

Thermal Transient Testing Alternatives for the Characterisation of GaN HEMT Power Devices

Zoltan Sarkany¹, Mattia Musolino², Alessandro Sitta², Michele Calabretta², Gabor Farkas¹, Mark Nemeth¹, Marta Rencz¹

¹Siemens DI SW STS, Budapest, Hungary; ²STMicroelectronics S.p.A, Agrate Brianza MB, Italy
- 07

J-Fraction Approach for Calculating Thermal Structure Functions

Nils J. Ziegeler¹, Peter W. Nolte², Stefan Schweizer^{1,2}

¹Faculty of Electrical Engineering, South Westphalia University of Applied Sciences, Soest, Germany; ²Fraunhofer Application Center for Inorganic Phosphors, Branch Lab of Fraunhofer IMWS, Soest, Germany
- 08

Thermal Characterization Issues of LEDs during Reliability Testing

János Hegedüs, Gusztáv Hantos, András Poppe, Máté Lukács, Bence Bodnár, Gyula Lipák

Department of Electron Devices, Faculty of Electrical Engineering and Informatics, Budapest University of Technology and Economics, Budapest, Hungary
- 09

Mutual Thermal Couplings in Selected Networks with Power LEDs

Krzysztof Górecki¹, Przemysław Ptak¹, Marcin Janicki²

¹Gdynia Maritime University, Gdynia, Poland; ²Politechnika Łódzka, Łódź, Poland
- 10

Performance Analysis of Perovskite Solar Cell by Considering Temperatures Effect on Physical Parameters of the Absorber Layer

Ahmad Halal¹, Ahmed Issa Alnahhal^{1,2}, Balázs Plesz¹

¹Budapest University of Technology and Economics, Budapest, Hungary; ²University of Palestine, Ghazah, Palestine

→ POSTER
INTRODUCTIONS II

- 11

Multi-Objective Evolutionary Optimization of Multi-node Network for Thermal Modelling of Electronic Package

Eric Monier-Vinard, Najib Laraqi
Paris Nanterre University, Paris, France
- 12

Study of Two-phase Microchannel Heat Sink Fabricated by A.M. Technology

Nan Chen¹, Yunshui Chen², He Zhao³
¹Advanced Liquid Cooling Technologies; ²Airsys Cooling Technologies; ³Airsys Singapore
- 13

Including Transistor-level Hotspots in Standard Parameters and Models

Patrick Elebert¹, Xiaojie Xue², Colm Heffernan¹
¹Analog Devices, Inc., Limerick, Ireland; ²Analog Devices, Inc., Wilmington, MA, USA
- 14

Thermal-Electrical Model of Concentrated Photovoltaic-Thermoelectric Generator Combined System for Energy Generation

Ahmed Issa Alnahhal^{1,2}, Ahmad Halal¹, Balazs Plesz¹
¹Budapest University of Technology and Economics, Budapest, Hungary; ²University of Palestine, Gaza Strip, Palestine
- 15

Thermal-Hydraulic Characterization of Electronics Cooling Liquids: A Case Study of Jet Impingement Coldplate on Emulated CPU

Gemma Murray¹, Jonathan William Elliott¹, Richard Jenkins², Michel Thomas Lebon², Gerard Bryne¹, Anthony James Robinson¹
¹Trinity College Dublin, Dublin, Ireland; ²Nexalus Ltd., Cork, Ireland.
- 16

Mass-Diffusivity Determination of Four Tropical Wood used in Benin

Carlos Alain Houngbeme¹, Armand Djossou¹, Aristide Houngan^{1,2}
¹Energy and Applied Mechanics Laboratory (LEMA); ²Multidisciplinary Research Laboratory for Technical Education (LARPET) ENSET Lokossa, Brnin

- 17

Failure Analysis by Infrared and Thermoreflectance Imaging Applied on Active Devices

Daniel May¹, Kenza Jbari³, Dominique Carisetti³, Ana Borta-Boyon³, Patrick Garabedian³, Afshin Ziaei³, Mohamad Abo Ras², Bernhard Wunderle¹
¹TU Chemnitz, Chemnitz, Germany; ²Berliner Nanotest & Design GmbH, Berlin, Germany; ³Thales Research, Palaiseau, France
- 18

Thermal Performance Analysis of a Pulsating Heat Pipe with a Long Adiabatic Section for Different Working Fluids

Sauro Filippeschi¹, Roberta Perna¹, Mauro Mameli¹, Maksym Slobodeniuk³, Luca Pagliarini², Cyril Romestant³, Luca Cattani², Vincent Ayel³, Fabio Bozzoli²
¹University of Pisa, DESTEC - Italy; ²University of Parma; ³Pprime Institute, CNRS – ENSMA – Universite de Poitiers
- 19

Measurements of the Thin Liquid Droplet Thickness by the Schlieren Method

Yulia Peschenyuk¹, Andrey Semenov¹, Evgeny Shatskiy², Gagik Ayvazyan³, Elizaveta Gatapova¹
¹Kutateladze Institute of Thermophysics SB RAS, Novosibirsk, Russia; ²Department of Mechanical, Manufacturing & Biomedical Engineering, Trinity College Dublin, Dublin, Ireland; ³National Polytechnic University of Armenia, Yerevan, Armenia

→ SESSION 2.3 – 2.4

Session 2.3: Thermal Measurements and Characterisation I

🕒 1.30 pm – 2.50 pm

→ Session Chair: Lorenzo Codecasa, Politecnico di Milano (IT)

1.30 pm **Void Detection in the Solder Layer between Power Semiconductor and PCB**

Nils Jahn, Martin Pfof
TU Dortmund University, Dortmund, Germany

1.50 pm **Raman Thermometry Characterization of GeSbTe Based Phase Change Materials**

Akash Rajendra Patil^{1,2}, Yannick Le-Friec², Jury Sandrini², Roberto Simola³, Philippe Boivin³, Emmanuel Dubois¹, Jean-François Robillard¹
¹Univ. Lille, CNRS, Centrale Lille, Junia, Univ. Polytechnique Hauts-de-France, UMR8520 - IEMN – Institut d’Electronique de Microélectronique et de Nano-technologie, Lille, France; ²STMicroelectronics, Crolles, France; ³STMicroelectronics, Rousset, France

2.10 pm **Experimental Three-dimensional Thermal Mapping of a GaN on RF-SOI Chip**

Isaac Haïk Dunn¹, Elyes Nefzaoui¹, Jérôme Loraine², Imene Lahbib², Georges Hamaoui¹, Tuyen Duc Nguyen¹, Brice Grandchamp², Philippe Bas-set¹, Gregory U’Ren²
¹Univ Gustave Eiffel, CNRS, ESYCOM Lab, Champs-sur-Marne, France; ²X-FAB France, Corbeil-Essonnes, France

2.30 pm **A Laser Stimulated Transient Thermal Analysis of Semiconductors**

Hannes Schwan¹, Maximilian Schmid², Gordon Elger¹
¹Technische Hochschule Ingolstadt, Ingolstadt, Germany; ²Fraunhofer IVI, Dresden, Germany

Session 2.4: Thermal Measurements and Characterisation II

🕒 3.30 pm – 4.50 pm

→ Session Chair: Mohamad Abo Ras, Berliner Nanotest und Design GmbH (DE)

3.30 pm **Thermo-electric Characterization of GST Materials for Smart Environment**

Gian Guido Gentili¹, Misagh Khosronejad¹, D’Asta Cristina¹, Codecasa Lorenzo¹, Squillantini Lorenzo¹, Draghi Lorenza¹, Nobili Luca¹, Spagnolini Umberto¹, Resteghini Laura², Milani Angelo², Mazzucco Christian²
¹Politecnico di Milano, Milano, Italy; ²Huawei Technology Italia

3.50 pm **Concepts for High throughput LED Testing and High-speed Optical Transients of LEDs**

András Poppe¹, János Hegedüs¹, Gusztáv Hantos¹, Péter Csuti²
¹Department of Electron Devices, Faculty of Electrical Engineering and Informatics, Budapest University of Technology and Economics, Budapest, Hungary; ²LightingLab Calibration Laboratory Ltd., Veszprém, Hungary

4.10 pm **Analytical Modeling and Numerical Simulation of Nonlinear Thermal Effects in Bipolar Transistors**

Vincenzo d’Alessandro¹, Ciro Scognamillo¹, Antonio Pio Catalano¹, Markus Müller², Michael Schröter², Peter Joseph Zampardi³, Lorenzo Codecasa⁴
¹University Federico II, Naples, Italy; ²TU Dresden, Dresden, Germany; ³Qorvo, USA; ⁴Politecnico di Milano, Milano, Italy

4.30 pm **Analysis of the Thermal Behavior of Li-Ion Pouch Battery Cell – Part II: Circuit-based Modeling for Fast and Accurate Thermo-Electrochemical Simulation**

Antonio Pio Catalano¹, Ciro Scognamillo¹, Francesco Piccirillo², Pierluigi Guerriero¹, Vincenzo d’Alessandro¹, Lorenzo Codecasa³
¹Dept. of Electrical Engineering and Information Technology, University Federico II, Naples, Italy; ²Dept. of Industrial Engineering, University Federico II, Naples, Italy; ³Politecnico di Milano, Milano, Italy

→ SOCIAL EVENTS

September 28, 2022

Welcome Reception: The Atrium, Trinity College

🕒 5.30 pm – 7.30 pm

The welcome reception on the first evening of the conference will be hosted in the Atrium of Trinity College Dublin, Ireland's highest ranked university and home to 18,000 undergraduate and postgraduate students. Trinity is the only Irish member of the prestigious League of 22 European Research Universities (LERU) and it is located within walking distance from the conference venue.

September 29, 2022

**Social Event & Gala Dinner –
Visit to the Guinness Storehouse**

🕒 6.45 pm – 11.00 pm

For our social event at this year's THERMINIC we have arranged a guided tour through the famous Guinness Storehouse at St. James's Gate brewery. This is one of Dublin's top attractions, with over 1 million visitors annually. You can immerse yourself in 7 floors of fun and excitement as you explore the story of Ireland's most iconic beer. The Gravity Bar offers a stunning panoramic view over the whole city. Let's dive into the history of Guinness in Dublin and experience the unique taste of Guinness.



THERMINIC 2022

– a truly green event!

We have taken great pains to make THERMINIC 2022 a “green event” in every sense of the word. To give but a few examples:

- Our conference venue is certified with the Green Key Award, a leading standard for excellence in environmental responsibility and sustainable operation within the tourism industry.
- The buffet choices at the conference venue are predominantly seasonal, regionally sourced, organically produced with as little packaging as possible
- All printed matter was printed on eco-certified materials
- We are not providing a stick or printed proceeding but sending a download link for the proceedings in order to save natural resources
- All conference materials were produced at exact numbers to avoid waste
- There are no plastic badge holders

Peatland conversation to mitigate climate change

This year the Therminic organizers are looking to Irish peatlands to help offset the participants' carbon footprint. This is because peatland habitats are the world leader in terms of stored terrestrial carbon. Known peatlands only cover about 3% of the world's land surface, but store at least twice as much carbon as all of Earth's standing forests.

The Irish Peatland Conservation Council restore damaged peatland habitat or help save a peatland through purchase of a site. We support their mission by buying an acre of bogland that will hopefully be restored to naturally sequester carbon once again.

<http://www.ipcc.ie/>

Friday, September 30, 2022

Keynote III:

🕒 9.00 am – 9.40 am

Unlocking Thermal Constraints on Electronics Systems: Key to
Revolutions in Transportation, Computing, and Communications

Prof. Justin A. Weibel

Session 3.1: Design and Simulation

🕒 9.40 am – 10.40 am

Coffee Break

🕒 10.40 am – 11.00 am

Session 3.2: Convective Two-Phase Cooling I

🕒 11.00 am – 12.40 pm

Lunch

🕒 12.40 pm – 1.40 pm

Session 3.3: Convective Two-Phase Cooling II

🕒 1.40 pm – 3.00 pm

Coffee Break

🕒 3.00 pm – 3.10 pm

Awards and Closing Remarks

🕒 3.10 pm – 3.30 pm

Chairs: Tim Persoons, Trinity College Dublin; John Janssen,
NXP Semiconductors; Vadim Tsoi, Huawei

→ SESSION 3.1 – 3.2

Session 3.1: Design and Simulation

🕒 9.40 am – 10.40 am

→ Session Chair: Marta Rencz, Budapest University of Technology and Economics (HU)

- 9.40 am

Extraction of Thermal Models for Electromigration Analysis at Advanced Nodes

Ron Martin¹, Aravind Vadakkekoithuruthil¹, Christoph Sohrmann¹, Volkhard Beyer¹, Avi Debnath², Hendrik Mau²

¹Fraunhofer IIS, Engineering of Adaptive Systems EAS, Dresden, Germany; ²GlobalFoundries Dresden, Germany
- 10.00 am

Sensitivity Analysis and Uncertainty Quantification of Data Processing Unit Thermal Model Dedicated for Micro-satellite Space Mission

Artur Jurkowski^{1,2}, Radosław Paluch¹, Marcin Wójcik¹, Adam Klimanek²

¹KP Labs, Gliwice, Poland; ²Silesian University of Technology, Gliwice, Poland
- 10.20 am

Design Optimization of Micro-Thermoelectric Cooler for Thermal Management using Finite Element Simulations

Rajvinder Kaur, Amit Tanwar, Parnika Gupta, N. Padmanathan, Peter O'Brien, Kafil Mahmood Razeeb

Tyndall National Institute, University College Cork, Cork, Ireland

Session 3.2: Convective Two-Phase Cooling I

🕒 11.00 am – 12.40 pm

→ Session Chair: Michael Gibbons, Trinity Colleg Dublin (IE)

- 11.00 am

Nucleate Pool Boiling Regimes Of Power Electronics Cooling

Ilya T'Jollyn^{1,2}, Jasper Nonneman^{1,2}, Wim Beyne¹, Michel De Paepe^{1,2}

¹Ghent University, Ghent, Belgium; ²FlandersMake@UGent – Core lab EEDT-MP, Ghent, Belgium
- 11.20 am

Simulation and Experimental Investigation of Single and Two-phase Cold Plate Using HFE 7100 with Discrete Heat Sources

Ammar Osman, Yogendra Joshi

Georgia Institute of Technology, Atlanta, USA
- 11.40 am

Numerical Simulations of Conjugate Heat Transfer Effects on Single- and Two-Phase Cooling via Multi-Microchannels Heat Sinks

Mirco Magnini¹, Federico Municchi²

¹University of Nottingham, Nottingham, United Kingdom; ²Colorado School of Mines, Golden, USA
- 12.00 pm

Investigation of Groove Heat Pipe Embedded Cold Plate Design with Additive Manufacturing Technologies

Vedat Yagci^{1,2}, Murat Parlak¹, Sertac Cadirci²

¹ASELSAN INC- REHIS-Engineering Division, Ankara, Turkey; ²Istanbul Technical University, Istanbul, Turkey
- 12.20 pm

The Impact of Roughness Parameters on Laminar Convective Heat Transfer Applied to Additive Manufactured Minichannels

Mohammadreza Kadivar^{1,2}, David Tormey^{1,2}, Gerard McGranaghan^{1,2}

¹Atlantic Technological University, Sligo, Ireland; ²I-Form, The SFI Advanced Manufacturing Research Centre, Dublin, Ireland

→ SESSION 3.3

Session 3.3: Convective Two-Phase Cooling II

🕒 1.40 pm – 3.00 pm

→ Session Chair: Justin Weibel, Purdue University (USA)

1.40 pm Evaluation of the Performance of a Magnetic Shuttle Micropump in a Two-phase Mechanical Pumping Loop
Valeria Nico¹, Barry O'Donovan², Eric Dalton¹
¹University of Limerick, Limerick, Ireland; ²ASML, Leixlip, Ireland

2.00 pm Time-Resolved Measurement of Enhanced Phase Change by a Fiber in an Oscillating Two-Phase Plug Flow
Nooshin Karami, Albert Tessier-Poirier, Alihossein Nikkhah, Etienne Leveille, Luc Frechette
Laboratoire Nanotechnologies et Nanosystèmes, LN2 CNRS, Université de Sherbrooke, 3IT (Institut Interdisciplinaire d'Innovation Technologique), Sherbrooke, QC, Canada

2.20 pm Review on Flow Boiling Patterns in Microchannels
Joseph J Widgington, Atanas Ivanov, Tassos G Karayiannis
Brunel University London, London, United Kingdom

2.40 pm Immersion Cooling of Lithium-ion Batteries for Electric Vehicles
Niall Patrick Williams, Séamus O'Shaughnessy
Trinity College Dublin, Dublin, Ireland

Awards & Closing Remarks

🕒 3.10 pm – 3.30 pm

→ Session Chairs: Tim Persoons, Trinity College Dublin (IE); John Janssen, NXP Semiconductors (NL), Vadim Tsoi, Huawei (SE)



**CONFERENCE PROGRAM CHAIRS &
LOCAL ORGANIZING COMMITTEE**

Tim Persoons, Trinity College Dublin, Ireland
Michael Gibbons, Trinity College Dublin, Ireland
Anthony Robinson, Trinity College Dublin, Ireland
Rocco Lupoi, Trinity College Dublin, Ireland

ACKNOWLEDGEMENTS

Sara Doherty, Trinity College Dublin, Ireland

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