

ITherm 2008 Program

ITherm 2008

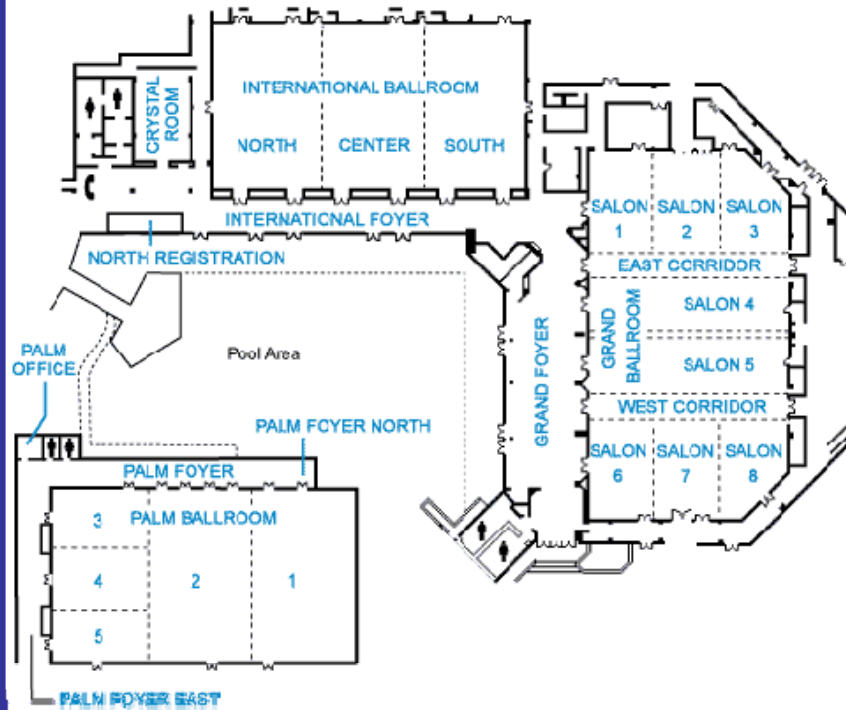
Hilton at Walt Disney World Resort
Orlando, Florida USA
May 28 - 31, 2008

THE ELEVENTH INTERSOCIETY CONFERENCE ON

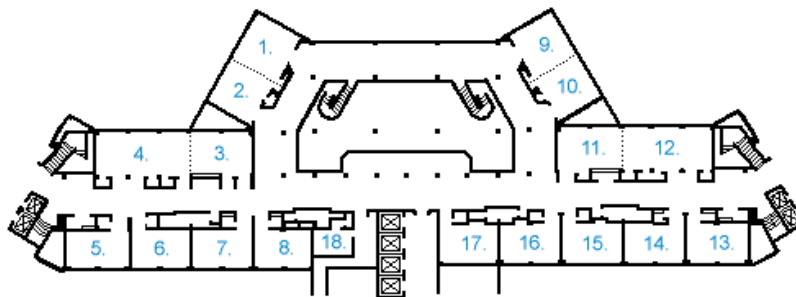
Thermal and Thermomechanical Phenomena in Electronic Systems



HILTON in the WALT DISNEY WORLD RESORT LOBBY LEVEL



HILTON in the WALT DISNEY WORLD Resort - Mezzanine Level



- | | |
|-------------------|---------------|
| 1. QUINCE | 10. BEGONIA |
| 2. POINSETTA | 11. CAMELIA |
| 3. ORANGE BLOSSOM | 12. DOGWOOD |
| 4. NARCISSUS | 13. EDELWEISS |
| 5. MAGNOLIA | 14. FUSCHIA |
| 6. LILY | 15. GARDENIA |
| 7. KAHILI | 16. HIBISCUS |
| 8. JASMINE | 17. IRIS |
| 9. AZALEA | 18. ROSE |

Welcome to

ITHERM 2008

Welcome to Orlando, Florida for the Eleventh Intersociety Conference on Thermal and Thermomechanical Phenomena in Emerging Technologies and Micro Systems, ITherm 2008 ! ITherm 2008 is co-sponsored by the Components, Packaging and Manufacturing Technology (CPMT) Society of the Institute of Electrical and Electronics Engineers (IEEE), and the Heat Transfer Division K-16 Committee on Electronics Cooling, and the Electronics and Photonics Packaging Division (EPPD) of the American Society of Mechanical Engineers (ASME).

This is a particularly special occasion, as we celebrate the twentieth anniversary of the ITherm conference. Over the past two decades, ITherm has developed the reputation of being the premier venue for reporting the latest research advances, and showcasing the newest technologies, tools and services in the areas covered. Continuing the tradition, ITherm 2008 has attracted outstanding papers in the broad areas of thermal management, mechanics, materials, and emerging technologies in multi-functional microsystems. Out of over 300 abstracts initially submitted, the peer review process has yielded about 170 papers for presentations. These will be along four tracks: The first three, including Thermal Management, Mechanics, and Emerging Technologies have been a familiar part of previous ITherms. In addition, for ITherm 2008 we have created a new Thrust to focus on the growing interest in Energy Efficient Electronics. The vibrant research focus of the conference will be preceded on Wednesday (May 27) with a series of Tutorials (2 hours each) and Short Courses (4 hours each) on a variety of topics of current interest. Three Keynote/Invited presentations by leading experts are intended to provide an exciting glimpse of the future technical challenges to the ITherm community. A popular feature of ITherm conferences is lively panel discussions led by leading experts. We are excited about the four panels to be held on a diverse set of topics, and thank the moderators and panelists for putting together a compelling agenda. ITherm 2008 preserves the strong historical links with the IEEE Electronics Components and Technology Conference (ECTC), held nearly concurrently at a nearby venue in Orlando. Through a joint Exhibits program on Wednesday and Thursday, we expect to provide the ITherm participants a glimpse to the latest technological products, software, and services relating to microsystems packaging.

We are fortunate to have the dedicated support and participation of a large group of outstanding individuals on the ITherm 2008 Program Committee. The excellent program with a strongly maintained peer-review process is a result of the hard work, and perseverance of the Session Chairs and Co-Chairs. We would also like to thank many of our peers, who have generously given their time to reviewing manuscripts and helping improve the quality of the papers included in the program. Acknowledgements also go to our International Liaisons for their help in promoting ITherm worldwide. We thank Ms. Kelly Sutton for directing us through a maze of complex nuances and deadlines to organize a large successful conference. Last, but not least, we are grateful to the members of the ITherm Executive Committee, Dereje Agonafer, Cristina H. Amon, Avram Bar-Cohen, Sushil H. Bhavnani, Gary Kromann, Alfonso Ortega, Koneru Ramakrishna, and Bahgat Sammakia for their guidance on the planning and organization of the conference.

Dr. Tien-Yu Tom Lee, General Chair, TSMC, San Jose, California
Prof. Y. K. Joshi, Chair, Program Chair, Georgia Institute of Technology, Atlanta, Georgia
Dr. Sandeep Tonapi, Chair, Thermal Management Track, Anveshak Technology and Knowledge Solutions, Phoenix, Arizona
Dr. Mehdi Asheghi, Co-Chair, Thermal Management Track, Stanford University, Palo Alto, California
Prof. John Hock-Lye Pang, Chair, Mechanics Track, Nanyang Technological University, Singapore.
Dr. Jie-Hua "Jeff" Zhao, Co-Chair, Mechanics Track, Texas Instruments, Inc., Dallas, Texas
Dr. David Copeland, Chair, Energy Efficient Electronics Track, Sun Microsystems, Sunnyvale California.
Prof. S. B. Park, Co-Chair, Energy Efficient Electronics Track, Binghamton University, Binghamton, New York
Mr. Michael J. Ellsworth, Jr., Chair, Emerging Technologies Track, IBM Corporation, Poughkeepsie, NY
Prof. Prof. Timothy Fisher, Co-Chair, Emerging Technologies Track, Purdue University, West Lafayette, Indiana.
Dr. Gamal Refai-Ahmed, Chair, Short Courses, AMD Inc., Ontario, Canada
Prof. Samuel Graham, Co-Chair, Short Courses, Georgia Institute of Technology, Atlanta, Georgia
Dr. Victor Chiriac, Chair, Panels, Freescale Semiconductor, Tempe, Arizona
Prof. Patrick Phelan, Co-Chair, Panels, Arizona State University, Tempe, Arizona
Prof. Sushil H. Bhavnani, Co-Chair, ITherm Achievement Award, Auburn University, Auburn, Alabama
Dr. Koneru Ramakrishna, Co-Chair, ITherm Achievement Award, Freescale Semiconductor, Austin, Texas
Prof. Bahgat Sammakia, Co-Chair, Keynote Speakers, Binghamton University, Binghamton, New York
Prof. Dereje Agonafer, Co-Chair, Keynote Speakers, University of Texas at Arlington, Arlington, Texas
Dr. Kamal K. Sikka, Chair, Publicity, IBM, Hopewell Junction, New York
Dr. Khalid Sheltami, Chair, Joint Exhibit, AMD Inc., Ontario, Canada

ITHERM 2008

Organizing Committee

General Chair:

Dr. Tom Lee, TSMC North America, USA

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Prof. Yogendra K. Joshi, Georgia Institute of Technology, USA

Thermal Management Track:

Dr. Sandeep Tonapi, Anveshak Technology and Knowledge Solutions, USA

Dr. Mehdi Asheghi, iCONA Technology, USA

Mechanics Track:

Prof. John Hock Lye Pang, Nanyang Technological University, Singapore

Dr. Jie-Hua Zhao, Texas Instruments, USA

Emerging Technologies Track:

Mr. Michael Ellsworth, IBM, USA

Prof. Timothy Fisher, Purdue University, USA

Panel Discussions:

Dr. Victor Chiriac, Freescale Semiconductor, USA

Prof. Patrick Phelan, Arizona State University, USA

Poster Session:

Dr. David Copeland, Sun Microsystems, USA

Prof. Suengbae Park, State University of New York at Binghamton, USA

Short Courses:

Dr. Gamal Refai-Ahmed, AMD, Canada

Prof. Samuel Graham, Georgia Institute of Technology, USA

Keynote Speakers:

Prof. Dereje Agonafer, University of Texas at Arlington, USA

Prof. Bahgar G. Sammakia, State University of New York at Binghamton, USA

Exhibits Chair:

Dr. Khalid Sheltami, AMD, Canada

ITherm Achievement Award:

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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 G. Sammakia
2008	Tom Lee

ITHERM 2008 Achievement Award

We are pleased to recognize Dr. Roger R. Schmidt 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 and Dr. Robert J. Moffatt in 2006.

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Ying Sun
Yizhang Yang
Yoav Peles
Younes Shabany
Zane
Zhen Zhang

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Alchimer
Allivia, Inc.
Amkor Technology
Ansoft Corp.
ANSYS, Inc.
AOS Thermal Compounds
Applied Relay Testing Ltd.
Aviza Technology, Inc.
AZ Electronic Materials USA
Bergquist Company
Chalmers University CPMT Student Chapter
Chip Scale Review
Chomerics
Cinch Connectors, Inc.
CMC Interconnect Technologies
CoolIT Systems Inc.
CPS Technologies Corp.
CST of America
CT Electronics Ltd.
Dage Precision Industries
Dow Chemical Company
DuPont Embedded Passive Materials
DuPont Microcircuit Materials
DuPont Wafer Level Packaging
Electronics Cooling Magazine
Endicott Interconnect Technologies, Inc.
Enerdyne Solutions
ESPEC Corp.
ficonTEC GmbH
FlipChip International
Flomerics Inc.
Fujipoly America Corp.
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Henkel, Emerson & Cuming
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Quik-Pak
Reactive NanoTechnologies
Reflex Photonics Inc.
SET - Smart Equipment Technology
Shin-Etsu MicroSi
SIGRITY, Inc.
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sp3 Diamond Technologies, Inc.
Starfire Systems, Inc.
Surface Technology Systems
SUSS MicroTec
TechFilm
TechSearch International, Inc.
Ticona
Tokyo Ohka Kogyo Co., Ltd.
Toray Engineering Co., Ltd.
Xcelaero
Yole Development
Yuken Industry Co., Ltd.
Zymet, Inc.

ITherm 2008: Program
Wednesday, May 28, 2008

TIME	Camelia	Dogwood	Narcissus	Orange Blossom
7:45 -9:45	Course 1: High Resolution Thermal Metrology For Electronic Systems	Course 2: Employing Innovative Cooling Technologies in Present and Future Electronic Products	Course 3: Constitutive and Failure Behavior of SnAgCu Solder Joints	Course 4: On-Chip Thermal Management and Hot Spot Remediation
9:45 -10:00	Refreshment Break			
10:00-12:00	Course 5:Energy Efficient Thermal Management of Data Centers	Course 2 (Contd.): Employing Innovative Cooling Technologies in Present and Future Electronic Products	Course 6:An Introduction to the Analysis of Delamination in IC Packages Using Fracture Mechanics	Course 7: Advanced Cooling Technologies for Next-Generation Microelectronics Systems
12:00 -12:45	Lunch on your own			
12:45 -2:45	Course 8: Thermal Engineering of Phase Change Random Access Memory (PCRAM) Devices	Course 9: Design of Experiments for Thermal Engineering	Course 10: Mechanics of Interfaces in Microelectronic Packaging	Course 11: Thermoelectric Modules: Principles and Research
2:45 -3:00	Refreshment Break			
3:00 - 5:00	Course 12: Carbon and Graphene Nanoribbon Interconnects	Course 9 (Contd.): Design of Experiments for Thermal Engineering		Course 13: Measurement Techniques in the Thermal Management of Electronics
5:30 -6:30	ECTC/ITHERM Joint Exhibit and Reception			

**ITherm 2008: Program
Thursday, May 29, 2008**

TIME	Salon IV	Salon I	Salon II	Salon III	Salon VI
7:00 - 8:00	Breakfast				
8:00 -8:10					Opening Remarks
8:10 – 8:55					Keynote Address: Rao Tummala, Georgia Institute of Technology, "Emerging Systems Packaging Technologies "
9:00 -10:40		1.1 Thermal Management Track - Session 1 Heat Pipes, Thermosyphons, Capillary Pumped Loops and Vapor Chambers	1.2 Thermal Management Track - Session 2 Advances in Air Cooling	1.3 Mechanics Track - Session 1 Lead Free Solder Materials & Reliability	1.4 Panel -1 Thermal Management Challenges for Military Electronics
10:40-10:50	Refreshment Break				
10:50 -12:30		2.1 Emerging Technologies. Track - Session 1 MEMS/NEMS/Sensors	2.2 Thermal Management Track - Session 3 Thermal Management Utilizing Two Phase Cooling	2.3 Mechanics Track - Session 2 Materials Characterization & Const. Mod.	2.4 Panel-2 Cooling Challenges and Energy Efficiency in Low Form Factor Electronics
2:50 – 3:00	Refreshment Break				
12:30 2:00	Lunch Achievement Award presentation to Dr. Roger Schmidt, IBM. Award Talk: "IBM, Mainframes, and Environmentals "				
2:30 -5:30	Joint ECTC/ITherm Exhibit (buses provided)				

**ITherm 2008: Program
Friday, May 30, 2008**

TIME	Salon IV	Salon I	Salon II	Salon III	Salon VI
7:00 - 8:00	Breakfast				
8:00 -8:10	Opening Remarks				
8:10 – 9:50		3.1 Thermal Management Track – Session 4 Microchannel Heat Sinks I	3.2 Thermal Management Track – Session 5 Thermal Modeling and Experimental Characterization III	3.3 Mechanics Track– Session 3 Experimental Characterizations	3.4 Emerging Technologies Track - Session 2 Micro/Nano-Scale Single and 2-Phase Convection
9:50 – 10:00	Refreshment Break				
10:00 -11:40		4.1 Thermal Management Track - Session 6 Microchannel Heat Sinks II	4.2 Thermal Management Track- Session 7 Thermal Interface Materials I	4.3 Mechanics Track- Session 4 Failure Mech & Damage Modeling	4.4 Panel 3 Cyber Infrastructure Resources for Thermal Management
11:40 – 1:10	Lunch Keynote Address: "Engineering and Thermal Transport Research at the National Science Foundation" by Drs. Patrick Phelan and Richard Buckius, National Science Foundation				
1:10-2:50		5.1 Thermal Management Track - Session 8 Spray, Mist, and Liquid Jet Impingement Cooling I	5.2 Thermal Management Track - Session 9 Thermal Modeling and Experimental Characterization II	5.3 Mechanics Track- Session 5 Modeling and Simulation I	5.4 Panel-4 Energy Efficient Data Centers
2:50 – 3:00	Refreshment Break				
3:00 -4:40	Poster Session				
4:40-5:50	Dinner on your own				
5:50-7:30		7.1 Thermal Management Track - Session 10 Spray, Mist, and Liquid Jet Impingement Cooling II	7.2 Thermal Management Track - Session 11 Thermal Characterization of Fin/Fan Assembly	7.3 Thermal Management Track- Session 12 Thermal Interface Materials II	7.4 Emerging Technologies Track – Session 3 Nano-Scale Compact/Analytical Models

**ITherm 2008: Program
Saturday, May 31, 2008**

TIME	Salon IV	Salon I	Salon II	Salon III	Salon VI
7:00 - 8:00	Breakfast				
7:45 -7:55	Opening Remarks				
7:55 – 9:15		8.1 Thermal Management Track– Session 13 Thermal Modeling and Experimental Characterization I	8.2 Thermal Management Track- Session 14 Advances in Thermal Engineering of Fin/Fan Assembly	8.3 Emerging Technologies Track - Session 4 Interfacial Thermal Behavior at Micro/Nano Scales	8.4 Mechanics Track– Session 6 Modeling and Simulation II
9:20-930	Refreshment Break				
9:30-10:50		9.1 Emerging Technologies Track- Session 5 Nano-Scale Modeling	9.2 Thermal Management Track - Session 15 Novel Thermal Management Approaches I	9.3 Thermal Management Track – Session 16 System Level Thermal Management - Thermal Characterization	9.4 Mechanics Track– Session 7 Quality & Reliability I
10:55 11:05	Refreshment Break				
11:05-12:25		10.1 Thermal Management Track– Session 17 System Level Thermal Management - Consumer Electronics	10.2 Thermal Management Track– Session 18 Novel Thermal Management Approaches II	10.3 Emerging Technologies Track - Session 6 Advanced Packaging	10.4 Mechanics Track- Session 8 Quality & Reliability II
12:30- 2:00	Lunch Best Paper Awards, Program Committee Recognition				

WEDNESDAY, MAY 28, 2008

7:45-9:45

Camelia

High Resolution Thermal Metrology for Electronic Systems

Kenneth Goodson, Stanford University

Dogwood

Employing Innovative Cooling Technologies in Present and Future Electronic Products

Gamal Refai-Ahmed, AMD
Dereje Agonafer, Univ. of Texas at Arlington
Bahgat Sammakia, Binghamton University

Narcissus

Constitutive and Failure Behavior of SnAgCu Solder Joints

Ganeth Subbarayan, Purdue University
Dhruv Bhate, Intel

Orange Blossom

On-Chip Thermal Management and Hot Spot Remediation

Avram Bar-Cohen, University of Maryland

9:45-10:00 Refreshment Break

10:00-12:00

Camelia

Energy Efficient Thermal Management of Data Centers

Yogendra Joshi, Georgia Institute of Technology

Dogwood

Employing Innovative Cooling Technologies in Present and Future Electronic Products (Continued)

Gamal Refai-Ahmed, AMD
Dereje Agonafer, Univ. of Texas at Arlington
Bahgat Sammakia, Binghamton University

Narcissus

An Introduction to the Analysis of Delamination in IC Packages using Fracture Mechanics

Andrew Tay, National University of Singapore

Orange Blossom

Advanced Cooling Technologies for Next-Generation Microelectronics Systems

Suresh V. Garimella, Purdue University

12:00-12:45 Lunch on your own (not provided by conference)

12:45-2:45

Camelia

Thermal Engineering of Phase Change Random Access Memory (PCRAM) Devices

Mehdi Asheghi, Stanford University
Ken Goodson, Stanford University

Dogwood

Design of Experiments for Thermal Engineering

James Petroski, GE Lumination

Narcissus

Mechanics of Interfaces in Microelectronic Packaging

Jianmin Qu, Georgia Institute of Technology

Orange Blossom

Thermoelectric Modules: Principles and Research

Marc Hodes, Bell Labs

2:45-3:00 Refreshment Break

3:00-5:00

Camelia

Carbon and Graphene Nanoribbon Interconnects

Azad Naeemi, Georgia Institute of Technology

Dogwood

Design of Experiments for Thermal Engineering (Continued)

James Petroski, GE Lumination

Orange Blossom

Measurement Techniques in the Thermal Management of Electronics

Seri Lee, Nextreme Thermal Solutions

THURSDAY, MAY 29, 2008

7:00-8:00

Salon IV Breakfast (for conference attendees)

8:00-8:10

Salon VI Opening Remarks

8:10-8:55

Salon VI Keynote Address:
"Emerging Systems Packaging Technologies"
Rao Tummala, Georgia Institute of Technology

9:00-10:40

PARALLEL SESSIONS

Salon I **1.1 Thermal Management Track-Session 1**
Heat Pipes, Thermosyphons, Capillary Pumped Loops and Vapor Changers
Chairs: Jay Ochtrbeck
Ratnesh Sharma

Study on Heat Sink Performance with a Thermo-Siphon Structure for LSI Packages
Masaru Ishizuka, Toyama Prefectural University
Shinji Nakagawa, Toyama Prefectural University

Thermal Performance of Non-Metallic Two-Phase Cold Plates for Humanoid Robot Cooling
Kyudae Hwang, Yuhan College
Suk Won Lee, University of Seoul
Sang Woo Kang, KIST
Seo Young Kim, KIST

Heat Transport Characteristics of Capillary Pumped Loop with Plate-type Evaporator
Atsushi Tsujimori, Kanto Gakuin University
Kosuke Hirata, Kanto Gakuin University
Kentaro Nakaguchi, Kanto Gakuin University
Maiko Uchida, Kanto Gakuin University

Loop Heat Pipe Technology for Cooling Computer Servers
Walter Zimbeck, Technology Assessment & Transfer
Greg Slavik, Technology Assessment & Transfer
John Cennamo, Aavid Thermalloy
Sukhvinder Kang, Aavid Thermalloy
James Yun, ATK Space
Edward Krolczek, ATK Space

Passive, Lightweight Thermal Solutions for Remote Radio Head (RRH) Electronics
Prathib Skandakumaran, GrafTech International Holdings
Vikash Khanikar, GrafTech International Holdings
Martin Smalc, GrafTech International Holdings
Julian Norley, GrafTech International Holdings
Brad Reis, GrafTech International Holdings

Salon II **1.2 Thermal Management Track – Session 2**
Advances in Air Cooling
Chairs: Aniruddha Pal
Mehdi Asheghi

Forced Convection Cooling Benchmark Study of a HDD In Various Consumer Electronics Applications
R.A. van Es, Philips Healthcare
A.C. Geerlings, Philips Applied Technologies

An Assessment of Air Cooling for Use with Automotive Power Electronics
Desikan Bharathan, National Renewable Energy Lab
Kenneth Kelly, National Renewable Energy Lab

The Performance of Active Cooling in a Mobile Phone
Ed Walsh, University of Limerick
Ronan Grimes, University of Limerick
Pat Walsh, University of Limerick

Conjugate Heat Transfer of Jet Impingement on Short Fins with Different Shapes
X. C. Li, Lamar University

Forced Convection Air Cooling in Porous Graphite Foam for Thermal Management Applications
K.C. Leong, Nanyang Technological University
L.W. Jin, Nanyang Technological University
H.Y. Li, Nanyang Technological University
J.C. Chai, Nanyang Technological University

Salon III **1.3 Mechanics Track – Session 1**
Lead Free Solder Materials & Reliability
Chairs: John H. L. Pang
Rainer Dudek

Strain-Rate-Dependant Mechanical Properties for Sn-3.8Ag-0.7Cu and SAC-X Solder Alloy
Luhua Xu, Nanyang Technological University
Kok Ee Tan, Nanyang Technological University
John H.L.Pang, Nanyang Technological University

Algorithms for Prognostication of Prior Damage and Residual Life in Lead-Free Electronics Subjected to Thermo-Mechanical Loads
Pradeep Lall, Auburn University
Madhura Hande, Auburn University
Chandan Bhat, Auburn University
Vikrant More, Auburn University
Rahul Vaidya, Auburn University
Jeff Suhling, Auburn University

Influence of Temperature and Strain on Phase Growth Process in Sn-3.0Ag-0.5Cu Solder Joints
Takao Mori, Toyama Prefectural University
Yasuhiro Ejiri, Toyama Prefectural University
Toshihiko Sayama, Toyama Industrial Technology Center
Takeshi Talayanagi, Cosel Co
Yoshiyuki Okamoto, Cosel Co
Qiang Yu, Yokohama National University

Effects of Strain Rate and Aging on Deformation and Fracture of Sn-Ag-Cu Solder Joints
Praveen Kumar, Naval Postgraduate School, Monterey
I. Dutta, Naval Postgraduate School, Monterey
V. Sarihan, Freescale Semiconductor
D.R. Frear, Freescale Semiconductor
M. Renavikar, Intel

Thermal Test- and Field Cycling Induced Degradation and Its Fe-Based Prediction for Different SAC Solders

Rainer Dudek, Fraunhofer- IZM
Wolfgang Faust, Fraunhofer- IZM
Roumen Ratchev, Robert Bosch GmbH
Mike Roellig, Dresden University of Technology
Hans-J. Albrecht, Siemens AG
Bernd Michel, Fraunhofer- IZM

Salon VI **1.4 Panel - 1**

Thermal Management Challenges for Military Electronics
Chairs: Mark S. Spector
Nicholas R. Jankowski

Panelists: Kevin King, NSSWC Ship Systems Engineering Station
Steven Bernstein, Raytheon
Mary Goryca, Army Tank-Automotive Research
Kirk Yerkes, Air Force Research Laboratory
C. L. Chen, Teledyne Scientific & Imaging
Ross Wilcoxon, Rockwell Collins

10:40-10:50 Refreshment Break

10:50-12:30

Salon I **2.1 Emerging Technologies Track–Session 1**

MEMS/NEMS/Sensors
Chairs: Xin Zhang
Mark Da Silva
Samuel Graham

Experimental Investigation of Nanoscale Thermal Transport in Hotspots at Cryogenic Temperatures

Hyuk Ju Ryu, University of Wisconsin-Madison
Levente J. Klein, IBM T. J. Watson Research Center
Mehdi Asheghi, iCONA Technology & Stanford University
Hendrik F. Hamann, IBM T. J. Watson Research Center

Shot Noise Thermometry with Carbon Nanotubes

Robert A. Sayer, Purdue University
Timothy S. Fisher, Purdue University

Geometric Modifications to Simple Microchannel Design for Enhanced Mixing

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

Stress Analysis of a Micro-machined Inertial Sensor at Dynamic Load

Torsten Hauck, Freescale Semiconductor
Ilko Schmadlak, Freescale Semiconductor
Jan Mehner, Chemnitz University of Technology

Salon II **2.2 Thermal Management Track – Session 3**

Thermal Management Utilizing Two Phase Cooling
Chairs: Karl Geisler
Mehdi Asheghi

Numerical and Experimental Investigations of Boiling Enhancement In Buoyancy-Driven Microchannels

Karl J.L. Geisler, University of Maryland
Avram Bar-Cohen, University of Maryland

Experiments on a Novel Vapor Chamber

Shwin-Chung Wong, National Tsing Hua University
Jia-Da Wu, National Tsing Hua University
Wei-Lun Han, National Tsing Hua University

Two Phase Cooling with Heat Transfer Enhancement for BGA Package

Navas Khan, Institute of Microelectronics
K.C.Toh, Nanyang Technological University
Pinjala, Institute of Microelectronics
V.Kripesh, Institute of Microelectronics
Seung Wook Yoon, Insti .of Microelectronics, Singapore

Forced Convection and Flow Boiling of a Dielectric Liquid in a Foam-Filled Channel

Dae Whan Kim, Samsung Electronics
Avram Bar-Cohen, University of Maryland at College Park
Bongtae Han, University of Maryland at College Park

Salon III **2.3 Mechanics Track – Session 2**

Materials Characteristics & Construction Modeling
Chairs: Pradeep Lall
Shengmin Wen

Rate-Dependent Behavior of Sn3.8Ag0.7Cu Solder Over Strain Rates of 10-6 TO 102 s-1

X. Nie, Purdue University
D. Bhate, Purdue University
D. Chan, Purdue University
W. Chen, Purdue University
G. Subbarayan, Purdue University
I. Dutta, Naval Postgraduate School

Constitutive Relations of Indium Solder Joint in Cold Temperature Electronic Packaging Based on Anand Model

Rui Wu, University of Maryland
F. Patrick McCluskey, University of Maryland

Salon VI **2.4 Panel – 2**

Cooling Challenges and Energy Efficiency in Low Form Factor Electronics
Chairs: Bahgat Sammakia
Anandaroop Bhattacharya

Panelists: Suresh Garimella, Purdue University
Alfonso Ortega, Villanova University
Andre Ali, Apple Computers
Mani Prakash, Intel
Kazuaki Yazawa, Sony

12:30-2:00

Salon IV Lunch for attendees
**Achievement Award Presentation
"IBM, Mainframes and Environments"
Dr. Roger Schmidt, IBM**

2:30-5:30 Joint ECTC/ITherm Exhibit
Buses will be provided

6:30-9:00

Camelia Committee Dinner

FRIDAY, MAY 30, 2008

7:00-8:00

Salon IV Breakfast (for authors and attendees) and
Opening Remarks

8:10-9:50

PARALLEL SESSIONS

Salon I **3.1 Thermal Management Track – Session 4**
Microchannel Heat Sinks I
Chairs: Arun Gowda
Weilin Qu

Computational Method for System-Level Analysis of Two-Phase Pumped Loops for Cooling of Electronics
Kanchan M. Kelkar, Innovative Research
Suhass V. Patankar, Innovative Research
Sukhvinder S. Kang, Aavid Thermalloy

Comparison of Thermal-Hydraulic Performance of Single-Phase Micro-Pin-Fin and Micro-Channel Heat Sinks
Weilin Qu, University of Hawaii at Manoa

Development of a Complete Transient Microchannel Heat Sink Model
Dylan Farnam, State Univ of New York at Binghamton
Bahgat Sammakia, State Univ of New York at Binghamton
Kanad Ghose, State Univ of New York at Binghamton

Single-Phase and Two-Phase Hybrid Cooling Schemes for High-Heat-Flux Thermal Management of Defense Electronics
Myung Ki Sung, Purdue University
Issam Mudawar, Purdue University

Low-Temperature Two-Phase Micro-Channel Cooling for High-Heat-Flux Thermal Management of Defense Electronics
Jaeseon Lee, Purdue University
Issam Mudawar, Purdue University

Salon II **3.2 Thermal Management Track – Session 5**
Thermal Modeling and Experimental
Characterization III
Chairs: Al Ortega
Ankur Jain

Thermal Characterization of COTS Electronic Boards
E. Monier-Vinard, THALES Research & Technology
J.M Deu, THALES Research & Technology
V Bissuel, THALES Research & Technology

Transient Thermal Performance Optimization for an Automotive Wireless Application
Victor Chiriac, Freescale Semiconductor

Reduced Order Modeling of Power Electronics Cabinet with Double-Sided Cooling
Qihong Nie, Georgia Institute of Technology
Yogendra Joshi, Georgia Institute of Technology

A Modified Effectiveness-NTU Approach for Analysis of Low-Aspect Ratio Mini-Channel Heat Sinks Using Novel Shape Factor Formulations

Alfonso Ortega, Villanova University
Prathib Skandakumaran, University of Arizona
Bryan Hassell, Villanova University

Thermal Characterization of Thermal Interface Material Bondlines

T. Z. Fullem, Binghamton University
D. F. Rae, Binghamton University
A. Sharma, Binghamton University
J. A. Wolcott, Binghamton University
E. J. Cotts, Binghamton University

Salon III **3.3 Mechanics Track – Session 3**
Experimental Characterizations
Chairs: Jeffrey Suhling
Viksa Gupta

Experimental Evaluations of the Strength of Silicon Die by 3-Point-Bend versus Ball-On-Ring Tests

Jie-Hua Zhao, Texas Instruments
John Tellkamp, Texas Instruments
Vikas Gupta, Texas Instruments
Darvin Edwards, Texas Instruments

Physical Aging and Evolving Mechanical Behavior of Underfill Encapsulants

Chang Lin, Auburn University
Jeffrey C. Suhling, Auburn University
Pradeep Lall, Auburn University

Die Stress Variation in Area Array Components Subjected to Accelerated Life Testing

Jordan C. Roberts, Auburn University
M. Kaysar Rahim, Auburn University
Safina Hussain, Auburn University
Jeffrey C. Suhling, Auburn University
Richard C. Jaeger, Auburn University
Pradeep Lall, Auburn University

Ultra Low-K Dielectric Mechanical Property Characterization

Vikas Gupta, Texas Instruments
Jie-Hua Zhao, Texas Instruments
Darvin Edwards, Texas Instruments
Clay Dustin Mortensen, University of Oregon
Colby Heideman, University of Oregon
David C. Johnson, University of Oregon
Kuan-Hsun (Gary) Lu, University of Texas, Austin

A New Technique for Calibrating Piezoresistive Stress Sensor Chips

S. Chaparala, State University of New York, Binghamton
F. Andros, State University of New York, Binghamton
W. Infantolino, State University of New York, Binghamton
B. Sammakia, State University of New York, Binghamton

Salon VI **3.4 Emerging Technologies Track–Session 2**

Micro/Nano-Scale Single and 2-Phase

Convection

Chairs: Unni Vaddakan

Greg Walker

Application of Flow Boiling for Thermal Management of Electronics in Microgravity and Reduced Gravity Space Systems

Hui Zhang, Purdue University

Issam Mudawar, Purdue University

Mohammad M. Hasan, NASA Glenn Research Center

Flow Boiling in a Micro-Channel Coated with Carbon Nanotubes

Vikash Khanikar, Purdue University

Issam Mudawar, Purdue University

Timothy Fisher, Purdue University

Convective Heat Transfer for Water-Based Alumina Nanofluids in a Single 1.02-Mm Tube

W.Y. Lai, Arizona State University

P.E. Phelan, Arizona State University

S. Vinod, Arizona State University

Ravi Prasher, Intel Corporation

Thermofluid Characteristics of Two-Phase Flow in Micro-Gap Channels

Dae Whan Kim, University of Maryland at College Park

Emil Rahim, University of Maryland at College Park

Avram Bar-Cohen, University of Maryland at College Park

Bongtae Han, University of Maryland at College Park

9:50-10:00 Refreshment Break

10:00-11:40

PARALLEL SESSIONS

Salon 1 **4.1 Thermal Management Track – Session 6**

Microchannel Heat Sinks II

Chairs: Varaprasad Calmidi

Ankur Jain

Stereolithographically Fabricated Aluminum Nitride Microchannel Substrates for Integrated Power Electronics Cooling

Nicholas R. Jankowski, U.S. Army Research Laboratory

Lauren Everhart, U.S. Army Research Laboratory

Bruce R. Geil, U.S. Army Research Laboratory

C. Wesley Tipton, U.S. Army Research Laboratory

Jared Chaney, Technology Assessment & Transfer

Todd Heil, Technology Assessment & Transfer

Walter Zimbeck, Technology Assessment & Transfer

Thermal Characteristics of Two-Phase Flow of a Dielectric Fluid in Surface-Augmented Microchannels

Naveenan Thiagarajan, Auburn University

Rory J. Jones, Auburn University

Daniel T. Pate, Auburn University

Sushil H. Bhavnani, Auburn University

An Investigation of Flow Boiling Regimes in Microchannels of Different Sizes by Means of High-Speed Visualization

Tannaz Harirchian, Purdue University

Suresh V. Garimella, Purdue University

Assessment of the Performance of Dielectric Fluids in Microchannel Heat Sinks

Dylan Farnam, State Univ of New York at Binghamton

Bahgat Sammakia, State Univ of New York at Binghamton

A Micro Channel with Integrated Gas Flow Sensor for High Sensitivity

Bolin Yu, Huazhong University of Science & Technology

Zhiyin Gan, Huazhong University of Science & Technology

Shu Cao, Huazhong University of Science & Technology

Jingping Xu, Huazhong Univ of Science & Technology

Sheng Liu, Huazhong University of Science & Technology

Salon II **4.2 Thermal Management Track – Session 7**

Thermal Interface Materials I

Chairs: Sandeep Tonapi

Ying Sun

Development of a High-Accuracy Thermal Interface Material Tester

R. Kempers, Trinity College Dublin

P. Kolodner, Alcatel-Lucent

A. Lyons, Alcatel-Lucent

A.J. Robinson, Trinity College Dublin

Microstructural Characteristics Influencing the Effective Thermal Conductivity of Particulate Thermal Interface Materials

S. Kanuparthi, Purdue University

G. Subbarayan, Purdue University

B. Sammakia, State University of New York at Binghamton

T. Siegmund, Purdue University

Hotspot Remediation with Anisotropic Thermal Interface Materials

Christopher Bachmann, University of Maryland

Avram Bar-Cohen, University of Maryland

Technical Review of Characterization Methods for Thermal Interface Materials (TIM)

Nitin Goel, Intel Technology India

T.K. Anoop, Intel Technology India

A. Bhattacharya, Intel Technology India

Joseph A. Cervantes, Intel Corporation

Rajiv K. Mongia, Intel Corporation

Sridhar V. Machiroutu, Intel Corporation

Hau-Lan Lin, Compal Electronics

Ya-Chi Huang, Compal Electronics

Kuang-Cheng Fan, Compal Electronics

Bar-Long Denq, Compal Electronics

Chen-Hua Liu, Compal Electronics

Chun-Hung Lin, Compal Electronics

Chi-Wei Tien, Compal Electronics

Jenq-Haur Pan, Compal Electronics

TIM Degradation in Flip Chip Packages

Nokibul Islam, Amkor Technology

SeoWon Lee, Amkor Technology Korea

Miguel Jimarez, Amkor Technology

JoonYeob Lee, Amkor Technology Korea

Jesse Galloway, Amkor Technology

Salon III **4.3 Mechanics Track – Session 4**
Failure Mechanics and Damage Modeling
Chairs: Jie-Hua Zhao
Patrick McCluskey

Health Monitoring of Implantable Biological Electronic Systems by Statistical Pattern Recognition Techniques

Pradeep Lall, Auburn University
Prashant Gupta, Auburn University
Prakriti Choudhary, Dell Computer
Manish Kulkarni, Auburn University
Jeff Suhling, Auburn University

Singularities at Solder Joint Interfaces and Their Effects on Fracture Models: Part I

D. Bhate, Purdue University
G. Subbarayan, Purdue University
L. Nguyen, National Semiconductor
J. Zhao, Texas Instruments

Singularities at Solder Joint Interfaces and Their Effects on Fracture Models: Part II

D. Bhate, Purdue University
G. Subbarayan, Purdue University
L. Nguyen, National Semiconductor
J. Zhao, Texas Instruments

3D Fracture Mechanics Analysis of Underfill Delamination for Flip Chip Packages

Zhen Zhang, Advanced Micro Devices
Charlie J Zhai, Advanced Micro Devices
Raj N Master, Advanced Micro Devices

Fracture Risk Assessment for Interface Flaws in the 3D-Interconnect Systems of a CMOS Chip

Torsten Hauck, Freescale Semiconductor
Wolfgang H. Mueller, Technische Universität Berlin
Ilko Schmadlak, Freescale Semiconductor

Fracture, Delamination, and Buckling of Elastic Thin Films on Compliant Substrates

Haixia Mei, University of Texas at Austin
Yaoyu Pang, University of Texas at Austin
Se Hyuk Im, University of Texas at Austin
Rui Huang, University of Texas at Austin

Salon VI **4.4 Panel 3**

Cyberinfrastructure Resources for Thermal Management
Chair: Tim Fisher

Panelists: Mark Juds, Eaton Corp.
Rajiv Mongia, Intel
Jayathi Murthy, Purdue University
Greg Walker, Vanderbilt University
Sunil Murthy, GE

11:40-1:10

Salon IV **Lunch for attendees**

Keynote Address
"Engineering and Thermal Transport Research at the National Science Foundation"
Patrick Phelan and Richard Buckius, NSF

1:10-2:50

PARALLEL SESSIONS

Salon I **5.1 Thermal Management Track – Session 8**
Spray, Mist and Liquid Jet Impingement Cooling I
Chairs: Madhusudan Iyengar
Avram Bar-Cohen

The Evolution of Water Cooling for IBM Large Server Systems: Back to the Future

M.J. Ellsworth, Jr., IBM
L.A. Campbell, IBM
R.E. Simons, IBM
M.K. Iyengar, IBM
R.R. Schmidt, IBM
R.C. Chu, IBM

Application of Two-Phase Spray Cooling for Thermal Management of Electronic Devices

Milan Visaria, Purdue University
Issam Mudawar, Purdue University

Parametric Study of Liquid Microjet Impingement for Electronics Cooling

Srivathsan Ragunathan, University of Alaska, Fairbanks
Douglas J. Goering, University of Alaska, Fairbanks

Spray Cooling with Ammonia on Micro-Structured Surfaces

Huseyin Bostanci, Rini Technologies
Benjamin A. Saarloos, Rini Technologies
Daniel P. Rini, Rini Technologies
John P. Kizito, North Carolina A&T State University
Louis C. Chow, University of Central Florida

Salon II **5.2 Thermal Management Track – Session 9**

Thermal Modeling and Experimental Characterization II
Chairs: Pat Phalen
Lang Yuan

System Level Thermal Performance Optimization of Leaded Packages for Automotive Applications

Victor Adrian Chiriac, Freescale Semiconductor

A Study of the Thermal Characterization of a High – Performance Flip Chip Package

Siddharth Bhopte, State Univ of New York at Binghamton
Bahgat Sammakia, State Univ of New York at Binghamton
Varaprasad Calmidi, Endicott Interconnect Technologies

Thermal Modeling for Warpage Effects in Organic Packages

Xiaojin Wei, IBM Systems and Technology Group
Ken Marston, IBM Systems and Technology Group
Kamal Sikka, IBM Systems and Technology Group

Full-Chip to Device Level 3D Thermal Analysis of RF Integrated Circuits

Marek Turowski, CFD Research Corporation
Steven Dooley, 2Air Force Research Laboratory
Patrick Wilkerson, CFD Research Corporation
Ashok Raman, CFD Research Corporation
Matthew Casto, Air Force Research Laboratory

Thermal Performance Evaluation and Methodology for Pyramid Stack Die Packages

S. Krishnamoorthi, United Test and Assembly Center
W.H. Zhu, United Test and Assembly Center
C.K.Wang, United Test and Assembly Center
Siew Hoon Ore, United Test and Assembly Center
H.B. Tan, United Test and Assembly Center
Anthony Y.S. Sun, United Test and Assembly Center

Salon III **5.3 Mechanics Track – Session 5**

Modeling and Simulation I
Chairs: Kuo-Nin Chiang
Bernhard Wunderle

Principal Component Regression Models for Life Prediction of Plastic Ball Grid Arrays On Copper-Core and No-Core Assemblies

Pradeep Lall, Auburn University
Aniket Shirgaokar, Auburn University
Luke Drake, Auburn University
Timothy Moore, Auburn University
Jeff Suhling, Auburn University
Milan Shah, Northrop Grumman

Effect of Integrated Heat Spreader on Thermal Performance and Bump Joint Reliability for Flip Chip Packages

Mandal Rathin, AMD Singapore
YC Mui, AMD Singapore
Hengyun Zhang, AMD Singapore

Lifetime Model for Flip-Chip on Flex Using Anisotropic Conductive Adhesive under Moisture and Temperature Loading

B. Wunderle, Fraunhofer IZM
C. Kallmayer, Fraunhofer IZM
H.Walter, Fraunhofer IZM
T. Braun, Fraunhofer IZM
B. Michel, Fraunhofer IZM
H. Reichl, Technische Universität Berlin

Finite Element Analysis of Cantilever Plate Structure Excited by Patches of Piezoelectric Actuators

Mohammed W. Al-Hazmi, Umm Al-Qura University

Power Cycle Fatigue Reliability Evaluation for Power Device Using Coupled Electrical-Thermal-Mechanical Analysis

Takashi Anzawa, Yokohama National University
Qiang Yu, Yokohama National University
Masanori Yamagiwa, Yokohama National University/
Tadahiro Shibutani, Yokohama National University
Masaki Shiratori, Yokohama National University

Salon VI **5.4 Panel 4**

Energy Efficient Data Centers
Chairs: Roger Schmidt
Yogendra Joshi

Panelists: Bruno Michel, IBM
Prajesh Bhattacharya, OSISoft
Michael Patterson, Intel
Rocky Shih, Hewlett Packard

2:50-3:00 Refreshment Break

3:00-4:30

POSTER SESSION

Salon IV **6.1 Energy Efficient Data Center I**

Chairs: Shlomo Novotny
Lang Yuan

Methods and Techniques for Measuring and Improving Data Center Best Practices

Hendrik F. Hamann, IBM T.J. Watson Research Center
Michael Schappert, IBM T.J. Watson Research Center
Madhusudan Iyengar, IBM Systems and Technology
Theodore van Kessel, IBM T.J. Watson Research Center
Alan Claassen, IBM Systems and Technology Group

The Impact of Air Flow Leakage on Server Inlet Air Temperature in a Raised Floor Data Center

Hendrik Hamann, IBM T. J. Watson Research Center
Madhusudan Iyengar, IBM Advanced Thermal Laboratory
Martin O'Boyle, IBM T. J. Watson Research Center

Optimization of Cluster Cooling Performance for Data Centers

Saurabh K. Shrivastava, American Power Conversion
James W. VanGilder, American Power Conversion
Bahgat G. Sammakia, SUNY Binghamton

The Effect of Data Center Temperature on Energy Efficiency

Michael K Patterson, Intel

Impact of Rack-Level Compaction on the Data Center Cooling Ensemble

Amip Shah, Hewlett Packard
Chandrakant Patel, Hewlett Packard
Cullen Bash, Hewlett Packard
Ratnesh Sharma, Hewlett Packard
Rocky Shih, Hewlett Packard

6.2 Energy Efficient Data Center II

Chairs: Michael Patterson
Hendrik Hamann

Effect of Rack Modeling Detail on the Numerical Results of a Data Center Test Cell

Xuanhang (Simon) Zhang, American Power Conversion
James W. VanGilder, American Power Conversion
Madhusudan Iyengar, International Business Machines
Roger R. Schmidt, International Business Machines

Enhanced Cooling in a Sealed Cabinet Using an Evaporating-Condensing Dielectric Mist

Vaibhav Bahadur, Purdue University
Marc Hodes, Alcatel Lucent
Alan Lyons, Alcatel Lucent
Shankar Krishnan, Alcatel Lucent
Suresh V. Garimella, Purdue University

Data Center TCO Benefits of Reduced System Airflow

Christopher G. Malone, Google
Wade Vinson, Hewlett-Packard
Cullen E. Bash, Hewlett-Packard

Data Center Characteristic Temperature Signatures and Shi Correlation to Nondimensional Parameters

Escobar Sergio, Hewlett-Packard
Sharma Ratnesh, Hewlett-Packard

6.3 Energy Efficient Thermal Management I

Chairs: Marc Hodes
Seo Kim

Two-Phase Spray Cooling of Hybrid Vehicle Electronics

Issam Mudawar, Mudawar Thermal
Desikan Bharathan, National Renewable Energy Lab
Kenneth Kelly, National Renewable Energy Laboratory
Sreekant Narumanchi, National Renewable Energy Lab

6.4 Energy Efficient Thermal Management II

Chairs: Deepak Ganapathy
Gary Solbrekken

Heat Sink Design for a Thermoelectric Cooling System

Hun Sik Han, KAIST
Seo Young Kim, KIST
Tae Ho Ji, KAIST
Young-Jun Jee, Halla Climate Control
Daewoong Lee, Halla Climate Control
Kil Sang Jang, Halla Climate Control
Dong Hoon Oh, Halla Climate Control

Impact of Integrated Superlattice μ TEC Structures on Hot Spot Remediation

Viatcheslav Litvinovitch, Univer of Maryland College Park
Peng Wang, University of Maryland at College Park
Avram Bar-Cohen, University of Maryland at College Park

6.5 Energy Efficient Thermal Management III

Chairs: Gary Solbrekken
Saurabh Shrivastava

Defining Thermal Design Power Based on Real-World Usage Models

Deepak Ganapathy, Intel
Ethan J Warner, Intel

Effect of Isolating Cold Aisles on Rack Inlet Temperature

Srujan Gondipalli, State Univ of New York at Binghamton
Siddharth Bhopte, State Univ of New York at Binghamton
Bahgat Sammakia, State Univ of New York at Binghamton
Madhusudan K. Iyengar, IBM
Roger Schmidt, IBM

6.6 Energy Efficient Applications

Chairs: Amip Shah
Christian Bonilla

Information Technology Energy Usage and Our Planet

Roger Schmidt, IBM
Madhusudan Iyengar, IBM

Evaluation of System Configurations for Thermoelectric Power Generation

H. Peter J. de Bock, GE Global Research
Vladimir Novak, GE Global Research

4:40-5:50 Dinner on your own

5:50-7:30

PARALLEL SESSIONS

Salon I 7.1 Thermal Management Track – Session 10

Spray, Mist and Liquid Jet Impingement Cooling II
Chairs: Avram Bar-Cohen
Madhusudan Iyengar

Evaporation-Enhanced, Dynamically-Adaptive Air (Gas)-Cooled Heat Sink for Thermal Management of High Heat Dissipation Devices

Andrei G. Fedorov, Georgia Institute of Technology
J. Mark Meacham, Georgia Institute of Technology

Measurement of Heat Transfer Coefficient in Spray Cooling of a Flip Chip

Andrew A. O. Tay, National University of Singapore
Sivanand Somasundaram, National Univ of Singapore

Evaporative Spray Cooling of Power Electronics Using High Temperature Coolant

Louis J. Turek, Rini Technologies
Daniel P. Rini, Rini Technologies
Benjamin A. Saarloos, Rini Technologies
Louis C. Chow, University of Central Florida

The Effect of Droplet Length on Nusselt Numbers in Digitized Heat Transfer

Patrick Young, University of Colorado at Boulder
Kamran Mohseni, University of Colorado at Boulder

Salon II 7.2 Thermal Management Track – Session 11

Thermal Characterization of Fin/Fan Assembly
Chairs: Ahmed Zaghlool
Antar Mohamed

Comparison of Thermal Performances of Plate-Fin and Pin-Fin Heat Sinks Subject to an Impinging Flow

Dong-Kwon Kim, KAIST
Jin-Kwon Bae, KAIST
Sung Jin Kim, KAIST

An Investigation on the Conduction and Convection Heat Transfer from Advanced Heat Sinks

M. Baris Dogruoz, ANSYS Fluent
Mehmet Arik, General Electric Global Research Center

Interaction of a Synthetic Jet with an Actively Cooled Heat Sink

Mehmet Arik, GE Global Research Center
Yogen Utturkar, GE Global Research Center

Forced Convection Analysis of a High-Power Dissipating Automotive Control Module

Steven E. Larson, Continental Automotive Systems
Tony A. Asghari, Continental Automotive Systems

Salon III 7.3 Thermal Management Track – Session 12

Thermal Interface Materials II
Chairs: Maat Touzelbaev
Vadim Gektin

BLT Control and Its Impact on FCBGA Thermal Performance

Jesse Galloway, Amkor Technology
Sasanka Kanuparthi, Amkor Technology

Thermal Interface Materials for Power Electronics Applications

Sreekant Narumanchi, National Renewable Energy Lab
Mark Mihalic, National Renewable Energy Lab
Kenneth Kelly, National Renewable Energy Lab
Gary Eesley, Delphi Electronics

In-Situ Cure Assembly and Thermal Performance Verification of Electronic Packages Using Chip Heat

Kamal Sikka, IBM Systems and Technology Group
Xiaojin Wei, IBM Systems and Technology Group
Kathryn Rivera, IBM Systems and Technology Group

Design of Thermal Interfaces with Embedded Microchannels to Control Bond Line Formation

Brian Smith, IBM Research
Hugo Rothuizen, IBM Research
Ryan Linderman, IBM Research
Thomas Brunschweiler, IBM Research
Bruno Michel, IBM Research

Design Optimization of Custom Engineered Silver-Nanoparticle Thermal Interface Materials

Viral Chhasatia, State Univ of New York at Binghamton
Fan Zhou, State University of New York at Binghamton
Ying Sun, State University of New York at Binghamton
Liwei Huang, State University of New York at Binghamton
Howard Wang, State Univ of New York at Binghamton

Salon VI 7.4 Emerging Technologies Track—Session 3

Nano-Scale Compact/Analytical Models
Chairs: Sunil Murthy
Siva Gurrum

Monte Carlo Study of Thermal Transport of Frequency and Direction Dependent Reflecting Boundaries in High KN Systems

N.A. Roberts, Vanderbilt University
D.G. Walker, Vanderbilt University

Nano-scaled SRAM Thermal Stability Analysis Using Hierarchical Compact Thermal Models

Jaydeep P. Kulkarni, Purdue University
Mesut Meterelliyoz, Purdue University
Kaushik Roy, Purdue University
Jayathi Murthy, Purdue University

Hierarchical Modeling of Heat Transfer in Silicon-Based Electronic Devices

Javier V. Goicochea, Carnegie Mellon University
Marcela Madrid, Pittsburgh Supercomputing Center
Cristina Amon, University of Toronto

Compact Thermal Model for Phase Change Memory Nanodevices

R. Warren, Stanford University
J. Reifenberg, Stanford University
K. Goodson, Stanford University

SATURDAY, MAY 31, 2008

7:00-7:45

Salon IV Breakfast (for authors and attendees) and Opening Remarks

7:55-9:35

PARALLEL SESSIONS

Salon I **8.1 Thermal Management Track – Session 13**

Thermal Modeling and Experimental Characterization I

Chairs: Hendrik Hamann
Anandroop Bhattacharya

The Effect of Various Wafer Thicknesses on Hot Spot Temperature

Kyo Sung Choo, KAIST
Young Han, KAIST
Sung Jin Kim, KAIST

Multi-Objective Optimization Entailing Computer Architecture and Thermal Design for Non-Uniformly Powered Microprocessors

Uthaman Raju, University of Texas at Arlington
Abhijit Kaisare, University of Texas at Arlington
Dereje Agonafer, University of Texas at Arlington
A. Haji-sheikh, University of Texas at Arlington
Greg Chrysler, Intel
Ravi Mahajan, Intel

Modelling Guidelines and Non-Destructive Analysis for Thermal and Mechanical Behaviour of Via-Structures in Organic Boards

R. Schacht, IZM and Univ of Applied Sciences Lausitz
B. Wunderle, Fraunhofer IZM
D. May, Fraunhofer IZM
B. Michel, Fraunhofer IZM
H. Reichl, Technical University Berlin

Transient Thermal Characterization with Applications to Optimized Thermal Packaging of Multi-Core Microprocessors

Yizhang Yang, Advanced Micro Devices
Maxat Touzelbaev, Advanced Micro Devices

Spatial Frequency Domain Heat Transfer Analysis of Hot Spot Spreading in Convectively Cooled Microprocessors

Keivan Etessam-Yazdani, Carnegie Mellon University
Mehdi Asheghi, iCONA Technology/Stanford University

Salon II **8.2 Thermal Management Track – Session 14**
Advances in Thermal Engineering of Fin/Fan
Assembly
Chairs: Younes Shabany
Satish Chaparala

Acoustic Emissions from Active Cooling Solutions for Portable Devices

E.J. Walsh, University of Limerick
P.A. Walsh, University of Limerick
R. Grimes, University of Limerick
J. Punch, University of Limerick

Quantification of Piezoelectric Fan Flow Rate Performance and Experimental Identification of Installation Effects

Mark Kimber, Purdue University
Kazuhiko Suzuki, Sony Corporation
Nobutaka Kitsunai, Sony Corporation
Kenichi Seki, Sony Corporation
Suresh V. Garimella, Purdue University

Effect of Upstream Vortex Generators on a Longitudinally-Finned Heat Sink

Domhnaill Hernon, Alcatel-Lucent

Scroll Heat Sink: A Heat Sink with the Moving Fins Inserted Between the Cooling Fins

Tae Young Kim, KAIST
Dong-Kwon Kim, KAIST
Sung Jin Kim, KAIST

An Experimental Study on the Performance of Miniature Heat Sinks for Forced Convection Air Cooling

V. Egan, University of Limerick
J. Stafford, University of Limerick
P. Walsh, University of Limerick
E. Walsh, University of Limerick
R. Grimes, University of Limerick

Salon III **8.3 Emerging Technologies Track–Session 4**

Interfacial Thermal Behavior at Micro/Nano Scales

Chairs: Koneru Ramakrishna
Dong Liu

Thermal Analyses of Confined Cell Design for Phase Change Random Access Memory (PCRAM)

Evan Small, Stanford University
Sadegh M. Sadeghipour, Carnegie Mellon University
Larry Pileggi, Carnegie Mellon University
Mehdi Asheghi, Stanford University

Estimating Kapitza Resistance between Si-SiO₂ Interface using Molecular Dynamics Simulations

Sanket S. Mahajan, Purdue University
Ganesh Subbarayan, Purdue University
Bahgat G. Sammakia, State Univ of New York Binghamton

Modeling Heat Transport in Thermal Interface Materials Enhanced with MEMS Based Microinterconnects

Fan Zhou, State University of New York at Binghamton
Parthiban Arunasalam, State Univ of New York at Binghamton
Bruce Murray, State University of New York at Binghamton
Bahgat Sammakia, State Univ of New York at Binghamton

Electrothermally Bonded Carbon Nanotube Interfaces

Sriharsha V. Aradhya, Purdue University
Suresh V. Garimella,
Timothy S. Fisher, Purdue University

Salon VI **8.4 Mechanics Track – Session 6**

Modeling and Simulation II

Chairs: Qiang Yu
Zane Johnson

Development of Survivability Envelopes for SnAg Leadfree Packaging Architectures under Shock and Vibration

Pradeep Lall, Auburn University
Deepti Iyengar, Auburn University
Sandeep Shantaram, Auburn University
Dhananjay Panchagade, Auburn University
Jeff Suhling, Auburn University

Finite Element Models for Simulation of Wear in Electrical Contacts

Pradeep Lall, Auburn University
Darshan Shinde, Auburn University
Brett Rickett, Molex
Jeff Suhling, Auburn University

An Improved Estimate for Thermal Stresses in Multi-Layer Assemblies

Yaping Luo, Purdue University
Ganesh Subbrayyan, Purdue University

Drop Testing and Finite Element Simulation of Stacked Chip Scale Packages with and without Underfill

Nathan Schneck, North Dakota State University
Zane Johnson, North Dakota State University
Chris Schaff, North Dakota State University
Merideth Bell, North Dakota State University
James Stone, North Dakota State University

9:20-9:30 Refreshment Break

9:30-10:50

PARALLEL SESSIONS

Salon I **9.1 Emerging Technologies Track–Session 5**

Nano-Scale Modeling

Chairs: Jayathi Murthy
Sreekant Narumanchi

Molecular Dynamics Simulation of Phonon Scattering at Rough Semiconductor Interfaces

Lin Sun, Purdue University
Jayathi Y Murthy, Purdue University

Sub-Micron Thermal Transport Modeling by Phonon Boltzmann Transport with Anisotropic Relaxation Times

Chunjian Ni, Purdue University
Jayathi Murthy, Purdue University

Parallel Computation of the Phonon Boltzmann Transport Equation

Chunjian Ni, Purdue University
Jayathi Murthy, Purdue University

Mixed Convection Cooling of a Microsphere

Mohamed A. Antar, King Fahd University of Petroleum and Minerals

Salon II **9.2 Thermal Management Track – Session 15**
Novel Thermal Management Approaches I
Chairs: Victor Chiriac
Enchao Yu

Fluid-to-Fluid Spot-to-Spreader (F2/S2) Hybrid Heat Sink for Integrated Chip-Level and Hotspot-Level Thermal Management

Craig Green, Georgia Institute of Technology
Andrei G. Fedorov, Georgia Institute of Technology
Yogendra K. Joshi, Georgia Institute of Technology

Cooling Technique Based on Evaporation of Thin and Ultra Thin Liquid Films

O.A. Kabov, Universite Libre de Bruxelles & Russian Academy of Sciences
E.Y. Gatapova E.Y., Russian Academy of Sciences
D.V. Zaitsev, Russian Academy of Sciences

Experimental Studies on Synthetic Jet Cooling Enhancement for Portable Platforms

David B. Go, Purdue University
Rajiv K. Mongia, Intel Corporation

Numerical Evaluation of 2D and 3D Parallel Unsteady Confined Dual Air Jets

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

Salon III **9.3 Thermal Management Track – Session 16**

System Level Thermal Management – Thermal Characterization

Chairs: Sridhar Sundaram
Ali Heydari

Study on the Natural Air Cooling Design of Electronic Equipment Casings: Effects of the Height and Size of Outlet Vent on the Flow Resistance

Masaru Ishizuka, Toyama Prefectural University
Shinji Nakagawa, Toyama Prefectural University

Transient Thermal Management Using Phase Change Materials with Embedded Graphite Nanofibers for Systems with High Power Requirements

Amy S. Fleischer, Villanova University
Kireeti Chintakrinda, Villanova University
Randy Weinstein, Villanova University
Carol A. Bessel, Villanova University

Coolant Quality for Magnetic Resonance Imaging Systems

Julie Wong, General Electric Healthcare
Garron K Morris, General Electric Healthcare

Thermal Management of High Power Memory Module for Server Platforms

Qi Zhu, Intel Corporation
Xiang Li, Intel Corporation
Yinan Wu, Intel Corporation

Cable Management Arm Airflow Impedance Study

Brandon Rubenstein, Hewlett Packard Company

Salon VI **9.4 Mechanics Track – Session 7**

Quality and Reliability I

Chairs: Deepak Goyal
Milenna Vujosevic

Trace Line Failure Analysis and Characterization of the Panel Base Package (PBP™) Technology with Fan-Out Capability

Ming-Chih Yew, National Tsing Hua University
Chung-Jung Wu, National Tsing Hua University
Ching-Shun Huang, Advanced Chip Engineering Techn
Mars Tsai, Advanced Chip Engineering Technology
Dyi-Chung Hu, Advanced Chip Engineering Technology
Wen-Kung Yang, Advanced Chip Engineering Technology
Kuo-Ning Chiang, National Tsing Hua University

Ageing-Informed Behavior of Sn3.8Ag0.7Cu Solder Alloys

K Mysore, Purdue University
D Chan, Purdue University
D Bhate, Purdue University
G Subbarayan, Purdue University
I Dutta, Naval Postgraduate School
V Gupta, Texas Instruments
J Zhao, Texas Instruments
D Edwards, Texas Instruments

Influence of Fastening Methods on the Dynamic Response and Reliability Assessment of PCBs in Cellular Phones under Free Drop

Seungbae Park, State Univ of New York at Binghamton
Abdullah Al-Yafawi, State Univ of New York at Binghamton
Da Yu, State University of New York at Binghamton
Jae B. Kwak, State University of New York at Binghamton
John Lee, State University of New York at Binghamton
Nam Seo Goo, Konkuk Univeristy

Study of Thermal Fatigue Life Caused by Dispersion of Solder Joint

Kanji Takagi, Yokohama National University/Omron
Qiang Yu, Yokohama National University
Dahiro Shibutani, Yokohama National University
Iroki Miyauchi, Yokohama National University
Masaki Shiratori, Yokohama National University
Yukihiro Noro, Omron Corporation

CFD Modeling of a Thermoelectric Device for Electronics Cooling Applications

Nikhil Lakhkar, University of Texas- Arlington
Mohammad Hossain, Intel Corporation
Dereje Agonafer, University of Texas- Arlington

10:55-11:05 Refreshment Break

11:05-12:45

PARALLEL SESSIONS

Salon I **10.1 Thermal Management Track–Session 17**

System Level Thermal Management – Consumer Electronics

Chairs: Ali Heydari
Sridhar Sundaram

Thermal Tests and Analysis of Thin Graphite Heat Spreader for Hot Spot Reduction in Handheld Devices

Yin Xiong, GrafTech International Holdings
Martin Smalc, GrafTech International Holdings
Julian Norley, GrafTech International Holdings
John Chang, GrafTech International Holdings
Helen Mayer, GrafTech International Holdings
Prathib Skandakumaran, GrafTech International Holdings
Brad Reis, GrafTech International Holdings

Lid Cooling for Notebooks

Krishnakumar Varadarajan, Intel Technology India
Rajiv K. Mongia, Intel Corporation
Himanshu Pokharna, Intel Corporation
Jerry Pan, Compal Electronics
Kevin Tien, Compal Electronics
Mark Wu, Compal Electronics

Set-level Thermal Management with Package Thermal Design in Digital TV Application

Eun Seok Cho, Samsung Electronics
Mi-Na Choi, Samsung Electronics
Chung-Hyo Jung, Samsung Electronics
Jaewook Yoo, Samsung Electronics
Heejung Hwang, Samsung Electronics
Heeseok Lee, Samsung Electronics
Kiwon Choi, Samsung Electronics
Sayoon Kang, Samsung Electronics

Parametric Thermal Modeling of Heat Transfer in Handheld Electronic Devices

Jaeho Lee, Stanford University
David W. Gerlach, United Technologies Research Center
Yogendra K. Joshi, Georgia Institute of Technology

Salon II **10.2 Thermal Management Track –Session 18**

Novel Thermal Management Approaches II
Chairs: Mehmet Arik
Baris Dogruoz

Effect of Wall Proximity on Convective Heat Transfer from a Heated Block in a Pulsating Channel Flow

Tae Ho Ji, KAIST
Seo Young Kim, KIST
Jae Min Hyun, KAIST

An Overview and Comparison of Various Refrigeration Methods for Microelectronics Cooling

Victor Chiriac, Freescale Semiconductor
Florea Chiriac, Technical University of Civil Engineering

Hybrid Solid State/Fluidic Cooling for Hotspot Removal

Vivek Sahu, Georgia Institute of Technology
Yogendra K. Joshi, Georgia Institute of Technology
Andrei G. Fedorov, Georgia Institute of Technology

Microfluidic Pumping Based on Dielectrophoresis for Thermal Management of Microelectronics

Dong Liu, University of Houston
Suresh V. Garimella, Purdue University

Salon III **10.3 Emerging Technologies Track–Session 6**

Advanced Packaging
Chairs: Arun Gowda
Saketh Mahalingam
Xiulin Ruan

Forced Convection Interlay Cooling in Vertically Integrated Packages

Thomas Brunschweiler, IBM Research
B. Michel, IBM Research
Hugo Rothuizen, IBM Research
U. Kloter, IBM Research
B. Wunderle, Fraunhofer IZM
H. Oppermann, Fraunhofer IZM
H. Reichl, Technische Universität Berlin

The Sustainable Information Technology Ecosystem

Cullen E. Bash, Hewlett-Packard Laboratories
Chandrakant D. Patel, Hewlett-Packard Laboratories
Amp J. Shah, Hewlett-Packard Laboratories
Ratnesh K. Sharma, Hewlett-Packard Laboratories

Convective Heat Transfer from a Die-Stacked Electronic Package

Venkat Natarajan, Intel Technology India

Thermal Modeling and Design of 3D Integrated Circuits

Ankur Jain, Freescale Semiconductor
Robert E. Jones, Freescale Semiconductor
Ritwik Chatterjee, Freescale Semiconductor
Scott Pozder, Freescale Semiconductor
Zhihong Huang, Freescale SemiconductorUSA

Salon VI **10.4 Mechanics Track – Session 8**

Quality and Reliability II
Chairs: Yifan Guo
Charlie Zhai

Effects of Dispensed Solder Paste Amount on Solder Void Performance in a PQFN Package

Youmin Yu, Freescale Semiconductor
S. A. Yao, Freescale Semiconductor
Sonder Wang, Freescale Semiconductor
Weimin Chen, Freescale Semiconductor
Y. W. Jiang, Freescale Semiconductor

Effects of Reflow Atmosphere on Solder Void and Wire Bond Performances in a PQFN Package

Youmin Yu, Freescale Semiconductor
S. A. Yao, Freescale Semiconductor
G. J. Lv, Freescale Semiconductor
Wei Xiao, Freescale Semiconductor
Sonder Wang, Freescale Semiconductor
Y. W. Jiang, Freescale Semiconductor
Weimin Chen, Freescale Semiconductor

Reliability Study of Mounting Structure for High Temperature Power Semiconductor Device Chip using High Purity Aluminum

Masanori Yamagiwa, Yokohama National University & Nissan Motor Company
Qiang Yu, Yokohama National University
Masato Fujita, Yokohama National University
Masanori Shinohara, Yokohama National University
Yoshinori Murakami, Nissan Motor Company

A Review of Non-Hermetic Optoelectronic Packaging

Sushma Madduri, State Univ of New York, Binghamton
Bahgat G. Sammakia, State Uni of New York, Binghamton
Bill Infantolino, State University of New York, Binghamton
Satish Chaparala, Corning

Experimental Characterization of Adhesion between Micro-size Polymer Particles and Silicon Substrates

Weiqliang Ding, Clarkson University
Huan Zhang, Clarkson University
Cetin Cetinkaya, Clarkson University

12:30-2:00

Salon IV **Lunch for attendees**

Best Paper Awards, Program Committee
Recognition