

ITHERM 2010

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Achievement Award

We are pleased to recognize Dr. Bahgat Sammakia as the recipient of the ITherm Achievement Award for this year's conference. The ITherm Achievement Award was instituted in 1996 and is presented biennially in recognition of significant fundamental and applied contributions to the field of electronics packaging and systems in the areas of thermal management and thermomechanical aspects.

Previous recipients are Mr. Richard C. Chu in 1996, Prof. Avram Bar-Cohen in 1998, Dr. Wataru Nakayama in 2000, Prof. Arthur E. Bergles in 2002, Prof. Michael Yovanovich in 2004, Dr. Robert J. Moffat in 2006 and Dr. Roger R. Schmidt in 2008

ITherm Past General Chairs

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1990..... Avram Bar-Cohen
1992..... Sevgin Oktay
1994..... Alfonso Ortega
1996..... Dereje Agonafer
1998..... Sushil H. Bhavnani
2000..... Gary Kromann
2002..... Cristina H. Amon
2004..... Koneru Ramakrishna
2006..... Bahgat Sammakia
2008..... Tom Lee

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Abhjit Kaisare - Iota technologies
Adam Pautsch - GE Global Research Center
Ahmed Zaghlool - Ferraz Shawmut Inc
Ahmet Sahin – King Fahd Univ of Petroleum & Minerals
Alex Corwin - GE
Amip Shah - Hewlett Packard
Amir Jokar - ThermoFluids Tech
Amy Fleischer - Villanova University
Amy Xia - Intel
Anand Desai - GE
Anandaroop Bhattacharya - Intel Technology India
Andrew Tay - National University of Singapore
Andy Delano -Honeywell
Aniruddha Pal – Applied Materials
Ankur Jain - Molecular Imprints Inc
Antar Mohamed - King Fahd U of Petroleum & Minerals
Arun Gowda - GE Global Research
Arun Raghupathy - Electronics Cooling Solutions
Ashish Gupta - Intel Corporation
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 Nick Roberts - Vanderbilt University
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 Shakti Chauhan - GE
 Shankar Krishan –
 Shawn Litster – Carnegie Mellon University
 Shidong Li - Maverick Applied Science
 Shlomo Novotny - Vette Corp
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 Siddharth Bhopte - State Univ of New York, Binghamton
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 Technologies
 Veerendra Mulay - The University of Texas at Arlington
 Vibhash Jha - CALCE, UMD
 Victor Chiriac - Freescale Semiconductor
 Vijay Sarihan - Freescale Semiconductors
 Vikas Gupta - Texas Instruments
 Vincent Manno - Tufts University
 Vinod Kamath - IBM
 Weilin Qu - University of Hawaii at Manoa
 Xuanhang Zhang - APC-MGE
 Yaomin Lin – Univeristy of California, Irvine
 Yeong-Yan Perng – Fluent TEchnologies
 Yi-Shao Lai - Advanced Semiconductor Engineering
 Ying Sun – Drexel University
 Ying-Feng Pang - Intel
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 Yongho Ju - UCLA
 Yoon Jo Kim - Georgia Institute of Technology
 Yuri Muzychka - Memorial University of Newfoundland
 Zaher Aboumourad -
 Zane Johnson - North Dakota State University
 Zhikui Wang - Hewlett-Packard Company

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Exhibitors (in Paris Exhibit Hall; please stop by)

3D Packaging Research Center
Advanced Cooling Technologies
AGC
AI Technology, Inc.
Alchimer
ALLVIA, Inc.
American Furukawa
Amkor Technology
ANSYS
AOS Thermal Compounds
Bergquist Company, The
CEA - LETI – MINATEC
Chip Scale Review
Cinch Connectors, Inc.
CPS Technologies Corp
DELO Industrial Adhesives LLC
Disco Hi-Tec America
Dow Corning
Dow Electronic Materials
DuPont Wafer Level Packaging
Electronics Cooling
Endicott Interconnect Technologies, Inc
ESW GmbH
E-tec Interconnect Ltd
Finetech
Fraunhofer IZM
Fujipoly America Corp
Henkel Corp.
Heraeus, Inc.
IMEC
Innovative Research
Interconnect Systems, Inc.
JSR Micro, Inc.
Malico Inc.
Mini-Systems, Inc
Momentive Performance Technologies
Nagase & Co. Ltd
Namics Technologies, Inc
Nordson-Dage
Pac Tech USA
Palomar Technologies Inc.
Pure Technologies
Quik-Pak
RTI International
SET - Smart Equipment Technology
Shin-Etsu MicroSi
Sierra Circuits Inc.
Sigrity, Inc.
Simulia
Sony Chemicals Corp. of America
SPP Surface Technology Systems
STATS ChipPAC
Tango Systems, Inc.
TechSearch International, Inc
Tokyo Ohka Kogyo Co., Ltd.
Toray Engineering Co., Ltd.
XYZTEC BV
Yole Development
Zymet, Inc.

**ITherm 2010: Program
Wednesday, June 2, 2010**

TIME	SKYVIEW V/VI	SKYVIEW I	SKYVIEW II	SKYVIEW III	SKYVIEW IV
7:00-7:30	Speakers Breakfast				
7:30- 9:30		SC-1: Integrated Power and Thermal Co-Design of Microprocessors Towards Achieving Optimal Performance	SC-2: Thermal Management of Three-Dimensional Integrated Circuits: Challenges and Opportunities	SC-3: Microchannel Heat Exchangers for Thermal Management of High Performance Microelectronics Systems	SC-4: Methodologies and Engineering Tools for Component Reliability
9:30-10:00		Refreshment Break			
10:00-11:00	Plenary: Evolving Efficiencies in Data Center Design and Operation Scott Noteboom (Yahoo)				
11:00-12:30		TT-1: Thermal Interface Materials	TT-2: Device Level Thermal Management and LED Cooling	MT-1: Modeling and Simulation I	ET-1: Thermoelectrics/acoustics and Sensors
12:30-2:00		Lunch			
2:00-3:30		TT-3: Single Phase Liquid Cooling 1	TT-4: Data Center Cooling and Phase Change Materials	MT-2: Modeling and Simulation II	ET-2: Micro-Fluidics
3:30-4:00		Refreshment Break			
4:00-5:30		P1: Discussion on Energy Harvesting	P-2: Cooling Challenges for Military Platforms	MT3: Modeling and Simulation III	P3: Cooling of 3D Packaging (NSF Sponsored Panel)
5:30-7:00	Exhibitor Reception (Joint with ECTC) in Paris Exhibit Hall				

ITherm 2010: Program
Thursday, June 3, 2010

TIME	SKYVIEW V/VI	SKYVIEW I	SKYVIEW II	SKYVIEW III	SKYVIEW IV
7:00 - 7:30	SPEAKER BREAKFAST				
7:30-9:30		SC-5: Integrated Power and Thermal Co-Design of Microprocessors Towards Achieving Optimal Performance	SC-6: Why We Do Thermal Management: An Introduction to Reliability Engineering and Thermomechanics	SC-7: Extracting Thermal Data from Component Datasheets	SC-8: Methodologies and Engineering Tools for Component Reliability
9:30-10:00	Refreshment Break (Skyview Foyer)				
10:00-11:00	Plenary: Thermal Considerations in Electronic Packaging Raj Master, Microsoft				
11:00-12:30		TT-5: Data Center Cooling 1	TT-6: Single Phase Liquid Cooling 2	MT4: Reliability 1	ET-3: Nanotechnology: Thermal, Mechanics, Material and Process Related Issues in Nanostructures
12:30-2:00	Lunch , Achievement Award Presentation				
2:00-3:30		TT-7: Data Center Cooling 2	TT-8: Two Phase Liquid Cooling	MT5: Reliability 2	ET-4: Nano-enhanced Thermal Management
3:30-4:00	Refreshment Break/Exhibitors (Paris)				
4:00-5:30		P-4: Green Data Center: Thermal Challenges and Opportunities (NSF Sponsored Panel)	P-5: 3-D Integration Technologies, Thermo-Mechanical Challenges, Applications and Roadmaps	MT6: Reliability 3	P6: Top Thermal Management Innovations from the Past 100 Years and the Next 100 Years
5:30-7:00	Committee Meetings				

**ITherm 2010: Program
Friday, June 4, 2010**

TIME	SKYVIEW V/VI	SKYVIEW 1	SKYVIEW II	SKYVIEW III	SKYVIEW IV
7:00-7:30	Speaker's Breakfast				
7:30-9:30		SC-9: Semiconductor Device Thermal Characterization and System Analysis	SC-10: Why We Do Thermal Management: An Introduction to Reliability Engineering and Thermomechanics	SC-11: Design of Experiments for Thermal Engineers	SC-12: Introduction to Thermoelectric Modules
9:30-10:00	Refreshment Break (Skyview Foyer)				
10:00-11:00	Keynote: Silent Air Cooling - A Solution to the "Cooling Quandary"? Liam Goudge, Tesserra				
11:00-12:30		TT-9: Thermal Modeling & Design 1	TT17: Heat Conduction & Spreaders	MT7: Reliability of Solar PV Devices and Modules	ET5: Data Center Thermal Management and Energy Efficiency
12:30-2:00	Lunch/Awards and Committee Recognition				
2:00-3:30		TT-11: Thermoelectrics & Refrigeration 1	TT-12: Thermal Modeling & Design 2	MT8: Materials 1	TT-13: Air Cooled Heat Sinks
3:30-4:00	Refreshment Break/Exhibitors				
4:00-5:30		TT14: Thermoelectrics & Refrigeration 2	TT15: Chip Cooling & Stacked Dies	MT9: Materials 2	P8: Carbon Nanotube as Thermal Interface Material: Thermal Performance from Theory to Application

ITherm 2010: Program
Saturday, June 5, 2010

TIME	SKYVIEW V/VI	SKYVIEW I	SKYVIEW II	SKYVIEW III	SKYVIEW IV
7:00-7:30	Speaker's Breakfast				
7:30-9:30		TT16: Heat Pipes	TT-10: Air Cooling	SC-13: Semiconductor Device Thermal Characterization and System Analysis	SC-14: Thermal Management with Synthetic Jets
9:30-10:00	Refreshment Break				
10:00-11:30		TT18: Transient Heat Transfer		MT10: Materials 3	TT19: Experimental Methods

PROGRAM

Wednesday June 2, 2010

7:00 – 7:30 am

Skvview 6 Speaker's Breakfast

7:00 - 8:00 am

Skvview Lobby Registration

7:30 – 9:30 am **SHORT COURSES**

Skvview 1

Short Course #1

Integrated Power and Thermal Co-Design of
Microprocessors towards Achieving Optimal
Performance
Bhagat Sammakia SUNY Binghamton

Skvview 2

Short Course #2

Thermal Management of Three-Dimensional Integrated
Circuits: Challenges and Opportunities
Ankur Jain.....Molecular Imprints Inc

Skvview 3

Short Course #3

Microchannel Heat Exchangers for Thermal
Management of High Performance Microelectronics
Systems
Suresh Garimella.....Purdue University

Skvview 4

Short Course #4

Methodologies and Engineering Tools for Component
Reliability
Jie-Hua (Jeff) ZhaoTexas Instruments
Kamal Karimanal and Sheldon Imaoka ANSYS

9:30 – 10:00 am

Skvview Lobby Refreshment Break

10:00 – 11:00 am

Skvview 5 Plenary: Evolving Efficiencies in Data Center
Design and Operation
Scott Noteboom, Yahoo

11:00 – 12:30 pm **PARALLEL SESSIONS**

Skvview 1

TT-1: Thermal Interface Materials

Chairs: Vadim Gektin
Sandeep Ahuja

**Advances in Thermal Interface Technology: Mono-Metal
Interconnect Formation, Processing and Characterisation**

B. Wunderle, M. Kleinand, L. Dietrich
.....Fraunhofer Institute Reliability and Microintegration
M. Abo Ras and R. Mrossko Berliner Nanotest und Design
D. May, R. Schacht, H. Oppermann, B. Michel and H. Reichl..
..... Fraunhofer Institute Reliability and Microintegration

TIM Selection Methodology for High Power Flip Chip Packages

Nokibul Islam, SeoWon Lee, JoonYeob Lee, YunHyeon Ka,
JinYoung Khim and Jesse GallowayAmkor Technology

**Non-Uniform Thermal Properties of an Alumina Granule/Epoxy
Potting Compound**

John F. Maddox, Roy W. Knight and Sushil H. Bhavnani.....
..... Auburn University

**New Developments for a No-Pump-Out High-Performance
Thermal Grease**

Sara N. PaisnerLord Corporation
Maxat Touzelbaev, Gamal Refai-Ahmed and Yizhang Yang....
..... Advanced Micro Devices

**Efficient Method for Characterization of Various Thermal
Interface Materials**

M. Cummings, N. Shephard, K. Su and D. Bhagwagar
..... Dow Corning

**On Refining the Parameters of a Random Network Model for
Determining the Effective Thermal Conductivity of Particulate
Thermal Interface Materials**

B. Dan and B.G. Sammakia SUNY at Binghamton
G. SubbarayanPurdue University

Skvview 2 **TT-2: Device Level Thermal Management and
LED Cooling**

Chairs: Mehdi Asheghi
Gamal Refai-Ahmed
James Petroski
Mehmet Arik

**On The Determination of the Thermal Impedance of
Microwave Bipolar Transistors**

Raphael Sommet, Antonio A. L. de Souza, Alain Xiong,
Juan Obregon, J.C Nallatamby, Michel Prigent and
Raymond Quéré..... XLIM University of Limoges

**Scaling Consideration on Local Hotspot for Si MOSFETS- for
Device Length Scale Typically Larger than 100 nm**

Kazuyoshi Fushinobu and Yasufumi Yamamoto
.....Tokyo Institute of Technology
Tomoyuki Hatakeyama Toyama Prefectural University

**Thermal Simulation for IC Devices with Large Number of
Heat Sources**

Ri Li GE Global Research
Jianjun Jiang State University of New York at Binghamton
Arun Gowda, Kankasabapathi Subramanian and
Krishnaswami Srihari
.....State University of New York at Binghamton

Immersion Cooling of Light Emitting Diodes

Mehmet Arik, Yogen Utturkar and Stanton Weaver
..... General Electric Company Global Research

Conduction Cooling of Large LED Array Systems

James Petroski, Julian Norley, John Schober, Brad Reis and
R. Andrew Reynolds
..... GrafTech International Holdings

Thermal Characteristics of Edge-Illumination Type LED

Backlight System in a Thin Flat Panel Display

Sung Ki Kim, Joon Kang, Woo Young Kan and
Sang Hak Kim Samsung Electronics

Skvview 3 **MT-1: Modeling and Simulation I**

Chairs: Pradeep Lall
Zane Johnson

**Reliability Evaluation of Power Semiconductor Devices Using
Coupled Analysis Simulation**

Kazunori Shinohara
.....Kanagawa Academy of Science and Technology
Qiang Yu Yokohama National University

Development of a Microstructurally Adaptive Unified Primary-Cum-Secondary Creep Model for SAC387 Solder Joints

Z. Huang, P. Kumar and I. Dutta ..Washington State University
G. SubbarayanPurdue University
V. GuptaTexas Instruments
D. Chan.....Purdue University
C. H. Wen.....Washington State University

Impacts of Solder Voids on PQFN Packages' Thermal and Mechanical Performances

Victor A. Chiriac Freescale Semiconductor, Inc.
Youmin Yu University of Minnesota

Stochastic Finite Element Modeling of Fatigue Damage Evolution for Visco-Plastic Materials in Micro-Electronics

Leila J. Ladani and Jafar Razmi Utah State University

Skvview 4 ET-1: Thermoelectrics/Acoustics and Sensors
Chair: Peter DeBock

Thermophones by Quantum Mechanics

Thomas Prevenslik QED Radiation

Thermal and Power Generating Performances of Thermoelectric Energy Recovery Modules

Kyoung Joon Kim Alcatel-Lucent

Prediction of Electrical Contact Resistivity in Thermoelectric Modules (TEMs) from Module-Level Measurements

S. Ravi Annapragada.....Purdue University
Todd Salamon and Paul Kolodner Alcatel-Lucent
Marc HodesTufts University
Suresh V. GarimellaPurdue University

Acoustic Approach to Thermal Management

Orest G. Symko and Iván A. Rodríguez University of Utah

Performance and Reliability of MEMS Gyroscopes at High Temperatures

Chandradip Patel and Patrick McCluskey
..... University of Maryland
David LemusTRX Systems, Inc.

Thermal Modeling of Novel Monolithic Pyroelectric Infrared Image Sensors

A. Matin and T. SugaiToyohashi University of Technology
N. Kawazu Sony Corporation
D. Akai, K. Sawada and M. Ishida
.....Toyohashi University of Technology

12:30 – 2:00 pm

Skvview 6 Lunch

2:00 – 3:30 pm PARALLEL SESSIONS

Skvview 1 TT-3: Single Phase Liquid Cooling 1

Chairs: Michael Ellsworth
Unni Vaddakan

Numerical Investigation of Optimal Spacing between Heat-Generating Blocks in Laminar Forced Convection

Raed I. Bourisli Kuwait University

Hot Spot Mitigation Using Single-Phase Microchannel Cooling for Microprocessors

Anjali Chauhan, B. Sammakia and K. Ghose
..... Binghamton University
Gamal Refai-AhmedAMD, Inc
Dereje AgonaferUniversity of Texas at Arlington

Novel Heat Transfer Fluids using Mixture Formulations for Electronics Thermal Management

Aravind Sathyanarayana and Yogendra Joshi
..... Georgia Institute of Technology
Yunhyeok Im KAIST

Heat Transfer in Microchannels: Substrate Effects and Cooling Efficiency for Rectangular and Circular Ducts

M. Baris Dogruoz Ansys
Mehmet Arik and Adam Pautsch.....
..... General Electric Global Research Center

Innovative Liquid Cooling Configurations for High Heat Flux Applications

Prithish R. Parida, Srinath V. Ekkad and Khai Ngo
..... Virginia Tech

Numerical Investigation of Inlet Condition Effect on Thermo-Fluid Characteristics of Turbulent Plane Jet

Ehsan Faghani Simon Fraser University
Pedram Faghani University of Tehran
Mehrdad EskandariAmir Kabir University of Technology

Skvview 2 TT-4: Data Center Cooling and Phase Change Materials

Chairs: Victor Chiriac
Sukhvinder Kang
Mehdi Asheghi
Madhusudan Iyengar

Thermodynamic Modeling and Calorimetry of Nanostructured Materials for Capacitive Thermal Management

Oksen T. Baris, Hongxiang Tian and Sanjiv Sinha
..... University of Illinois at Urbana-Champaign

An Improved PCM Heat Storage Technology Utilizing Metal Foam

Nihad Dukhan and Sujay BodkeUniversity of Detroit Mercy

Numerical Simulation of Thermal Management with Heat Sink Composites

T. Fiedler, C. Veyhl, I.V. Belova and G.E. Murch
..... University of Newcastle

Data Center Air Management Metrics-Practical Approach

Robert Tozer and Munther Salim.....
.....Hewlett Packard Critical Facilities Services

Improved CFD Modeling of a Small Data Center Test Cell

Waleed A. Abdelmaksoud, H. Ezzat Khalifa and
Thong Q. DangSyracuse University
Roger R. Schmidt and Madhusudan IyengarIBM

Hybrid Cooled Data Center Using above Ambient Liquid Cooling

Brandon A Rubenstein, Hewlett Packard
Roy ZeighamiCisco
Robert Lankston and Eric Peterson..... Microsoft

Skvview 3 MT-2: Modeling and Simulation II

Chairs: Charlie Zhai
Erdogan Madenci

Packaging Optimization to Mitigate Stress Induced Parameter Shift in Precision Devices

Jie-Hua Zhao, Siva Gurrum and Darvin Edwards
..... Texas Instruments

Modeling of Multi-Temperature-Cycle Wafer Curvature

Javad Zarbakhsh KAI – Kompetenzzentrum Automobil- und Industrie-Elektronik
Martin Lederer University of Vienna
Rui Huang KAI – Kompetenzzentrum Automobil- und Industrie-Elektronik
Thomas Detzel Infineon Technologies Austria
Brigitte Weiss University of Vienna

Fatigue Failure Model with Peridynamic Theory

Erkan Oterkus, Ibrahim Guven and Erdogan Madenci University of Arizona

Damage Initiation and Propagation Modeling Using Energy Partitioning Damage Evolution Model for Pb-Free Solder Materials

Leila J. Ladani Utah State University

PHM-Based Residual Life Computation of Electronics Subjected to a Combination of Multiple Cyclic-Thermal Environments

Pradeep Lall, Rahul Vaidya and Vikrant More Auburn University
Kai Goebel NASA Ames Research Center
Jeff Suhling Auburn University

Skvview 4 ET-2: Micro-Fluidics

Chairs: Pramod Chamrathy
Jin Yang

Optical Waveguiding through Thermal Boundary Layer Development over a Microchannel Walls

Seyed Reza Mahmoudi and Jayshri Sabarinathan University of Western Ontario

Numerical Study of a Novel Passive Micromixer Design

Siddharth Bhopte, Bahgat Sammakia and Bruce Murray State University of New York at Binghamton

Thermal Performance of Microchannels with Wavy Walls for Electronics Cooling

Liang Gong Xi'an Jiaotong University
Krishna Kota Georgia Institute of Technology
Wenquan Tao Xi'an Jiaotong University
Yogendra Joshi Georgia Institute of Technology

Heat Transfer Enhancement with Laminar Liquid-Gas Slug Flows

James A. Howard, Patrick A. Walsh, Edmond J. Walsh and Yuri S. Muzychka University of Limerick

3:30 – 4:00 pm

Skvview Lobby Refreshments/Exhibits (Paris)

4:00 – 5:30 pm PANELS/SESSION

Skvview 1 P-1: Discussion on Energy Harvesting

Moderator: Ihtesham H Chowdhury, Intel

Panelists:

Jim Bierschenk, Marlow Industries
Greg Carman, UCLA
Carl Schulenberg, PowerMEMS
Dan Steingart, CUNY
Kazuaki Yazawa, USCS

Skvview 2 P-2: Cooling Challenges for Military Platforms

Moderator: Avram Bar-Cohen, University of Maryland

Panelists:

Adam Scofield, DARPA
Peter De Bock, General Electric
Mark Spector, Office of Naval Research
Karl Geisler, General Dynamics
Andrew Flemming - Air Force Research Laboratory

Skvview 3 MT-3: Modeling and Simulation III

Chairs: John H. L. Pang
Vikas Gupta

Hygroscopic Swelling Behavior of Molding Compound at High Temperature

Haojun Zhang and Seungbae Park State University of New York at Binghamton,
Soonmin Hong Samsung Electronics

Modeling of Transport Phenomena in Polymer Electrolyte Fuel Cells

Dong Myung Suh and SB Park State University of New York at Binghamton

Peridynamic-Models Using Finite Elements for Shock and Vibration Reliability of Leadfree Electronics

Pradeep Lall, Sandeep Shantaram and Dhananjay Panchagade Auburn University

Guideline to Avoid Cracking in 3D TSV Design

Zhen Zhang Microsoft

Interfacial Failure Simulation of Single Solder Joint Using a Multiscale Approach

Feng Gao and Jianmin Qu Northwestern University
Frank Z. Liang and Richard L. Williams Intel Corporation

Skvview 4 Cooling of 3D Packaging (NSF Sponsored Panel)

Moderators: Gamal Refai-Ahmed, AMD
Dereje Agonafer, University of Texas at Arlington

Panelists:

Victor A. Chiriach, Qualcomm
Maxat Touzelbaev, Texas Instruments
Mohammad Hossain, Intel
Ahmer Syed, Amkor Technologies
E. Jan Vardaman, TechSearch International

5:30 – 7:00 pm

Paris Exhibit Hall Exhibitor Reception (joint with ECTC)

THURSDAY, JUNE 3, 2010

7:00 – 7:30 am

Skvview 6 **Speakers' Breakfast and Continental Breakfast for all attendees**

7:30 – 9:30 am SHORT COURSES

Skvview 1 **Short Course #5**
Integrated Power and Thermal Co-Design of Microprocessors towards Achieving Optimal Performance
Bahgat Sammakia SUNY Binghamton

Skvview 2 **Short Course #6**
Why We Do Thermal Management: An Introduction to Reliability Engineering and Thermomechanics
Karl Geisler General Dynamics

Skvview 3 **Short Course #7**
Extracting Thermal Data from Component Datasheets
Patrick Loney Northrop Grumman

Skvview 4 **Short Course #8**
Methodologies and Engineering Tools for Component Reliability
Jie-Hua (Jeff) Zhao Texas Instruments
Kamal Karimanal and Sheldon Imaoka ANSYS, Inc

9:30 – 10:00 am

Skvview Fover **Refreshment Break**

10:00 – 11:00

Skvview 5 **Keynote**
Thermal Considerations in Electronic Packaging
Raj Master, Microsoft

11:00 – 12:30 pm PARALLEL SESSIONS

Skvview 1 **TT-5: Data Center Cooling I**
Chairs: Siddharth Bhopte
Ali Heydari

Open Side Car Heat Exchanger that Removes Entire Server Heat Load without any Added Fan Power

Roger Schmidt, Madhu Iyengar, Don Porter, Gerry Weber,
David Graybill and James Steffes IBM

Optimizing Data Center Cooling Infrastructures Using Exergothermovolumes

Amip Shah, Cullen Bash and Chandrakant Patel Hewlett Packard Laboratories

From Chip to Cooling Tower Data Center Modeling: Part I Influence of Server Inlet Temperature and Temperature Rise across Cabinet

Thomas J. Breen, Ed J. Walsh and Jeff Punch University of Limerick
Amip J. Shah and Cullen E. Bash Hewlett Packard Company

From Chip to Cooling Tower Data Center Modeling: Part II Influence of Chip Temperature Control Philosophy

Ed J. Walsh, Thomas J. Breen and J. Punch University of Limerick
Amip J. Shah and Cullen E. Bash Hewlett Packard Company

Energy Savings Achievable through Liquid Cooling: A Rack Level Case Study

Douglas C. Hwang, Vincent P. Manno, Marc Hodes and
George J. Chan Tufts University

Skvview 2 **TT-6: Single Phase Liquid Cooling II**

Chairs: David Copeland
Amir Jokar

Numerical Investigation of a Liquid Droplet Transported by a Gas Stream Impinging on a Heated Surface: Single-Phase Regime

Andres J. Diaz and Alfonso Ortega Villanova University

Reliability Modeling of a Single Phase Liquid Cooling System for Power Electronics Applications

Douglas DeVoto and Patrick McCluskey University of Maryland

Numerical Investigation of Flow and Heat Transfer Characteristics from an Impinging Jet on a Circular Cylinder

Pedram Faghani University of Tehran
Mehrdad Eskandari Amir Kabir University of Technology
Ehsan Faghani Simon Fraser University
Shahin Amiri McGill University

Characterization of Thermal Field in Mixed-Convection Cooling of a Flat Plate by an Impinging Slot Jet

Kaveh Habibi and Shahin Amiri McGill University
Mehdi Ashjaee University of Tehran

Experimental Investigation of Oblique Finned Microchannel Heat Sink

Yong-Jiun Lee, Poh-Seng Lee and Siaw-Kiang Chou National University of Singapore

Skvview 3 **MT4: Reliability I**

Chairs: Qiang Yu
Kuo-Ning Chiang

Study on High Reliable Design Method for Lead-free Solder Joints on Electronic Components

Kanji Takagi, Qiang Yu and Tadahiro Shibusaki Yokohama National University
Yukihiro Noro Omron Corporation

Assessing Au-Al Wire Bond Reliability Using Integrated Stress Sensors

Michael J. McCracken, Hyoung Joon Kim and Michael Mayer University of Waterloo
John Persic Microbonds Inc
June Sub Hwang and Jeong-Tak Moon MK Electron

A Study on Reliability of Ni Plating in a High Temperature Power Device

Takayuki Ishikawa, Toshikazu Oshidari, Hiromi Sugihara and
Qiang Yu Yokohama National University

Reliability Assessment of a 28 V DC Power Module

Vibhash Jha and F. P. McCluskey University of Maryland

Measurement of Die Stress Distributions in Flip Chip CBGA Packaging

Jordan Roberts, Safina Hussain, M. Kaysar Rahim,
Mohammad Motalab, Jeffrey C. Suhling, Richard C. Jaeger and
Pradeep Lall Auburn University
Ron Zhang Oracle

Skvview 4 ET-3: Nanotechnology: Thermal, Mechanics, Material and Process Related Issues in Nanostructures
Chairs: Kripa Varanasi
Huseyin Kizil

On the Charging and Thermal Characterization of a Micro/Nano Structured Thermal Ground Plane

H. Peter J. de Bock, Shakti Chauhan, Pramod Chamarthy, Stanton E. Weaver and Tao Deng GE Global Research
Frank M. Gerner and Mohammed T. Ababneh University of Cincinnati
Kripa Varanasi Massachusetts Institute of Technology

Optimization of Mass Transport in Integrated Nanostructured Wicking Surfaces for the Reduction of Evaporative Thermal Resistance

Justin A. Weibel, Suresh V. Garimella and Jayathi Y. Murthy..
..... Purdue University
David H. Altman Raytheon Integrated Defense Systems

Experimental Characterization of a Micro-Scale Thin Film Evaporative Cooling Device

Shankar Narayanan, Andrei G. Fedorov and Yogendra K. Joshi
..... Georgia Institute of Technology

Controlling Nucleation and Growth of Water Using Hybrid Hydrophobic-Hydrophilic Surfaces

Kripa K. Varanasi Massachusetts Institute of Technology
Tao Deng GE Global Research Center

Dynamic Wetting on Superhydrophobic Surfaces: Droplet Impact and Wetting Hysteresis

Katherine Smyth, Adam Paxon and Hyuk-min Kwon
..... Massachusetts Institute of Technology
Tao Deng GE Global Research Center
Kripa K. Varanasi Massachusetts Institute of Technology

12:30 – 2:00 pm

Skvview 6

Lunch for Attendees
ITherm 2010 Achievement Award
Dr. Bahgat Sammakia
“An overview of Thermal management of Electronic Systems Research at the Small Scale Systems Integration and Packaging Center. (S3IP)”

2:00 – 3:30 PM PARALLEL SESSIONS

Skvview 1

TT-7: Data Center Cooling II
Chairs: Xuanhang Zhang
Tahir Cader

Numerical Modeling of Data Center with Transient Boundary Conditions

Srujan Gondipalli, Mahmoud Ibrahim, Siddharth Bhopte, Bahgat Sammakia, Bruce Murray and Kanad Ghose
..... State University of New York at Binghamton
Madhusudan K. Iyengar and Roger Schmidt IBM

Data Center Damage Boundaries

Cullen Bash, Rocky Shih, Amip Shah and Chandrakant Patel
..... Hewlett Packard Company

Reducing Energy Usage in Data Centers through Control of Room Air Conditioning Units

Madhusudan Iyengar and Roger Schmidt IBM
Joe Caricari Grubb + Ellis Management Services

Measurement-Based Modeling for Data Centers

Vanessa López and Hendrik F. Hamann
..... IBM T. J. Watson Research Center

Computational Method for Generalized Analysis of Pumped Two-Phase Cooling Systems and its Application to a System Used in Data-Center Environments

Kanchan M. Kelkar and Suhas V. Patankar
..... Innovative Research
Sukhvinder S. Kang Aavid Thermalloy
Madhusudan Iyengar and Roger R. Schmidt IBM

Experimental and Computational Study of Perforated Floor Tile in Data Centers

Waleed A. Abdelmaksoud, H. Ezzat Khalifa, Thong Q. Dang and Basman Elhadidi Syracuse University
Roger R. Schmidt and Madhusudan Iyengar IBM

Skvview 2 TT-8: Two Phase Liquid Cooling

Chairs: Karl Geisler
Avram Bar-Cohen

Pressure Effects on the Pool Boiling of the Fluorinated Ketone $C_2F_5C(O)CF(CF_3)_2$

Eric C. Forrest, Lin-Wen Hu, Thomas J. McKrell,
Jacopo Buongiorno and Yakov Ostrovsky
..... Massachusetts Institute of Technology

A Two-Phase Heat Spreader for Cooling High Heat Flux Sources

Mitsuo Hashimoto, Hiroto Kasai, Yuichi Ishida and Hiroyuki Ryoson Sony
Kazuaki Yazawa University of California Santa Cruz
Justin A. Weibel and Suresh V. Garimella Purdue University

Decoupled Thermal Resistances of Phase Change Material and Their Impact on PCM Devices

Jaeho Lee, John P. Reifenberg, Elah Bozorg-Grayeli, Lewis Hom, Zijian Li, Sangbum Kim, Mehdi Asheghi, H.-S. Philip Wong and Kenneth E. Goodson
..... Stanford University

Heat Transfer in Gas-Liquid and Liquid-Liquid Two Phase Plug Flow Systems

N. Janes, Y.S. Muzychka and B. Guy
..... Memorial University of Newfoundland
E.J. Walsh and P. Walsh University of Limerick

Fundamental Study on Heat Transfer Characteristics of Microencapsulated Phase Change Material Suspensions Flowing in Circular Mini-Pipe

Shinji Nakagawa, Takehiro Hashimoto, Tatsuya Hayashi, Tomoyuki Hatakeyama and Masaru Ishizuka
..... Toyama Prefectural University

Feedback Stabilization of Transition Boiling States

Rob van Gils, Michel Speetjens and Henk Nijmeijer
..... Eindhoven University of Technology

Skvview 3 MT5: Reliability II

Chairs: Deepak Goyal
Patrick McCluskey

Statistical Phase Shifting Step Estimation Based on Continuous Wavelet Transform for High Resolution Interferometry Metrology

Bicheng Chen and Cemal Basaran University at Buffalo

xError Analysis for

Piezoresistive Stress Sensors Used in Flip Chip Packaging
Safina Hussain, Richard C. Jaeger, Jeffrey C. Suhling,
Jordan C. Roberts and Mohammad A. Motalab Auburn University
Chun-Hyung Cho Hongik University

Effect of Shield-Can for Drop/Shock Behavior of Board Level Assembly
Jae Kwak, Da Yu and Seungbae Park State University of New York at Binghamton
Soonwan Chung, Ji-Young Yoon and Kyung-Woon Jang Samsung Electronics

Use of Prognostics in Risk-Based Decision Making for BGAs under Shock and Vibration Loads
Pradeep Lall and Ryan Lowe Auburn University
Kai Goebel NASA Ames Research Center

Fault-Isolation in Portable Electronics Subjected to Drop and Shock
Pradeep Lall, Prashant Gupta, Dhananjay Panchagade and Arjun Angral Auburn University

Effect of Shield-Can for Drop/Shock Behavior of Board Level Assembly
Jae Kwak, Da Yu and Seungbae Park State University of New York at Binghamton
Soonwan Chung, Ji-Young Yoon and Kyung-Woon Jang Samsung Electronics Co

Skvview 4 ET-4: Nano-Enhanced Thermal Management
Chairs: Huseyin Kizil
Kripa Varanasi

Nanofluids in a Forced-Convection Liquid Cooling System – Benefits and Design Challenges –
Steve P. Schroeder and Garron K. Morris General Electric Healthcare Systems

Phonon Wave-Packet Simulations of Ar/Kr Interfaces
N. A. Roberts and D.G. Walker Vanderbilt University

An Investigation into the Solidification of Nano-Enhanced Phase Change Material for Transient Thermal Management of Electronics
Omar Sanusi, Amy Fleischer and Randy Weinstein Villanova University

Spray Cooling by Al₂O₃ and TiO₂ Nanoparticles in Water
Hana Bellerova, Michal Pohanka and Miroslav Raudensky University of Technology
Ampere A Tseng Arizona State University

3:30 – 4:00 pm
Skvview Lobby Refreshments/Exhibits (Paris)

4:00 – 5:30 pm PANELS/SESSION

Skvview 1 P-4: Green Data Center: Thermal Challenges and Opportunities (NSF Sponsored Panel)
Moderators: Roger Schmidt, IBM
Bahgat Sammakia, SUNY Binghamton

Panelists:
Michael Patterson, Intel
Yogendra Joshi, Georgia Tech
Kanad Ghose, Binghamton University
Chris Malone, Google Corp.

Skvview 2 P-5: 3-D Integration Technologies, Thermo-Mechanical Challenges, Applications and Roadmaps
Moderator: Riko Radojcic, Qualcomm

Panelists:
Victor Chiriac, Qualcomm
Yogendra Joshi, Georgia Tech
Robert Darveaux, Amkor Technology
Paul Franzon, NCSU
Arif Rahman, Xilinx

Chairs: Jie-Hua Zhao
Takashi Kawakami

Thermal Fatigue Life Evaluation of CSP Joints by Mechanical Fatigue Testing
Yoshihiko Kanda, Kunihiro Zama and Yoshiharu Kariya Shibaura Institute of Technology
Hironori Oota NEC Corporation
Shunichi Kikuchi Fujitsu Advanced Technologies
Hideki Yamabe Nihon Superior Co
Kazuhiko Nakamura HDP User Group International

Investigation on the Interactions among Light, Material and Temperature Field in Transient Lens Effect, Transmission Characteristics in 1D Temperature Field
Hong Duc Doan, Kazuyoshi Fushinobu and Ken Okazaki Tokyo Institute of Technology

Application of Thermo-Viscoelastic Laminated Plate Theory to Predict Warpage of Printed Circuit Boards
Takaya Kobayashi and Masami Sato Mechanical Design & Analysis Corp

Initiation and Propagation of Interfacial Delamination in Integrated Thin-Film Structures
Haixia Mei, Shravan Gowrishankar, Kenneth M. Liechti and Rui Huang University of Texas at Austin

Random Vibration Test for Electronic Assemblies Fatigue Life Estimation
Abdullah Al-Yafawi, Saket Patil, Da Yu, Seungbae Park and James Pitarresi State University of New York at Binghamton
Namseo Goo Konkuk University

Skvview 4 P-6: Top Thermal Management Innovations from the Past 100 Years and the Next 100 Years
Moderator: Suzana Prstic, Intel

Panelists:
Madhusudan Iyengar, IBM
Mehmet Arik, GE Global Research
Vadim Gektin, Oracle
Marc Hodes, Tufts University
Sridhar Narasimhan, Intel
Karl Geisler, General Dynamics

6.00 - 6.30 pm
Skyview 4 InterPACK 2011 Planning Meeting

6.30 - 8.00 pm
Skyview 1 EPPD Executive Committee Meeting

FRIDAY, JUNE 4, 2010

7:00 – 7:30 am

Skvview 6 Speakers' Breakfast and Continental Breakfast for all attendees

7:30 – 9:30 am SHORT COURSES

Skvview 1 Short Course #9
Semiconductor Device Thermal Characterization and System Analysis
Roger Stout ON Semiconductor

Skvview 2 Short Course #10
Why We Do Thermal Management: An Introduction to Reliability Engineering and Thermomechanics
Karl Geisler General Dynamics

Skvview 3 Short Course #11
Design of Experiments for Thermal Engineers
James Petroski GrafTech

Skvview 4 Short Course #12
Introduction to Thermoelectric Modules
Marc Hodes Tufts University

9:30 – 10:00 am

Skvview Fover Refreshment Break

10:00 – 11:00 Keynote:
Silent Air Cooling - A Solution to the "Cooling Quandary"?
Liam Goudge, Tesserra

11:00 – 12:30 pm PARALLEL SESSIONS

Skvview 1 TT-9: Thermal Modeling & Design I
Chairs: Bill Maltz
Ioan Sauciu

Multiphysics Optimization, Synthesis, and Application of Jet Impingement Target Surfaces
Ercan M. Dede..... Toyota Research Institute of North America

Delphi Style Compact Modeling for Multi-Chip Package Including Its Bottom Board Area Based on Genetic Algorithm Optimization
Eric Monier-Vinard, Valentin Bissuel, Paul Murphy,
Olivier Daniel and Julien Dufrenne..Thales Corporate Services

Boundary-Condition-Independent Reduced-Order Modeling of 3D Objects by the Pod-Galerkin Methodology
Arun Prakash Raghupathy and William Maltz
..... Electronic Cooling Solutions
Urmila Ghia and Karman Ghia University of Cincinnati

Droplet Meniscus Motion of Thermocapillary Pumping in a Closed Microchannel with External Heating
Y. Yang, A. Odukoya and G. F. Naterer ..University of Ontario

Validation of an Advanced Fan Model with Multiple Reference Frame Approach
Gokul V. Shankaran and M. Baris Dogruoz..... Ansys

Skvview 2 TT17: Transient Heat Transfer

Chairs: Baris Dogruoz
Koneru Ramakrishna

Study of the Transient Behavior of Microfluidic Heat Sinks
Alireza Motieifar, Cyrus Shafai and Hassan M. Solima.....
..... University of Manitoba

Transient Thermal Analysis of High-Concentration Photovoltaic Cell Module Subjected to Coupled Thermal and Power Cycling Test Conditions
Ning-Yuan Wang, Shih-Ying Chiang and Tsung-Lin Chou
..... National Tsing Hua University
Zun-Hao Shih and Hwen-Fen Hong
..... Institute of Nuclear Energy Research
Kuo-Ning Chiang National Tsing Hua University

Thermal Design and Transient Analysis of Insulated Gate Bipolar Transistors of Power Module
Tuan-Yu Hung, Shih-Ying Chiang, Chan-Yen Chou,
Chien Chia Chiu and Kuo-Ning Chiang
..... National Tsing Hua University

Experimental Investigation of Hotspot Removal Using Superlattice Cooler
Vivek Sahu, Yogendra K. Joshi and Andrei G. Fedoro.....
..... Georgia Institute of Technology

Thermal Characterization of Planar Interconnect Architectures under Different Rapid Transient Currents Using the Transmission Line Matrix and Finite Element Methods
Banafsheh Barabadi, Yogendra K. Joshi and Satish Kumar.....
..... Georgia Institute of Technology
Gamal Refai-Ahmed..... Advanced Micro Devices

Skvview 3 MT7: Reliability of Solar PV Devices and Modules
Chairs: Andrew Tay
Koneru Ramakrishna

Mechanical Challenge of Frameless PV-Modules
Bernhard Weller and Lutz Tautenhahn
..... Technische Universität Dresden

Damp Heat Induced Physical Aging of PV Encapsulation Materials
Gernot Oreski and Gernot M. Wallner.....
..... Polymer Competence Center Leoben

Adhesion of Encapsulating Films Used in PV Module Manufacturing
Ricky Santoso and Maryann Kenney
..... Saint Gobain Performance Plastics

Improved Quality Test Method for Solder Ribbon Interconnects on Silicon Solar Cells
J. Wendt and M. Träger Q-Cells SE
R. Klengel and M. Petzold
..... Fraunhofer Institute for Mechanics of Materials
D. Schade and R. Sykes XYZTEC

Skvview 4 ET5: Data Center Thermal Management and Energy Efficiency
Chairs: Madhusudan Iyengar
Ankur Jain

Thermal Anomaly Prediction in Data Centers
Manish Marwah, Ratnesh Sharma and Cullen Bash..... HP Labs

Numerical Modeling Approach to Dynamic Data Center Cooling
Mahmoud Ibrahim, Srujan Gondipalli, Siddharth Bhopte,
Bahgat Sammakia, Bruce Murray and Kanad Ghose State
University of New York at Binghamton
Madhusudan K. Iyengar and Roger Schmidt..... IBM

**Thermal Zones for More Efficient Data Center Energy
Management**
Hendrik F. Hamann, Vanessa López and Andrew Stepanchuk..
.....IBM T.J. Watson Research Center

**Experimental Investigations on the Effect of Perforated Tile Air
Jet Velocity on Server Air Distribution in a High Density Data
Center**
Pramod Kumar and Yogendra Joshi
..... Georgia Institute of Technology

A Sustainable Data Center with Heat-Activated Cooling
Anna Haywood, Jon Sherbeck, Patrick Phelan,
Georgios Varsamopoulos and Sandeep K. S. Gupta
..... Arizona State University

12:30 – 2:00 pm Lunch for attendees
Awards and Committee Recognition

2:00 – 3:30 pm PARALLEL SESSIONS

Skyview 1 TT-11: Thermoelectrics & Refrigeration I
Chairs: Poh-Seng Lee
Marc Hodes

**Absorption Refrigeration Method with Alternative Water-
Ammonia Solution Circulation System for Microelectronics
Cooling**
Victor Chiriac Freescale Semiconductor Inc.
Florea Chiriac Technical University of Civil Engineering

**Thermal Performance of a Thermoelectric Air-Cooling System
with Heat Sinks**
Sang Woo Kang.. Korea Institute of Science and Technology
Jae-Hoon Shin and Hun Sik Han
.....Korea Advanced Institute of Science and Technology
Yun Ho KimUniversity of Seoul
Seo Young Kim..... Korea Institute of Science and Technology

**Performance Measurement and Analysis of a Thermoelectric
Power Generator**
Hun Sik Han
.....Korea Advanced Institute of Science and Technology
Yun Ho KimUniversity of Seoul
Seo Young Kim..... Korea Institute of Science and Technology
Sukkee UmHanyang University
Jae Min Hyun
.....Korea Advanced Institute of Science and Technology

**Cooling Microprocessors Using Vapor Compression
Refrigeration**
Gareth F. Davies and Ian W. Eames
.....London South Bank University
Paul Bailey and Michael W. Dadd..... University of Oxford
Adam Janiszewski Newcastle University
Richard Stone University of Oxford
Graeme G. Maidment.....London South Bank University
Brian Agnew University of Northumberland

**A Hybrid Thermoelectric Cooler Thermal Management System
for Electronic Packaging**
M.K. Russel, D. Ewing and C.Y. Ching ...McMaster University

Skyview 2 TT-12: Thermal Modeling & Design II
Chairs: Mudasar Ahmad
Antar Mohamed

**Development of Practical Thermal Design Technique of
Printed Circuit Boards for Power Electronics**
Tomoyuki Hatakeyama, Masaru Ishizuka, Shinji Nakagawa and
Kazumitsu Watanabe..... Toyama Prefectural University

**Thermal Characterization of High-Density Interconnects: A
Methodology Tested on a Model Coupon**
Wataru NakayamaThermTech International
Katsuhiro Koizumi COSEL
Takashi Fukue and Masaru Ishizuka
..... Toyama Prefectural University
Tatsuya Nakajima.....CD-adapco Japan Co.
Hiroko Ohta and Ryuichi Matsuki Shinko Electric Industries

Solar Shroud Design Using Computational Fluid Dynamics
Keduse P. Agonafer, Nikhil Lakhkar and Dereje Agonafer.....
..... University of Texas at Arlington
Andrew MorrisonMotorola Corporation

**Chip-Package Thermal Co-Simulation Technique for
Thermally Aware Chip Design**
Kamal Karimanal Ansys

**Electro-Thermal Modeling, Control and Optimization in
Power Distribution Networks**
Wayne WeaverMichigan Technological University

Skyview 3 MT8: Materials 1
Chairs: Jeffrey Suhling
Takashi Kawakami

Thermal Cycling Fatigue Analysis of SAC387 Solder Joints
Chandra Williams, Kok Ee Tan and John H. L. Pang
..... Nanyang Technological University

**The Influence of Aging on the Stress-Strain and Creep
Behavior of SAC Solder Alloys**
Yifei Zhang, Zijie Cai, Muhannad Mustafa, Jeffrey C. Suhling,
Pradeep Lall and Michael J. BozackAuburn University

**Effect of Joint Size on Low-cycle Fatigue Properties of
Sn-Ag-Cu Solder Joint**
Yoshiharu Kariya, Kana Sato, Shota Asari and
Yoshihiko Kanda.....Shibaura Institute of Technology

Thermo-Mechanical Reliability of SAC Leadfree Alloys
Pradeep Lall and Robert Hinshaw..... Auburn University
Ranjit PandherCookson Electronics
Mahendra Harsha and Jeff Suhling Auburn University

**Comprehensive Evaluation of Solder Paste for Assembly of
PQFN Packages**
Youmin YuUniversity of Minnesota
Sean Xu..... Freescale Semiconductor (China)
Victor Chiriac Freescale Semiconductor

Skyview 4 TT-13: Air Cooled Heat Sinks
Chairs: Ahmed Zaghlool
Ridvan Sahar

**Experimental Investigation into Honeycomb Heat Sinks
Incorporating Varying Size Slots for Enhanced Heat Transfer**
Domhnaill Hernon..... Alcatel-Lucent Ireland

Impingement Heat Sink Optimization for Microprocessors with Significant Hot Spots

Shiladitya Chakravorty, Bahgat Sammakia and Krishnaswami Srihari State University of New York at Binghamton
Gamal Refai-Ahmed Advanced Micro Devices

Thermal Management of an Electronical Device Using PCM Embedded in a Pin Fin Heat Sink

Murat Parlak and Ugur Etiz Aselsan Inc

Fin-Shape Optimization of an Impingement-Parallel Plate Heat Sink

Pravara Gondipalli, Bahgat Sammakia and Susan Lu State University of New York at Binghamton
Gamal Refai-Ahmed Advanced Micro Devices

Understanding the Performance Metrics for Advanced Cooling Methodologies

Stephen A. Solovitz..... Washington State University Vancouver
Mehmet Arik General Electric Global Research

3:30 – 4:00 pm

Skvview Lobby Refreshments/Exhibits (Paris)

4:00 – 5:30 pm PANELS/PARALLEL SESSIONS

Skvview 1 TT14: Thermoelectrics & Refrigeration II

Chairs: Kazuaki Yazawa
Peter DeBock

Thermoelectrics Enhanced Air Cooling Limits and Improvement Techniques: Experimental and Computational Studies

H. Y. Zhang, Y. C. Mui and Gamal Refai-Ahmed
..... Advanced Micro Devices

Performance of Two-Step Thermoelectric-Adsorption Heat Pump for Harsh Environment Electronics Cooling

Ashish Sinha and Yogendra Joshi.....
..... Georgia Institute of Technology

Two-Phase Flow Instability Analysis for Transient Electronics Cooling

TieJun Zhang, Yoav Peles, John T. Wen and Michael K. Jensen
..... Rensselaer Polytechnic Institute

Experimental Identification of Evaporator Dynamics for Vapor Compression Refrigeration Cycle during Phase Transition

Juan E. Catano, TieJun Zhang, Yoav Peles, Michael K. Jensen and John T. Wen
..... Rensselaer Polytechnic Institute

On-Chip Peltier Cooling Using Current Pulse

Man Prakash Gupta, Min-hee S Sayer, Saibal Mukopadhaya and Satish Kumar
..... Georgia Institute of Technology

Skvview 2 TT18: Chip Cooling & Stacked Dies

Chairs: Varaprasad (Vara) Calmidi
Aniruddha Pal

Analysis of the Spatial and Temporal Behavior of Three-dimensional Multi-Core Architectures towards Run-Time Thermal Management

E. Kursun, J. Wakil and M. Iyengar IBM Research

Heat-Removal Performance Scaling of Interlayer Cooled Chip Stacks

T. Brunschweiler, S. Paredes, U. Drechsler and B. Michel.....
..... IBM Research
W. Cesar and Y. Leblebici
..... Swiss Federal Institute of Technology in Lausanne
B. Wunderle and H. Reichl
..... Fraunhofer Institute for Reliability and Microintegration

Floorplanning 1024 Cores in a 3D-Stacked Network-on-Chip with Thermal-Aware Redistribution

Jui-Hung Chien, Chiao-Ling Lung, Chin-Chi Hsu,
Yung-Fa Chou and Ding-Ming Kwai
..... Industrial Technology Research Institute

Thermal Management of Multicore Processors Using Power Multiplexing

Man Prakash Gupta, Minki Cho, Saibal Mukopadhaya and Satish Kumar
..... Georgia Institute of Technology

Thermal Characteristics of Multi-Die, Three-Dimensional Integrated

Circuits with Unequally Sized Die

Ankur Jain, Molecular Imprints Inc

Skvview 3 MT9: Materials II

Chairs: John H. L. Pang
Vijay Sarihan

Novel Carbon-Aluminum Composites with Low Coefficient of Thermal Expansion (CTE) and High Thermal Conductivity

N. Jiang and J. Novak.....
..... Applied Nanotech, Inc

Squeeze Flow Characterization of Particle-Filled Polymeric Materials through Image Correlation

Nikhil Bajaj, Ganesh Subbarayan and Suresh V. Garimella
..... Purdue University

Verification of Ball-On-Ring Test Using Finite Element Analysis

Seung-Hyun Chae.....
..... University of Texas at Austin
Jie-Hua Zhao and Darvin R. Edwards
..... Texas Instruments
Paul S. Ho
..... University of Texas at Austin

Extracting Nanowire Mechanical Properties from Three-Point Bendig Test

Yun Liu.....
..... Kunming University of Science and Technology
Yin Zhang
..... Chinese Academy of Sciences

Effect of Backside Scratch Direction on the Si Die Strength

Seung-Hyun Chae.....
..... University of Texas at Austin
Jie-Hua Zhao and Darvin R. Edwards
..... Texas Instruments
Paul S. Ho
..... University of Texas at Austin

Skvview 4 P8: Carbon Nanotube as Thermal Interface Material: Thermal Performance from Theory to Application

Moderator: Arun Gowda, GE Global Research

Panelists:

C.P Wong, Georgia Tech
Suresh Garimella, Purdue University
Ihtesham Chowdhury, Intel

6:00 – 7:30 pm

Skvview 4 K16 Meeting

SATURDAY, JUNE 5, 2010

7:00 – 7:30 am

Skvview 6 **Speakers' Breakfast and Continental
Breakfast for all attendees**

7:30 – 9:30 am **SHORT COURSES/PARALLEL SESSIONS**

Skvview 1 **TT15: Heat Pipes**
Chairs: Mark North
 Hemanth K. Dhavaleswarapu

The Effect of Orientation on U-Shaped Grooved and Sintered Wick Heat Pipes

M.K. Russel, C. Young, J.S. Cotton and C.Y. Ching
.....McMaster University

Design and Analysis of High-Performance Air-Cooled Heat Exchanger with an Integrated Capillary-Pumped Loop Heat Pipe

Matthew McCarthy, Teresa Peters, Jon Allison, Alonso Espinosa, David Jenicek, Arthur Kariya, Catherine Koveal, John G. Brisson, Jeffrey H. Lang and Evelyn N. Wang
.....Massachusetts Institute of Technology

Heat Pipe Embedded AlSiC Plates for High Conductivity – Low CTE Heat Spreaders

J. Weyant and S. Garner Advanced Cooling Technologies
M. Johnson National Nuclear Security Administration
M. Occhionero CPS Technologies

Thermal Performance of Novel Thin Heat Pipe

Hiroyuki Ryoson, Takashi Yajima, Kazuo Goto and Koji Hirata Sony Chemical & Information Device Corp
Kazunao Oniki Sony Corp

A Numerical Model for Transport in Heat Pipes Considering Wick Microstructure Effects

Ram Ranjan, Jayathi Y. Murthy and Suresh V. Garimella
.....Purdue University
Unnikrishnan Vadakkan Intel

Skvview 2 **TT16: Heat Conduction & Spreaders**
Chairs: Yuri Muzychka
 Greg Walker

Extraordinary Thermal Conductivity of Graphene: Possibility of Thermal Management Applications

S. Ghosh, S. Subrina, V. Goyal, D.L. Nika, E.P. Pokatilov and A.A. Balandin
.....University of California – Riverside

Thermal Management with Graphene Lateral Heat Spreaders: A Feasibility Study

Samia Subrina, Dmitri Kotchikov and Alexander A. Balandin
.....University of California – Riverside

Thermal Conduction through Diamond - Silicon Heterostructures

V. Goyal, D. Kotchikov, S. Subrina, M. Rahman and A.A. Balandin
.....University of California - Riverside

Orthotropic Thermal Conductivity and Joule Heating Effects on the Temperature Distribution of Printed Circuit Boards

Gokul V. Shankaran, M. Baris Dogruoz and Daniel deAraujo ..
..... Ansys

XMT-Based Direct Simulation of Flow and Heat Transfer through Open-cell Aluminum Foams

Karthik K. Bodla, Jayathi Y. Murthy and Suresh V. Garimella.
.....Purdue University

Skvview 3 **Short Course #13**
Semiconductor Device Thermal Characterization and System Analysis
Roger Stout ON Semiconductor

Skvview 4 **Short Course #14**
Thermal Management with Synthetic Jets
Raghav Mahalingam Nuventix

9:30 – 10:00 am

Skvview Foyer **Refreshment Break**

10:00 – 11:00 **PARALLEL SESSIONS**

Skvview 1 **TT-10: Air Cooling**
Chairs: Ed Walsh
 Emad Samadiani

Comparison between Experimental Results and CFD Simulations for Air Flows in a Thin Electronics Casing Model
Masaru Ishizuka, Shinji Nakagawa, Tomoyuki Hatakeyama and Yasushi Nishino Toyama Prefectural University

Augmenting Forced Convection Heat Transfer Coupled with an Aerodynamic Surface and a Synthetic Jet

Pradeep Salapakkam, Ri Li, Mehmet Arik and Bill Gerstler
..... General Electric Global Research Center

Comparison of 2D and 3D Unsteady Effects of a Pair of Opposed Confined Impinging Jets

Victor Adrian Chiriac Freescale Semiconductor
Jorge Luis Rosales... Phoenix Analysis & Design Technologies

Enhancement of Natural Convection Using Synthetic Jets

Ri Li, William D. Gerstler, Mehmet Arik and Benjamin Vanderploeg GE Aviation Systems

Convective Heat Transfer Due to an Impinging Synthetic Jet: A Numerical Investigation of a Canonical Geometry

Luis A. Silva and Alfonso Ortega Villanova University

Skvview 3 **MT8: Materials III**
Chairs: Indranath Dutta
 Tz-Cheng Chiu

Thermo-Mechanical Properties of High Performance Thermal Interface Gap Filler Pads

Y. Joon Lee Parker Hannifin

Intermediate Strain Rate Dependant Mechanical Properties for Lead-Free Solders

Luhua Xu, Kok Ee Tan and John H. L. Pang
..... Nanyang Technological University

The Influence of Aging on the Creep Behavior of Underfill Encapsulants

Chang Lin, Nusrat Chhanda, Jeffrey C. Suhling and Pradeep Lall Auburn University

IMC Growth in Solid-Liquid Interdiffusion Bonds

Leila J. Ladani and Jafar Razmi Utah State University

Board Trace Fatigue Models and Design Guidelines for Electronics under Shock-Impact

Pradeep Lall, Arjun Angral and Jeff Suhling
..... Auburn University

Skvview 4 TT19: Experimental Methods

Chairs: Amy Fleischer
Kyoung Joon Kim

**Development of a Measurement Technique for Highly
Conductive CVD Diamonds and Analysis of Uncertainties Due to
3D Heat Losses**

Mehmet Arik, Ri Li, Kristian Andreini, Jared Crosby and
Dave Shaddock..... General Electric Global Research Center
Huseyin Kizil..... Istanbul Technical University

**Thermal Conductivity and Boundary Resistance Measurements
of GeSbTe and Electrode Materials Using Nanosecond
Thermoreflectance**

E. Bozorg-Grayeli and J.P. Reifenberg..... Stanford University
K.W. Chang Intel
M. Panzer and K.E. Goodson..... Stanford University

**Numerical and Experimental Study of the Effect of
Thermocouple Wire Attachment on Thermal Characterization of
a High Performance Flipchip Package**

Sravan Gondipalli, Siddharth Bhopte and Bahgat Sammakia....
..... State University of New York at Binghamton
Varaprasad Calmidi.....Endicott Interconnect Technologies

**Design and Development of a Miniaturized Black Body Device for
In-Situ IR-Camera Calibration**

R. Schacht.....Fraunhofer Inst Reliability & Microintegration
Ch. Gerner and T. Nowak
..... University of Applied Sciences Lausitz
D. May, B. Wunderle and B. Michel
.....Fraunhofer Institute Reliability and Microintegration

**Design Challenges of Thermal Margining Tools for Silicon
Validation**

Rahima K. Mohammed, Ridvan A. Sahan and
Mohanraj Prabhugoud..... Intel Corporation

11:30 am Conference Ends

