Advance Conference Program

The 24th Intersociety Conference on Thermal and Thermomechanical Phenomena in Electronic Systems

ITherm

DALLAS, TX

2025

Gaylord Texan Resort & Convention Center
Dallas, TX
May 27 – 30, 2025

IEEE Advancing Technology for Humanity

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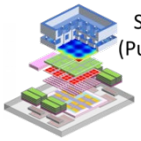

CONFERENCE DESCRIPTION

Sponsored by the IEEE's Electronics Packaging Society (EPS), ITherm 2025 is the leading international conference for the scientific and engineering exploration of thermal, thermomechanical and emerging technology issues associated with electronic devices, packages and systems. ITherm 2025 will be held along with the 75th Electronic Components and Technology Conference (ECTC 2025 - http://www.ectc.net), a premier electronics packaging conference at the Gaylord Texan Resort & Convention Center (Dallas, TX).

REGISTRATION

For registration link, schedule, rates and policies please visit our webpage:

https://www.ieee-itherm.net/itherm-2025-registration/.

Registrations include admission to all sessions, conference luncheons, continental breakfasts for all attendees, and an electronic copy of the conference proceedings. Joint registration for ITherm and ECTC is offered at a substantial discount. Registration prices increase after May 2, 2025.

Registration Type	**Early** *Until ~~April 1~~ April 11, 2025*	**Regular** *Until May 2, 2025*	**Late** *Door Registration*
IEEE Member	$775	$875	$925
Non-Member	$925	$1025	$1075
IEEE Life Member	$375	$475	$475
IEEE Student Member	$425	$525	$525
Student Non-Member	$525	$625	$625
IEEE Member Joint ITherm+ECTC	$1430	$1665	$1665
Non-Member Joint ITherm+ECTC	$1665	$1995	$1995
IEEE Member 1-Day	$675	$775	$775
Non-Member 1-Day	$825	$925	$925
IEEE Member Proceedings Only	$300	$325	$325
Non-Member Proceedings Only	$400	$425	$425

LODGING

The conference venue is the Gaylord Texan Resort & Convention Center (Dallas, TX). Special discounted hotel rates are available using the conference room block until May 3, 2025 or until rooms sell out. To reserve the hotel at the conference rates, please visit https://www.ieee-itherm.net/hotel-2025/ for more information. Rooms are filling up fast, so please reserve your rooms early.

CONNECT WITH ITHERM

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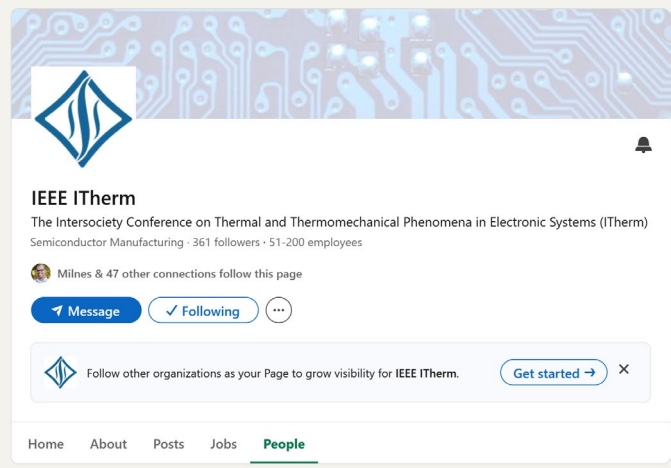

- Tag ITherm in your LinkedIn Posts using @IEEE ITherm
- Follow ITherm on X / X handle: @IEEE_ITherm
- Follow ITherm stories on Medium.com

CONFERENCE SUMMARY

- **Over 180 Technical Papers and presentations** organized across four Technical Tracks:
  - Component-Level Thermal Management (TI)
  - System-Level Thermal Management (TII)
  - Mechanics & Reliability (M)
  - Emerging Technologies & Fundamentals (E)

- **3 Keynote Talks**
  - **Future of AI Hardware Enabled by Advanced Packaging**
    Raja Swaminathan, Corporate VP, AMD
  - **Accelerating the Energy Transition through Digital Engineering and Simulation**
    Scott Parent, VP and Field CTO, Ansys
  - **Data Center Energy Efficiency in a Post-Exascale Era**
    Cullen Bash, VP of R&D, HP Labs

- **Richard Chu ITherm Award and Seminar**
  - **Energy and Thermal Management of Chips, Systems and Datacenters Necessitates a Return to Fundamentals**
    Chandrakant D. Patel, HP Chief Engineer and Senior Fellow (retired)

- **9 Technology-Talks** providing deep-dive talks on high-profile topics

- **4 Panels** discussing the latest industry challenges and trends

- **2 Panels** discussing special interest topics
  - COOLERCHIPS Research Overview
  - Technology Transition: From Concept to Commercialization

- **58 Student Posters** showcasing the latest research in an interactive networking environment

- **ASME/K16 & IEEE/EPS Student Design Challenge Presentations**

- **ECTC/ITherm Young Professional Networking Event**

- **2025 ECTC Student and Start-Up Innovation Challenge (open to ITherm delegates)**

- **16 Professional Development Courses** offered as a collaboration with ECTC

CONFERENCE ORGANIZATION COMMITTEE

ORGANIZATION COMMITTEE		
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Co-Chair	Darin Sharar	TauMat
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MECHANICS & RELIABILITY TRACK (M)		
Chair	David Huitink	University of Arkansas
Co-Chair	Paul Paret	NREL
Co-Chair	Sanjoy Saha	AMD
Co-Chair	Tiwei Wei	Purdue University
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Panels Co-Chair	Luca Amalfi	Seguente
Panels Co-Chair	Chirag Kharangate	Case Western Reserve University
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Technology-Talk Co-Chair	Rinaldo Miorini	GE
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Poster Session Co-Chair	Kalind Baraya	IBM Corporation
Poster Session Co-Chair	Karthekeyan Sridhar	TI
Keynote Chair	Justin Weibel	Purdue University
Keynote Co-Chair	Vadim Gektin	Qualcomm
PDC Short Course Chair	Jeffrey Suhling	Auburn University
PDC Short Course Co-Chair	Kitty Pearsall	IBM (Retired)

EPS/K16 Student Design Competition	P. Subrahmanyam	Dell
EPS/K16 Student Design Competition	Sameer Rao	University of Utah
EPS/K16 Student Design Competition	Chirag Kharangate	Case Western Reserve University
EPS/K16 Student Design Competition	Han Hu	University of Arkansas
EPS/K16 Student Design Competition	Tiwei Wei	Purdue University
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CONFERENCE EXECUTIVE COMMITTEE

The Executive Committee is made up of past ITherm General Chairs who are willing to assist the conference. It provides the leadership and continuity needed to carry forward the thrust of our Inter Society Conference.

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Cristina H. Amon	University of Toronto
Mehdi Asheghi	Stanford University
Sushil H. Bhavnani	Auburn University
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Michael Ohadi	University of Maryland / Flexnode
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Koneru Ramakrishna	Thermal Consultant
Bahgat Sammakia	State University of New York at Binghamton
Jeffrey Suhling	Auburn University
Sandeep Tonapi	Anveshak
Justin Weibel	Purdue University

KEYNOTES

Chairs: Justin Weibel (Purdue University) and Vadim Gektin (Qualcomm)

K-1: FUTURE OF AI HARDWARE ENABLED BY ADVANCED PACKAGING

WEDNESDAY, MAY 28, 9:30 AM – 10:30 AM

Raja Swaminathan
Corporate Vice President

AMD

Abstract: Chiplet architectures are fundamental to the continued economic viable growth of power efficiency of AI, 5G and edge computing. The slowing of Moore's law has also placed advanced packaging at the critical juncture of technology-architecture intersection driving unique product capabilities. New heterogeneous architectures like 2.5D architectures and 3D Hybrid bonded architectures driving AMD's industry leading advanced technology roadmap to enable power, performance, area, and cost (PPAC) will be discussed. Other topics including Chiplets for AI, challenges and solutions for large chiplet modules etc. will also be discussed.

Bio: Dr. Raja Swaminathan is the Corporate Vice President of Packaging at AMD, spearheading the development of AMD's advanced packaging and heterogeneous integration roadmap. With a distinguished career spanning roles at Intel, Apple, and now AMD, Dr. Swaminathan's expertise in design-technology co-optimization and dedication to optimizing power, performance, area, and cost (PPAC) have led to significant technological advancements such as EMIB, Apple's Mx packages, 3D V-Cache, and 3.5D architectures for AI accelerators. Dr. Swaminathan holds a PhD from Carnegie Mellon University and an undergraduate degree from IIT Madras. With over 100 patents and more than 40 published papers to their name, Dr. Swaminathan was recently recognized as an IEEE Fellow and serves as a technical advisor to multiple startups. His unwavering commitment to heterogeneous integration continues to drive the boundaries of silicon technology.

K-2: ACCELERATING THE ENERGY TRANSITION THROUGH DIGITAL ENGINEERING AND SIMULATION

THURSDAY, MAY 29, 9:30 AM – 10:30 AM

Scott Parent
Vice President & Field CTO,
Energy | Aerospace | Industrials

Ansys

Abstract: The energy transition depends on three critical pillars. First, better efficiency as the world wastes over 65% of the energy produced, converted and consumed. Secondly, we need to have reliable, securable energy for a growing global demand. And thirdly, we need to mature rapidly new low-carbon energy solutions such as renewables, hydrogen, SMR and Fusion. There are five digital scalers: 1- High performance multi-physics simulation 2- High performance computing 3- AI/ML methodologies 4- IoT, cloud and connected sensing and 5- Digital engineering, comprised of model-based systems development, digital twinning and mission engineering. These five technologies, when brought together, become a digital hyper scaling ecosystem. This enables engineers to develop, adapt, deploy, mature and scale new products & technologies faster with less risk, accelerating our transition to a more efficient and sustainable future.

Bio: Scott is currently VP & Field CTO at Ansys, connecting globally with customers to understand their digital engineering development needs and aligning methodologies Ansys has to support their transitions. Scott had a number of preceding CTO/COO roles with GE, BP and Baker Hughes.

Scott has a broad leadership background in technology from multi-physics simulation to robotics, analytics, sensors development, asset health monitoring, AI/ML, additive, computer vision, edge analytics and other associated 5-IR technologies. He sits on Pennsylvania State University's Nuclear Engineering Advisory Council and is a Trained Six Sigma Blackbelt.

Scott has a bachelor's degree in mechanical engineering from the University of Maine, and a master's degree in aerospace engineering from Pennsylvania State University.

K-3: DATA CENTER ENERGY EFFICIENCY IN A POST-EXASCALE ERA

FRIDAY, MAY 30, 9:30 AM – 10:30 AM

Cullen Bash
Vice President of Research & Development

Hewlett Packard Labs

Abstract: The growth of generative AI has led to unprecedented advances in information processing not thought possible a decade ago. It's also resulted in significant increases in energy consumption that are putting pressure on scalability and operations. This talk will cover recent research in improving the energy efficiency of data center and IT infrastructure.

Bio: Cullen is a Vice President of R&D at Hewlett Packard Labs and currently serves as Director of the Systems Architecture Lab. Focusing on a wide range of inter-related topics including system and fabric architecture, system software, simulation and modeling, software-hardware co-design, optimization and sustainability. The multidisciplinary lab is tasked with advancing next generation systems architecture from research to revenue.

Prior to his current focus on systems, he served as Director of the Platform Architecture Lab where he led a cross-functional hardware, software and architecture team that spanned several organizations and business units as part of the Machine program within Hewlett Packard Labs.

Cullen also served as interim Director of the Sustainable Ecosystems Research Group at HP Labs where he led wide-ranging research into the sustainability of IT equipment, and the use of IT to improve the sustainability of customer ecosystems. During this time, he was also Principal Investigator of the Sustainable Data Center project which investigated the design and operation of data centers to reduce overall resource consumption. In previous roles, he has led research in thermal technologies over a variety of different length scales, from integrated circuits to data centers. Cullen has also taught undergraduate and graduate level courses in heat transfer and electronics cooling. He is a Fellow of both IEEE and the American Society of Mechanical Engineers.

RICHARD CHU ITHERM AWARD FOR EXCELLENCE

ENERGY AND THERMAL MANAGEMENT OF CHIPS, SYSTEMS AND DATACENTERS NECESSITATES A RETURN TO FUNDAMENTALS

AWARD LUNCHEON TALK, WEDNESDAY, MAY 28, 12:30 PM – 2:00 PM,

2025 Richard Chu ITherm Awardee

Chandrakant D. Patel, P.E.
HP Chief Engineer and Senior Fellow (retired)

Hewlett Packard

Abstract: The mainframe era of high-performance computers led to innovative approaches in heat removal. The cooling solutions developed by Dr. Richard Chu and colleagues at IBM, including the thermal conduction module and multi-tier air-liquid hybrid cooling, were based on engineering fundamentals. Many individuals, including myself, referred to classic textbooks and models created by researchers at industrial and academic labs for heat transfer design and analysis. This comprehensive approach also included structural analysis due to the emergence of multi-chip modules in computer mainframes.

In the late 20th century, compute utilities evolved into large-scale data centers with densely packed standard computing, storage, and networking equipment. Power requirements for these modern data centers are in multi-megawatts, while AI data centers using planetary-scale data may reach gigawatt levels, comparable to hydroelectric power plants. The electrical energy supplied to chips converts to heat, requiring active cooling methods that also consume power.

Although many innovative measures have been implemented for heat removal and energy management in data centers, there is a notable gap in the application of engineering principles compared to the methods used by early contributors in Dr. Chu's era. For instance, early contributors often performed exergy (2nd law of thermodynamics) analysis for a comprehensive understanding. Indeed, many data centers today rely on power infrastructure established during the 19th century machine age. Contributors from that era, grounded in the 2nd law of thermodynamics, prioritized building hydro-electric power plants before constructing Aluminum factories. Given the continuous growth of data centers driven by AI and the associated energy demands, it is crucial to revisit these engineering fundamentals, especially considering environmental challenges.

In my talk, I will present a holistic approach that traces the energy flow from a power plant to a chip, and from the chip core to the cooling tower.

Bio: A former SVP, Chief Engineer, and Senior Fellow at HP Inc. - Chandrakant has been a Silicon Valley contributor for 42 years. Formerly leading HP Labs, he has shaped advancements in chips, high performance computing systems, storage, networking, 3D additive manufacturing systems, and software platforms. Pioneering energy-efficient data center solutions, he founded the Smart Data Center research

program at HP Laboratories that led to multi-billion-dollar data center infrastructure and services business. He is a recognized leader in AI, energy efficient computing, and sustainability.

With deep passion for fundamentals, and workforce development, he has also served as adjunct faculty in engineering at UC Berkeley, San Jose State, Santa Clara University and Chabot College for two decades. An IEEE Fellow, ASME Fellow, member of the National Academy of Engineering (NAE) and the Silicon Valley Engineering Hall of Fame, Chandrakant holds 167 US patents and has published more than 150 papers. He is a registered professional mechanical engineer in the State of California.

Chandrakant has served on the company board of Mphasis, an IT Services Company in India. He has also served on the Industrial Advisory Boards in EECS at UC Berkeley and Mechanical Engineering at Santa Clara University.

PROFESSIONAL DEVELOPMENT COURSES

A set of 16 Professional Development Courses (PDCs) are being offered as a collaboration between ITherm and ECTC conferences. Each of these courses are presented by world-class experts, enabling participants to broaden their technical knowledge base. All PDC courses will be held on Tuesday, May 27, 2025, the first day of the ITherm and ECTC conferences. A separate registration fee is required to attend these courses, and the PDC course registration can be performed at the ECTC registration website: https://www.ectc.net/registration/ or at the ECTC registration desk.

MORNING COURSES 8:00 AM – 12:00 PM

1. High Reliability Soldering in Semiconductor Packaging
Course Leader: Ning-Cheng Lee – Shinepure Hi-Tech

2. Photonic Technologies for Communication, Sensing, and Displays
Course Leader: Torsten Wipiejewski – Huawei Technologies

3. From Wafer to Panel Level Packaging
Course Leaders: Tanja Braun and Piotr Mackowiak – Fraunhofer IZM

4. Eliminating Failure Mechanisms in Advanced Packages
Course Leader: Darvin Edwards – Edwards Enterprises

5. Inroduction to and Advances in 2.3d Fan-Out Wafer Level Packaging (FO-WLP)
Course Leader: Beth Keser – Zero ASIC

6. Wafer-to-Wafer and Die-to-Wafer Hybrid Bonding for Advanced Interconnects
Course Leader: Viorel Dragoi – EV Group

7. Fundamentals of Fabrication Processes and RF Design of Advanced Packages including Fan-Out, Chiplets, Glass and Polymer Interposers
Course Leaders: Ivan Ndip – Brandenburg University of Technology/Fraunhofer IZM and Markus Wöhrmann – Fraunhofer IZM

8. Design of Reliable Data Center Cooling Systems
Course Leaders: Patrick McCluskey and Damena Agonafer – University of Maryland

AFTERNOON COURSES 1:30 PM – 5:30 PM

9. 3D Packaging Failure Analysis - Failure Mechanisms and Analytical Tools
Course Leader: Deepak Goyal – Independent Consultant

10. Diamond for Heterogeneous Integration
Course Leader: Joana Mendes – University of Aveiro

11. Chiplet, Heterogeneous Integration, and Co-Packaged Optics
Course Leader: John Lau – Unimicron

12. Analysis of Fracture and Delamination in Microelectronic Packages
Course Leader: Andrew Tay – National University of Singapore

13. Advanced Fan-Out Developments and Applications
Course Leaders: John Hunt and Jan Vardaman – Techsearch International, Inc.

14. Flip Chip Technologies
Course Leader: Shengmin Wen – TATA Electronics

15. Design-On-Simulation for Advanced Packaging Reliability and Life Prediction
Course Leaders: Kuo-Ning Chiang – National Tsing Hua University and Xuejun Fan – Lamar University

16. Current and Future Challenges and Solutions in AI & HPC System and Thermal Management
Course Leader: Gamal Refai-Ahmed – AMD

HETEROGENEOUS INTEGRATION ROADMAP (HIR) SPECIAL SESSIONS

TUESDAY, MAY 27, 8:00 AM – 5:30PM

Chairs: Ravi Mahajan (Intel) and William Chen (ASE)

- IoT & AI at the Edge
- Advancing Heterogeneous Integration through Metrology & AI
- Integrating Photonics in HPC & Network Systems
- Advances in Panels, Substrates and Printed Circuit Boards

YOUNG PROFESSIONALS NETWORKING PANEL

TUESDAY, MAY 27, 7:00 – 7:45 PM

Chair: Aakrati Jain (IBM)

Join us for an invaluable opportunity to connect with industry leaders and fellow emerging talents! Tailored specifically for young professionals, including current graduate students, this event is crafted with your needs in mind. Engage in dynamic interactions with senior EPS members and professionals through a series of active and engaging activities. Seize the chance to delve deeper into packaging-related topics, pose career questions, and connect with industry professionals for a valuable learning experience.

2025 ECTC STUDENT & START-UP INNOVATION CHALLENGE

WEDNESDAY, MAY 28, 6:30 – 8:30 PM

Chair: Rozalia Beica (Rapidus), Farhang Yazdani (BroadPak) and Jason Rouse (Taiyo America, Inc.)

This session is organized as a competition and will have competing pitches of both student teams and start-ups followed by deliberation of a jury panel, awards announcements, and networking session. We will have three student pitches and six start-up pitches (7 min. each) followed by Q&A from the jury panel. The Q&A will be open to the audience. The jury will deliberate and choose the winning student team and start-up. The session will end with the announcement of the winners and a networking session.

STUDENT POSTER & NETWORKING SESSION

THURSDAY, MAY 29, 5:30 – 7:00 PM

Students get the opportunity to present their research and interact with other conference attendees from industry and academia during the Student Poster and Networking Session. They can also distribute resumes and get connected to industrial representatives. Outstanding posters will be selected for awards and will be judged based on technical merit, clarity and self-sufficiency of the content, novelty and originality of the work, overall impact of the poster display, and oral presentation at the poster session.

ASME/K16 & IEEE/ EPS STUDENT DESIGN CHALLENGE

WEDNESDAY, MAY 28, 5:30 – 6:30 PM

The Student Design Challenge is a team competition in which students design, analyze, and optimize an additively manufactured cold-plate to cool constant heat flux power electronics modules that are subjected to forced convection liquid cooling using water. The design from each student team is evaluated based on a series of design and manufacturing criteria. Those with the highest predicted performance and creativity, will be 3D printed and tested. Thanks to our printing sponsor (Fabric8Labs), testing sponsors (Intel and the S-PACK lab at Purdue University) and competition sponsors (Accelsius and Toyota).

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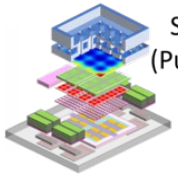
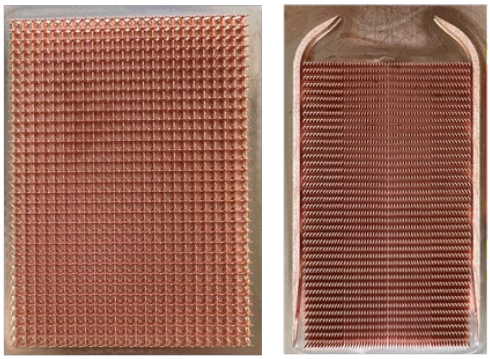


S-PACK (Purdue)

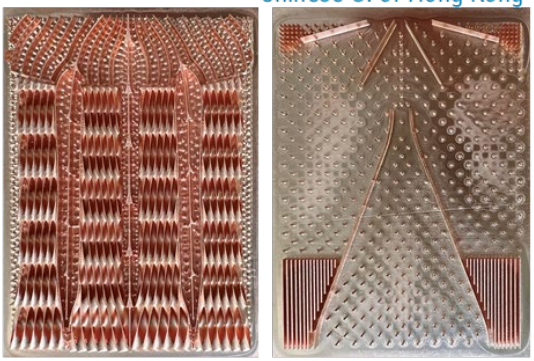
FINALISTS

Aero Product
U. Of Nottingham - China



Chilly Platter
U. of Bristol, U. of Sheffield,
U. of Nottingham, & Loughborough U.

CUHK MAE
Chinese U. of Hong Kong



MSAM MDAM
U. of Waterloo
U. of Alberta

EPS PRESIDENT'S PANEL SESSION

ECTC AT 75: CELEBRATING THE PAST, INNOVATING FOR THE FUTURE

FRIDAY, MAY 30, 8:00 - 9:15 AM

Chair: Patrick Thompson (Texas Instruments)

Join EPS/ECTC luminaries as they share:

- Early memories of ECTC and key innovations that revolutionized the industry
- What's happening now that is exciting to them
- Their thoughts on what we'll be reviewing at the 100th ECTC

SPECIAL INTEREST PANELS

TECHNOLOGY TRANSITION: FROM CONCEPT TO COMMERCIALIZATION

THURSDAY, MAY 29, 4:00 – 5:30 PM

Session Chairs: Patrick Shamberger (Texas A&M University), Sreekant Narumanchi (NREL), and Satish Kumar (Georgia Tech)

This panel will discuss the process, challenges, and best practices of moving emerging technologies from research and development into operational use. Panelists will include start-up companies and small businesses describing their experiences, as well as federal and private funding representatives speaking to expectations and pitfalls of the commercialization process. This panel will explore key factors such as funding, commercialization strategies, and collaboration models that facilitate successful transitions. Panelists will share individual case studies and insights on overcoming barriers, followed by a moderated discussion and Q&A session with the audience

Speakers:

- **Richard Bonner**, CTO & CPO, Accelsius
- **Baratunde Cola,** CEO & Founder, Carbice
- **Brent Ridley,** Tech-to-Market Advisor, ARPA-e

ARPA-E COOLERCHIPS RESEARCH OVERVIEW

FRIDAY, MAY 30, 8:15 – 9:15 AM (PART 1) & 11:30 AM – 12:30 PM (PART II)

Moderator: Peter de Bock (ARPA-e)

The $42M ARPA-E COOLERCHIPS program supports high risk/high reward technology concepts to cool high density (AI) compute systems to enable next generation high density computing. The teams have to achieve this performance while simultaneously achieving a transformational reduction in cooling energy use and achieving similar or higher reliability and cost effectiveness than systems today. The teams supported have developed their first server concepts and will share their progress, learnings and projection for the future.

Speakers:

Hybrid-Cooling
- **Ali Heydari,** NVIDIA
- **Dereje Agonafer,** UT Arlington

Single-Phase
- **Mike Ohadi,** Flexnode
- **Chris Roper,** HRL
- **Evgeny Shatskiy**, UIUC
- **Michael Cumbie,** HPI

Tools
- **Pat McCluskey,** UMD

Thermosyphon or Self/Hybrid-Pumped Systems
- **Kim Saviers,** RTX
- **Saeed Moghaddam,** UF
- **Chanwoo Park,** University of Missouri
- **Todd Salamon,** Nokia Bell Labs

Two-Phase Pumped
- **Pritish Parida**, IBM
- **Tiwei Wei,** Purdue

TECHNOLOGY-TALKS

TT-01: DESIGN CHALLENGES FOR MOSA TACTICAL SYSTEMS IN HARSH ENVIRONMENTS

WEDENSDAY, MAY 28, 8:15 – 9:15 AM

EFFECTS OF PUSHING HIGH PERFORMANCE COMPUTING SOLUTIONS WITHIN POWER LIMITED, SWAP-OPTIMIZED CONSTRAINT AND REQUIREMENTS IN OPEN SYSTEM ARCHITECTURES

Thomas King
Distinguished Staff Engineer
Emerging Technologies
GE Aerospace Avionics

Abstract: This presentation addresses the thermal challenges in high-performance computing (HPC) applications within SOSA-aligned VNX and small form factor (SFF) modular systems, emphasizing a systems engineering approach to balancing SWaP (Size, Weight, and Power) constraints. With the growing adoption of modular and interoperable architectures for edge computing, aerospace, and defense applications, the integration of advanced thermal management solutions is critical to maintaining computational efficiency and system reliability in demanding environments and explores the interplay of thermal management solutions, modular design, and HPC capabilities in SOSA frameworks through a systems engineering lenses.

Bio: Thomas King is a Distinguished Staff Engineer with over 25 years of experience in the Department of Defense (DoD) aerospace sector, having worked with industry leaders such as Lockheed Martin, Boeing, and GE Aerospace. He holds a Master's degree in Electrical Engineering from Syracuse University and a Bachelor's degree in Electrical Engineering from Oakland University. Thomas specializes in open mission systems and serves as the Chief Architect for Mission Systems within the Advanced Technology Organization (ATO).

TT-03: HIGH FIDELITY SIMULATION OF BOILING COOLANTS, NEW APPROACHES, CHALLENGES AND OPPORTUNITIES

WEDNESDAY, MAY 28, 2:00 - 3:30 PM

THE ROLE OF HIGH-PERFORMANCE COMPUTING FOR THE ADVANCEMENT OF MULTI-PHASE HEAT TRANSFER FLOWS IN ELECTRONICS COOLING

Constantine M. Megaridis
James P. Hartnett Professor of Energy Engineering
University Distinguished Professor
University of Illinois Chicago

Abstract: 3D Heterogeneous Integration (3DHI) of electronic components has attracted attention due to its promise to produce advanced packages with superior power-handling capabilities. But 3DHI faces critical challenges posed by the ever-increasing power requirements, the limited space available for the

package, the reduced access to the hot spots and the inability of single-phase cooling approaches to handle the required power loads. Among several approaches that are considered for cooling 3D-integrated stacks, microchannel flows of phase-changing fluids offer an attractive option for keeping the heat sensitive components within their safe temperature limits. Multiphysics modeling can guide the design of microchannel cooling strategies where heat fluxes may exceed 1 kW/cm2 in packages with characteristic length scales below a few centimeters. These conditions necessitate refrigerant flows whose residence times are in the millisecond range. When one considers the transient nature of these flows, along with the wide range of length scales (microns to cm) and time scales (milliseconds to seconds) that must be resolved, the computing requirements exceed those available in typical laboratory installations. High Performance Computing (HPC) resources offer an attractive option, but these become prohibitive -due to high licensing fees- when commercial CFD packages are employed. We present examples of a public-domain model (OpenFOAM) used to analyze diverging microchannel flows with Reynolds numbers in the turbulent regime. These examples offer a glimpse of how such models can be enhanced to create tools for analyzing complex multi-phase, multi-dimensional flows encountered in cooling of electronic packages. Challenges and opportunities are discussed, and ideas are offered on how various computational approaches can be used in a complementary fashion to promote technological advancement.

Bio: Dr. Megaridis holds the James P. Hartnett Chair of Energy Engineering and is the Director of the Micro/Nanoscale Fluid Transport Laboratory at the U Illinois Chicago (UIC). He received his Ph.D. in Fluid/Thermal Sciences from Brown University, and a M.S. in Applied Mathematics also from Brown. He is a Fellow of the American Physical Society and the American Society of Mechanical Engineers. He was named UIC Distinguished Professor in 2018, UIC Inventor of the Year in 2015, and University of Illinois Scholar in 2012. His current research activities focus on thermal management, multiphase heat and mass transfer, multifunctional coatings and interfacial phenomena relevant to micro and nanotechnologies.

Advances in Two-Phase Modeling Research to Meet Future Thermal Management Challenges

Chirag Kharangate
Assistant Professor
Mechanical and Aerospace Engineering
Case Western Reserve University

Abstract: Developments in many modern applications are encountering rapid escalation in heat dissipation, coupled with a need to decrease the size of thermal management hardware. These developments have spurred unprecedented interest in replacing single-phase hardware with other more efficient configurations including two-phase boiling and condensation counterparts. However, accurately modeling of two-phase thermal transport has been a challenge for decades leading to limited implementation of these technologies. In today's talk, I will showcase fundamental research being conducted to gain clarity on thermal transport in flow boiling and flow condensation configurations. For both flow boiling and flow condensation, a combination of theoretical, computational, and data sciences driven approaches to modeling phase-change will be covered. In the theoretical part, control volume-based approaches to modeling phase-change performance parameters will be discussed. In the computational part, various approaches to developing computational fluid dynamics (CFD) simulations for predicting transient and steady-state boiling and condensation configurations will be discussed. In the data sciences part, machine learning approaches like physics-informed neural network (PINN) for model discovery and PINNs-based CFD modeling will be discussed. With development of novel thermal design tools, this research effort aims to increase the implementation of boiling and condensation across systems and devices to meet their future heat dissipation needs.

Bio: Chirag Kharangate is an Assistant Professor of Mechanical and Aerospace Engineering at Case Western Reserve University and Director of the Two-Phase Flow and Thermal Management Laboratory, where his group addresses research and development needs in electronics packaging and thermal management technologies utilizing single-phase and two-phase flows for automotive, computer,

defense, and aerospace applications. Dr. Kharangate's research group explores methodologies for testing and modeling flow boiling, flow condensation, and single-phase cooling schemes. He complements his experimental and theoretical work with the development of computational fluid dynamics (CFD) as well as novel machine learning tools for predicting phase change phenomena. Dr. Kharangate has co-authored over 90 refereed journal and conference papers (h-index of 25). He has been recognized by the Case School of Engineering Research Award, ASME K-16 Outstanding Early Faculty Career in Thermal Management Award, ASME EPPD Early Career Engineer Award, and the Office of Naval Research Young Investigator Program Award.

HYBRID METHODS FOR OPTIMAL MODELING OF COMPONENTS AND SYSTEMS WITH TWO PHASE FLOW AND HEAT TRANSFER

David Geb
Applications Engineer
ANSYS

Abstract: Liquid cooling has emerged as a prominent solution for electronics thermal management and has gained mainstream application in areas such as datacenters (e.g. processor cooling in servers), and electric vehicles (e.g. battery, motor and inverter cooling). While single phase is common, two-phase flow and heat transfer designs are beneficial in many cases. Methods for modeling two phase flow hydraulics and heat transfer have been established. However, they can be costly (in terms of computing resources), difficult to implement, or lacking fidelity. An optimal modeling method might consider a complementary, hybrid modeling approach. However, such hybrid modeling methods are less established. One potential hybrid modeling method could implement co-simulation of a 3D model and a 0D/1D model representing different domains, coupled across a heat transfer interface. Another could implement embedded thermal Reduced Order Models (ROMs) within a CFD model. Such approaches have benefits but come with challenges. This talk will highlight such approaches. An optimized hybrid model that balances cost and accuracy can overcome modeling challenges and enable improved design space exploration for components and systems with two phase flow and heat transfer.

Bio: David Geb is an Application Engineer at Ansys, specializing in electronics thermal management applications. He has been with Ansys for over 10 years. Prior to Ansys he received his Ph.D. in Mechanical Engineering from UCLA and was a postdoctoral scholar at University of Colorado Boulder.

TT-05: WHAT'S NEEDED TO DECARBONIZE DATA CENTERS?

THURSDAY, MAY 29, 8:15 – 8:45 AM

Dustin Demetriou
Senior Technical Staff Member
IBM Infrastructure Advanced Thermal Energy Efficiency Lab
IBM

Abstract: Technology and digitization are key to achieving the net zero goals necessary to mitigate the worst impacts of climate change. The data center industry has been at the forefront of working towards these goals with continual innovation in IT and data center cooling designs. With the growing demand for AI, the industry needs to again refocus around the conversation of lifecycle emissions impact. This Tech Talk session will provide a review of the relevant industry sustainability frameworks, how they apply to the data center industry, and where the biggest opportunities exist to continue pushing towards Net Zero. It will discuss targets and metrics across multiple disciplines - energy efficiency, renewable energy, water, circular economy, and heat reuse – and the latest research going on in these areas. Lastly, it will

talk about the evolving data center landscape, from enterprise to colocation services to cloud services and how these impact an organization's emissions.

Bio: Dustin Demetriou is a Senior Technical Staff Member and leads sustainability and data center innovation for IBM Infrastructure. He is an Accredited Sustainability Advisor by the Uptime Institute and an ASHRAE Distinguished Lecturer. He holds a Ph.D. in Mechanical and Aerospace Engineering from Syracuse University. He is a globally recognized expert in the field of thermal management and data center energy efficiency and is the current Chair of the ASHRAE Technical Committee 9.9 (TC 9.9) IT Subcommittee and the past Chair of ASHRAE TC 9.9. He is a past Chair of the IEEE ITherm conference and currently serves on the Executive Committee.

TT-07: ELECTRIC VEHICLE THERMAL MANAGEMENT

THURSDAY, MAY 29, 2:00 – 3:30 PM

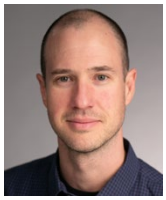
ADVANCED POWER ELECTRONICS AND ELECTRIC MACHINES PACKAGING AND THERMAL MANAGEMENT

Sreekant Narumanchi
Distinguished Member of Research Staff
Advanced Power Electronics and Electric Machines Group Manager
National Renewable Energy Laboratory (NREL)

Abstract: Power electronics and electric machines are being used and envisioned for use in vehicles as well as in other applications. In this presentation, I will describe some challenges and opportunities for power electronics and electric machines for vehicular applications. After that, I will give an overview of my group's recent research activities in power electronics, electric machines and integrated traction drive systems with a focus on packaging and thermal management.

Bio: Sreekant Narumanchi is a Distinguished Member of Research Staff, and the Group Manager of the Advanced Power Electronics and Electric Machines (APEEM) Group within the Energy Conversion and Storage Systems Center at the National Renewable Energy Laboratory, in Golden, CO, U.S.A., where he is currently in his 21st year. He leads a Group of 15 full-time researcher staff members focused on electro-thermal, thermal-fluids, thermo-mechanical and reliability aspects of power electronics and electric machines for electric-drive vehicles and multiple other applications. Over the years, his group has collaborated with almost 100 institutions cutting across industry, universities, national labs, federal agencies, and other research institutions.

Sreekant is an American Society of Mechanical Engineers (ASME) Fellow, and an Institute of Electrical and Electronics Engineers (IEEE) Senior Member. He has published over 125 peer-reviewed journal- and conference papers and book chapters. Professionally, he is active in leadership roles on multiple committees, advisory boards, conferences, and journals – including those under IEEE and ASME. Some of the external awards Sreekant has received include the 2023 ASME Avram Bar-Cohen Memorial Medal, and the 2022 THERMI Award. Sreekant received a Ph.D. from Carnegie Mellon University (2003), M.S. from Washington State University (1999), and B. Tech. from Indian Institute of Technology Kanpur (1997), all in Mechanical Engineering.



SELECT TECHNOLOGIES FOR COOLING OF HIGH HEAT FLUX POWER SEMICONDUCTOR DEVICES

Ercan Dede
Director, Electronics Research Department
Toyota Research Institute of North America

Abstract: The aim of this talk is to examine advancements in cooling technologies for high-performance power semiconductor devices, and particular focus is placed on concepts researched and developed in the last ~15 years. Starting from a summary of a preceding strategic analysis in the late-2000 timeframe, we more deeply explore technologies categorized into four main groups: single-phase (especially jet impingement) cooling, microchannel cooling, two-phase cooling, and embedded (or near-junction) cooling. Based on the research outcomes, we highlight the significance of effective thermal management utilizing these technologies in enhancing the performance of power electronics, especially as devices operate at higher power densities. Key findings include the rapid growth of novel thermal-fluid design methods, such as multiphysics topology optimization for conjugate heat transfer, and exploration of associated prototypes, such as combined single-phase jet impingement plus microchannel, two-phase jet impingement, and near-junction chip-embedded coolers. Demonstrated design methods and cold plate concepts are shown to have promise in reducing thermal resistance and improving heat transfer efficiency, and tradeoffs between the various cooling technology categories are identified. Finally, we will cover the ongoing need for innovative cooling solutions to meet the demands of next-generation power electronics and directions for future research in this critical area.

Bio: Ercan (Eric) Dede received his BS degree and PhD in mechanical engineering from the University of Michigan and an MS degree in mechanical engineering from Stanford University. Currently, he is the Director of the Electronics Research Department at the Toyota Research Institute of North America. He is a Fellow of the American Society of Mechanical Engineers (ASME) and a Senior Member of the Institute of Electrical and Electronics Engineers (IEEE). His team focuses on vehicle systems involving advanced sensors, human-machine interfaces, power semiconductors, electronics and photonics packaging, and thermal management technology. He has 240+ issued patents and has published more than 125 articles in archival journals and conference proceedings on topics related to design and structural optimization of thermal, mechanical, and electromagnetic systems. He is an author of a book entitled “Multiphysics Simulation: Electromechanical System Applications and Optimization.” His team has received two R&D 100 Awards for the development of technologies related to next-generation electronics for electrified vehicles. He currently serves as an Associate Editor for the ASME Open Journal of Engineering and a Guest Editor for IEEE Transactions on Components, Packaging and Manufacturing Technology.

EV HIGH VOLTAGE SYSTEM THERMAL PERFORMANCE AND IMPACT ON RELIABILITY

Unique Rahangdale
Senior Staff/Lead Reliability Engineer
Rivian

Abstract: The burgeoning electric vehicle (EV) market demands systems with increased power output and efficiency. Battery and power electronics, including inverters, motors, and energy management systems, are crucial for converting chemical energy into final kinetic energy. To achieve sustainability goals, minimizing losses and maximizing the conversion of input power to useful power is paramount. This necessitates sophisticated thermal management strategies. Battery systems require optimal operating temperatures, achieved through both active cooling and heating, while other high-voltage systems rely on efficient cooling to minimize losses. Critically, the temperature of these systems is intrinsically linked to their reliability, making accurate assessment of component lifespan a primary concern.

This presentation discusses the approach and overview that prioritizes both thermal performance and reliability, especially within the context of dynamic vehicle operation, including demanding off-road scenarios. The drive definition is critical in knowing required load for vehicle in development therefore using virtual simulation techniques, incorporating realistic drive cycle inputs to analyze thermal profiles and assess reliability is part of development process. This virtual prototyping enables iterative design optimization, where thermal management solutions are refined based on Simulink simulation results. The outcome assures the system runs within the rated temperature limit but design for reliability assess distribution of thermal over life and can provide stricter rated limit to demonstrate better life. By integrating these considerations, we can develop robust and efficient thermal management strategies for high-performance electric vehicles. This presentation will provide a comprehensive overview of these processes and their application in the EV industry.

Bio: Unique Rahangdale is a Senior Lead Reliability Engineer at Rivian Automotive Inc., where he has worked for over four years. He leads the reliability of electric power conversion systems, including inverters, motors, and energy management systems. With nearly a decade of experience, patent, and published research in electronics reliability, Unique has a proven track record of implementing innovative solutions that enhance product durability. Prior to Rivian, he honed his expertise at Joby Aviation as a Design for Reliability Engineer, focusing on electric vertical takeoff and landing (eVTOL) aircraft. His diverse background also includes a role as a Reliability Simulation Scientist at Waymo, where he contributed to the development of high safety lidar and computing product for autonomous vehicles. Unique holds a master's degree and has returned to academia to pursuing a Ph.D. under the guidance of Professor Dr. Dereje Agonafer, further deepening his knowledge of reliability challenges in heterogeneous packaging. With his extensive experience across various industries, including automotive, aviation, and autonomous driving, Unique Rahangdale loves to participate in discussion related to reliability challenges and provide his inputs to contribute towards sustaining future.

PANEL SESSIONS

P-02: DATA CENTER / LIQUID COOLING

WEDNESDAY, MAY 28, 11:00 AM – 12:30 PM

Moderator: Luca Amalfi (Seguente)

Panelists: Alfonso Ortega (Villanova University), Nitin Karwa (Honeywell), Remco van Erp (Corintis), Filippo Cataldo (Wieland)

Data processing, transport, and storage demands are exponentially increasing, driven by applications in mobile broadband, video/gaming, cloud, 5G networks, Artificial Intelligence, and Internet of Things. Such trends are directly linked to next-generation “digital transformation”, which is dominated by intelligent machine-to-machine and human-to-machine communications, automating “everything everywhere” in a new ecosystem. This has profound implications in terms of overall design that mandates greater system functionalities per unit volume, inevitably associated with higher heat densities. Consequently, thermal management using liquid-cooling approaches will be critical to solve increasingly onerous sustainability and performance challenges pressing the large-scale computing and telecommunication systems, which are driving the integration of digital technology into nearly every corner of a society at an unprecedented pace. A panel of distinguished members will share their vision on the future of liquid-cooling technology for data centers.

P-04: THERMAL/MECHANICAL CHALLENGES AND OPPORTUNITIES OF ADVANCED MOBILE/AI/IOT COMPUTING DEVICES AND BEYOND

WEDENSDAY, MAY 28, 4:00 – 5:30 PM

Moderator: Victor Chiriac (Global Cooling Technology Group)

Panelists: Eric Bert (Exentis AG), Yogendra Joshi (DARPA), Russell Kemp (Diamond Foundries), Amy Marconnet (Purdue University), Rozalia Beica (Rapidus Japan)

The demand for higher performance, faster processors, and increased data capacity drives advancements in heterogeneous computing. This includes CPUs, GPUs, and high-speed interconnects, among other elements. The rise of 5G and IoT has enabled innovations in Smart Cities, autonomous vehicles, AR/VR, AI robotics, and digital healthcare. This panel will discuss the future of thermal management for electronics across scales and address system-level thermo-mechanical challenges.

P-05: INTEGRATED ELECTROMECHANICAL, FLEXIBLE AND THERMAL DEVICES

THURSDAY, MAY 29, 8:15 – 9:15 AM

Moderator: Janos Veres (NextFlex US)

Panelists: Andras Vass-Varnai (Siemens), Pradeep Lall (Auburn University), Mike Matthews (Fabric8Labs), Mark Polis (SUNY Binghamton)

Advanced Packaging is becoming critically important for semiconductor scaling as we are approaching the limits of miniaturization. In turn, packaging architectures of increasing complexity require managing not only electrical, but also mechanical, thermal, and environmental effects. As scales of integration are converging from silicon to entire systems, these effects must be addressed at ever higher level. Multi-functional, integrated electromechanical systems are emerging, with examples in medical, wearable, robotics, automotive and aerospace applications. The panel will discuss trends in multi-functional integration and their impact on design automation, materials, process technologies, manufacturing, and supply chains.

P-06: THERMAL MANAGEMENT TECHNOLOGIES FOR HIGH-POWER SYSTEMS

THURSDAY, MAY 29, 11:00 AM – 12:30 PM

Moderator: Kimberly Saviers (RTX)

Panelists: Chirag Kharanagate (Case Western Reserve University), Satish Kumar (Georgia Institute of Technology), Rinaldo Miorini (GE Research), Arun Muley (Boeing), Darin Sharar (TauMat)

As aerospace systems continue to push the boundaries of performance, efficient thermal management is critical to ensuring reliability and operational efficiency. This panel will bring together experts to discuss cutting-edge approaches, challenges, and innovations in electronics cooling for high-power, aerospace, and space applications. Topics will include advancements in thermal management techniques, novel cooling technologies, integration strategies, and emerging applications. With increasing power densities and demanding environmental conditions, cooling techniques such as liquid cooling, two-phase heat transfer, and advanced thermal materials are required to address thermal challenges. These innovative approaches enable improved heat dissipation, allowing electronics to operate with higher power, higher power density, more efficiently, and more reliably.

CONFERENCE TECHNICAL PROGRAM

TRACKS & SESSIONS

COMPONENT-LEVEL THERMAL MANAGEMENT

- TI-01 Jet Impingement
- TI-02 TIM and Heat Spreader Characterization
- TI-03A TIM and Heat Spreader Design
- TI-03B Packaging and Thermoelectrics
- TI-04 Topology Optimization
- TI-05 Capillary-Driven Two-Phase Flow
- TI-06 Pump-Driven Two-Phase Flow
- TI-07A Embedded and Immersion Cooling
- TI-07B Advanced Modeling and Characterization
- TI-08 Power Electronics Cooling
- TI-09 TIM and Heat Spreader Development
- TI-10 Thermosiphons, Heat Pipes and Vapor Chambers

SYSTEM-LEVEL THERMAL MANAGEMENT

- TII-01 Liquid Cooling Solutions
- TII-02 PCM and Transient Cooling
- TII-03 Data Center Liquid Cooling Reliability and Leak Mitigation
- TII-04 Data Center Scaling and Machine Learning
- TII-05 Immersion Cooling I
- TII-06 Data Center Direct Liquid and Immersion Cooling
- TII-07 Next-Gen Electronics Systems Co-Design
- TII-08 Air Cooling and Heat Exchangers
- TII-09 Microchannels and Jet Impingement
- TII-10 Immersion Cooling II

EMERGING TECHNOLOGIES & FUNDAMENTALS

- E-01 Heat Pipes and Wicking Structures
- E-02 Power Electronics, Photonics, and Flexible Electronics
- E-03 Thermophysical Properties and Interfacial Thermal Transport
- E-04 Additive Manufacturing I
- E-05 Boiling and Condensation
- E-06 Boiling Enhancement
- E-07 Machine Learning and AI
- E-08 Advanced Modeling Technique
- E-09 Additive Manufacturing II
- E-10 Data Centers

MECHANICS & RELIABILITY

- M&R-01 Modeling and Simulations I
- M&R-02 High Temperature Reliability
- M&R-04 Material Characterization
- M&R-05 Modeling and Simulations II
- M&R-06 Accelerated TestingM-08 Solder Metallurgy
- M&R-08 Design Optimization

Day 1: Wed, May 28th 8:15 AM–9:15 AM

TI-01 Jet Impingement

Tate Ballroom A1 Chairs: *TBD*

8:15 AM (53) **Investigation of an Air-Cooled Integrated Synthetic Jet Heat Sink for Electronics Thermal Management**; ***Faisal Ahmed***[1], ***Mehmet Arik***[1]; [1]*Auburn University*

8:30 AM (109) **Novel Multi-Nozzle Jet Impingement Liquid Cold Plate for Cooling of High-Power Density Electronic Chip**; ***Sangram Kumar Samal***[1], ***Chi-Chuan Wang***[1], ***Yogesh Fulpagare***[2]; [1]*National Yang Ming Chiao Tung University,* [2]*Cooler Master Co., Ltd.*

8:45 AM (166) **Numerical Investigation of Surface Structures for Enhancement of Liquid Jet Impingement Cooling**; ***Georg Elsinger***[1], ***Herman Oprins***[2], ***Vladimir Cherman***[2], ***Geert Van der Plas***[2], ***Eric Beyne***[2], ***Ingrid De Wolf***[1]; [1]*KU Leuven, imec,* [2]*imec*

9:00 AM (184) **Energy Efficient Data Center Cooling With Liquid Synthetic Jet Technology**; ***Mohammad Azarifar***[1], ***Mehmet Arik***[1]; [1]*Auburn University*

TII-01 Liquid Cooling

Tate Ballroom A2 Chairs: *TBD*

8:15 AM (49) **The Study of Cold Plate Liquid Cooling Solution for Optics and ASIC on 51.2T Switch**; ***Yaoyin Fan***[1], ***Yan Liu***[1], ***Peng Xiao***[1]; [1]*Celestica*

8:30 AM (62) **Design &Amp; Development of Cold Plate for 4.4 kW Solid State Power Amplifier**; ***Kiran S K***[1], ***Pankaj Gupta***[2], ***Sudip Kumar Murmu***[3]; [1]*Senior Engineer,* [2]*Deputy General Manager,* [3]*Manager*

8:45 AM (189) **Prediction of the Behavior of a Two-Phase Closed-Loop System Coupled With a Single-Phase Cooling System**; ***Shahin N.Oskouie***[1], ***Sukhvinder Kang***[1], ***Jan Visser***[1]; [1]*Boyd Corporation*

9:00 AM (360) **Thermal Performance of Liquid Cooled and Air Cooled Thermal Ground Plane-Based Battery Thermal Management Systems for a High-Power Density Lithium-Ion Battery**; ***Arthur S. Labalte***[1], ***Amrid Amnache***[1], ***Alihossein Nikkhah***[1], ***Nooshin Karami***[1], ***Luc G. Fréchette***[1]; [1]*University of Sherbrooke*

M&R-01 Modeling and Simulation I

Tate Ballroom A3 Chairs: *TBD*

8:15 AM (132) **The Reliability Impact of 3D Package TSV Materials on Interfacial Cracks**; ***Unique Rahangdale***[1], ***Akshay Lakshminarayana***[1], ***Rohit Kumar Suthar***[1], ***Dereje Agonafer***[1]; [1]*The University of Texas at Arlington*

8:30 AM (142) **Enhancing EMI Shield Design for EV Inverter Using Advanced Simulation Techniques**; ***NITISH JETITHOR***[1], ***Matthew Graham***[2]; [1]*senior technical lead,* [2]*Engineering Manager*

8:45 AM (368) **Finite Element Analysis of the Thermal Cycling Performances of PBGA Assemblies Subjected to Various Prior Isothermal Aging Conditions**; ***Omma Sumaiya***[1], ***Souvik Chakraborty***[1], ***Golam Rakib Mazumder***[1], ***Mahbub Alam Maruf***[1], ***Jeffrey Suhling***[1], ***Pradeep Lall***[1]; [1]*Auburn University*

9:00 AM (407) **Considerations on Thermal Analysis of Inertial Microsystems Including Microsensors and Readout Analog Integrated Circuit.**; ***Jacek Nazdrowicz***[1], ***Mariusz Jankowski***[1]; [1]*Lodz University of Technology*

E-01 Heat Pipes and Wicking Structures

Tate Ballroom A4 Chairs: *TBD*

8:15 AM (48) **Nucleate Flow Boiling Enhancement in Copper Inverse Opal-Coated Manifold Microchannel**; ***Youngseob Lee***[1], ***Jaewon Hwang***[1], ***Daeyoung Kong***[2], ***Jungwan Cho***[3], ***Hyoungsoon Lee***[1]; [1]*Chung-Ang University,* [2]*Stanford University,* [3]*Sungkyunkwan University*

8:30 AM (54) **Direct Printing of Wick Structures Onto Chips for Two-Phase Jet Impingement Cooling**; ***Harish Kumar Lattupalli***[1], ***Emily M. Stallbaumer-Cyr***[1], ***Md Asif Iqbal***[1], ***Sina Ghadi***[1], ***Tiwei Wei***[2], ***Scott Schiffres***[1]; [1]*Binghamton University,* [2]*Purdue University*

8:45 AM (232) **Fabrication and Experimental Evaluation of Bendable Copper Flat-Plate Oscillating Heat Pipes**; ***Ishan Tandon***[1], ***Qian Qian***[1], ***Zekun Wu***[1], ***Ahmad Rosmahidi***[1], ***Liang Pan***[1], ***Justin A. Weibel***[1]; [1]*Purdue University*

9:00 AM (344) **Thermal Imaging and Flow Visualization of Capillary-Driven Two-Phase Boiling in Silicon Microchannels Coated With Porous Copper Wick**; ***Yujui Lin***[1], ***Heungdong Kwon***[1], ***Kewei Xiao***[2], ***Man Prakash Gupta***[2], ***Michael Degner***[2], ***Mehdi Asheghi***[1], ***Alan Mantooth***[3], ***Kenneth Goodson***[1]; [1]*Stanford University,* [2]*Ford Motor Company,* [3]*University of Arkansas*

Day 1: Wed, May 28th 11:00 AM–12:30 PM

TI-02 TIM and Heat Spreader Characterization

Tate Ballroom A1 Chairs: *TBD*

11:00 AM (72) **Multiscale Evaluation of Thermal Conductance of Thermal Interface Materials**; ***Jaehyung Song***[1], ***Hyun Woo***[1], ***Hakjun Kim***[1], ***Sung-Jun Kim***[1], ***Woong-Ryeol Yu***[1], ***Chan Park***[1], ***Hye-jin Jang***[1]; [1]*Seoul National University*

11:15 AM (129) **Indium Solder TIM Stability Under Temperature Cycling**; ***Piyush Kulkarni***[1], ***Ali Davoodabadi***[2], ***Zechen Zhang***[1], ***Scott Schiffres***[1]; [1]*Binghamton University,* [2]*Universal Instruments Corporation*

11:30 AM (170) **Evaluating the Degradation of Thermal Interface Materials in Liquid Immersion Cooling Systems Using Ultrasonic Methods**; ***Jacey Birkenmeyer***[1], ***Bijay Bansal***[1], ***Shubhra Bansal***[1], ***Luz D. Sotelo***[1]; [1]*Purdue University*

11:45 AM (285) **Thermal Interface Material Characterization Using Thermal Test Vehicle Assemblies With Bare Die and Lidded Packages**; ***Onur Yenigun***[1], ***Vladimir Cherman***[1], ***Herman Oprins***[1], ***Michiaki Yajima***[2], ***Shinichi Suzuki***[2], ***Hitoshi Onozeki***[2], ***Kei Togasaki***[2], ***Masatoshi Katagiri***[2], ***Takahiro Iseki***[2], ***Geert Van der Plas***[1], ***Eric Beyne***[1]; [1]*imec,* [2]*Resonac*

12:00 PM (343) **Measurement of Thermal Impedance in Heterogeneous Media**; ***Lucas Oelkers***[1], ***Patrick Shamberger***[2], ***Adam Wilson***[3], ***Rachel McAfee***[4], ***Michael Fish***[3]; [1]*Texas A&M University- College Station,* [2]*Texas A&M,* [3]*DEVCOM Army Research Laboratory,* [4]*University of Maryland*

12:15 PM (354) **Direct Visualization of Local Thermal Conductivity and Boundary Conductance of Diamond Particles**; ***Luke Gyubin Min***[1], ***Heungdong Kwon***[1], ***Christopher Perez***[1], ***Mehdi Asheghi***[1], ***Kenneth Goodson***[1]; [1]*Stanford University*

TII-02 PCM and Transient Cooling

Tate Ballroom A2 Chairs: *TBD*

11:00 AM (18) **Thermal Characterization of Select Metallic Phase Change Materials for Transient Load Thermal Management**; ***Kayden Maiorine***[1], ***Rachel McAfee***[2], ***Harshil Patel***[1], ***Adam Wilson***[3], ***Michael Fish***[3]; [1]*Drexel University,* [2]*University of Maryland,* [3]*DEVCOM Army Research Laboratory*

11:15 AM (31) **Hierarchical Thermal Transport Across Multiple Length Scales in High-Capacity Lithium-Ion Batteries for Stationary Energy Storage Systems**; ***Oscar A. Alvarez***[1], ***Carlos Da Silva***[1], ***Cristina H. Amon***[1]; [1]*University of Toronto*

11:30 AM (97) **Novel Predictive Model of Thermal Transient Behavior**; ***Hwanjoo Park***[1], ***Jaewon Yun***[1], ***Wook Moon***[1], ***Byunghan Ko***[1], ***Duksoo Kim***[1], ***Sunghoon Chun***[1]; [1]*Samsung Electronics Co., Ltd.*

11:45 AM (111) **Discretized TIM Thermal Modeling Technique for Capturing Nonuniform Pressure Distribution Effects**; ***Ghouse Mohammed***[1], ***Don Nguyen***[1], ***Damaruganath Pinjala***[1]; [1]*CISCO*

12:00 PM (154) **Enhanced Thermal Management in High-Performance Computing: A Novel Cascaded Solid-Solid Phase Change Material Honeycomb Heat Sink Design**; ***Mayank Maroliya***[1], ***SANDIP KUMAR SAHA***[1]; [1]*Indian Institute of Technology Bombay*

12:15 PM (365) **Rate of Thermal Energy Storage in Composite Phase Change Material Slabs**; ***Derian Morphew***[1], ***Emmanuel Nwoye***[1], ***Hyunji Park***[1], ***Sophia Ahmed***[1], ***Choongho Yu***[1], ***Jonathan Felts***[1], ***Patrick Shamberger***[2]; [1]*Texas A&M University- College Station,* [2]*Texas A&M*

M&R-02 High Temperature Reliability

Tate Ballroom A3 Chairs: *TBD*

11:00 AM (293) **Evaluation of Board-Level Drop Test Reliability of Flexible in-Mold Electronics Under After Isothermal Exposure**; ***Aathi Raja Ram Pandurangan***[1], ***Md Golam Sarwar***[1], ***Pradeep Lall***[1], ***Scott Miller***[2]; [1]*Auburn University,* [2]*NextFlex*

11:15 AM (329) **Damage Model for Assessment of the Combined Effects of High-Temperature Storage and Harmonic Vibration on Reliability of Lead-Free Doped Solder Joint Assemblies**; ***Vishal Mehta***[1], ***Pradeep Lall***[1], ***Ken Blecker***[2], ***Jeff Suhling***[1]; [1]*Auburn University,* [2]*US Army CCDC-AC*

11:30 AM (331) **Impact of Non-Flat Heat Sink Surface on Degradation of Thermal Greases**; ***Ritwik Kulkarni***[1], ***Nolan Gronowski***[1], ***Pranay Nagrani***[1], ***Amy Marconnet***[1]; [1]*Purdue University*

11:45 AM (333) **Humidity and High-Temperature Effects on Non-Pfas Thermal Interface and Underfill Materials**; ***Padmanava Choudhury***[1], ***Pradeep Lall***[1], ***Aathi Raja Ram Pandurangan***[1]; [1]*Auburn University*

12:00 PM (375) **Thermal Conductivity Evolution of Non-Pfas Automotive Packaging Material Under High Temperature and Humidity Exposure**; ***Yunli Zhang***[1], ***Pradeep Lall***[1], ***Daniel Harris***[1]; [1]*Auburn University*

12:15 PM (377) **Evaluating High Temperature Die Attachment Materials: Reliability and Fatigue Performance Beyond 175°C**; ***Saroj Majakoti***[1], ***Okafor G.***[2], ***David Huitink***[2]; [1]*Department of Mechanical Engineering, University of Arkansas, Fayetteville, AR,* [2]*University of Arkansas*

E-02 Power Electronics, Photonics, and Flexible Electronics

Tate Ballroom A4 Chairs: *TBD*

11:00 AM (4) **Fully Stretchable Electrochromic Smart Films for Innovative Energy Saving**; ***Youngno Kim***[1], ***Sung-Jin Jung***[1], ***Hyeon Woo Son***[1], ***MinSoo Kim***[1], ***Junwoo Suh***[1]; [1]*Samsung Electronics*

11:15 AM (66) **Evaluating the Environmental and Performance Impact of Bio-Based Epoxy Composites for Semiconductor Packaging**; ***Visakhan Vijayan Nambiar***[1], ***Sameer Abass***[2], ***Karthik Gundala***[2], ***Bharat Gopathi***[2], ***Hongbing Lu***[1], ***Nandika D'Souza***[1], ***Varughese Mathew***[3], ***Abdullah Fahim***[3], ***Greta Terzariol***[3]; [1]*University of Texas at Dallas,* [2]*University of North Texas,* [3]*NXP Semiconductors*

11:30 AM (128) **Effect of Two-Step Methane Concentration on the Quality and Growth Rate of Diamond Film Grown by Hot-Filament Chemical Vapor Deposition (HFCVD)**; ***Dipa Devkota***[1], ***Florence Nugera***[1], ***Jonathan W Anderson***[1], ***Anival Ayala***[1], ***Anupum K.C***[1], ***Biddhut Lamichhane***[1], ***Chris Engdahl***[2], ***Edwin L Piner***[1], ***Mark Holtz***[1]; [1]*Texas state university,* [2]*Crystallume Inc.,*

11:45 AM (254) **A Computational Study of a Mixed Multi Color LED Lighting System for Optical Uniformity**; ***Md Shafiqul Islam***[1], ***Ozlem Ozturk***[2], ***Mehmet Arik***[1]; [1]*Auburn University,* [2]*Antolin North America*

12:00 PM (431) **Thermal Management of GaN HEMTs Through Electro-Thermal Modeling**; ***Changhwan Song***[1], ***Hyeonjin Nam***[1], ***Jisu Kim***[1], ***Daeyoung Kong***[2], ***Hyoungsoon Lee***[3], ***Jungwan Cho***[1]; [1]*Sungkyunkwan University,* [2]*Stanford University,* [3]*Chung-Ang University*

Day 1: Wed, May 28th 2:00 PM–3:30 PM

TI-03A TIM and Heat Spreader Design and Selection

Tate Ballroom A1 Chairs: *TBD*

2:00 PM (23) **Optimizing SSD Performance With One-Part Thermal Gap Fillers: A Sustainable Approach**; ***VIGNESHWARRAM KUMARESAN***[1], ***Mutharasu Devarajan***[2]; [1]*Sandisk Corporation*, [2]*Western Digital Corporation*

2:15 PM (42) **Effect of Pressure-Dependent TIM Thermal Resistance on Thermal Performance of First-Level Packages**; ***Kalind Baraya***[1], ***Krishna Tunga***[1], ***Phil Buchling***[1]; [1]*IBM Systems*

2:30 PM (81) **Polymer-Based Thermal Interface Material Modeling and Selection**; ***Liangkai Ma***[1], ***Brian Clark***[1], ***Joe Sootsman***[1]; [1]*The Dow Chemical Company*

2:45 PM (240) **Quantitative and Qualitative Evaluation on the Influence of Heat Spreader Topography and Thermal Interface Material Properties on Thermal Performance of High-Power Computing (HPC) Semiconductor Packaging**; ***alexis Jacques-Fortin***[1], ***Ken Marston***[1], ***Stephanie Allard***[1]; [1]*IBM Infrastructure*

TII-03 Data Center Liquid Cooling Reliability and Leak Mitigation

Tate Ballroom A2 Chairs: *TBD*

2:00 PM (68) **Long-Term Reliability Characterization of High-Speed Cables in Immersion-Cooled Data Center Environments**; ***Ying Zhang***[1], ***Pengfei Cheng***[1], ***Hongrui Peng***[1], ***Bing Chen***[2], ***Dong Xu***[3], ***Jialiang Xu***[4], ***Wenxi Yang***[4], ***Wenbin Tian***[4], ***Kai Wang***[4], ***Nishi Ahuja***[4]; [1]*ByteDance China*, [2]*Lenovo*, [3]*IEIT Systems*, [4]*Intel*

2:15 PM (87) **Investigation on Negative Pressure Cold Plate Liquid Cooling Solution for Data Center Application**; ***Wenbin Tian***[1], ***Ting Tian***[2], ***Chenglong Gui***[2], ***Yulong Wang***[2], ***Chen Shen***[2], ***Tangbo Jing***[2], ***Yuanlin Ren***[2], ***Jialiang Xu***[1], ***Xiaoguo Liang***[1], ***Nishi Ahuja***[1]; [1]*Intel*, [2]*ByteDance Technology*

2:30 PM (94) **Experimental Investigation on Molding Isolation Process to Eliminate Liquid Leakage on Connection Areas of Liquid Cooling Cold Plate**; ***Wenbin Tian***[1], ***Chengjian Wang***[2], ***Yangfan Zhong***[2], ***Xiaopeng Li***[2], ***Yangyang Xu***[2], ***Lu She***[1], ***Lijie Yang***[1], ***Haifeng Gong***[1], ***Nishi Ahuja***[1]; [1]*Intel*, [2]*Alibaba*

2:45 PM (161) **Solving Industry Pain Point of Water-Cooling AI Server System Through Innovative SuperFluid Technology**; ***Jiahong Wu***[1], ***Carrie Chen***[1], ***Jun Zhang***[2], ***Kevin Lv***[3], ***Liwen Guo***[4], ***Jun Zhang***[5]; [1]*Intel*, [2]*Enginetech Computer Co.,LTD*, [3]*Lightelligence*, [4]*UESTC*, [5]*HZF Consulting*

3:00 PM (162) **The Research on Decoupling Techniques for Fluid Connectors in Liquid-Cooled Server Systems**; ***Hongjie Wu***[1], ***Nishi Ahuja***[2], ***Jun Zhang***[3], ***Hailiang Luo***[1], ***Hong Liu***[1], ***Jiaqi Hou***[1], ***Zeqi Tian***[1], ***Hansong Xiao***[1], ***Li Chen***[1]; [1]*China Mobile Group Design Institute Co., Ltd.*, [2]*Intel*, [3]*Enginetech Computer Co.,LTD*

3:15 PM (383) **Resiliency of Liquid-to-Liquid Cooling Systems in Data Centers Under Failure Scenarios**; ***Ali Heydari***[1], ***Himanshu Modi***[1], ***Pardeep Shahi***[1], ***Lochan Sai Reddy Chinthaparthy***[2], ***Anto Barigala***[3], ***Md Raisul Islam***[2], ***Dereje Agonafer***[2], ***Mohammad Tradat***[1], ***Saket Karajgikar***[1], ***Jeremy Rodriguez***[1]; [1]*Nvidia Corporation*, [2]*University of Texas at Arlington*, [3]*The University of Texas at Arlington*

TI-03B Packaging and Thermoelectrics

Tate Ballroom A3 Chairs: *TBD*

2:00 PM (7) **Thermal Design Principles for High Efficiency in Wearable Thermoelectric Devices**; ***Youngno Kim***[1], ***Hyeon Woo Son***[1], ***MinSoo Kim***[1], ***Junwoo Suh***[1], ***Sung-Jin Jung***[1]; [1]*Samsung Electronics*

2:15 PM (80) **Silicon TTV for Advanced Thermal Investigations of High Powered Lidless Package AI Silicon**; ***Jonathan Stever***[1], ***Cheng Yang***[2], ***Yin Hang***[1], ***Pascale El Kallassi***[1], ***Chloe Xu***[1], ***Chen Wang***[2], ***Yanbo (Herry) Tang***[2], ***Shuainan Lin***[2], ***Dongkai Shangguan***[3]; [1]*Meta,* [2]*JCET,* [3]*TEA*

2:30 PM (145) **Analysis of Thermal Characteristics According to Semiconductor Package Structure and Application**; ***Youngsang Cho***[1], ***Wonsik Shin***[1], ***Moonseob Jeong***[1], ***Junso Pak***[1], ***Seungwook Yoon***[1], ***Ilryong Kim***[1]; [1]*Samsung Electronics Co., Ltd.*

2:45 PM (147) **A Multiscale Workflow for Thermal Analysis of 3DI Chip Stacks**; ***Max Bloomfield***[1], ***Amogh Wasti***[1], ***Zongmin Yang***[1], ***Matthew Galarza***[1], ***Theodorian Borca-Tasciuc***[1], ***Jacob Merson***[1], ***Timothy Chainer***[2], ***Prabudhya Roy Chowdhury***[3], ***Aakrati Jain***[3]; [1]*Rensselaer Polytechnic Institute,* [2]*IBM TJ Watson Research Center,* [3]*IBM Research*

3:00 PM (160) **Evaluation of Thermoelectric Modules for Energy Harvesting in Supersonic Rocket Systems: Design, Testing, and Analysis**; ***Utku Akman***[1], ***Fazıl Doruk İnanç***[1], ***Sercan Altintas***[1], ***Oğuzhan Cavnar***[1], ***Emre Ertürk***[1]; [1]*Roketsan A.Ş.*

3:15 PM (400) **Thermal Challenges in Co-Packaging of Si-Iii/v Components in Silicon Photonics**; ***Krishna Bhavana Sivaraju***[1], ***Sai Abhideep Pundla***[1], ***Akhil Kalapala***[1], ***Pratik Bansode***[1], ***Gautam Gupta***[1], ***Dereje Agonafer***[2]; [1]*The University of Texas at Arlington,* [2]*University of Texas at Arlington*

E-03 Thermophysical Properties and Interfacial Thermal Transport

Tate Ballroom A4 Chairs: *TBD*

2:00 PM (121) **The Effects of Electron-Phonon Interactions on the Lattice Thermal Conductivity of Wurtzite AlN**; ***Chuang Zhang***[1], ***Jianshi Sun***[1], ***Xiangjun Liu***[1], ***Shouhang Li***[2]; [1]*Institute of Micro/Nano Electromechanical System and Integrated Circuit, College of Mechanical Engineering, Donghua University,* [2]*Centre de Nanosciences et de Nanotechnologies, CNRS, Université Paris-Saclay*

2:15 PM (362) **Experimental Cross-Plane Thermal Transport Characterization of BEOL Materials and Sensitivity to in-Plane Thermal Transport**; ***Amogh Wasti***[1], ***Zongmin Yang***[1], ***Matthew Galarza***[1], ***Jonas Kendra***[1], ***Davis Knight***[1], ***Timothy Chainer***[2], ***Roy Yu***[3], ***Prabudhya Roy Chowdhury***[3], ***Aakrati Jain***[3], ***Max Bloomfield***[1], ***Jacob Merson***[1], ***Theodorian Borca-Tasciuc***[1]; [1]*Rensselaer Polytechnic Institute,* [2]*IBM TJ Watson Research Center,* [3]*IBM Research*

2:30 PM (376) **Interfacial Thermal Resistance Evolution of Non-Pfas Thermal Interface Materials Under High Temperature and Humidity Exposure**; ***Yunli Zhang***[1], ***Pradeep Lall***[1], ***Daniel Harris***[1], ***Jeff Suhling***[1]; [1]*Auburn University*

2:45 PM (429) **Thermal Conductivity Measurements of BeO Thin Films Grown by Plasma Enhanced Atomic Layer Deposition**; ***Jihyun Kim***[1], ***Jonghyun Bae***[2], ***Dongyun Seo***[1], ***Dohwan Jung***[2], ***Jungwoo Oh***[2], ***Jungwan Cho***[1]; [1]*Sungkyunkwan University,* [2]*Yonsei University*

3:00 PM (430) **Thermal Conductivity Measurements of CVD-grown H-Bn Films**; ***Taeyeon Kim***[1], ***Sungsan Kang***[2], ***Minkyu Je***[1], ***Jihyun Kim***[1], ***Sangyeon Pak***[2], ***Jungwan Cho***[1]; [1]*Sungkyunkwan University,* [2]*Hongik University*

3:15 PM (445) **Systematic Errors in Non-Ideal ASTM D5470 Measurements**; ***Andres Becerra***[1], ***Daniel Ramirez***[1]; [1]*The Dow Chemical Company*

Day 1: Wed, May 28th 4:00 PM–5:30 PM

TI-04 Topology Optimization

Tate Ballroom A1 Chairs: *TBD*

4:00 PM (14) **Thermohydraulic Optimization of 3d-Printed Trifurcated Heat Exchangers**; ***Jebin Joshua Isaac Raj***[1], ***Durga Prasad Ghosh***[1], ***Sajjad Bigham***[1]; [1]*North Carolina State University*

4:15 PM (29) **Multi-Objective 3D Topology Optimisation for Heat Sinks With Multiple Heat Sources**; ***Zihan Zhang***[1], ***Henry Martin***[1], ***Willem van Driel***[1], ***René Poelma***[1], ***Guoqi Zhang***[1]; [1]*Delft University of Technology*

4:30 PM (50) **Phasor-Based Dehomogenisation for Microchannel Cooling Topology Optimisation**; ***Hao Li***[1], ***Peter Dørffler Ladegaard Jensen***[2], ***Rebekka Vaarum Woldseth***[3], ***Joe Alexandersen***[1]; [1]*University of Southern Denmark,* [2]*Technical University of Denmark,* [3]*Centre Inria de l'Université de Lorraine*

4:45 PM (117) **Topology Optimization for Embedded Cooling of Multiple and Transient Workloads in 3D Semiconductor Packages**; ***Zekun Wu***[1], ***Ashwin Kidambi***[1], ***Yu-Tao Yang***[2], ***Chih-Ming Hung***[3], ***Shurong Tian***[4], ***Xin Zhang***[4], ***Justin A. Weibel***[1], ***Liang Pan***[1]; [1]*Purdue University,* [2]*MediaTek USA Inc.,* [3]*MediaTek Inc.,* [4]*IBM TJ Watson Research Center*

5:00 PM (242) **Multiphysics Topology Optimization of Metal-Polymer Composite Thermal Interface Materials.**; ***Devang Prabhu Tavkari***[1], ***Xiulin Ruan***[1], ***Amy Marconnet***[1], ***Tiwei Wei***[1]; [1]*Purdue University*

5:15 PM (373) **Optimal Heat Spreading Solutions for Three-Dimensional Heterogeneously Integrated Modules Using a Multigrid Topology Optimization Method**; ***Chun-Pei Chen***[1], ***Xiaoyue Zhang***[2], ***Chung-Shuo Lee***[2], ***Ganesh Subbarayan***[2]; [1]*Apple,* [2]*Purdue University*

TII-04 Data Center Scaling and Machine Learning

Tate Ballroom A2 Chairs: *TBD*

4:00 PM (63) **Liquid Cooling Optimization for Data Centers With Reinforcement Learning**; ***Avisek Naug***[1], ***Antonio Guillen-Perez***[1], ***Vineet Gundecha***[1], ***Ricardo Luna Gutiérrez***[1], ***Paolo Faraboschi***[1], ***Cullen Bash***[1], ***Soumyendu Sarkar***[1]; [1]*Hewlett Packard Enterprise*

4:15 PM (122) **Integrating Experimental, Numerical and Machine Learning Models for Real-Time, Efficient Data Center Cooling Control**; ***Dayananda swamy Kattimani math***[1], ***Venkata Achyuth Kunchapu***[1], ***Srikanth Rangarajan***[1], ***Kanad Ghose***[1], ***Bahgat Sammakia***[1], ***Mohammad Tradat***[2]; [1]*State University of New York at Binghamton,* [2]*Nvidia Corporation*

4:30 PM (320) **Enhancing Thermal Management Through Deep Learning-Based Analysis of Bubble Dynamics in Flow Boiling**; ***Forouzan Naderi***[1], ***Farshad Barghi Golezani***[1], ***Chirag Kharangate***[1]; [1]*Case Western Reserve University*

4:45 PM (359) **From Air to Liquid: Cooling Methods in Data Center Network Switch Technology**; ***Bharath Ravi***[1], ***Alex Massicotte***[1], ***Jiwon Yu***[1], ***Stephen Keefe***[1]; [1]*Celestica*

5:00 PM (433) **Scaling Liquid Cooling for Google Data Center AI Applications to a 1 GW Fleet**; ***Madhusudan Iyengar***[1], ***Jorge Padilla***[1]; [1]*Google LLC*

M&R-04 Material Characterization

Tate Ballroom A3 Chairs: *TBD*

4:00 PM (125) **Study of Moisture Analysis Technology Based on Embedded Silicon Bridge Substrates**; ***yang yang***[1], ***jie zhang***[1], ***rui ma***[1], ***zijun zhong***[1], ***peng sun***[1], ***Meiying Su***[1], ***Qidong Wang***[2], ***Liqiang Cao***[1], ***Fengze Hou***[1]; [1]*Institute of Microeletronics of The Chinese Academy of Sciences,* [2]*Institute of Microelectronics of the Chinese Academy of Sciences*

4:15 PM (267) **Characterization of the Anand Model Parameters of SAC305 Lead Free Solder With Various Levels of Damage**; ***Golam Rakib Mazumder***[1], ***Mahbub Alam Maruf***[1], ***Souvik Chakraborty***[1], ***Omma Sumaiya***[1], ***Jeffrey Suhling***[1], ***Pradeep Lall***[1]; [1]*Auburn University*

4:30 PM (327) **Process-Performance-Thermal Reliability Evaluation of Screen-Printed Electronics on BPET Substrates**; ***Shriram Kulkarni***[1], ***Pradeep Lall***[1], ***Scott Miller***[2]; [1]*Auburn University,* [2]*NextFlex*

4:45 PM (332) **High Strain Rate Property Prediction and the Effect of Bismuth Concentration on the High-G Level Shock Damage With Sustained High-Temperature Operation**; ***Vishal Mehta***[1], ***Pradeep Lall***[1], ***David Locker***[2], ***Jeff Suhling***[1]; [1]*Auburn University,* [2]*US Army CCDC-AvMC*

5:00 PM (347) **Specific Heat Capacity Measurements of Thin Films Using Nanocalorimetry**; ***Feng Yi***[1], ***John Pettibone***[1], ***Lakshmi Ravi Narayan***[1], ***Meghavin Bhatasana***[1], ***William Osborn***[1]; [1]*National Institute of Standards and Technology*

5:15 PM (350) **Micromechanical Properties of Mixed SAC/LTS Solder Alloys With Various Bismuth Contents**; ***Souvik Chakraborty***[1], ***Mahbub Alam Maruf***[1], ***Golam Rakib Mazumder***[1], ***Jeffrey Suhling***[1], ***Pradeep Lall***[1]; [1]*Auburn University*

E-04 Additive Manufacturing I

Tate Ballroom A4 Chairs: *TBD*

4:00 PM (28) **An Experimental Study of the Thermal-Hydraulic Performance of an Additively Manufactured Mini-Channel Cold Plate**; ***Zane Oligee***[1], ***Nicholas Tsolas***[1]; [1]*Auburn University*

4:15 PM (255) **Enhancing Power-Dense and Reliability-Oriented Heat Sink Structures Through Additive Manufacturing for Power Electronics in Aviation Applications**; ***Jannes Kai Briese***[1], ***Hendrik Schefer***[1], ***Lukas Radomsky***[1], ***Robert Keilmann***[1], ***Regine Mallwitz***[1]; [1]*TU Braunschweig*

4:30 PM (306) **Development of High-Temperature Capable Semi-Additive Logic Gate Circuits on Copper-Clad Ceramic Substrates for Automotive Applications**; ***Aditya Amatya***[1], ***Pradeep Lall***[1], ***Ved Soni***[1], ***Scott Miller***[2]; [1]*Auburn University,* [2]*NextFlex*

4:45 PM (308) **Seed Paper Based Sustainable Electronics With Water-Based Inks and Low-Temperature Processing for Additive Electronics**; ***Emran Hassan Bejoy***[1], ***Pradeep Lall***[1], ***Md Golam Sarwar***[1], ***Scott Miller***[2]; [1]*Auburn University,* [2]*NextFlex*

5:00 PM (338) **High-Temperature Operating Reliability of Direct-Write Additively Printed Sustainable Flexible Circuits**; ***Md Golam Sarwar***[1], ***Pradeep Lall***[1], ***Scott Miller***[2]; [1]*Auburn University,* [2]*NextFlex*

5:15 PM (342) **Evaluation of High-Temperature Performance of Additive Rectifier Circuits at 175C**; ***Bishal Bashyal***[1], ***Pradeep Lall***[1], ***Ved Soni***[1], ***Aditya Amatya***[1], ***Scott Miller***[2]; [1]*Auburn University,* [2]*NextFlex*

Day 2: Thu, May 29th 8:15 AM–9:15 AM

TI-05 Capillary-Driven Two-Phase Flow

Tate Ballroom A1 Chairs: *TBD*

8:15 AM (13) **Thermohydraulic Characterization of 3d-Printed Metallic Wick Flow Condensers**; ***Durga Prasad Ghosh***[1], ***Behzad Ahmadi***[1], ***Vivek Mohan***[1], ***Mohammadreza Shaeri***[2], ***Sajjad Bigham***[1]; [1]*North Carolina State University,* [2]*Advanced Cooling Technologies, Inc.*

8:30 AM (98) **Comparsion of Pumped vs. Capillary-Driven Two-Phase Microcoolers for High Heat Flux Applications**; ***Daeyoung Kong***[1], ***Roman Giglio***[2], ***Chi Zhang***[1], ***Katherine Jiang***[1], ***James Palko***[3], ***Hyoungsoon Lee***[4], ***Mehdi Asheghi***[1], ***Kenneth Goodson***[1]; [1]*Stanford University,* [2]*University of California Merced,* [3]*University of California, Merced,* [4]*Chung-Ang University*

8:45 AM (118) **Performance Characterization of Capillary-Driven Thin-Film Boiling Under Sub-Atmospheric (25-100 kPa) Environment**; ***Yujui Lin***[1], ***Heungdong Kwon***[1], ***Kewei Xiao***[2], ***Man Prakash Gupta***[2], ***Michael Degner***[2], ***Mehdi Asheghi***[1], ***Alan Mantooth***[3], ***Kenneth Goodson***[1]; [1]*Stanford University,* [2]*Ford Motor Company,* [3]*University of Arkansas*

9:00 AM (356) **Enhanced Capillary-Driven Boiling in Two-Phase Micro-Cooler With Engineered Copper Inverse Opals (CIOs) Wick and Silicon 3D Manifold for High Heat Flux Cooling Application**; ***Heungdong Kwon***[1], ***Daeyoung Kong***[1], ***James Palko***[2], ***Ercan M. Dede***[3], ***Mehdi Asheghi***[1], ***Kenneth Goodson***[1]; [1]*Stanford University,* [2]*University of California, Merced,* [3]*Toyota Research Institute of North America*

TII-09 Microchannels and Jet Impingement

Tate Ballroom A2 Chairs: *TBD*

8:15 AM (99) **Experimetal Study of Oil Cooling of Large Electric Machine for High Power Application**; ***Stephane Saddour***[1], ***Riadh Boubaker***[1], ***Safouene Ouenzefi***[1], ***Aurelie Fasquelle***[2], ***Daniel Laloy***[3], ***Hakim El Bahi***[4], ***Souad Harmand***[1]; [1]*Laboratoire d'Automatique, de Mécanique et d'Informatique Industrielles et Humaines (LAMIH-UMR CNRS 8201), Université Polytechnique Hauts-de-France,* [2]*Framatome, Business Unit Projets & Components Manufacturing (PCM), R&D,* [3]*Jeumont Electric,* [4]*Research Division, TOTAL Marketing & Services*

8:30 AM (127) **Automated Electro-Thermal Modeling Framework of Distributed Vertical Power Delivery Architectures With Substrate-Embedded Microfluidic Cooling**; ***Mingeun Choi***[1], ***Sriharini Krishnakumar***[2], ***Yaroslav Popryho***[2], ***Ramin Rahimzadeh Khorasani***[3], ***Madhavan Swaminathan***[3], ***Inna Partin-Vaisband***[2], ***Satish Kumar***[1]; [1]*Georgia Institute of Technology,* [2]*University of Illinois Chicago,* [3]*The Pennsylvania State University*

8:45 AM (158) **A Novel Liquid Cooled Heat Sink With Adjacent Micro Synthetic Jets for Thermal Management in Microelectronic Devices**; ***Delara Soltani***[1], ***Tim Persoons***[2], ***Sajad Alimohammadi***[1]; [1]*Department of Mechanical Engineering, TUDublin,* [2]*Trinity College Dublin*

9:00 AM (316) **Radial Manifold Microchannel Heat Sink for Electronics Thermal Management**; ***Faramarz Kahbandeh***[1], ***Mohammad Azarifar***[1], ***Mehmet Arik***[1], ***Daniel Harris***[1]; [1]*Auburn University*

M&R-05 Modeling and Simulations II

Tate Ballroom A3 Chairs: *TBD*

8:15 AM (73) **Predictive Modeling of PCB Thermo-Mechanical Properties for Reliable Stack-Up Configurations**; ***VIGNESHWARRAM KUMARESAN***[1], ***Mutharasu Devarajan***[1]; [1]*Western Digital Corporation*

8:30 AM (96) **Multi-Physics Modeling of Dissipation Analysis for Lithium-Ion Batteries**; ***Tae-Hyun Kim***[1], ***Eun-Ho Lee***[1]; [1]*Sungkyunkwan university*

8:45 AM (171) **Modeling of Microstructural Evolution Within TSVs Using Atomistic Simulations**; ***Shengfeng Yang***[1], ***Jiali Lu***[1]; [1]*Purdue University*

9:00 AM (266) **Impact of Solder Joint Design Profile on the Reliability of QFN Packages**; ***Unique Rahangdale***[1], ***Rishikesh Tendulkar***[1], ***Sai Abhideep Pundla***[1], ***Dereje Agonafer***[1]; [1]*The University of Texas at Arlington*

E-10 Data Centers

Tate Ballroom A4 Chairs: *TBD*

8:45 AM (168) **Comparison of Operating Costs and Energy Use in a Thermo-Caloric Heat Pump and an Air-Cooled Chiller System for Data Center Cooling**; ***Brandon Kibbel***[1], ***Bryce Cox***[1]; [1]*University of Wisconsin-Platteville*

9:00 AM (297) **Performance of a Novel 1.5U Boiling Chamber With Higher Coolant Temperatures for High Heat Flux Dissipation in Data Center Applications**; ***Maharshi Shukla***[1], ***Nooruldeen Mustafa***[1], ***Satish Kandlikar***[1]; [1]*Rochester Institute of Technology*

Day 2: Thu, May 29th 11:00 AM–12:30 PM

TI-06 Pump-Driven Two-Phase Flow and Forced Convection

Tate Ballroom A1 Chairs: *TBD*

11:00 AM (12) **Additively Manufactured Stacked Refrigerant-to-Water Condenser**; ***Mohammadreza Shaeri***[1], ***Sajjad Bigham***[2], ***Vivek Mohan***[2], ***Maksym Demydovych***[1]; [1]*Advanced Cooling Technologies, Inc.*, [2]*North Carolina State University*

11:15 AM (45) **Flash Cooling With Methanol/Water Mixtures for 1 W/Mm2 Fluxes Without Lateral Heat Spreading**; ***Naarendharan Meenakshi Sundaram***[1], ***Rishi Pugazhendhi***[2], ***Subramanian S Iyer***[1], ***Timothy Fisher***[1]; [1]*University of California, Los Angeles*, [2]*Intel*

11:30 AM (106) **Two-Phase Counter-Flow Expanding Channels for Compliant Direct Attach**; ***Mark Schultz***[1], ***Pritish Parida***[1], ***Shurong Tian***[1], ***Cory VanDeventer***[2], ***Brian Werneke***[2], ***Timothy Chainer***[1]; [1]*IBM TJ Watson Research Center*, [2]*IBM Infrastructure*

11:45 AM (294) **Experimental Characterization of a Low Thermal Resistance Microchannel Heatsink Utilizing Low GWP Refrigerant for High Power GPU Applications**; ***David Apigo***[1], ***Sarwesh Parbat***[1], ***Haotian Jia***[2], ***Haoyun Qiu***[3], ***Pouya Kabirzadeh***[3], ***Manohar Bongarala***[1], ***Syed Faisal***[1], ***Rishav Roy***[1], ***Nenad Milijkovic***[3], ***Todd Salamon***[1]; [1]*Nokia Bell Labs*, [2]*Tufts University*, [3]*Department of Mechanical Science and Engineering, University of Illinois Urbana-Champaign*

12:00 PM (363) **Experimental Investigation of Heating Orientation Effects on Flow Boiling in Manifold Microchannel Heat Sinks**; ***Huigang Wang***[1], ***Chirag Kharangate***[1]; [1]*Case Western Reserve University*

12:15 PM (380) **Prediction of Junction Temperature to Estimate Thermal Resistance in 1.7kV SiC Power Module Using Real-Time VSD Monitoring Method**; ***Saroj Majakoti***[1], ***Okafor G.***[2], ***David Huitink***[2], ***Liyang Du***[3], ***Alan Mantooth***[2]; [1]*Department of Mechanical Engineering, University of Arkansas, Fayetteville, AR*, [2]*University of Arkansas*, [3]*Department of Electrical Engineering, University of Arkansas*

TII-06 Data Center Direct Liquid and Immersion Cooling

Tate Ballroom A2 Chairs: *TBD*

11:00 AM (34) **Revolutionary Thermal Solution for Hot Chips**; ***Ron Zhang***[1], ***Laura Mirkarimi***[1], ***Belgacem Haba***[1], ***Gill Fountain***[1], ***KM Bang***[1], ***Suhail Sadiq***[1], ***Arianna Avellan***[1]; [1]*Adeia*

11:15 AM (41) **Performance Comparison of R1233zd(E) and R515B for Two-Phase Direct-to-Chip Cooling**; ***Qingyang Wang***[1], ***Akshith Narayanan***[1], ***Serdar Ozguc***[1], ***Jacob Moore***[1], ***Richard Bonner***[1]; [1]*Accelsius*

11:30 AM (51) **Thermal Performance Evaluation of Single-Phase Immersion Cooling for High-Power (≫1kW) AI Processors**; ***Hyunhee Kim***[1], ***Youngsang Cho***[1], ***Junso Pak***[1], ***Seungwook Yoon***[1]; [1]*Samsung Electronics Co., Ltd.*

11:45 AM (136) **System Level Reliability Modeling of Direct-to-Chip Liquid Cooled Data Centers**; ***Sidharth Rajeev***[1], ***Venkata Achyuth Kunchapu***[1], ***Ryan Enright***[2], ***Tiwei Wei***[3], ***Srikanth Rangarajan***[1], ***Bahgat Sammakia***[1]; [1]*Binghamton University*, [2]*Seguente*, [3]*Purdue University*

12:00 PM (280) **G-Flow Immersion Cooling Solution for High-Power Data Center Servers**; ***Yuehong Fan***[1], ***Chuanlou Wang***[1], ***Yang1 Yao***[1], ***Yingqiong Bu***[1], ***Guangying Zhang***[1], ***Liguang Du***[1], ***Xiang Que***[1], ***Luping Zhao***[2], ***Shuisheng Fan***[2], ***Hongming Xie***[2], ***Libo Chen***[3], ***Xinxin Wang***[3], ***Zhitao Xin***[3], ***Jiaying Huang***[3], ***Shanshan Zhang***[4], ***Feiyang Wu***[4], ***Xiaohan Sun***[4]; [1]*Intel*, [2]*Eco-atlas Technology Corp*, [3]*New H3C Technologies Co., Ltd*, [4]*ExxonMobil Asia Pacific Research and Development Co.,Ltd*

12:15 PM (405) **A Comparative Analysis of Single Phase Liquid Cooled Data Center Coolants Using ASTM D1384 &Amp; D8040 Standards**; ***Ali Heydari***[1], ***Lochan Sai Reddy Chinthaparthy***[2], ***Pardeep Shahi***[1], ***Himanshu Modi***[1], ***Anto Barigala***[3], ***Ivneet Banga***[3], ***Sean Sivapalan***[1], ***Harold Miyamura***[1], ***Dereje Agonafer***[2], ***Mohammad Tradat***[1], ***Saket Karajgikar***[1], ***Jeremy Rodriguez***[1]; [1]*Nvidia Corporation*, [2]*University of Texas at Arlington*, [3]*The University of Texas at Arlington*

M&R-06 Accelerated Testing

Tate Ballroom A3 Chairs: *TBD*

11:00 AM (55) **HALT With PoF for Class P Electronics Assembly**; ***Reza Ghaffarian***[1]; [1]*NASA-JPL*

11:15 AM (56) **FCBGA1657 Assemblies Under Thermal Cycle and Drop**; ***Reza Ghaffarian***[1]; [1]*NASA-JPL*

11:30 AM (210) **Reliability of Opto-Electronics :Thermal Cycles Plus Vibrations**; ***Reza Ghaffarian***[1], ***Alireza Azizi***[1]; [1]*NASA-JPL*

11:45 AM (265) **The Combined Effects of High-Temperature Aging, Mechanical Cycling, and Exposure Sequence on the Constitutive Behavior of SAC305 Solder**; ***Mahbub Alam Maruf***[1], ***Souvik Chakraborty***[1], ***Golam Rakib Mazumder***[1], ***Jeffrey Suhling***[1], ***Pradeep Lall***[1]; [1]*Auburn University*

12:00 PM (304) **Comparison of Non-Pfas and Pfas Underfills in Fcbgas Based on Evolution of Bulk and Interfacial Properties Under Long-Term Isothermal Exposure**; ***Aathi Raja Ram Pandurangan***[1], ***Padmanava Choudhury***[1], ***Madhu Kasturi***[1], ***Pradeep Lall***[1]; [1]*Auburn University*

12:15 PM (323) **Screen-Printed Thermoformed Additive in-Mold Electronics Thermal Cycling Reliability for Automotive Applications.**; ***Aditya Harsha***[1], ***Pradeep Lall***[1], ***Scott Miller***[2]; [1]*Auburn University,* [2]*NextFlex*

E-06 Boiling Enhancement

Tate Ballroom A4 Chairs: *TBD*

11:00 AM (83) **Femtosecond Laser Surface Processing (FLSP) of Silicon for Pool Boiling Enhancement Using Dielectric PF-5060**; ***Josh Gerdes***[1], ***Andrew Butler***[1], ***Suchit Sarin***[1], ***Rahul Rajan***[1], ***Truman Stoller***[1], ***Jeffrey Shield***[1], ***Craig Zuhlke***[1], ***George Gogos***[1]; [1]*University of Nebraska - Lincoln*

11:15 AM (86) **Femtosecond Laser Surface Processing (FLSP) of 6061 Aluminum Exhibits Flow Boiling Enhancement Using Opteon™ 2P50 for Various Mass Fluxes**; ***Josh Gerdes***[1], ***Logan Pettit***[1], ***Graham Kaufman***[1], ***Craig Zuhlke***[1], ***George Gogos***[1]; [1]*University of Nebraska - Lincoln*

11:30 AM (197) **Minichannel Flow Boiling Enhancement Using Femtosecond Laser Surface Processed Stainless Steel Surfaces in Water: Effect of Laser Fluence**; ***Logan Pettit***[1], ***Josh Gerdes***[1], ***Andrew Reicks***[1], ***Craig Zuhlke***[1], ***George Gogos***[1]; [1]*University of Nebraska - Lincoln*

11:45 AM (290) **Exploring the Impact of Nanoscale Roughness on the Pool Boiling Performance of Femtosecond Laser Processed Copper in Dielectric Fluid**; ***Graham Kaufman***[1], ***Josh Gerdes***[1], ***Mohamed Marey***[1], ***George Gogos***[1], ***Craig Zuhlke***[1]; [1]*University of Nebraska - Lincoln*

12:00 PM (352) **Pool Boiling Enhancement Using Engineered Nucleation Sites**; ***Priyanka Viswanath***[1], ***Tomasz Kulakowski***[1], ***Yimin Zhou***[1], ***Solomon Adera***[1]; [1]*University of Michigan*

Day 2: Thu, May 29th 2:00 PM–3:30 PM

TI-07A Embedded and Immersion Cooling

Tate Ballroom A1 Chairs: *TBD*

2:00 PM (8) **A Thermo Responsive Film With High Thermal Conductivity Embedded Into a Stacked PBA**; ***MIN PARK***[1], ***Jihyeon Son***[1], ***Jinhwan Jung***[1], ***Jeonggen Yoon***[1], ***Jieun Hwang***[1], ***Yoonhee Chang***[1]; [1]*Samsung Electronics*

2:15 PM (131) **Experimental Investigation of Phase Change Material Embedded in Lattice Structures via Additive Manufacturing**; ***Vedat Yağcı***[1], ***Orkun Doğu***[1], ***Ahmet Koyuncu***[1], ***Atakan Kabukcu***[1]; [1]*ASELSAN INC.*

2:30 PM (143) **Thermal-Electrical Co-Analysis of Microchannel-Embedded TSV Interposers for Double-Sided Cooling in 3D HPC Stacks**; ***Yunting Liu***[1], ***Rong Fu***[2], ***Jianyu Feng***[2], ***Chuan Chen***[2], ***Chenglin Yang***[2], ***Huimin He***[2], ***Fengman Liu***[2]; [1]*School of Integrated Circuits, University of Chinese Academy of Sciences,* [2]*State Key Laboratory of Fabrication Technologies for Integrated Circuits Institute of Microelectronics, Chinese Academy of Sciences*

2:45 PM (225) **Thermo-Hydraulic Performance of Targeted Flow in Aluminum and Copper Heat Sinks for Immersion Cooling Applications**; ***Prasanna Jayaramu***[1], ***Meysam Emami***[2], ***Vishal Talari***[1], ***Md Raisul Islam***[1], ***Kaustubh Adsul***[2], ***Rohit Kumar Suthar***[1], ***Lochan Sai Reddy Chintha-parthy***[1], ***Dereje Agonafer***[1], ***Pratik Bansode***[3], ***Ahson Hussain***[3], ***Puxuan Li***[3], ***Tao Geng***[3]; [1]*University of Texas at Arlington,* [2]*The University of Texas at Arlington,* [3]*LiquidStack*

3:00 PM (246) **Embedded Cooling of Planar Magnetic Components for High Power Density Power Converters**; ***Yanghe Liu***[1], ***Tianzhu Fan***[1], ***Feng Zhou***[1], ***Shailesh N. Joshi***[1], ***Ashwini Dubey***[2], ***Sayan Paul***[2], ***Dragan Maksimovic***[2], ***Ercan M. Dede***[1]; [1]*Toyota Research Institute of North America,* [2]*University of Colorado Boulder*

3:15 PM (288) **Effect of Pin-Shapes on Chip-Embedded Two-Phase Cooling**; ***Pritish Parida***[1]; [1]*IBM TJ Watson Research Center*

TII-07 Next-Gen Electronic Systems Co-Design

Tate Ballroom A2 Chairs: *TBD*

2:00 PM (6) **Two-Phase Cooling System Performance Under Different Operating Scenario**; ***Pritish Parida***[1], ***Timothy Chainer***[1]; [1]*IBM TJ Watson Research Center*

2:15 PM (67) **Novel Active Magnetic Regenerator for Next Generation Eco-Friendly Cooling Technology**; ***Hyeon Woo Son***[1], ***Youngno Kim***[1], ***Joosik Jung***[1], ***Sung-Jin Jung***[2], ***Junwoo Suh***[1], ***MinSoo Kim***[1]; [1]*Samsung Electronics,* [2]*Samsung Research*

2:30 PM (77) **Topology Optimization of EV Battery Immersion Cooling Channel**; ***Seunghwan Keum***[1], ***Peter Andruskiewicz***[1], ***Erik Yen***[1], ***Ronald Grover***[1]; [1]*General Motors*

2:45 PM (144) **Thermal Aware Floorplan Methodology Considering Heat Transfer Coefficient of Package to SOC Power Scenario**; ***Youngsang Cho***[1], ***Heonwoo Kim***[1], ***Haerim Kim***[1], ***Hyunhee Kim***[1], ***Seungwook Yoon***[1], ***Ilryong Kim***[1]; [1]*Samsung Electronics Co., Ltd.*

3:00 PM (149) **Thermal Management Studies of the Bulk Capacitor Through Design Evolution for the EV Inverter**; ***Himanshu Agrawal***[1], ***Abhijit Kaisare***[2], ***Ted Zeunik***[3]; [1]*Technical Lead,* [2]*Manager,* [3]*Staff Mechanical Design Engineer*

3:15 PM (434) **Harnessing Ocean Thermal Gradients Using Thermoelectric-Based Submersibles for Ocean Power Applications**; ***Prashant Saini***[1], ***Julian Osorio***[1]; [1]*National Renewable Energy Laboratory*

TI-07B Advanced Modeling and Characterization

Tate Ballroom A3 Chairs: *TBD*

2:00 PM (70) **Compact Thermal Modeling Methodology for HBM**; ***Younghoon Hyun***[1], ***Seongwoo Yang***[1], ***Daewoong Lee***[1], ***Heejin Lee***[1], ***Kang-Wook Lee***[1]; [1]*SK hynix Inc.*

2:15 PM (107) **Experimental Characterization and Numerical Simulation of Liquid Flow and Heat Transfer Through Offset Strip Fins**; ***Saeel S. Pai***[1], ***Eoin Oude Essink***[2], ***Abhijeet Banthiya***[1], ***Liang Pan***[1], ***Justin A. Weibel***[1]; [1]*Purdue University,* [2]*TU Dublin*

2:30 PM (198) **A Simulation Study of Impact of Defect Configuration at Die-Attach Solder Joint on LED Performance and Applicability of MIL-STD-883**; ***Erik Sorensen***[1], ***Roy Luo***[1]; [1]*Excelitas*

2:45 PM (201) **Methodology for Thermal Performance Evaluation Using Linear Parameter Varying Thermal Resistance Matrix Modeling of Mobile SoC**; ***Myunghoon Lee***[1], ***Subodh Deodhar***[1], ***Vamsi Krishna***[1], ***Yunhyeok Im***[2], ***Gyuick Jung***[1], ***Ankit Adhiya***[1]; [1]*Ansys Inc,* [2]*Georgia Tech*

3:00 PM (236) **Molecular Dynamics Simulations of the Phonon Bridge Effect at Interfaces Between Si and Diamond.**; ***Youhwan Jo***[1], ***Kyeongjae Cho***[1]; [1]*University of Texas at Dallas*

3:15 PM (393) **Numerical and Experimental Investigation of High-Powered Chips for Efficient Cooling Using Optimized Electrochemical Additive Manufacturing Based Cold Plates**; ***Gautam Gupta***[1], ***Douglas Castro***[2], ***Joseph Madril***[2], ***Tim Ouradnik***[2], ***Ian Winfield***[2], ***Michael Matthews***[2], ***Dereje Agonafer***[3]; [1]*The University of Texas at Arlington,* [2]*Fabric8Labs,* [3]*University of Texas at Arlington*

E-07 Machine Learning and AI

Tate Ballroom A4 Chairs: *TBD*

2:00 PM (82) **Predicting Thermomechanical Degradation in Bonded Interfaces Using Enhanced Image Processing and Deep Learning Techniques**; ***Sang Hyeon Chang***[1], ***Paul Paret***[2], ***Sreekant Narumanchi***[2], ***Yoonjin Won***[1]; [1]*University of California, Irvine,* [2]*National Renewable Energy Laboratory*

2:15 PM (173) **Adaptive Gain Controller With State Restrictions for Fan Speed Control in Temperature Stabilization During Thermal Margin Testing**; ***Marlene Cobian***[1], ***David Arana***[1], ***Kevin Mistofsky***[1], ***Dhruvalkumar Shah***[1], ***Alexander Eamons***[1], ***Lang Yuan***[1]; [1]*Intel*

2:30 PM (263) **Energy Efficient Cooling in Networking Equipments: A Neural Network Based Predictive Approach**; ***Ashok Kumar Sankaran***[1], ***Mukul Golash***[2], ***Damaruganath Pinjala***[2], ***Majid Khan Mohammed Zai***[2]; [1]*Thermal Engineer, Cisco Systems, Inc,* [2]*CISCO*

2:45 PM (336) **Predicting Flow Boiling Heat Transfer Coefficient Utilizing Physics-Informed Machine Learning Model**; ***Thanh Hoang Phan***[1], ***Logan Pirnstill***[1], ***Jiayuan Li***[2], ***Chirag Kharangate***[2]; [1]*Department of Mechanical and Aerospace Engineering, Case Western Reserve University,* [2]*Case Western Reserve University*

3:00 PM (427) **Physics-Driven Learning for Two-Phase Heat Transfer**; ***Haeun Lee***[1], ***Hyoungsoon Lee***[2]; [1]*Stanford University,* [2]*Chung-Ang University*

3:15 PM (460) **Steady-State Temperature Prediction Based on Compact Thermal Models Using Machine Learning**; ***Mohammadamin Hajikhodaverdian***[1], ***Sherief Reda***[2], ***Ayse Coskun***[1]; [1]*Boston University,* [2]*Brown University*

Day 2: Thu, May 29th 4:00 PM–5:30 PM

TI-08 Power Electronics Cooling

Tate Ballroom A1 Chairs: *TBD*

4:00 PM (79) **Thermal &Amp; Electrical Performance Characterization of Power Modules in Single-Phase Liquid Immersion Cooling Environments**; ***Rohit Kumar Suthar***[1], ***Amit Kumar***[1], ***Akshay Lakshminarayana***[1], ***Vishal Talari***[2], ***Dereje Agonafer***[1], ***Karthekeyan Sridhar***[3], ***Rajen Murugan***[3], ***Lalith Karsani***[3], ***Osvaldo (Ozzie) Lopez***[3], ***Nicolas Forcade-Perkins***[3]; [1]*The University of Texas at Arlington,* [2]*University of Texas at Arlington,* [3]*Texas instruments*

4:15 PM (130) **Enhanced Thermal Management of Outer-Rotor Electric Motors Through Additively Manufactured Heat Exchangers With End-Winding Cooling**; ***Md. Jubayer Hossain***[1], ***Amitav Tikadar***[1], ***Bidzina Kekelia***[2], ***Rajneesh Chaudhary***[2], ***Sreekant Narumanchi***[2], ***Yogendra Joshi***[1], ***Satish Kumar***[1]; [1]*Georgia Institute of Technology,* [2]*National Renewable Energy Laboratory*

4:30 PM (182) **Impact of Slot Liner Compression on the Total Thermal Resistance of the Stator-Winding Assembly in Electric Motors**; ***Lindsay Sutherland***[1], ***Shanmukhi Sripada***[1], ***Amy Marconnet***[1]; [1]*Purdue University*

4:45 PM (216) **Accurate Implementation of Gate Resistance Thermometry for GaN HEMTs With a Source Connected Field Plate**; ***Daniel Shoemaker***[1], ***Seokjun Kim***[1], ***Emils Gustav Jurcik***[2], ***Matthew DeJarld***[3], ***Maher Tahhan***[3], ***Eduardo Chumbes***[3], ***Jeffrey Laroche***[3], ***Samuel Graham***[2], ***Nicholas Miller***[4], ***Sukwon Choi***[1]; [1]*The Pennsylvania State University,* [2]*University of Maryland,* [3]*Raytheon,* [4]*Michigan State University*

5:00 PM (238) **Thermal Management for a Stacked Die Power Module**; ***Himel Barua***[1], ***Shajjad Chowdhury***[1], ***Pedro Ribeiro***[1], ***Burak Ozpineci***[1]; [1]*Oak Ridge National Laboratory*

5:15 PM (417) **Analysis of the Thermal Resistance Network of Packaged GaN HEMTs**; ***Seokjun Kim***[1], ***Daniel Shoemaker***[1], ***Husam Walwil***[1], ***Bill Zivasatienraj***[2], ***Isaac Wildeson***[2], ***Sukwon Choi***[1]; [1]*The Pennsylvania State University,* [2]*BAE Systems*

TII-08 Air Cooling and Heat Exchangers

Tate Ballroom A2 Chairs: *TBD*

4:00 PM (33) **Design-Simulation-Improvement of Thermal Management System Combining Two Passives Cooling for Electromechanical Actuators in Aerospace Industry**; ***Leopold Nzonou***[1], ***Faridreza Attarzadeh***[1], ***Jiajun Xu***[1]; [1]*University of the District of Columbia*

4:15 PM (76) **Comparison of 3D Manifold Architectures for Cooling of Internal Heatsinks Using External Airflow**; ***Gearóid Farrell***[1], ***Rajesh Nimmagadda***[1], ***Shailesh N. Joshi***[2], ***Danny J. Lohan***[2], ***Ercan M. Dede***[2], ***Tim Persoons***[1]; [1]*Trinity College Dublin,* [2]*Toyota Research Institute of North America*

4:30 PM (101) **Comparison of Entropy and Exergy-Based Dynamic Optimization of Air Cycle Machine Architectures**; ***Ara Bolander***[1], ***Trevor Bird***[1], ***Kevin McCarthy***[1], ***Neera Jain***[2]; [1]*PC Krause and Associates,* [2]*Purdue University*

4:45 PM (163) **Computational Investigation of the Thermal Performance of an Adjustable Air Amplifier**; ***David Salter***[1], ***Eoin Oude Essink***[1], ***Tim Persoons***[2], ***Sajad Alimohammadi***[1]; [1]*TU Dublin,* [2]*Trinity College Dublin*

5:00 PM (367) **Thermofluidic Performance of a Two-Phase Loop Thermosyphon for Server Cooling: Effects of Condenser Secondary Side**; ***Manohar Bongarala***[1], ***Rishav Roy***[1], ***David Apigo***[1], ***Sarwesh Parbat***[1], ***Syed Faisal***[1], ***Yang Liu***[1], ***Todd Salamon***[1]; [1]*Nokia Bell Labs*

M&R-08 Design Optimization

Tate Ballroom A3 Chairs: *TBD*

4:00 PM (30) **Bond Optimization for Ceramic LGA Image Sensor Solder Joint Under Thermal &Amp; Mechanical Fatigue**; ***Unique Rahangdale***[1], ***Rohit Kumar Suthar***[1], ***Akshay Lakshminarayana***[1], ***Dereje Agonafer***[1]; [1]*The University of Texas at Arlington*

4:15 PM (65) **Development of a Reduced-Order Nodal Reliability Framework for Data Center Applications**; ***Tyler Schostek***[1], ***Nirmal Rai***[2], ***Kimberly Saviers***[2], ***Davide Ziviani***[1]; [1]*Purdue University,* [2]*RTX Technology Research Center*

4:30 PM (399) **Optimization of Copper Filled Through Package via Geometry to Minimize Thermal Induced Stresses at Glass - TPV Interface in Borosilicate Glass Interposer**; ***Krishna Bhavana Sivaraju***[1], ***Pratik Bansode***[1], ***Sai Abhideep Pundla***[1], ***Rabin Bhandari***[1], ***Akhil Kalapala***[1], ***Dereje Agonafer***[2]; [1]*The University of Texas at Arlington,* [2]*University of Texas Arlington*

E-08 Advanced Modeling Techniques

Tate Ballroom A4 Chairs: *TBD*

4:00 PM (102) **Investigation of Heat Sinks With Hybrid Pin-Fin/Absorber-Fin Arrays Considering Multiphysics Thermal-Acoustic Performance**; ***Ziqi Yu***[1], ***Taehwa Lee***[1], ***Ercan M. Dede***[1]; [1]*Toyota Research Institute of North America*

4:15 PM (159) **Numerical Investigations Into Boiling Surface Design**; ***Mitchell Whiting***[1], ***Ilya T'Jollyn***[1]; [1]*Universiteit Antwerpen*

4:30 PM (257) **Molecular Dynamics Simulations of Water Evaporation in Nanochannels**; ***Ahmet Ata Ersoy***[1], ***Mustafa Ozsipahi***[2], ***Adam Wilson***[2], ***Ali Beskok***[1]; [1]*Southern Methodist University,* [2]*DEVCOM Army Research Laboratory*

4:45 PM (233) **Parameterized Thermal Compact Modeling for Effective Thermal Management of Advanced Common Multigate Transistors in Sub-7nm Technology Nodes**; ***Harsh Kumar***[1], ***Vivek Kumar***[1]; [1]*National Institute of Technology Uttarakhand*

5:00 PM (353) **3D Simulations of Microgravity Annular Flow Condensation With Two-Phase Inlets**; ***Farshad Barghi Golezani***[1], ***Jayachandran Narayanan***[1], ***Chirag Kharangate***[1]; [1]*Case Western Reserve University*

5:15 PM (385) **Numerical Analysis of Thermal Transport Through a Lithium-Ion Battery Module**; ***Elifalet Garcia***[1], ***Shadi Mahjoob***[1]; [1]*California State University Northridge*

Day 3: Fri, May 30th 8:15 AM–9:15 AM

TI-09 TIM and Heat Spreader Development

Tate Ballroom A1 Chairs: *TBD*

8:15 AM (108) **High-Performance Low-Loss Ceramic Filler With Enhanced Surface for Next-Generation Thermal Management in Electronics**; ***Bei Xiang***[1], ***Jiarui Yan***[1], ***Kade McGarrity***[1], ***Anand Murugaiah***[1]; [1]*Momentive Technologies*

8:30 AM (134) **Graphene-Enhanced Heat Spreaders for Hotspot Remediation in Direct Liquid Cooling of Electronics**; ***Arani Mukhopadhyay***[1], ***Anish Pal***[1], ***Roshan Y. Nemade***[1], ***Sungjoon Kim***[1], ***Vikas Berry***[1], ***Constantine Megaridis***[1]; [1]*University of Illinois Chicago*

8:45 AM (369) **Development of Liquid Metal and Silicon Pin Fin Composite Thermal Interface Materials**; ***Matthew Coughlin***[1], ***Andrew Clements***[1], ***Fangzhou Wang***[1], ***Luke Gyubin Min***[1], ***Katherine Jiang***[1], ***Heungdong Kwon***[1], ***Mehdi Asheghi***[1], ***Kenneth Goodson***[1]; [1]*Stanford University*

TII-05 Immersion Cooling I

Tate Ballroom A2 Chairs: *TBD*

8:15 AM (110) **Investigation on Thermal Characteristics of Solid State Drive Under Single Phase Immersion Cooling Environment**; ***Byunghan Ko***[1], ***Heechul lee***[1], ***Woochul Jeong***[1], ***Hwanjoo Park***[1], ***Duksoo Kim***[1], ***Sunghoon Chun***[1]; [1]*Samsung Electronics Co., Ltd.*

8:30 AM (181) **Experimental Parametric Study of Direct Dielectric Fluid Cooling of Lithium-Ion Batteries for Electric Vehicles**; ***Safouene Ouenzefi***[1], ***Rodrigo Amorim Dias***[2], ***Julien Plet***[2], ***Souad Harmand***[1]; [1]*Laboratoire d'Automatique, de Mécanique et d'Informatique Industrielles et Humaines (LAMIH-UMR CNRS 8201), Université Polytechnique Hauts-de-France,* [2]*MOTUL, Vaires sur Marne*

8:45 AM (204) **Hybrid Static Immersion Cooling of a Single Lithium-Ion Prismatic Battery Cell**; ***Rajesh Nimmagadda***[1], ***David Salter***[1], ***Kantharuphan Annathurai***[1], ***Daniel Trimble***[1], ***Seamus O'Shaughnessy***[1]; [1]*Trinity College Dublin*

9:00 AM (205) **Single Phase Immersion Cooling: Going Above and Beyond 400W**; ***Shiraz Gulraiz***[1], ***John Bean***[1], ***Bachar Geha***[1]; [1]*Green Revolution Cooling*

E-09 Additive Manufacturing II

Tate Ballroom A4 Chairs: *TBD*

8:15 AM (324) **Thermal Cycling Reliability of Gravure Offset Additive Electronics With Water-Based Ink, Biodegradable Substrate and Room-Temperature Curable Adhesives**; ***Aditya Harsha***[1], ***Pradeep Lall***[1], ***Scott Miller***[2]; [1]*Auburn University,* [2]*NextFlex*

8:30 AM (328) **Screen-Printed in-Mold Electronics Reliability on Polycarbonate Substrates Under Sustained High-Temperature Conditions**; ***Shriram Kulkarni***[1], ***Pradeep Lall***[1], ***Scott Miller***[2]; [1]*Auburn University,* [2]*NextFlex*

8:45 AM (334) **High Temperature, High Humidity and Thermal Cycling Effects on Gravure Offset Printed Additive Circuits for Automotive Applications.**; ***Padmanava Choudhury***[1], ***Pradeep Lall***[1], ***Ved Soni***[1], ***Scott Miller***[2]; [1]*Auburn University,* [2]*NextFlex*

9:00 AM (335) **Additively Manufactured Electrocardiogram Wire Profiles Compared to Commercially Available Wire Connections**; ***Devin Palmer***[1], ***Pradeep Lall***[1], ***Abigail Winn***[2], ***John Morris***[2], ***Stefanie Ledbetter***[2]; [1]*Auburn University,* [2]*EAH*

Day 3: Fri, May 30th 11:30 AM–12:30 PM

TI-10 Thermosiphons, Heat Pipes and Vapor Chambers

Tate Ballroom A1 Chairs: *TBD*

11:30 AM (11) **3d-Printed SiC Cold Plate With Evaporator Wicks**; ***Mohammadreza Shaeri***[1], ***Maksym Demydovych***[1]; [1]*Advanced Cooling Technologies, Inc.*

11:45 AM (167) **Experimental Investigation of Heat Pipe Embedded Cold Plates in Conduction Cooled Chassis**; ***Vedat Yağcı***[1], ***Sertaç Çadırcı***[2], ***Murat Parlak***[1]; [1]*ASELSAN INC.*, [2]*Istanbul Technical University*

12:00 PM (221) **3-D Numerical Simulation and Optimization of Wick-Free Vapor Chambers for Enhanced Thermal Management in High-Power-Density Applications**; ***Anish Pal***[1], ***MD Naim Hossain***[1], ***Arani Mukhopadhyay***[1], ***Rajneesh Chaudhary***[2], ***Sreekant Narumanchi***[2], ***Constantine Megaridis***[1]; [1]*University of Illinois Chicago*, [2]*National Renewable Energy Laboratory*

12:15 PM (283) **Experimental Investigation of Flow Pattern in a Loop Thermosyphon With Horizontal Evaporator**; ***Prem Kumar***[1], ***AALEKH SRIVASTAVA***[2], ***Susmita Dash***[1], ***Amrit Ambirajan***[1], ***Pradip Dutta***[1]; [1]*Indian Institute of Science, Bangalore*, [2]*Indian Institute of Science*

TII-10 Immersion Cooling II

Tate Ballroom A2 Chairs: *TBD*

11:30 AM (214) **Optimize the Use of the CDU Return Flow to Enhance Single Phase Immersion Cooling**; ***Chuanlou Wang***[1], ***David Zhou***[1], ***Guangying Zhang***[1], ***Yuehong Fan***[1], ***Yingqiong Bu***[1], ***Xiang Que***[1], ***Yang1 Yao***[1]; [1]*Intel*

11:45 AM (235) **Forced Convective Liquid Immersion Cooling of a Prismatic Battery Module**; ***David Salter***[1], ***Rajesh Nimmagadda***[1], ***Daniel Trimble***[1], ***Seamus O'Shaughnessy***[1]; [1]*Trinity College Dublin*

12:00 PM (401) **Performance Analysis of Single-Phase Immersion Cooling in High Powered Electronic Components**; ***Ali Heydari***[1], ***Anto Barigala***[2], ***Pardeep Shahi***[1], ***Himanshu Modi***[1], ***Lochan Sai Reddy Chinthaparthy***[3], ***Md Raisul Islam***[3], ***Dereje Agonafer***[3], ***Mohammad Tradat***[1], ***Saket Karajgikar***[1], ***Jeremy Rodriguez***[1]; [1]*Nvidia Corporation*, [2]*The University of Texas at Arlington*, [3]*University of Texas at Arlington*

E-05 Boiling and Condensation

Tate Ballroom A4 Chairs: *TBD*

11:30 AM (179) **Concept Design of a Confined Direct Two-Phase Jet Impingement Cooler With Phase Separation of Low-Surface-Tension Fluids**; ***Gopinath Sahu***[1], ***Ketan Yogi***[1], ***Tiwei Wei***[1], ***Justin A. Weibel***[1]; [1]*Purdue University*

11:45 AM (317) **An Experimental Study on the Local Heat Transfer Behavior of the Shell-Side Flow Condensation**; ***Jiayuan Li***[1], ***Jayachandran Narayanan***[1], ***XiaoYang Gao***[1], ***Chirag Kharangate***[1]; [1]*Case Western Reserve University*

12:00 PM (351) **Optimal Contact Angle for Dropwise Condensation**; ***Tomasz Kulakowski***[1], ***Yimin Zhou***[1], ***Grzegorz Celichowski***[2], ***Maciej Psarski***[2], ***Solomon Adera***[1]; [1]*University of Michigan*, [2]*University of Lodz*

Conference Program Overview

Day-0: Tuesday, May 27, 2025

8:00 - 12:00	12:00 - 1:30	1:30 - 5:30	BREAK	6:45 - 7:45
ECTC/ITherm Joint Professional Development Courses (PDC)	Luncheon for PDC Course Attendees	ECTC/ITherm Joint Professional Development Courses (PDC)		ECTC Young Professionals Networking Event
HIR Workshop				
Registration (11:00 am - 5:00 pm)				

Day-1: Wednesday, May 28, 2025

7:00 - 8:15	8:15 -9:15	BREAK	9:30-10:30	COFFEE BREAK	11:00 - 12:30	12:30 - 2:00	2:00 - 3:30	COFFEE BREAK	4:00 - 5:30	5:30 - 6:30	6:30-8:30
Breakfast	TI-01		K-1 Keynote		TI-02	**Luncheon** Richard Chu ITherm Award Presentation	TI-03A		TI-04	Student Heat Sink Design Challenge	ECTC Student & Start-Up Innovation Challenge
	TII-01				TII-02		TII-03		TII-04		ASME K-16 and JEP Meetings
	M-01				M-02		TI-03B		M-04		
	E-01				E-02		E-03		E-04		
	TT-01				P-02		TT-03		P-04		
							ITherm Sponsors & Exhibits				
Registration (6:30 am - 5:30 pm)											

Day-2: Thursday, May 29, 2025

7:00 - 8:15	8:15 -9:15	BREAK	9:30-10:30	COFFEE BREAK	11:00 - 12:30	12:30 - 2:00	2:00 - 3:30	COFFEE BREAK	4:00 - 5:30	5:30 - 7:00	7:00-9:00
Breakfast	TI-05		K-2 Keynote		TI-06	**Luncheon** ITherm Sponsors and Partners	TI-07A		TI-08	Student Poster Networking Session and Reception	ITherm Organizers' Dinner (by Invitation)
	TII-05				TII-06		TII-07		TII-08		
	M-05				M-06		TI-07B		M-08		
	TT-05 E-05				E-06		E-07		E-08		
	P-05				P-06		TT-07		Tech Transition Panel		
			ITherm Sponsors & Exhibits				ITherm Sponsors & Exhibits				
Registration (7:00 am - 5:30 pm)											

Day-3: Friday, May 30, 2025

7:00 - 8:15	8:15 -9:15	BREAK	9:30-10:30	10:30-11:30	11:30 - 12:30	12:30 - 2:00
Breakfast	TI-09		K-3 Keynote	COFFEE BREAK & ITherm 2026 Planning (open)	TI-10	**Luncheon** ITherm Awards & Organizer Recognitions
	TII-09				TII-10	
	E-09				E-10	
	COOLERCHIPS I				COOLERCHIPS II	
	EPS President's Panel		ITherm Sponsors & Exhibits			
Registration (7:00 am - 12:00 pm)						

Legend:	
TI: Component Thermal	Keynote
TII: System Thermal	Special Events
M: Mech & Reliabiltiy	Meetings
E: Emerging Tech.	PDCs
TT: Tech Talks	P: Panels

ITherm DALLAS, TX 2025