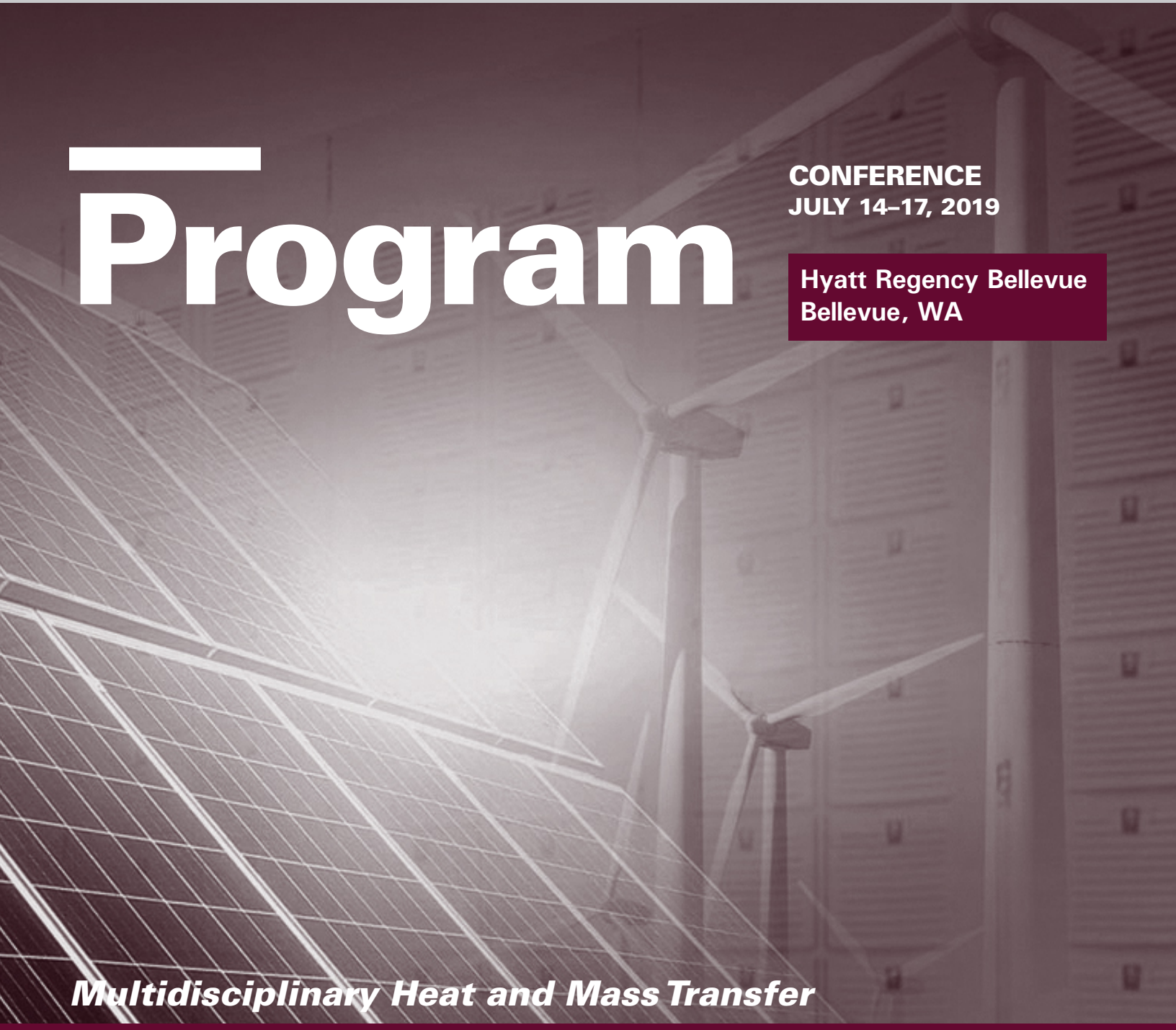
ASME® 2019 SHTC

Summer Heat Transfer Conference co-located with the
13th International Conference on Energy Sustainability



Program

CONFERENCE
JULY 14–17, 2019

Hyatt Regency Bellevue
Bellevue, WA

Multidisciplinary Heat and Mass Transfer

The American Society of Mechanical Engineers®
ASME®

ASME
SETTING THE STANDARD

Contents

Welcome

Satwindar Singh Sadhal
Conference General Chair

Sandra Boetcher
Program Technical Chair

Dear Colleagues,

On behalf of the ASME Heat Transfer Division, it is our pleasure to welcome you to participate in the ASME 2019 Summer Heat Transfer Conference in Bellevue, Washington, during July 14–17, 2019. This is a premier event that offers excellent opportunities to disseminate your research and network with the international heat transfer community. The technical content of the conference is broad in scope and deep in content and is featured on the theme of Multidisciplinary Heat and Mass Transfer. It is co-sponsored by the AIChE and co-located with the ASME 13th International Conference on Energy Sustainability.

The conference offers a vibrant program with several symposiums, panels, tutorials, workshops, and a technical tour. The plenary sessions include presentations from the DQ Kern award winner as well as one from a senior industrial representative. Two hundred and fifty papers, presentations, and posters are scheduled in sixty technical sessions. Several keynote presentations, panels, and tutorials are scheduled in Energy Systems, Computational Heat Transfer, and Electronic Cooling and Heat Transfer Equipment tracks. Special events at the conference are the Welcome Reception on Sunday evening and the Conference Banquet on Monday evening. In addition, a tour of the Boeing Commercial Aircraft facility is offered on Wednesday, July 17. On the afternoon of Sunday July 14 before the welcome reception, a workshop is offered on CO_2 Capture and Utilization. A special forum to discuss funding opportunities has been organized with representatives from the National Science Foundation and Oak Ridge National Laboratories. Additionally, there will be a panel and open discussion for women in heat transfer and energy sustainability to address diversity and inclusiveness issues.

A highlight of the Conference is the AIChE Symposium in Honor of Peter C. Wayner, Jr. This Symposium is organized jointly by AIChE and the ASME Heat Transfer Division. We will be honored by Prof. Wayner's presence and celebrate his accomplishments together with the many years of service and contributions in heat transfer and fluid dynamics, which have bridged research in both chemical and mechanical engineering applications. This symposium also includes insightful technical as well biographical review presentations that highlight the lasting impact of the honoree.

The many contributions of both the volunteer members of the ASME Heat Transfer Division and the ASME professional staff were invaluable in organizing the many aspects of the conference. We specifically acknowledge the ASME staff, Mary Jakubowski, Camille Cruz, Stacy Cooper, and the webmaster Laraine Lee, as well as Kristine Chin and Stéphanie Orvoine-Couvrette of AIChE. We also thank track and session organizers for supporting the conference technical program, overseeing the reviews of the technical papers, and helping maintain high standards. Most importantly, we thank you the participants for giving strength to the conference with your presence and by engaging in the important task of the review process and the ongoing technical engagement. We are grateful to representatives from the AIChE together with the ASME Advanced Energy Systems and the Solar Energy Divisions for the cooperative spirit in bringing together this jointly sponsored co-located event.

We also call your attention to next year's Summer Heat Transfer conference that will be run jointly with the ASME Fluids Engineering Division and ICNMM, and will take place during July 12–15, 2020, at the Rosen Shingle Creek Hotel in Orlando, Florida. We urge your participation in that Conference and look forward to being with you again next year in 2020.

Conference Information

CONFERENCE REFRESHMENT BREAKS

Morning and afternoon breaks will be provided in the exhibition area, Grand Ballroom Foyer, Second Floor. Come and meet our exhibitors, and join your fellow attendees for a few minutes of networking and discussion.
The schedule is as follows:

Monday–Wednesday, July 15–17
10:10AM–10:30AM
and
3:40PM–4:00PM

EXHIBITS INFORMATION

Grand Ballroom Foyer, Second Floor

Monday, July 15
10:00AM–4:00PM

Tuesday, July 16
10:00AM–4:00PM

Wednesday, July 17
10:00AM–4:00PM

AUDIOVISUAL EQUIPMENT IN SESSION ROOMS

All technical sessions are equipped with one LCD projector and one screen. Laptops will NOT be provided in the sessions. Presenters MUST bring their own or make arrangements in advance with the session organizers to share. Bring your presentation on a thumb drive 15 minutes prior to the session start time.

BADGES REQUIRED FOR ADMISSION

All conference attendees must wear the official ASME 2019 SHTC badge at all times in order to gain admission to technical sessions, exhibits, and other conference events. Without a badge, you will NOT be allowed to attend any conference activities.

CONFERENCE AWARDS BANQUET

(TICKET REQUIRED FOR GUESTS)

The Heat Transfer Division Awards Banquet will take place during the conference to recognize and celebrate a select group of individuals for their contributions and achievements in heat transfer engineering.

The Banquet is on Monday, July 15, 6:30–9:00PM in Grand Ballroom EFG, on the Second Floor. The banquet is included in the full registration. Guests are required to purchase a ticket.

CONFERENCE LUNCHES

Conference lunches will be held from 12:15PM to 1:45PM on Monday, Tuesday, and Wednesday during the conference in Grand Ballroom HIJK, Second Floor. Please join your fellow attendees for a good meal and a great networking opportunity.
On Tuesday, July 16, a joint poster session with ES will also take place during lunch.

CONFERENCE EVENT CONNECT APP

Download the new ASME CrowdCompass App and hold the entire program in the palm at your hand! The new ASME CrowdCompass App allows you to easily look up sessions, search for papers or people, message with other attendees, post to various social media platforms, and create your own schedule.

The ASME CrowdCompass App is available at the App Store, Google Play, and Windows Market.

SPEAKER READY/AUTHORS' PRACTICE ROOM

The Maple Room on the third floor of the hotel is available as a Speaker Ready room for those who want to review or practice their presentations. An LCD projector and screen are provided during the following hours.

Sunday, July 14
12:00PM–5:00 PM

Monday, July 15–Tuesday, July 16
8:00AM–5:00PM

Wednesday, July 17
8:00AM–4:00 PM

CONFERENCE PROCEEDINGS

Each attendee receives a conference DVD that includes all of the papers accepted for presentation at the conference. The official conference archival proceedings will be published after the conference and will not include accepted papers that were not presented at the conference. The official conference proceedings collection is registered with the Library of Congress and submitted for abstracting and indexing. The proceedings is published with the ASME Digital Library. You will be provided with an individual link to the online papers via email. In the event you do not receive the email, send a request to toolboxhelp@asme.org.

EMERGENCY INFORMATION

In the event of an emergency, please dial 55 or 0 on any hotel phone to connect with the hotel emergency hotline. The hotel will communicate with the local authorities. The hotel also has 24-hour security, and officers trained in first aid, CPR, & AED service.

TECHNICAL TOUR

Wednesday, July 17

1:00PM–4:00PM

$50.00 for Members and Non-Members

Tickets Required

BOEING

Boeing Future of Flight is one of Seattle's most-loved, premier attractions. Located just 25 miles north of Seattle, the Boeing Tour is a one-of-a kind opportunity to view 747, 767, 777, and 787 Dreamliners on the assembly line before they take to the sky. This will be followed by The Boeing Factory Tour, which is a visit inside a working assembly plant. Each tour segment is approximately 90 minutes long and includes fascinating facts about Boeing and the planes that bear its name. The cost is $50, which includes transportation from the conference hotel to the Boeing facility and back, as well as the tour ticket.

https://www.futureofflight.org/boeing-tour-seattle

OPENING RECEPTION

Sunday, July 14

6:30PM–8:30PM

Grand Ballroom Foyer, Second Floor

AICHE SYMPOSIUM HONORING PROFESSOR PETER C. WAYNER, JR.

Monday, July 15

8:30–10:10AM and 2:00–5:40PM

Cedar Ballroom B, Second Floor

INTERNET ACCESS

Complimentary Basic Internet access is available in sleeping rooms and the hotel's public space as well as the meeting space. ASME19 will be the password for Internet access in the meeting space.

MEMBERSHIP TO ASME (ONE-YEAR FREE)

Registrants who paid the non-member conference registration fees will receive a complimentary one-year ASME Membership. ASME will automatically activate this complimentary membership for qualified attendees. Please allow approximately four weeks after the conclusion of the conference for your membership to become active. Visit www.asme.org/membership for more information about the benefits of ASME Membership.

PRESENTER ATTENDANCE POLICY

According to ASME's Presenter Attendance Policy, if a paper is not presented at the conference, the paper will not be published in the official Archival Proceedings, which are registered with the Library of Congress and are abstracted and indexed. The paper also will not be published in the ASME Digital Collection and may not be cited as a published paper.

REGISTRATION INFORMATION

Grand Ballroom Foyer, Second Floor

Sunday, July 14	12:00PM–5:00PM
Monday, July 15	7:00AM–5:30PM
Tuesday, July 16	7:00AM–5:30PM
Wednesday, July 17	7:00AM–5:30PM

Program At-A-Glance

Sunday, July 14			Monday, July 15	Tuesday, July 16	Wednesday, July 17
1:00PM– 5:00PM (Grand Ballroom C) **W01 – Workshop 25-1-1** **CO_2 Capture and Utilization**	8:30AM–10:10AM	Regency Ballroom A	**1-1-1**	**1-6-1 Energy Systems Heat Transfer Analysis Panel**	**1-3-1**
		Regency Ballroom B	**3-1-1**	**3-1-5**	**3-1-6**
		Regency Ballroom C	**4-1-1**	**4-3-1**	**5-1-3 Lifecycle of Heat Exchangers Panel**
		Regency Ballroom E	**8-1-1**	**8-1-4**	**8-1-9**
		Regency Ballroom F	**11-1-1**	**13-1-1**	**14-1-2**
		Regency Ballroom G	**14-1-1**	**14-2-1**	**14-2-3**
		Cedar Ballroom A	**20-1-1 Tutorial: Validation, Verification, and Uncertainty Quantification**	**12-1-2**	**6-1-1**
		Cedar Ballroom B	**19-1-1 AIChE Symposium**	**5-1-4**	**8-1-7**
	10:30AM–12:10PM	Grand Ballroom E/F	**24-4-1 Keynote Lecture: Donald Q. Kern Award**	**24-4-2 Keynote Lecture: Industry Perspective on Heat Transfer**	**24-4-3 Funding Opportunities for Research in Heat/Mass Transfer and Energy Systems Forum**
	12:15PM–1:45PM	Grand Ballroom HIJK	**Lunch**	**21-1-1 SHTC/ES Poster Session & Lunch**	**Lunch**
	2:00PM–3:40PM	Regency Ballroom A	**1-1-2**	**1-8-1**	
		Regency Ballroom B	**3-1-3**	**3-1-7**	**10-1-1**
		Regency Ballroom C	**4-2-1**	**5-1-1**	**9-1-1**
		Regency Ballroom E	**8-1-3**	**8-1-5**	
		Regency Ballroom F	**11-1-2**	**16-1-1**	
		Regency Ballroom G	**12-1-1**	**2-2-1**	**14-2-2**
		Cedar Ballroom A	**20-3-1 Tutorial: Computational Approaches**		**6-1-2**
		Cedar Ballroom B	**19-1-2 AIChE Symposium**		**8-1-8**
	4:00PM–5:40PM	Grand Ballroom A		**22-1-1 Women in Heat Transfer Panel**	
		Regency Ballroom A	**1-4-1**	**1-8-2**	
		Regency Ballroom B	**3-1-4**	**3-1-2**	
		Regency Ballroom C	**4-1-2**	**5-1-2**	
		Regency Ballroom E	**8-1-2**	**18-1-1**	
		Regency Ballroom F	**11-1-3**	**16-1-1**	
		Regency Ballroom G	**15-1-1 Heat Transfer Education Panel**	**2-2-2**	
		Cedar Ballroom A	**20-3-2 Tutorial: Computational Approaches**		
		Cedar Ballroom B	**19-1-3 AIChE Symposium**	**8-1-6**	
6:30PM–8:30PM (Grand Ballroom Foyer) **Opening Reception**	6:00PM–9:00PM		6:30PM–9:00PM (Grand Ballroom EFG) **Awards Banquet**	6:00PM–8:00PM **Committee Meetings** (some Committee Meetings are at different times)	

23-1 HTD EXECUTIVE COMMITTEE MEETING *(CLOSED SESSION)*
Sunday, July 14
1:30PM–3:15PM
Grand Ballroom A

23-2 HTD EXECUTIVE COMMITTEE MEETING *(OPEN SESSION)*
Sunday, July 14
3:30PM–5:30PM
Grand Ballroom A

23-4 HTD *JOURNAL OF HEAT TRANSFER* EDITORIAL BOARD
Monday, July 15
2:00PM–3:40PM
Grand Ballroom A

23-5 HTD *JOURNAL OF THERMAL SCIENCE & ENGINEERING APPLICATIONS* EDITORIAL BOARD
Tuesday, July 16
2:00PM–3:40PM
Grand Ballroom A

23-7 HONORS AND AWARDS COMMITTEE: K-3
Tuesday, July 16
6:00PM–8:00PM
Regency Ballroom A

23-8 COORDINATION COMMITTEE: K-5
Tuesday, July 16
6:00PM–8:00PM
Grand Ballroom A

23-9 HEAT TRANSFER IN ENERGY SYSTEMS: K-6
Tuesday, July 16
6:00PM–8:00PM
Grand Ballroom A

23-10 THEORY AND FUNDAMENTALS RESEARCH: K-8
Tuesday, July 16
6:00PM–8:00PM
Grand Ballroom B

23-11 NANOSCALE THERMAL TRANSPORT: K-9
Tuesday, July 16
6:00PM–8:00PM
Regency Ballroom B

23-12 HEAT TRANSFER EQUIPMENT: K-10
Tuesday, July 16
6:00PM–8:00PM
Regency Ballroom C

23-13 FIRE AND COMBUSTION: K-11
Tuesday, July 16
6:00PM–8:00PM
Regency Ballroom E

23-14 AEROSPACE HEAT TRANSFER: K-12
Tuesday, July 16
6:00PM–8:00PM
Regency Ballroom F

23-15 HEAT TRANSFER IN MULTIPHASE FLOW: K-13
Tuesday, July 16
6:00PM–8:00PM
Regency Ballroom G

23-17 TRANSPORT PHENOMENA IN MANUFACTURING AND MATERIALS PROCESSING: K-15
Tuesday, July 16
6:00PM–8:00PM
Grand Ballroom E

23-18 HEAT TRANSFER IN ELECTRONIC EQUIPMENT: K-16
Tuesday, July 16
6:00PM–8:00PM
Grand Ballroom F

23-19 HEAT TRANSFER UNDER EXTREME CONDITIONS: K-18
Tuesday, July 16
6:00PM–8:00PM
Grand Ballroom G

23-20 ENVIRONMENTAL HEAT TRANSFER: K-19
Tuesday, July 16
6:00PM–8:00PM
Grand Ballroom I

23-21 COMPUTATIONAL HEAT TRANSFER: K-20
Tuesday, July 16
6:00PM–8:00PM
Grand Ballroom J

23-22 EDUCATION COMMITTEE: K-21
Tuesday, July 16
6:00PM–8:00PM
Grand Ballroom K

23-23 VISUALIZATION COMMITTEE: K-22
Tuesday, July 16
6:00PM–8:00PM
Grand Ballroom C

23-16 GAS TURBINE HEAT TRANSFER: K-14
Wednesday, July 17
8:30 AM–10:10 AM
Grand Ballroom C

Special Sessions

WORKSHOP

Carbon Dioxide Capture and Utilization (CCU): Technology Opportunities and Challenges

Sunday, July 14
1:00PM–5:00PM
Cost: $30
Grand Ballroom C, Second Floor

A Comprehensive Overview of Carbon Management that will provide State-of-the-Art Knowledge and Information about Ongoing Development of Carbon Dioxide Capture and Utilization Technology

Synopsis

The impact of rising carbon dioxide (CO_2) levels on climate change is now taken seriously, which is expected to stimulate global action to reduce CO_2 emissions as well as finding economic ways to convert CO_2 to value-added products in addition to utilizing CO_2 for Enhanced Oil Recovery (EOR) and geologic sequestration. When the global demand for electricity increased from 8.3 million GWh in 1980 to 22.7 million GWh in 2012, the resulting annual CO_2 emissions increased from 5.5 to 13.3 trillion tonnes. As such, the magnitude of CO_2 emissions is so large, that all possible technologies must be considered to make a realistic impact in the foreseeable future, namely: a) energy-efficiency in power generation and manufacturing; b) alternate fuels; c) renewable energy; d) CO_2 capture and sequestration (CCS); and e) CO_2 capture and utilization (CCU). The challenges associated with CO_2 capture, transport, and storage have been well documented. Therefore, the conversion of captured CO_2 to value-added products would eliminate CO_2 transportation and geologic sequestration costs, and encourage more facilities to convert CO_2 into a revenue generating products. There is a *Window of Opportunity* for innovative process and equipment designs for CO_2 capture and conversion to high-value products for offsetting the costs of CO_2 capture and conversion to products competitively.

The purpose of this workshop is to provide a comprehensive overview of ongoing projects and to evaluate techno-economic opportunities and challenges for developing innovative technologies for abatement of CO_2 emissions.

The workshop is intended for process and design engineers, managers, environmental engineers, and decision makers in power and manufacturing industries. If you are seeking the awareness of the current technology status of CO_2 capture and utilization, to explore funding sources for new technologies, and collaboration with ongoing projects, then this workshop will provide the basic knowledge to pursue opportunities.

Workshop Outline

Topic Area 1: CO_2 Emissions from Power Generation and Manufacturing

Topic Area 2: Ongoing CO_2 Capture Technology Developments

Topic Area 3: Ongoing CO_2 Utilization Technology Developments

Topic Area 4: Economics of CO_2 Capture and Utilization

Topic Area 5: Life Cycle Analysis (LCA) of CO_2 Utilization

Topic Area 6: Heat and Mass Transfer Challenges in CO_2 Capture and Utilization

Topic Area 7: Equipment Design: Challenges and Opportunities

Topic Area 8: Interfacing with the CO_2 Sources

Q&A and Open Discussion

Speakers

Dr. C.B. Panchal, E3Tec Service, LLC: After working for 25+ years at Argonne National Laboratory, Dr. Panchal founded E3Tec to better serve the industry with the focus on energy efficiency and process intensification. E3Tec has been pursuing utilization of captured CO_2 with Grants from DOE-SBIR and ERA, Alberta Canada Round 1. E3Tec has developed Heat Integrated Reactive Distillation (HIRD) equipped with side reactors for conversion of CO_2 to alkyl carbonates. Dr. Panchal holds a PhD in chemical engineering from the University of Manchester Institute of Science and Technology (UMIST), UK, and a BS in chemical engineering from the University of Bombay, India. He is a Fellow member of AIChE and was and an active member of the AIChE Heat Transfer and Energy Division, now Transport and Energy Processes Division.

Richard D. Doctor, E3Tec Service, LLC: Chemical Engineer (P.E.) Northwestern University; investigates process design and economics for the full energy-chain analysis of fossil, nuclear, and renewable power cycles using ASPEN® including systems retrofitted for carbon capture and sequestration. Chapter chair for the IPCC Special Report on CO_2 Capture and Sequestration (2006). Coming from a background with ARCO Oil, during his 32-year career at Argonne National Laboratory he led the DOE energy and environmental monitoring of the Great Plains Coal-gasification plant (a $2.2 Billion facility in Beulah, ND) including heavy interaction with regulatory agencies.

AIChE Symposium in Honor of Professor Peter C. Wayner, Jr.

Monday, July 15
8:30AM–10:10AM, 2:00–5:40PM
Cedar Ballroom B, Second Floor

Prof. Peter C. Wayner, Jr., *Rensselaer Polytechnic Institute, Troy, NY*

"Advances in Phase-Change Phenomena and Heat/Mass Transfer"

Peter C. Wayner, Jr. was instrumental in establishing the importance of intermolecular force interactions on change-of-phase heat and mass transfer. His incorporation of disjoining pressure concepts into the overall interfacial resistance to phase change and his development of optical techniques to characterize those interfacial forces revolutionized how we view phase change processes today. This symposium is organized around a series of invited talks that will highlight many of the important

contributions of Professor Wayner and how he has influenced generations of researchers looking into probing the mysteries surrounding phase change phenomena.

TUTORIALS

20-1-1 - Tutorial: Verification, Validation, and Uncertainty Quantification

Monday, July 15
8:30AM–10:10AM
Cedar Ballroom A, Second Floor

20-3-1 and 20-3-2: Tutorial: Computational Approaches for Solving Inverse Heat Transfer Problems

Monday, July 15
2:00PM–3:40PM
4:00PM–5:40PM – Tutorial Continuation
Cedar Ballroom A, Second Floor

PANELS

15-1-1 - Panel on Heat Transfer Education *(Sponsored by K-21)*

Monday, July 15
4:00PM–5:40PM
Regency Ballroom G, Second Floor

Panel Organizer: Prof. Nesrin Ozalp, *University of Minnesota Duluth, Duluth, MN, United States*

Undergraduate education deserves utmost care in creating new generation mechanical engineers. It is important to pass knowledge without overwhelming students while stimulation of critical thinking is kept as the key to shape their minds. Heat transfer course is usually to referred as one of the hardest topics by engineering students. This presents a challenge to educators and leads them to seek methods to captivate students' attention and understanding of the subject matter. In this panel, different perspectives will be presented on how to make heat transfer course attractive and easier for students to understand. The panel discussions will bring experiences of the panelists together as example approaches. The panel involves highly experienced heat transfer professors who made appreciable contributions to the heat transfer research field who offer new techniques to attract students.

Panelists:

Prof. Michael Pate, *Texas A&M University, College Station, TX, USA*

Prof. Ashley F. Emery, *University of Washington, Seattle, WA, USA*

Prof. Sandip Mazumder, *Ohio State University, OH, USA*

Prof. Alexander Rattner, *Penn State University, PA, USA*

1-6-1 - Panel on the Key Role of Heat Transfer Analysis in Energy Systems Research

Tuesday, July 16
8:30AM–10:10AM
Regency Ballroom A, Second Floor

Panel Organizer: Prof. Nesrin Ozalp, *University of Minnesota Duluth, Duluth, MN, United States*

This panel compiles a variety of research discussions on the use of heat transfer techniques for experimental and numerical work. The panel discussions will bring experiences of the panelists together as example approaches as well as promising future directions for research. The panel involves highly experienced heat transfer professors who have made appreciable contributions to heat transfer research.

Panelists:

Yuwen Zhang, *University of Missouri, Columbia, MO, United States*

S.A. Sherif, *University of Florida, Gainesville, FL, United States*

Michael Epstein, *Tel Aviv University, Tel Aviv, Israel*

22-1-1 - Women in Heat Transfer Panel

Tuesday, July 16
4:00PM–5:40PM
Grand Ballroom A, Second Floor

Panel Organizer: Dr. Leslie Phinney, *Sandia National Laboratories, Albuquerque, NM, United States*

The Women in Heat Transfer Panel will be comprised of exemplary women engineers from academia and industry/national labs who will describe their career paths including opportunities and challenges they encountered. They will provide career advice to younger engineers. Early career engineers, of both genders, are especially encouraged to attend. There will also be discussion on how to make the thermal engineering community more inclusive and welcoming for all.

Panelists:

Jayathi Murthy, *University of California, Los Angeles, Los Angeles, CA, United States*

Jane Davidson, *University of Minnesota, Wayzata, MN, United States*

Amy Betz, *Kansas State University, Manhattan, KS, United States*

Special Sessions

5-1-3 - Panel on Lifecycle of Industrial Heat Exchangers: Concept to Trouble-Free Operation *(Sponsored by K-10)*

Wednesday, July 17
8:30AM–10:10AM
Regency Ballroom C, Second Floor

Panel Organizers: Dr. Maulik Shelat, *Praxair, Williamsville, NY, United States,* Dr. Amanie Abdelmessih, California Baptist University, Riverside, CA, United States

Researchers and development engineers from the industry and academia are invited to discuss their experiences of converting a heat exchanger concept to a commercial application and highlight learnings obtained along the way including successes, failures, and troubleshooting. Another purpose of this topic is to discuss studies conducted to evaluate performance of the heat exchangers in a system level operation compared to the design expectations and lessons learned as well as solutions implemented to address identified gaps.

Panelists:

Kevin Farrell, *HTRI, Navasota, Texas*

Francesco Coletti, *Hexxcell Ltd., Uxbridge, UK*

Richard Jibb, *McDermott, Houston, TX*

Maulik Shelat, *Praxair, Tonawanda, NY*

Douglas Decker, *Chart Energy and Chemicals, LaCrosse, WI*

POSTER SESSIONS AND PRESENTATIONS

SHTC and ES Joint Poster Session: Thermal Science and Engineering

Tuesday, July 16
12:15PM–1:45PM
Grand Ballroom HIJK, Second Floor

HEAT TRANSFER

16-1-1 - **Endoscopic Visualization of Pool Boiling.** HT2019-3835

16-1-1 - **Visualization of Two-Phase Flow Behavior Inside the Advanced Thermosyphon with Different Working Fluids.** HT2019-3555

16-1-2 - **Visual Investigation of Influence of Temperature on the Behavior of a Droplet's Spreading and Penetration Through an Oil/Water Column.** HT2019-3822

21-1-1 - **Refrigeration Systems for Heat Transfer Control of Space Exploration Vehicles in Extreme Environments.** HT2019-3440

Heat Transfer Through Thin Film Profile in a Closed Loop Pulsating Heat Pipe. HT2019-3507

Effect of Temperature on the Surface Tension Components of Polar Liquids. HT2019-3622

Experimental Study of Critical Heat Flux on a Confined Finite Surface Under Pool Boiling. HT2019-3584

Modeling Borehole Thermal Energy Storage to Increase the Range of Recovered Waste Heat Utilization. HT2019-3751

Electrothermal Immersion Technique for Studying Heat Transfer Media in High-Temperature (up to 1200°C) Corrosive Environments. HT2019-3754

Experimental Work for Thermal and Hydraulic Performance of Printed Circuit Heat Exchangers (PCHE). HT2019-3777

Experimental Study of Bicellular Natural Convection Inside a Closed Rectangular Cavity. HT2019-3802

Modulation of Heat Transfer Characteristics Using Thin Film Boiling. HT2019-3786

Thermal Energy Grid Storage (TEGS) Using Multi-Junction Photovoltaics (MPV) "Sun-in-a-Box." HT2019-3826

Investigating the Phase Change of a Two-Phase Salt Mixture for a Latent Heat Storage Device. HT2019-3811

Introducing Novel Convergent Geometries to Enhance Pipe Flow Convective Heat Transfer. HT2019-3830

Phonon Conduction of Phase Transition 2D Materials. HT2019-3834

ENERGY SUSTAINABILTY

9-2 - **CFD-Thermal Analysis of Flat Plate Solar Collectors.** ES2019-4053

18-1 - **Investigating the Phase Change of a Two-Phase Salt Mixture for a Latent Heat Storage Device.** ES2019-4055

A Study of Developing Economizer Dry-Bulb Temperature Control According to Variable Mixed Air Temperature. ES2019-4057

A Study on a Variable Water Flow Rate Control Method of the Circulation Pump in a Geothemal Heat Pump System. ES2019-4060

Design of a Domestic Water Heater Using a Phase Change Material for Heat Storage. ES2019-4073

Numerecal Modeling of Geothermal Heat Exchanger for Solar Panel Application. ES2019-4074

Examination of Cooling-Tower Performs With Treated Water on Industrial and Environmental Symbiosis. ES2019-3968

Design and Fabrication of Concentrated Solar Waste Water Treatment Apparatus. ES2019-3994

Solar Powered Atmospheric Water Generation. ES2019-4015

Design Aspects of Phase Change Material (PCM) Enhanced Gypsum Plasterboard. ES2019-4026

Development of Virtual Airflow Sensing Method in VAV Terminal Unit. ES2019-4022

KEYNOTE LECTURES

AIChE Donald Q Kern Lecture

Monday, July 15
10:30AM–12:10PM
Grand Ballroom EF, Second Floor

Multi-scale Thermal Management in Information Technology, Mobile Electronics, Off-Grid Shelters, and Urban Environments

Professor Yogendra Joshi, *G.W. Woodruff School of Mechanical Engineering, Georgia Institute of Technology, Atlanta, GA*

Abstract
In this presentation, some of our activities over the past two decades in multi-scale thermal management of electronic systems will be described. With the recent end of the International Technology Roadmap for Semiconductors, which has guided research on thermal packaging of microprocessors for nearly a quarter century, significantly different challenges are on the horizon for high performance and mobile information technology systems. Heterogeneous integration through chip stacking promises to bring in multiple system functionalities in highly compact form factors, along with great challenges to thermal management. Recent and ongoing research on microfluidic cooling and sub-mm vapor chambers to address the high heat fluxes, and localized hot spots in these applications will be discussed. High performance information technology systems of the future will see these emerging technologies deployed in servers and cabinets in data centers, which currently consume nearly 3% of the generated electricity nationally, of which 20%–50% is towards thermal management. Characterizing and managing air flows in data centers to ensure adequate cooling and energy efficiency, in the presence of varying workloads is a key challenge, and efforts in our laboratory to address this will be discussed. Control of thermal systems will play an increasingly important role in energy efficient operation of buildings and cities. The speaker will introduce some of the challenges by considering two areas of our focus, off-grid shelters and smart cities.

Biography

Yogendra Joshi is Professor and John M. McKenney and Warren D. Shiver Distinguished Chair at the G.W. Woodruff School of Mechanical Engineering at the Georgia Institute of Technology. His research interests are in multi-scale thermal management. He is the author or co-author of nearly four hundred publications in this area, including nearly two hundred journal articles. He received his B. Tech. in Mechanical Engineering from the Indian Institute of Technology (Kanpur) in 1979, M.S. in Mechanical Engineering from the State University of New York at Buffalo in 1981, and Ph.D. in Mechanical Engineering and Applied Mechanics, from the University of Pennsylvania in 1984. He has served as the Principal Investigator for multiple Defense Advanced Research Projects Agency (DARPA) programs, and Office of Naval Research Consortium for Resource-Secure Outposts (CORSO). He was Site Director for the National Science Foundation Industry/University Cooperative Research Center on Energy Efficient Electronic Systems. He has held visiting faculty appointments at Stanford University, Katholieke Universiteit Leuven, and Xi'an Jiaotong University. He is an elected Fellow of the ASME, the American Association for the Advancement of Science, and IEEE. He was a co-recipient of the ASME Curriculum Innovation Award (1999), Inventor Recognition Award from the Semiconductor Research Corporation (2001), the ASME Electronic and Photonic Packaging Division Outstanding Contribution Award in Thermal Management (2006), ASME Journal of Electronics Packaging Best Paper of the Year Award (2008), IBM Faculty Award (2008), IEEE SemiTherm Significant Contributor Award (2009), IIT Kanpur Distinguished Alumnus Award (2011), ASME InterPack Achievement Award (2011), ITherm Achievement Award (2012), ASME Heat Transfer Memorial Award (2013), and AIChE Donald Q. Kern Award (2018).

Tuesday, July 16
10:30AM–12:10PM
Grand Ballroom EF, Second Floor

Industry Perspective on Aerospace Technology Needs and Trends

Dr. Lesia Protsalio, *Senior Director, Emerging Technologies Program Office, United Technologies Research Center, East Hartford, CT*

Abstract
After many years of incremental innovation, we are in the golden age of invention in aerospace. With Internet, computing, and auto industries leading the frontiers of innovation in the past decade, the defense aerospace industry still remains one of the most risk-averse sectors. Meanwhile, commercial technology players are highly motivated to develop new technologies and are setting up to support rapid innovation. Air transport passenger demand is expected to almost double in the next 15 years and increased competition in this industry drives the pace of technology development.

In this keynote lecture we will take a look at some of the most interesting and exciting developments taking place in aerospace technology today and concentrate on a few specific areas that are of higher interest for fundamental research. The focus will be on the technology trends that are coming to fruition now as well as many more expected on the horizon. Discussion around fundamental research interests will cover a wide range of topics from advanced materials to additive manufacturing and technologies enabling sustainable and efficient hybrid and electric aircraft.

While currently existing technologies continue to advance and penetrate industry driving next generation aerospace products, further advances are required in the science, technology, and engineering in such areas as quantum computing, artificial intelligence-driven automation, virtual and augmented reality, and advanced electronics and sensor technologies as well smart and multifunctional materials.

Biography

Dr. Lesia Protsailo, Ph.D., is Senior Director, Emerging Technologies Program Office, at United Technologies Research Center (UTRC). In this role, she provides strategic direction and management for a research portfolio of nascent technologies that could provide a significant competitive advantage for the next generation of products across UTC. The portfolio consists of advanced programs in areas such as high-temperature materials, advanced manufacturing, hybrid electric propulsion, robust wireless networks, cyber-physical security, and autonomy.

Dr. Protsailo joined UTC in 2002 after graduating with Ph.D. in Chemistry/electrochemistry from University of California, Davis. She has held a variety of leadership roles at UTC since 2002, including technical and programmatic leadership at United Technologies Fuel Cell business division and UTC Research Center. In her tenure with UTC, she has served as a Research Fellow in the area of Electrochemistry, Advanced Materials Technology Manager at UTC Power. and lead Pratt and Whitney Advanced Materials portfolio at UTC Research Center. Her technical expertise spans from aerospace materials and nanotechnology to clean energy fields. In her 17 years with UTC, she has led new technology programs from concept feasibility to implementation stages as well as has been instrumental in negotiating and executing technology licensing and collaborative R&D agreements. Through the years of her professional career, Lesia has been an active member of Electrochemical Society, Society of Women Engineers, and American Chemical Society. She has also authored more than 40 technical publications and conference papers and holds numerous patents. Among other professional recognitions she has been selected by the Connecticut Technology Council as one of the honorees for the 2016 Women of Innovation award and finalist for the 2019 Class of Putman Media's Influential Women in Manufacturing.

Dr. Protsailo holds a Master's degree in Chemistry from the Ivan Franko State University in Lviv, Ukraine, and a Doctorate in Chemistry from the University of California, Davis.

FORUM

Funding Opportunities in Heat/Mass Transfer and Energy Systems

Wednesday, July 17
10:30AM–12:10PM
Grand Ballroom EF, Second Floor

This is a forum to discuss funding opportunities in Heat and Mass Transfer and Energy Systems. The panelists include Professor José Lage from the NSF's Thermal Transport Processes (TTP) program and Dr. Kyle Gluesenkamp from the Oak Ridge National Laboratories.

Specifically, Professor Lage will present to the audience the available opportunities in the TTP program that supports engineering research projects that lay the foundation for new discoveries in thermal transport phenomena. These projects should either develop new fundamental knowledge or combine existing knowledge in thermodynamics, fluid mechanics, and heat and mass transfer to probe new areas of innovation.

Dr. Gluesenkamp will discuss the opportunities for research projects in Energy Efficiency and Renewable Energy from the Department of Energy. The ORNL renewable energy research portfolio focuses on science and technology to support a cleaner environment, a stronger economy, and a more secure future for our nation.

José L. Lage, P.E., Ph.D., *Professor, Department of Mechanical Engineering, Southern Methodist University (on leave), Director, Thermal Transport Processes Program, National Science Foundation, Alexandra, VA*

Biography

A Professor of Mechanical Engineering (ME) at Southern Methodist University (SMU), where he began his career in 1991, Prof. Lage is currently on leave at the National Science Foundation where he is the Director of the Thermal Transport Processes (TTP) program. Among his current responsibilities is the identification of emerging frontiers of multidisciplinary activities and innovative research, the development of strategic plans for targeted investments in research and education, and the coordination and collaboration with other Federal agencies and organizations to ensure investments are made in a diverse, rich mix of bold, cutting-edge projects.

A Professional Engineer in the State of Texas, Lage has accumulated over 200 peer reviewed publications, including journal articles and book chapters. He has conducted interdisciplinary collaborative research, both at the national and international levels, in partnership with several colleagues in academia and industries, and with funding from several agencies, including the NSF, DOE, and NIST. He has pioneered the use of fractional calculus in fluid mechanics and micro-scale heat transfer, with direct application to thin film characterization. He has designed, built, and tested a new (patented) cold plate for phased-array radar systems, now used in the USAF F-35 joint strike fighter. His original work on the implications of blood flow in alveolar respiration has led to the discovery of a new, more efficient form of forced convection by particulates termed "sweeping convection." He has also coined the term "porous-continuum" to highlight the differences between experimental (measured) and analytical (predicted) quantities used in analytical models. His current h-index is 36 on Google Scholar, with over 4,350 citations.

He has created, got funded, and directed for over six years a FIPSE-CAPES bi-lateral, multi-university consortium in Manufacturing and Global Security. He has served as the Associate Chair of the SMU/ME Dep for three years, and more recently has been elected and served as the President of the SMU Faculty Senate when he led the highest faculty representation body in the university being a voting member of the Board of Trustees. Lage has been elected an Honorary Member of Pi Tau Sigma and a Fellow of the ASME, and served twice as an Associate Editor of the ASME *Journal of Heat Transfer*, among other journals. He is the recipient of several

awards, including the Sigma Xi for Outstanding Research, the ASEE for Outstanding Teaching, the ASME-NTS Engineer of the Year Award for "Outstanding Achievements in Mechanical Engineering," the SAE Ralph R. Teetor Educational Award for "Significant Contributions to Teaching, Research and Student Development," and the SMU Golden Mustang Award for "Sustained High Achievement as both a Teacher and Scholar." He has been a Visiting Professor of the Swiss Federal Institute of Engineering (ETH-Zurich) and of the Federal University of Technology Parana (UTF-PR-Brazil). In 2014 he was elected member of the Scientific Council of the International Centre for Heat and Mass Transfer.

Dr. Kyle R. Gluesenkamp, *Research and Development Staff Scientist in the Building Equipment Group, Oak Ridge National Laboratory, Oak Ridge, TN*

Biography

Dr. Kyle R. Gluesenkamp is Research and Development Staff Scientist in the Building Equipment Group at the Oak Ridge National Laboratory. He is an expert in thermodynamic cycle analysis and experimental evaluation, with research including non-vapor compression heat pumps, transcritical vapor compression heat pumps, energy efficient water heating and appliances, and appliance efficiency standards. He has published a book chapter, 16 conference and journal articles, numerous invention records, contributed to the IEA Heat Pump Program Annex 34 Final Report, and has been invited to present his work in Europe, Asia, and North America for industrial and academic audiences. Dr. Gluesenkamp is a member of ASHRAE where he serves on multiple TCs. He is also a member of SAE and led the AEE student chapter at University of Maryland. He is the recipient of numerous awards including:

- ORNL Significant Event Award, awarded by ORNL Leadership Team for "significant contribution to ORNL," October 2014
- World Record, FAI Class IE, Human Powered Rotorcraft, Duration: 49.9 seconds, June 2012
- Fellowship Recipient, US Department of Energy, Office of Fossil Energy Fellowship, 2010
- Scholarship Recipient, GDF Suez North America Scholarship, 2011; 2008

AWARDS AND RECOGNITIONS

Monday, July 15
6:30PM–9:00PM
Grand Ballroom EFG, Second Floor

2018 Donald Q Kern Award Winner

Professor Yogendra Joshi

John M. McKenney and Warren D. Shiver Distinguished Chair
G.W. Woodruff School of Mechanical Engineering, Georgia Institute of Technology, Atlanta, GA

Technical Sessions – SUNDAY and MONDAY

SUNDAY, JULY 14

WORKSHOPS

Topic 25-1
CARBON DIOXIDE CAPTURE AND UTILIZATION

25-1-1
Carbon Dioxide Capture and Utilization (CCU) – Technology Opportunities and Challenges
Second Floor, Grand Ballroom C 1:00PM–5:00PM

Carbon Dioxide Capture and Utilization (CCU) – Technology Opportunities and Challenges

Technical Presentation. HT2019-3846

Chandrakant Panchal, Richard D. Doctor, *E3tec Service, LLC, Hoffman Estates, IL, United States*

MONDAY, JULY 15

HEAT TRANSFER IN ENERGY FEMS – K6

Track Organizer: Nesrin Ozalp, *University of Minnesota Duluth, Duluth, MN, United States*

Track Co-Organizers: Matthew R. Jones, *Brigham Young University, Provo, UT, United States,* Alexander Rattner, *Penn State University, University Park, PA, United States*

Topic 1-1
MINI-SYMPOSIUM ON THERMAL MANAGEMENT AND STORAGE

1-1-1
Mini-Symposium on Thermal Management and Storage I
Second Floor, Regency Ballroom A 8:30AM–10:10AM

Session Organizer: Leitao Chen, *Rice University, Houston, TX, United States*

Session Co-Organizer: Alexander Rattner, *Penn State University, University Park, PA, United States*

Flowing Electrolyte as Coolant Inside the Microgrooves Embedded in the Electrodes: A Novel Thermal Management of Li-Ion Batteries

Keynote Paper Publication. HT2019-3664

Shahabeddin Keshavarz Mohammadian, Yuwen Zhang, *University of Missouri, Columbia, MO, United States*

Prototype Results for a Salt Hydrate PCM Thermal Energy Storage System

Technical Paper Publication. HT2019-3403

Sean Hoenig, Richard Bonner, Chien-Hua Chen, Fangyu Cao, *Advanced Cooling Technologies, Inc., Lancaster, PA, United States,* Josh Charles, *Lehigh University, Bethlehem, PA, United States*

Constructal Open Reactors for Thermochemical Energy Storage

Technical Paper Publication. HT2019-3455

Alexandre Malley-Ernewein, *LMDC – INSA Toulouse, Toulouse, France,* Sylvie Lorente, *University of Toulouse, INSA, Toulouse, France*

THEORY AND FUNDAMENTAL RESEARCH IN HEAT TRANSFER – K-8

Track Organizer: Amitabh Narain, *Michigan Technological University, Houghton, MI, United States*

Track Co-Organizers: Diana-Andra Borca-Tasciuc, *Rensselaer Polytechnic Institute, Troy, NY, United States,* Xiulin Ruan, *Purdue University, West Lafayette, IN, United States,* Vaibhav Bahadur, *University of Texas at Austin, Austin, TX, United States,* Navdeep Dhillon, *California State University Long Beach, Long Beach, CA, United States*

Topic 3-1
FUNDAMENTALS OF PHASE-CHANGE FLOWS, CONVECTION, AND MULTISCALE HEAT TRANSFER

3-1-1
Fundamentals of Boiling and Condensation including Micro/Nanoscale Effects – I
Second Floor, Regency Ballroom B 8:30AM–10:10AM

Session Organizer: Amitabh Narain, *Michigan Technological University, Houghton, MI, United States*

Session Co-Organizers: Van P. Carey, *University of California, Berkeley, Berkeley, CA, United States,* Enakshi Wikramanayake, *The University of Texas at Austin, Austin, TX, United States*

Separating Wickability and Wetting Effects During Water Droplet Evaporation on Superhydrophilic Nanoporous Surfaces

Technical Paper Publication. HT2019-3548

Alanna Cooney, Emma R. McClure, Samuel Cabrera, Van P. Carey, *University of California, Berkeley, Berkeley, CA, United States*

Efficient Enhancement of Nucleation Rates in Flow-Boiling – By Concurrent Micro-Structuring of the Boiling-Surface and Its Judicious Energization by Piezoelectric-Transducer Induced Acoustic Waves

Technical Presentation. HT2019-3661

Amitabh Narain, Divya Pandya, Soroush Sepahyar, Gaurav Kumar, Venkatmayur Sista, *Michigan Technological University, Houghton, MI, United States,* Vibhu Vivek, *Vivek Technologies LLC, Santa Clara, CA, United States*

Electrical Impedance Based Characterization of Wettability during Electrostatic Suppression of the Leidenfrost State

Technical Paper Publication. HT2019-3426

Onur Ozkan, Vaibhav Bahadur, *The University of Texas at Austin, Austin, TX, United States*

Theoretical Modeling of Thermal Transients in a PCM Substrate During Drop Impact

Technical Paper Publication. HT2019-3648

Andrew Quon, Abdul Ahad Khan, Navdeep Singh Dhillon, *California State University Long Beach, Long Beach, CA, United States*

Wicking Versus Contact Line Extension for Boiling Enhancement in Porous Structures

Technical Presentation. HT2019-3784

An Zou, Sajag Poudel, Shalabh Maroo, *Syracuse University, Syracuse, NY, United States*

NANOSCALE TRANSPORT PHENOMENA – K-9

Track Organizer: Chris Dames, *UC Berkeley, Berkeley, CA, United States*

Track Co-Organizers: Dong Liu, *University of Houston, Houston, TX, United States,* Liping Wang, *Arizona State University, Tempe, AZ, United States*

Topic 4-1
NANOSCALE HEAT CONDUCTION

4-1-1
Nanoscale Heat Conduction 1
Second Floor, Regency Ballroom C 8:30AM–10:10AM

Session Organizer: Zhen Chen, *Southeast University, Nanjing, China*

Modeling Electron Beam Heating in Thin Samples Using the Boltzmann Transport Equation

Technical Presentation. HT2019-3501

Geoff Wehmeyer, *Rice University, Houston, TX, United States*

Giant Effect of Spin-Lattice Coupling on the Thermal Transport in Two-Dimensional Ferromagnetic CrI3

Technical Presentation. HT2019-3485

Guangzhao Qin, Ming Hu, *University of South Carolina, Columbia, SC, United States*

Nanosecond ET-Raman for Characterizing the Thermal Conductivity of Suspended 2D Atomic-Layer Structures

Technical Presentation. HT2019-3424

Ridong Wang, Hamidreza Zobeiri, Xinwei Wang, *Iowa State University, Ames, IA, United States,* Tianyu Wang, *Institute of Chemistry Chinese Academy of Sciences, Beijing, China*

Adapting the E-Beam of an SEM as a Quantitative Nanoscale Heat Source

Technical Presentation. HT2019-3436

Pengyu Yuan, *University of California, Berkeley, Berkeley, CA, United States*

Nano Heat Pipe using Surface-Diffusion-Driven Condensate Return

Technical Presentation. HT2019-3824

Elnaz Norouzi, Chanwoo Park, *University of Missouri, Columbia, MO, United States,* Gisuk Hwang, *Wichita State University, Wichita, KS, United States*

HEAT TRANSFER IN MULTIPHASE SYSTEMS – K-13

Track Organizer: Abhijit Mukherjee, *CSUN, Northridge, CA, United States*

Track Co-Organizers: Scott Thompson, *Auburn University, Auburn, AL, United States,* Vinod Srinivasan, *University of Minnesota Twin Cities, Minneapolis, MN, United States*

Topic 8-1

8-1-1
Boiling and Evaporation Heat Transfer, Fundamentals I
Second Floor, Regency Ballroom E 8:30AM–10:10AM

Session Organizer: Herman Haustein, *Tel Aviv University, Ramat Aviv, Israel*

Session Co-Organizer: Vinod Srinivasan, *University of Minnesota Twin Cities, Minneapolis, MN, United States*

Combined Thermal and Meniscus Characterization During Evaporation From a Silicon Micropillar Wick

Technical Presentation. HT2019-3509

Evan Fleming, Gaohua Zhu, Debasish Banerjee, *Toyota Research Institute of North America, Ann Arbor, MI, United States*

Evaporation of Binary-Mixture Droplets

Technical Presentation. HT2019-3589

Ali Alshehri, Sahar Andalib, Pirouz Kavehpour, *University of California, Los Angeles, Los Angeles, CA, United States*

Evaporation Dynamics of Colloidal Pendant Drops Under Magnetic Stimulus

Technical Presentation. HT2019-3478

Ankur Chattopadhyay, Purbarun Dhar, *IIT Ropar, Rupnagar, Punjab, India*

Thin-Film Evaporation From Micropillar Arrays: Effect of the Liquid-Vapor Interface on Transport

Technical Presentation. HT2019-3456

Ruisong Wang, Karan Jakhar, Dion Antao, *Texas A&M University, College Station, TX, United States*

Wettability Effects on Falling Film Heat Transfer Over Horizontal Tubes in Jet Flow Mode

Technical Paper Publication. HT2019-3532

Avijit Karmakar, Sumanta Acharya, *Illinois Institute of Technology, Chicago, IL, United States*

HEAT TRANSFER IN ELECTRONIC EQUIPMENT – K-16

Track Organizer: Amanie Abdelmessih, *California Baptist University, Riverside, CA, United States*

Track Co-Organizers: Hendrik P.J. De Bock, *GE Global Research, Schenectady, NY, United States,* Seungbae Park, *Binghamton University, Binghamton, NY, United States*

Topic 11-1

11-1-1
Numerical Modeling and Simulation
Second Floor, Regency Ballroom F 8:30AM–10:10AM

Session Organizer: Gregory J. Michna, *South Dakota State University, Brookings, SD, United States*

Effect of Rack Models and Buoyancy Forces on a Small Data Center Facility

Technical Paper Publication. HT2019-3709

Beichao Hu, Long Phan, Cheng-xian Lin, *Florida International University, Miami, FL, United States*

Numerical Study of Gas-Liquid Two-Phase Flow in Ultra-High-Aspect-Ratio Microchannel With Capillary-Structured Wall

Technical Paper Publication. HT2019-3567

Xiang Mei, Zhenyu Liu, Huiying Wu, *Shanghai Jiao Tong University, Shanghai, China*

Numerical Simulation of Flow Boiling in Micro Channel to Study Bubble Dynamics

Technical Paper Publication. HT2019-3470

Uday Kumar Alugoju, Satish Kumar Dubey, Arshad Javed, *Birla Institute of Technology & Science, Pilani – Hyderabad, Hyderabad, India*

COMPUTATIONAL HEAT TRANSFER – K-20

Track Organizer: Sandip Mazumder, *Ohio State University, Columbus, OH, United States*

Track Co-Organizer: Aaron Wemhoff, *Villanova University, Villanova, PA, United States*

Topic 14-1
METHODS IN COMPUTATIONAL HEAT TRANSFER

14-1-1
Deep Learning, Reduced Order Modeling, and Non-Continuum Heat Transfer
Second Floor, Regency Ballroom G 8:30AM–10:10AM

Session Organizer: Leitao Chen, *Rice University, Houston, TX, United States*

Session Co-Organizers: John Tencer, *Sandia National Laboratories, Albuquerque, NM, United States,* Matthew R. Jones, *Brigham Young University, Provo, UT, United States*

Simulation of Fourier's Law With the Finite Volume Discrete Boltzmann Method

Technical Presentation. HT2019-3499

Leitao Chen, Timothy Petrosius, Laura Schaefer, *Rice University, Houston, TX, United States,* Xiaofeng Cai, *University of Delaware, Newark, DE, United States*

In-Situ Thermal ROM-Based Optimization Using Borg MOEA: A Preliminary Study

Technical Paper Publication. HT2019-3483

Kevin Irick, *Applied Technology Associates, Albuquerque, NM, United States,* Erich Brown, *COSMIAC at The University of New Mexico, Albuquerque, NM, United States*

Applying Artificial Intelligence to Modeling and Optimization of Nanomaterials in Photovoltaics

Technical Presentation. HT2019-3666

Mine Kaya, Shima Hajimirza, *Texas A&M University, College Station, TX, United States*

Thermal Transport Analysis of Aluminum Alloy Using Machine Learning Technique

Technical Presentation. HT2019-3752

Jiaqi Wang, Seungha Shin, Ali Yousefzadi Nobakht, J. Dean Blanks, Hassan Rezayat, *The University of Tennessee, Knoxville, Knoxville, TN, United States,* Dongwon Shin, Sangkeun Lee, Amit Shyam, *Oak Ridge National Laboratory, Oak Ridge, TN, United States*

Numerical Simulation of Melting in Metal Foam/Paraffin Composite Phase Change Material Using a Physically More Reasonable Macroscale Model

Technical Paper Publication. HT2019-3642

Yuanpeng Yao, Huiying Wu, *Shanghai Jiao Tong University, Shanghai, China*

AIChE SYMPOSIUM IN HONOR OF PROFESSOR PETER C. WAYNER, JR.

Track Organizer: Joel Plawsky, *Rensselaer Polytechnic Institute, Troy, NY, United States*

Track Co-Organizer: Raj M. Manglik, *University of Cincinnati, Cincinnati, OH, United States*

Topic 19-1
AIChE SYMPOSIUM IN HONOR OF PROFESSOR PETER C. WAYNER, JR.

19-1-1
AIChE Symposium in Honor of Professor Peter C. Wayner, Jr. I
Second Floor, Cedar Ballroom B 8:30AM–10:10AM

Session Organizer: Raj M. Manglik, *University of Cincinnati, Cincinnati, OH, United States*

Effect of a Soluble Surfactant on a Finite-Sized Bubble in Motion in a Blood Vessel

Technical Presentation. HT2019-3726

Protonovo Ayyaswamy, *University of Pennsylvania, Philadelphia, PA, United States*

Disjoining Pressure: Redefining Evaporation

Technical Presentation. HT2019-3718

Thao Nguyen, *Corning Inc., Big Flats, NY, United States,* Joel Plawsky, Peter Wayner, *Rensselaer Polytechnic Institute, Troy, NY, United States*

Droplet Evaporation From Heated Surfaces: Effect of Solid Conductivity and Contact Angle

Technical Presentation. HT2019-3825

Satwindar Singh Sadhal, *University of Southern California, Los Angeles, CA, United States*

The Accidental Thermal Engineer

Technical Presentation. HT2019-3671

Joel Plawsky, *Rensselaer Polytechnic Institute, Troy, NY, United States*

TUTORIALS

Track Organizer: Sandip Mazumder, *Ohio State University, Columbus, OH, United States*

20-1
TUTORIAL: VERIFICATION, VALIDATION, AND UNCERTAINTY QUANTIFICATION

20-1-1
Tutorial: Verification, Validation, and Uncertainty Quantification
Second Floor, Cedar Ballroom A 8:30AM–10:10AM

Session Organizer: John Tencer, *Sandia National Laboratories, Albuquerque, NM, United States*

Session Co-Organizer: Shima Hajimirza, *Texas A&M University, College Station, TX, United States*

Tutorial: Verification, Validation, and Uncertainty Quantification

Technical Presentation. HT2019-3430

Ashley Emery, *University of Washington, Seattle, WA, United States*

KEYNOTE LECTURE

Topic 24-1
KEYNOTE LECTURE

24-4-1
Donald Q Kern Award Lecture
Second Floor, Grand Ballroom E/F 10:30AM–12:10PM

Session Organizer: Masahiro Kawaji, *City College of New York, New York, NY, United States*

Session Co-Organizer: Satwindar Singh Sadhal, *University of Southern California, Los Angeles, CA, United States*

Multiscale Thermal Management in Information Technology, Mobile Electronics, Off-Grid Shelters, and Urban Environments

Keynote Presentation. HT2019-3844

Yogendra Joshi, *Georgia Institute of Technology, Atlanta, GA, United States*

HEAT TRANSFER IN ENERGY SYSTEMS – K6

Track Organizer: Nesrin Ozalp, *University of Minnesota Duluth, Duluth, MN, United States*

Track Co-Organizers: Matthew R. Jones, *Brigham Young University, Provo, UT, United States,* Alexander Rattner, *Penn State University, University Park, PA, United States*

Topic 1-1
MINI-SYMPOSIUM ON THERMAL MANAGEMENT AND STORAGE

1-1-2
Mini-Symposium on Thermal Management and Storage II
Second Floor, Regency Ballroom A 2:00PM–3:40PM

Session Organizer: Leitao Chen, *Rice University, Houston, TX, United States*

Session Co-Organizer: Alexander Rattner, *Penn State University, University Park, PA, United States*

Thermal Energy Grid Storage (TEGS) Using Multi-Junction Photovoltaics (MPV) "Sun-in-a-Box": Techno-Economics, Liquid Containment, and Pumping

Technical Presentation. HT2019-3411

Caleb Amy, *MIT, Allston, MA, United States,* Colin C. Kelsall, Henry Asegun, Mehdi Pishahang, *MIT, Cambridge, MA, United States*

Heat Transfer From a Row of Heated Pipes in Horizontally Layered Porous Media

Technical Paper Publication. HT2019-3598

Chean Chin Ngo, Ahmed Al Edhari, *California State University Fullerton, Fullerton, CA, United States*

Passive Thermal Management of Li-Ion Batteries Using PCM-Metal Foam Composite Materials

Technical Presentation. HT2019-3776

Derek Barnes, Fangzhou Wang, Xianglin Li, *University of Kansas, Lawrence, KS, United States,* Zheng Miao, *North China Electric Power University, Beijing, China*

Thermal Energy Grid Storage (TEGS) Using Multi-Junction Photovoltaics (MPV) "Sun-in-a-Box": MPV Design Challenges

Technical Presentation. HT2019-3773

Colin C. Kelsall, Henry Asegun, Caleb Amy, *Massachusetts Institute of Technology, Cambridge, MA, United States,* Daniel Friedman, Myles Steiner, *National Renewable Energy Laboratory, Lakewood, CO, United States*

THEORY AND FUNDAMENTAL RESEARCH IN HEAT TRANSFER – K-8

Track Organizer: Amitabh Narain, *Michigan Technological University Houghton, MI, United States*

Track Co-Organizers: Diana-Andra Borca-Tasciuc, *Rensselaer Polytechnic Institute, Troy, NY, United States,* Xiulin Ruan, *Purdue University, West Lafayette, IN, United States,* Vaibhav Bahadur, *University of Texas at Austin, Austin, TX, United States,* Navdeep Dhillon, *California State University Long Beach, Long Beach, CA, United States*

Topic 3-1
FUNDAMENTALS OF PHASE-CHANGE FLOWS, CONVECTION, AND MULTI-SCALE HEAT TRANSFER

3-1-3
Fundamentals of Multiscale Simulations – I
Second Floor, Regency Ballroom B 2:00PM–3:40PM

Session Organizer: Prabhakar Marepalli, *Intel Corporation, Hillsboro, OR, United States*

Session Co-Organizer: Vaibhav Bahadur, *University of Texas at Austin, Austin, TX, United States*

Theory of Lattice Thermal Conductivity Beyond the Phonon Gas Model

Technical Presentation. HT2019-3551

Yi Zeng, Jianjun Dong, *Auburn University, Auburn, AL, United States*

Atomic-Level Understanding of Thermal Management for Superionic Conductor Battery Materials

Technical Presentation. HT2019-3488

Ming Hu, *University of South Carolina, Columbia, SC, United States*

On the Accuracy of Interface Schemes for Conjugate Conditions in the Lattice Boltzmann Method

Technical Presentation. HT2019-3800

David Korba, Nanqiao Wang, Like Li, *Mississippi State University, Mississippi State, MS, United States*

NANOSCALE TRANSPORT PHENOMENA – K-9

Track Organizer: Chris Dames, *UC Berkeley, Berkeley, CA, United States*

Track Co-Organizers: Dong Liu, *University of Houston, Houston, TX, United States,* Liping Wang, *Arizona State University, Tempe, AZ, United States*

Topic 4-2
NANOSCALE THERMAL RADIATION

4-2-1
Nanoscale Thermal Radiation 1
Second Floor, Regency Ballroom C 2:00PM–3:40PM

Session Organizer: Anil Yuksel, *IBM Corporation, Austin, TX, United States*

Session Co-Organizer: Andrej Lenert, *University of Michigan, Ann Arbor, MI, United States*

Simultaneously Harvest Energy From the Sun and Outer Space Using the Same Physical Area

Technical Presentation. HT2019-3515

Zhen Chen, *Southeast University, Nanjing, China,* Linxiao Zhu, *University of Michigan, Ann Arbor, MI, United States,* Wei Li, Shanhui Fan, *Stanford University, Stanford, CA, United States*

Radiative Heat Transfer in van der Waals Metamaterials

Technical Presentation. HT2019-3460

Sean McSherry, Andrej Lenert, *University of Michigan, Ann Arbor, MI, United States*

Plasmonic Waveguiding in Subwavelength Particles Suspended in Various Dielectric Media

Technical Paper Publication. HT2019-3637

Anil Yuksel, *IBM Corporation, Austin, TX, United States,* Michael Cullinan, Edward T. Yu, *The University of Texas at Austin, Austin, TX, United States,* Jayathi Murthy, *University of California, Los Angeles, Los Angeles, CA, United States*

Plasmon-Enhanced Selective Radiative Transmission in Aerogels

Technical Presentation. HT2019-3462

Zachary Berquist, Ashley R. Beilinksi, Hannah Kim, Neil P. Dasgupta, Andrej Lenert, *University of Michigan, Ann Arbor, MI, United States*

HEAT TRANSFER IN MULTIPHASE SYSTEMS – K-13

Track Organizer: Abhijit Mukherjee, *CSUN, Northridge, CA, United States*

Track Co-Organizers: Scott Thompson, *Auburn University, Auburn, AL, United States,* Vinod Srinivasan, *University of Minnesota Twin Cities, Minneapolis, MN, United States*

Topic 8-1

8-1-3
Boiling and Evaporation Heat Transfer, Applications
Second Floor, Regency Ballroom E 2:00PM–3:40PM

Session Organizer: Anil Yuksel, *IBM Corporation, Austin, TX, United States*

Session Co-Organizer: Vinod Srinivasan, *University of Minnesota Twin Cities, Minneapolis, MN, United States*

A Planar Evaporator Design to Counter Parasitic Heat Flow During Device Startup of a Microscale Loop Heat Pipe

Technical Paper Publication. HT2019-3651

Navdeep Singh Dhillon, *California State University Long Beach, Long Beach, CA, United States*

Liquid Transport During Evaporation of Water From a Small Simulated Soil Column

Technical Paper Publication. HT2019-3734

Partha P. Chakraborty, Molly Ross, Hitesh Bindra, Melanie Derby, *Kansas State University, Manhattan, KS, United States*

Evaporation-Based Microfluidic Pump Using Super-Hydrophilic Diatom Biosilica Thin Films

Technical Paper Publication. HT2019-3502

Hunter Jarrett, Micah Wade, *Washington State University-Vancouver, Vancouver, WA, United States,* Joseph Kraai Kraai, Gregory Rorrer, Alan Wang, *Oregon State University, Corvallis, OR, United States,* Hua Tan, *Washington State University-Vancouver, Vancouver, WA, United States*

Study on Liquid Evaporation Characteristics and Storage Safety Technology of Large LNG Storage Tanks

Technical Presentation. HT2019-3816

Cunyong Song, Jianlu Zhu, Yuxing Li, *China University of Petroleum (East China), Shandong, Shandong, China*

HEAT TRANSFER IN ELECTRONIC EQUIPMENT – K-16

Track Organizer: Amanie Abdelmessih, *California Baptist University, Riverside, CA, United States*

Track Co-Organizers: Hendrik P.J. De Bock, *GE Global Research, Schenectady, NY, United States,* Seungbae Park, *Binghamton University, Binghamton, NY, United States*

Topic 11-1

11-1-2
Spray Cooling
Second Floor, Regency Ballroom F 2:00PM–3:40PM

Session Organizer: Dion Antao, *Texas A&M University, College Station, TX, United States*

Understanding the Effects of Surface Texturing on the Heat Transfer Characteristics of Spray Cooling

Technical Presentation. HT2019-3572

Sankar Muthukrishnan, Vinod Srinivasan, *University of Minnesota Twin Cities, Minneapolis, MN, United States*

The Effect of Chamber Pressure on the Thermal Performance of New Refrigerant R513a During Spray Cooling

Technical Paper Publication. HT2019-3628

Nabeel Abdulrazzaq, Azzam Salman, Noble Anumbe, Amitav Tikadar, Saad K. Oudah, Jamil Khan, *University of South Carolina, Columbia, SC, United States*

Measurement of Pressure Distributions at a Heat Sink Inlet to Study the Influence of Inlet Flow Characteristics on the Performance of a Heat Sink With Jet Impingement

Technical Presentation. HT2019-3789

Taehoon Kim, Kyu Hyung Do, Yongshik Han, Byung-Il Choi, *KIMM, Daejeon, Korea (Republic)*

HEAT TRANSFER UNDER EXTREME CONDITIONS – K-18

Track Organizer: Qiuwang Wang, *Xi'an Jiaotong University, Xi'an, Shaanxi, China*

Track Co-Organizer: Xinwei Wang, *Iowa State University, Ames, IA, United States*

Topic 12-1

12-1-1
Heat Transfer Related to Hydrogen and Space Exploration
Second Floor, Regency Ballroom G 2:00PM–3:40PM

Session Organizer: Kevin Anderson, *California State Polytechnic University at Pomona, Pomona, CA, United States*

Temperature Distribution in a Zero Boil-Off Hydrogen Tank With a Rotatable Spray Bar

Technical Paper Publication. HT2019-3435

Zhongqi Zuo, Wenbing Jiang, Xujin Qin, Yonghua Huang, *Shanghai Jiao Tong University, Shanghai, Shanghai, China*

Analysis on Thermal Design Concern of Vapor Cooled Shield for Cryogenic Tanks

Technical Paper Publication. HT2019-3439

Wenbing Jiang, Zhongqi Zuo, Yonghua Huang, *Shanghai Jiao Tong University, Shanghai, Shanghai, China,* Peijie Sun, Peng Li, S*hanghai Institute of Aerospace System Engineering, Shanghai, Shanghai, China*

Influence of Overweight Acceleration on Heat Transfer of Hydrocarbon Fuel in a Vertical Tube at Supercritical Pressures

Technical Paper Publication. HT2019-3552

Lulu Lv, Yanchen Fu, *BUAA, Beijing, China,* Bensi Dong, Jie Wen, Guoqiang Xu, *Beihang University, China*

AIChE SYMPOSIUM IN HONOR OF PROFESSOR PETER C. WAYNER, JR.

Track Organizer: Joel Plawsky, *Rensselaer Polytechnic Institute, Troy, NY, United States*

Track Co-Organizer: Raj M. Manglik, *University of Cincinnati, Cincinnati, OH, United States*

Topic 19-1
AIChE SYMPOSIUM IN HONOR OF PROFESSOR PETER C. WAYNER, JR.

19-1-2
AIChE Symposium in Honor of Professor Peter C. Wayner, Jr. II
Second Floor, Cedar Ballroom B 2:00PM–3:40PM

Session Organizer: Joel Plawsky, *Rensselaer Polytechnic Institute, Troy, NY, United States*

Near Contact Line Evaporation: Fundamentals and Applications

Technical Presentation. HT2019-3767

Van P. Carey, *University of California, Berkeley, Berkeley, CA, United States*

On the Contribution of Microlayer in Nucleate Boiling

Technical Presentation. HT2019-3724

Vijay K. Dhir, *University of California, Los Angeles, Los Angeles, CA, United States*

Origin and Evolution of Microlayer in Pool Boiling

Technical Presentation. HT2019-3720

An Zou, Manish Gupta, Shalabh Maroo, *Syracuse University, Syracuse, NY, United States*

Thermo-Mechanical Phase Change Stability of Liquid-Vapor Meniscus

Technical Presentation. HT2019-3723

Kishan Bellur, Jeffrey S. Allen, *Michigan Technological University, Houghton, MI, United States*

On the Role of Reagent and Polymeric Additives in Altering Interfacial Properties and Nucleate Pool Boiling Behavior of Water

Technical Presentation HT2019-3660

Raj M. Manglik, *Professor, University of Cincinnati, Cincinnati, OH, United States*

TUTORIALS

Track Organizer: Sandip Mazumder, *Ohio State University, Columbus, OH, United States*

20-3
TUTORIAL: COMPUTATIONAL APPROACHES FOR SOLVING INVERSE HEAT TRANSFER PROBLEM

20-3-1
Tutorial: Computational Approaches for Solving Inverse Heat Transfer Problem
Second Floor, Cedar Ballroom A 2:00PM–3:40PM

Session Organizer: Shima Hajimirza, *Texas A&M University, College Station, TX, United States*

Session Co-Organizer: John Tencer, *Sandia National Laboratories, Albuquerque, NM, United States*

Computational Approaches for Solving Inverse Heat Transfer Problem

Technical Presentation. HT2019-3432

Kevin Dowding, *Sandia National Laboratories, Albuquerque, NM, United States*

HEAT TRANSFER IN ENERGY SYSTEMS – K6

Track Organizer: *Nesrin Ozalp, University of Minnesota Duluth, Duluth, MN, United States*

Track Co-Organizers: Matthew R. Jones, *Brigham Young University, Provo, UT, United States,* Alexander Rattner, *Penn State University, University Park, PA, United States*

Topic 1-4
HEAT AND MASS TRANSFER IN HEATING, COOLING, AND POWER SYSTEMS

1-4-1
Heat and Mass Transfer in Heating, Cooling, and Power Systems I
Second Floor, Regency Ballroom A 4:00PM–5:40PM

Session Organizer: S.A. Sherif, *University of Florida, Gainesville, FL, United States*

Session Co-Organizers: Laura Schaefer, *Rice University, Houston, TX, United States,* Kashif Nawaz, *ORNL, Oak Ridge, TN, United States*

Modeling of Hydrogen Liquefaction Using Magnetocaloric Cycles With Permanent Magnets

Technical Presentation. HT2019-3788

Tianshi Feng, Renkun Chen, *University of California, San Diego, La Jolla, CA, United States,* Robin V. Ihnfeldt, *General Engineering & Research, San Diego, CA, United States*

Electrochemical Refrigeration: A Continuous Heat Pump Using Redox Reactions

Technical Presentation. HT2019-3536

Aravindh Rajan, Shannon K. Yee, *Georgia Institute of Technology, Atlanta, GA, United States*

Flow and Heat Transfer Characteristics Pass/Through Bluffed or Permeable Cylinders by Means of Improved LBM Simulations

Technical Presentation. HT2019-3764

Yingchun Zhang, Gongnan Xie, *Northwestern Polytechnical University, Xi'an, China,* Nesrin Ozalp, *University of Minnesota Duluth, Duluth, MN, United States*

Infrared Thermography of Additive Manufacturing

Technical Presentation. HT2019-3798

Nicholas Wallace, Matthew R. Jones, Nathan Crane, *Brigham Young University, Provo, UT, United States*

Design of a Heat Acquisition Unit for Cascaded Thermoelectric and Thermally Activated Refrigeration Waste Heat Recovery

Technical Presentation. HT2019-3799

Shahzaib Abbasi, Alexander Rattner, *Penn State University, University Park, PA, United States*

THEORY AND FUNDAMENTAL RESEARCH IN HEAT TRANSFER – K-8

Track Organizer: Amitabh Narain, *Michigan Technological University, Houghton, MI, United States*

Track Co-Organizers: Diana-Andra Borca-Tasciuc, *Rensselaer Polytechnic Institute, Troy, NY, United States,* Xiulin Ruan, *Purdue University, West Lafayette, IN, United States,* Vaibhav Bahadur, *University of Texas at Austin, Austin, TX, United States,* Navdeep Dhillon, *California State University Long Beach, Long Beach, CA, United States*

Topic 3-1
FUNDAMENTALS OF PHASE-CHANGE FLOWS, CONVECTION, AND MULTI-SCALE HEAT TRANSFER

3-1-4
Fundamentals of Boiling and Condensation Including Micro/Nanoscale Effects – II (Technical)
Second Floor, Regency Ballroom B 4:00PM–5:40PM

Session Organizer: Van P. Carey, *University of California, Berkeley, Berkeley, CA, United States*

Session Co-Organizers: Amitabh Narain, *Michigan Technological University, Houghton, MI, United States,* Navdeep Dhillon, *California State University Long Beach, Long Beach, CA, United States*

Droplet Spreading and Evaporation on Nanoporous Superhydrophilic Surfaces: Effects of Impact Parameters

Technical Paper Publication. HT2019-3510

Emma R. McClure, Van P. Carey, *University of California, Berkeley, CA, United States*

Critical Radius of Bubble Nucleation in Pool Boiling Using Molecular Simulations

Technical Presentation. HT2019-3721

Manish Gupta, An Zou, Shalabh Maroo, *Syracuse University, Syracuse, NY, United States*

Dropwise Condensation on Low Thermal Conductivity Surfaces

Technical Presentation. HT2019-3422

Sean Hoenig, Richard Bonner, *Advanced Cooling Technologies, Inc., Lancaster, PA, United States,* Sanat Modak, Massoud Kaviany, *University of Michigan, Ann Arbor, MI, United States,* James Gilchrist, *Lehigh University, Bethlehem, PA, United States*

Electrowetting-Based Coalescence of Droplets During Dropwise Condensation of Humid Air

Technical Paper Publication. HT2019-3425

Enakshi Wikramanayake, Vaibhav Bahadur, *University of Texas at Austin, Austin, TX, United States*

NANOSCALE TRANSPORT PHENOMENA – K-9

Track Organizer: Chris Dames, *UC Berkeley, Berkeley, CA, United States*

Track Co-Organizers: Dong Liu, *University of Houston, Houston, TX, United States,* Liping Wang, *Arizona State University, Tempe, AZ, United States*

Topic 4-1
Nanoscale Heat Conduction

4-1-2
Nanoscale Heat Conduction 2
Second Floor, Regency Ballroom C 4:00PM–5:40PM

Session Organizer: Ming Hu, *University of South Carolina, Columbia, SC, United States*

Nanoscale Thermal Transport Across 3-D Solid-Solid Interface Through Anharmonic Green's Function Approach

Technical Presentation. HT2019-3581

Jinghang Dai, Renjiu Hu, Zhiting Tian, *Cornell University, Ithaca, NY, United States*

Implications of the Interface Modelling Approach on the Heat Transfer Across Solid-Liquid Interfaces

Technical Presentation. HT2019-3605

C. Ulises Gonzalez-Valle, Bladimir Ramos-Alvarado, *Penn State University, University Park, PA, United States*

Thermal Transport in Silicon Nanowires With Axially Modulated Diameters

Technical Presentation. HT2019-3533

Sampath Kommandur, Gozde Tutuncuoglu, Abhinav Malhotra, Aravindh Rajan, Patrick Creamer, Martin Maldovan, Michael Filler, Shannon K. Yee, *Georgia Institute of Technology, Atlanta, GA, United States,*

Effects of Mass and Interaction Mismatches on In-Plane and Cross-Plane Thermal Transport of Si-Doped Graphene

Technical Presentation. HT2019-3792

Yu-Kai Weng, Seungha Shin, Ali Yousefzadi Nobakht, Kenneth Kihm, *The University of Tennessee, Knoxville, Knoxville, TN, United States*

HEAT TRANSFER IN MULTIPHASE SYSTEMS – K-13

Track Organizer: Abhijit Mukherjee, *CSUN, Northridge, CA, United States*

Track Co-Organizer: Scott Thompson, *Auburn University, Auburn, AL, United States,* Vinod Srinivasan, *University of Minnesota Twin Cities, Minneapolis, MN, United States*

Topic 8-1

8-1-2
Condensation Heat Transfer I
Second Floor, Regency Ballroom E 4:00PM–5:40PM

Session Organizer: Scott Thompson, *Auburn University, Auburn, AL, United States*

Session Co-Organizer: Mirza Mohammed Shah, *Engineering Research Associates, Redding, CT, United States*

Numerical Investigation on Pool Boiling Over a Vertical Tube Coupled With In-Tube Condensation

Technical Paper Publication. HT2019-3442

Shuai Ren, City *University of Hong Kong, Hong Kong,* Wenzhong Zhou, S*un Yat-sen University, College Station, TX, United States*

License to Chill: Delaying Surface Icing Using Phase Transitioning Surfaces

Technical Presentation. HT2019-3443

Rukmava Chatterjee, Sushant Anand, *University of Illinois at Chicago, Chicago, IL, United States,* Daniel Beysens, *PMMH/ESPCI & CNRS, Paris, France*

Atmosphere-Mediated Superhydrophobic Structured Copper Surfaces

Technical Presentation. HT2019-3511

Xiao Yan, Jiaqi Li, Nenad Miljkovic, *University of Illinois at Urbana-Champaign, Urbana, IL, United States,* Feng Chen, Zhiyong Huang, *Tsinghua University, Beijing, Beijing, China*

Experimental Study of Refrigerant (R134a) Condensate Retention on Paraffin Coated Plates and Fin Structures

Technical Paper Publication. HT2019-3508

Hong-Qing Jin, Wentao Ni, Xiaofei Wang, *University of Illinois at Urbana-Champaign, Urbana, IL, United States*

HEAT TRANSFER IN ELECTRONIC EQUIPMENT – K-16

Track Organizer: Amanie Abdelmessih, *California Baptist University, Riverside, CA, United States*

Track Co-Organizers: Hendrik P.J. De Bock, *GE Global Research, Schenectady, NY, United States,* Seungbae Park, *Binghamton University, Binghamton, NY, United States*

Topic 11-1

11-1-3
Heat Sinks and Capillary Flow
Second Floor, Regency Ballroom F 4:00PM–5:40PM

Session Organizer: Amanie Abdelmessih, *California Baptist University, Riverside, CA, United States*

Session Co-Organizer: Kashif Nawaz, *ORNL, Oak Ridge, TN, United States*

Capillary-Enhanced Filmwise Condensation in Porous Media: Effect of the Wick Thickness on Condensation Enhancement

Technical Presentation. HT2019-3615

Ruisong Wang, Karan Jakhar, Dion Antao, *Texas A&M University, College Station, TX, United States*

Experimental Study on Flow and Heat Transfer of Heat Sink With Ionic Wind for LED-Chip Cooling

Technical Paper Publication. HT2019-3453

Jingguo Qu, *Xi'an Jiaotong University, Xi'an, China,* Jian-Fei Zhang, *Xi'an Jiaotong University, Xi'an, Shaanxi, China*

Pore-Scale Investigation of Electronic Device Thermal Management Using Expanded Graphite Mixed Microencapsulated PCM/Metal Foam Composite

Technical Presentation. HT2019-3785

Qinlong Ren, *Xi'an Jiaotong University, Xi'an, Shaanxi, China,* Cholik Chan, *University of Arizona, Tucson, AZ, United States*

Technical Sessions – MONDAY

EDUCATION – K-21

Track Organizer: Nesrin Ozalp, *University of Minnesota Duluth, Duluth, MN, United States*

15-1
PANEL ON HEAT TRANSFER EDUCATION

15-1-1
Panel on Heat Transfer Education
Second Floor, Regency Ballroom G 4:00PM–5:40PM

Panel on Heat Transfer Education

Invited Presentation. HT2019-3758

Michael Pate, *Texas A&M University, College Station, TX, United States*

Invited Presentation. HT2019-3757

Ashley F. Emery, *University of Washington, Seattle, WA, United States*

Invited Presentation. HT2019-3848

Sandip Mazumder, *Ohio State University, OH, United States*

Invited Presentation. HT2019-3849

Alexander Rattner, *Penn State University, PA, United States*

AIChE SYMPOSIUM IN HONOR OF PROFESSOR PETER C. WAYNER, JR.

Track Organizer: Joel Plawsky, *Rensselaer Polytechnic Institute, Troy, NY, United States*

Track Co-Organizer: Raj M. Manglik, *University of Cincinnati, Cincinnati, OH, United States*

Topic 19-1
AIChE SYMPOSIUM IN HONOR OF PROFESSOR PETER C. WAYNER, JR.

19-1-3
AIChE Symposium in Honor of Professor Peter C. Wayner, Jr. III
Second Floor, Cedar Ballroom B 4:00PM–5:40PM

Session Organizer: Joel Plawsky, *Rensselaer Polytechnic Institute, Troy, NY, United States*

Liquid Film Thickness in Slug Flow in a Microchannel

Technical Presentation HT2019-3531

Toni W.M. Janssen, *Eindhoven University of Technology, Eindhoven, The Netherlands,* Masahiro Kawaji, *City College of New York, New York, NY, United States*

Advances and Opportunities of Integrating Heat Pipe Concepts in Active and Passive Energy Systems

Technical Presentation. HT2019-3766

Amir Faghri, *Mansfield Center, CT, United States*

Challenges for Enhancing Biodigestion through Heat Transfer

Technical Presentation. HT2019-3717

Rene Reyes Mazzoco, *Fundacion Universidad de las Americas, Puebla, San Andres Cholula, Puebla, Mexico*

Transient Thermo-Diffuso-Capillary Convection Around a Bubble in a Surfactant Solution: A Numerical Investigation Using the Volume-of-Fluid Technique

Technical Paper Publication. HT2019-3696

Deepak Saagar Kalaikadal, *Applied Materials Inc., Kalispell, MT, United States,* Raj M. Manglik, *University of Cincinnati, Cincinnati, OH, United States,* Milind Jog, *University of Cincinnati, Mason, OH, United States*

Electrowetting Assisted Evaporation Driven Micro and Nanoscale Patterning

Technical Presentation. HT2019-3747

Sunando Dasgupta, Sri Ganesh Subramanian, *Indian Institute of Technology Kharagpur, Kharagpur, WB, India*

Pete and Me: A Tale of Three Papers

Technical Presentation. HT2019-3753

George Homsy, *University of Washington, Seattle, WA, United States*

TUTORIALS

Track Organizer: Sandip Mazumder, *Ohio State University, Columbus, OH, United States*

20-3
TUTORIAL: COMPUTATIONAL APPROACHES FOR SOLVING INVERSE HEAT TRANSFER PROBLEM

20-3-2
Tutorial: Computational Approaches for Solving Inverse Heat Transfer Problem
Second Floor, Cedar Ballroom A 4:00PM–5:40PM

Session Organizer: Shima Hajimirza, *Texas A&M University, College Station, TX, United States*

Session Co-Organizer: John Tencer, *Sandia National Laboratories, Albuquerque, NM, United States*

TUESDAY, JULY 16

HEAT TRANSFER IN ENERGY SYSTEMS – K6

Track Organizer: Nesrin Ozalp, *University of Minnesota Duluth, Duluth, MN, United States*

Track Co-Organizers: Matthew R. Jones, *Brigham Young University, Provo, UT, United States,* Alexander Rattner, *Penn State University, University Park, PA, United States*

Topic 1-6
PANEL ON THE KEY ROLE OF HEAT TRANSFER ANALYSIS IN ENERGY SYSTEMS RESEARCH

1-6-1
Panel: Heat Transfer Analysis in Energy Systems
Second Floor, Regency Ballroom A 8:30AM–10:10AM

Session Organizer: Nesrin Ozalp, *University of Minnesota Duluth, Duluth, MN, United States*

Panel on the Key Role of Heat Transfer Analysis in Energy Systems Research

Invited Presentation. HT2019-3770

Yuwen Zhang, *University of Missouri, Columbia, MO, United States*

Invited Presentation. HT2019-3772

S.A. Sherif, *University of Florida, Gainesville, FL, United States*

Invited Presentation. HT2019-3755

Michael Epstein, *Tel Aviv University, Tel Aviv, Israel*

THEORY AND FUNDAMENTAL RESEARCH IN HEAT TRANSFER – K-8

Track Organizer: Amitabh Narain, *Michigan Technological University, Houghton, MI, United States*

Track Co-Organizer: Diana-Andra Borca-Tasciuc, *Rensselaer Polytechnic Institute, Troy, NY, United States,* Xiulin Ruan, *Purdue University, West Lafayette, IN, United States,* Vaibhav Bahadur, *University of Texas at Austin, Austin, TX, United States,* Navdeep Dhillon, *California State University Long Beach, Long Beach, CA, United States*

Topic 3-1
FUNDAMENTALS OF PHASE-CHANGE FLOWS, CONVECTION, AND MULTI-SCALE HEAT TRANSFER

3-1-5
Fundamentals of Boiling and Condensation Including Micro/Nanoscale Effects – III (Technical)
Second Floor, Regency Ballroom B 8:30AM–10:10AM

Session Organizer: Vaibhav Bahadur, *University of Texas at Austin, Austin, TX, United States*

Session Co-Organizer: Navdeep Dhillon, *California State University Long Beach, Long Beach, CA, United States*

Effect of a High Electric Field on the Thermal and Phase Change Characteristics of an Impacting Drop

Technical Paper Publication. HT2019-3649

Abhishek Basavanna, Prajakta Khapekar, Navdeep Singh Dhillon, *California State University Long Beach, Long Beach, CA, United States*

Comparison of Droplet Evaporation and Nucleate Boiling Mechanisms on Nanoporous Superhydrophilic Surfaces

Technical Paper Publication. HT2019-3539

Samuel Cabrera, Van P. Carey, *University of California, Berkeley, Berkeley, CA, United States*

Study of Pool Boiling Heat Transfer on Concave Nanostructured Surface With Molecular Dynamics Simulation

Technical Paper Publication. HT2019-3528

Runkeng Liu, Zhenyu Liu, Huiying Wu, *Shanghai Jiao Tong University, Shanghai, China*

Salt for Thought: Towards Ice-Free Roads and Safer Highways

Technical Presentation. HT2019-3437

Rukmava Chatterjee, Sushant Anand, *University of Illinois at Chicago, Chicago, IL, United States,* Daniel Beysens, *PMMH/ESPCI & CNRS, Paris, France*

NANOSCALE TRANSPORT PHENOMENA – K-9

Track Organizer: Chris Dames, *UC Berkeley, Berkeley, CA, United States*

Track Co-Organizer: Dong Liu, *University of Houston, Houston, TX, United States,* Liping Wang, *Arizona State University, Tempe, AZ, United States*

Topic 4-3
MICRO/NANOSCALE PHASE CHANGE HEAT TRANSFER

4-3-1
Micro/Nanoscale Phase Change Heat Transfer 1
Second Floor, Regency Ballroom C 8:30AM–10:10AM

Session Organizer: Shalabh Maroo, *Syracuse University, Syracuse, NY, United States*

Molecular Dynamics Simulation on the Friction Properties of Couette Flow With Superhydrophobic Rough Surfaces Under Different Load

Technical Paper Publication. HT2019-3729

Chengzhi Hu, Dawei Tang, Jizu Lv, Minli Bai, Xiaoliang Zhang, *Dalian University of Technology, Dalian, China*

Nanoscale Heat Transfer Across Flexible Interfaces of N-Eicosanes

Technical Presentation. HT2019-3550

Yi Zeng, Jeyhoon Khodadadi, Jianjun Dong, *Auburn University, Auburn, AL, United States*

Temperature-Dependent Wettability of Water on a Nickel Surface at Pressurized Condition: A Molecular Dynamics Study

Technical Paper Publication. HT2019-3521

Donglei Zeng, Biao Feng, Jiawen Song, Liwu Fan, *Zhejiang University, Hangzhou, Zhejiang, China*

A Molecular Dynamics Simulation of Rapid Boiling of Water Films on Copper Plates With Different Trapezoidal Nanochannels

Technical Paper Publication. HT2019-3577

Pu Bai, Leping Zhou, Xiaoze Du, *North China Electric Power University, Beijing, China*

Experimental and Numerical Study of Wicking in Porous Structure of Micro/Nano Channels

Technical Presentation. HT2019-3782

Sajag Poudel, An Zou, Sidharth P. Raut, Shalabh Maroo, *Syracuse University, Syracuse, NY, United States*

HEAT TRANSFER EQUIPMENT – K-10

Track Organizer: Subramanyaravi Annapragada, *United Technologies Research, East Hartford, CT, United States*

Track Co-Organizer: Gongnan Xie, *Northwestern Polytechnical University, Xi'an, China*

Topic 5-1
HEAT TRANSFER EQUIPMENT

5-1-4
Heat Transfer Equipment
Second Floor, Cedar Ballroom B 8:30AM–10:10AM

Session Organizer: Amanie Abdelmessih, *California Baptist University, Riverside, CA, United States*

Session Co-Organizer: Kevin Anderson, *California State Polytechnic University at Pomona, Pomona, CA, United States*

Design and Test of a Novel Dew-Point Evaporative Cooler

Technical Presentation. HT2019-3807

Liu Yuting, Li Junming, *Tsinghua University, Beijing, China*

Expansion Bends in Heat Exchanger Tubes as an Alternative Method to Mitigate Thermal Stress

Technical Presentation. HT2019-3809

Libin Babu, *Exergy LLC, Garden City, NY, United States*

Modified Manifold-Microchannel Heat Exchangers Fabricated Based on Additive Manufacturing: Experimental Characterization

Technical Paper Publication. HT2019-3535

William C. Yameen, Nathan A. Piascik, Andrew K. Miller, Riccardo C. Clemente, Jingru Benner, Anthony D. Santamaria, Seyed A. Niknam, Mehdi Mortazavi, *Western New England University, Springfield, MA, United States*

HEAT TRANSFER IN MULTIPHASE SYSTEMS – K-13

Track Organizer: Abhijit Mukherjee, *CSUN, Northridge, CA, United States*

Track Co-Organizers: Scott Thompson, *Auburn University, Auburn, AL, United States,* Vinod Srinivasan, *University of Minnesota Twin Cities, Minneapolis, MN, United States*

Topic 8-1

8-1-4
Multiphase Heat Transfer I
Second Floor, Regency Ballroom E 8:30AM–10:10AM

Session Organizer: Anil Yuksel, *IBM Corporation, Austin, TX, United States*

Session Co-Organizer: Abhijit Mukherjee, *CSUN, Northridge, CA, United States*

Numerical Simulation of Gas-Quenching Granulation Process for Blast Furnace Slag

Technical Paper Publication. HT2019-3566

Lige Tong, Yuxin Liu, Shaowu Yin, Chuanping Liu, Li Wang, *University of Science & Technology Beijing, Beijing, China*

Heat Transfer Characteristics of High-Temperature Dusty Gas in a Granular Bed With Buried Tubes

Technical Paper Publication. HT2019-3645

Shaowu Yin, Feiyang Xue, Xu Wang, Li Wang, Lige Tong, *University of Science and Technology Beijing, Beijing, China*

Parametric Study of SLM Processing Parameters on In-Situ Residual Stress

Technical Paper Publication. HT2019-3623

Emmanuel Amoako, Patrick Mensah, Stephen Akwaboa, *Southern University and A&M College, Baton Rouge, LA, United States,* Samuel Ibekwe, *Southern University and A&M College, Baker, LA, United States,* Guoqiang Li, *Louisiana State University, Baton Rouge, LA, United States*

The Effect of Net-Type Spacer on the Performance of Direct Contact Membrane Distillation System for Seawater Desalination: Heat and Mass Transfer Analysis

Technical Paper Publication. HT2019-3673

Anas M. Alwatban, Ahmed Alshwairekh, Umar Alqsair, Abdullah A. Alghafis, Alparslan Oztekin, *Lehigh University, Bethlehem, PA, United States*

HEAT TRANSFER UNDER EXTREME CONDITIONS – K-18

Track Organizer: Qiuwang Wang, *Xi'an Jiaotong University, Xi'an, Shaanxi, China*

Track Co-Organizer: Xinwei Wang, *Iowa State University, Ames, IA, United States*

Topic 12-1

12-1-2
Heat Transfer in Complex Systems and Materials
Second Floor, Cedar Ballroom A 8:30AM–10:10AM

Session Organizer: Zhiguo Qu, *Xi'an Jiaotong University, Xi'an, China*

Session Co-Organizer: Ridong Wang, *Iowa State University, Ames, IA, United States*

Experimental Research on Heat Transfer Performance in Carbon Foams and Carbon Foam/PCMs

Technical Presentation. HT2019-3544

Yong Liu, Zhiguo Qu, Bo Li, *Xi'an Jiaotong University, Xi'an, Shaanxi, China*

Outcomes of Droplet Impact on Supercooled Surfaces

Technical Presentation. HT2019-3428

Varun Kulkarni, Sushant Anand, *University of Illinois at Chicago, Chicago, IL, United States,* Vijay Prithiv Bathey Ramesh Bapu, *IntelliSense, Lynnfield, MA, United States*

Modeling and Analysis of a High Temperature, High Pressure Two-Phase NH3/FAME-MLL PFHX

Technical Paper Publication. HT2019-3406

Thomas Gross, Kevin Anderson, *California State Polytechnic University at Pomona, Pomona, CA, United States,* Christopher McNamara, *ITS, Inc, Cupertino, CA, United States,* Ariel Gatti, *Ingenium Technical Services, Inc., Cupertino, CA, United States*

Predicting the Electronic Thermal Conductivity of Metals via Direct Nonequilibrium ab Initio Molecular Dynamics Simulation and Its Application to H.C.P. Iron (ebuson-Fe) at the Earth's Core Conditions

Technical Presentation. HT2019-3486

Sheng-Ying Yue, *University of California, Santa Barbara, Santa Barbara, CA, United States,* Ming Hu, *University of South Carolina, Columbia, SC, United States*

Technical Sessions – TUESDAY

ENVIRONMENTAL HEAT TRANSFER – K-19

Track Organizer: Kashif Nawaz, *ORNL, Oak Ridge, TN, United States*

Track Co-Organizer: Sandra Boetcher, *Embry-Riddle Aeronautical University, Daytona Beach, FL, United States*

Topic 13-1

13-1-1
Environmental Heat Transfer
Second Floor, Regency Ballroom F 8:30AM–10:10AM

Session Organizer: Kashif Nawaz, *ORNL, Oak Ridge, TN, United States*

Learning in a Multidisciplinary Environment: Design of Thermal Fluids/Systems in Buildings

Technical Paper Publication. HT2019-3707

Cheng-xian Lin, Shahin Vassigh, *Florida International University, Miami, FL, United States*

Effectiveness of Intermittent Personalized Ventilation Assisting Chilled Ceiling in Protecting Occupants Against Active Particles

Technical Paper Publication. HT2019-3471

Douaa Al Assad, *American University of Beirut, Beirut, Lebanon,* Nesreen Ghaddar, *American University of Beirut, New York, NY, United States,* Kamel Ghali, *Mechanical Engineering/American University of Beirut, Beirut, Lebanon*

Performance of Intermittent Personalized Ventilation Assisting Mixing Ventilation in the Presence of Indoor Disturbance

Technical Paper Publication. HT2019-3473

Douaa Al Assad, Kamel Ghali, *American University of Beirut, Beirut, Lebanon,* Nesreen Ghaddar, *American University of Beirut, New York, NY, United States*

COMPUTATIONAL HEAT TRANSFER – K-20

Track Organizer: Sandip Mazumder, *Ohio State University, Columbus, OH, United States*

Track Co-Organizer: Aaron Wemhoff, *Villanova University, Villanova, PA, United States*

Topic 14-2
APPLICATIONS OF COMPUTATIONAL HEAT TRANSFER

14-2-1
Industrial and Medical Applications of Computational Heat Transfer
Second Floor, Regency Ballroom G 8:30AM–10:10AM

Session Organizer: Aaron Wemhoff, *Villanova University, Villanova, PA, United States*

Session Co-Organizer: Samuel Subia, *Sandia National Laboratories, Albuquerque, NM, United States*

Numerical Heat Transfer Simulations and Parametric Investigations Using Crossed Array Design of Experiments Approach during RFA of Breast Tumor

Technical Paper Publication. HT2019-3469

Sandeep Sulake, Satish Kumar Dubey, Arshad Javed, *BITS Pilani Hyderabad Campus, Hyderabad, Telangana, India*

Transient Thermal Modeling of Bioprocess Equipment

Technical Presentation. HT2019-3817

Cody Cummings, *Utah State University, Logan, UT, United States,* Mark T. Smith, *Thermo Fisher Scientific, Logan, UT, United States*

Numerical Simulation Study on the Solutal Capillary Flow of a Binary Mixture With a Nonlinear Surface Tension in a Shallow Annular Pool

Technical Presentation. HT2019-3775

Jia Jia Yu, Chuanyin Tang, Yourong Li, *Chongqing University, Shapingba District, Chongqing, China*

KEYNOTE LECTURE

Topic 24-1
KEYNOTE LECTURE

24-4-2
Industry Perspective on Heat Transfer
Second Floor, Grand Ballroom E/F 10:30AM–12:10PM

Session Organizer: Sandra Boetcher, *Embry-Riddle Aeronautical University, Daytona Beach, FL, United States*

Industry Perspective on Aerospace Technology Needs and Trends

Keynote Presentation. HT2019-3845

Lesia Protsailo, *United Technologies Research Center, East Hartford, CT, United States*

HEAT TRANSFER IN ENERGY SYSTEMS – K6

Track Organizer: Nesrin Ozalp, *University of Minnesota Duluth, Duluth, MN, United States*

Track Co-Organizers: Matthew R. Jones, *Brigham Young University, Provo, UT, United States,* Alexander Rattner, *Penn State University, University Park, PA, United States*

Topic 1-8
HEAT TRANSFER IN SOLAR THERMAL AND SOLAR PV SYSTEMS

1-8-1
Heat Transfer in Solar Thermal and Solar PV Systems I
Second Floor, Regency Ballroom A 2:00PM–3:40PM

Session Organizer: Kashif Nawaz, *ORNL, Oak Ridge, TN, United States*

Session Co-Organizer: Shima Hajimirza, *Texas A&M University, College Station, TX, United States*

Heat Transfer Driven Dynamics and Control of Transient Variations in a Solar Reactor

Technical Presentation. HT2019-3540

Mostafa Abuseada, Nesrin Ozalp, *University of Minnesota Duluth, Duluth, MN, United States*

Monte Carlo Ray Tracing Coupled CFD Modelling and Experimental Testing of a 1 kW Solar Cavity Receiver Radiated via 7 kW HFSS

Technical Paper Publication. HT2019-3541

Cedric Ophoff, *KU Leuven, Lier, Belgium,* Nesrin Ozalp, *University of Minnesota Duluth, Duluth, MN, United States,* David Moens, *KU Leuven, Leuven, Belgium*

Effect of Carbon Particle Seeding As Radiant Absorbent for Enhanced Heat Transfer

Technical Paper Publication. HT2019-3657

Hamed Abedini Najafabadi, *Iran University of Science and Technology, Tehran, Islamic Republic of Iran,* Nesrin Ozalp, *University of Minnesota Duluth, Duluth, MN, United States*

Experimental Analysis of Kinetics and Cyclic Performance of Cobalt Oxide Powder as Redox Reactant Agent for High-Temperature Thermochemical Energy Storage

Technical Paper Publication. HT2019-3681

Nasser Vahedi, Alparslan Oztekin, *Lehigh University, Bethlehem, PA, United States*

THERMOPHYSICAL PROPERTIES – K-7

Track Organizer: Nicholas Roberts, *Utah State University, Logan, UT, United States*

Topic 2-2
MEASUREMENTS OF THERMOPHYSICAL PROPERTIES

2-2-1
Experimental Measurements of Thermophysical Properties
Second Floor, Regency Ballroom G 2:00PM–3:40PM

Session Organizer: Nicholas Roberts, *Utah State University, Logan, UT, United States*

Transient Determination on the Bulk Thermal Conductivity of Sub-Millimeter Thin Films of Composite Phase Change Thermal Interfacial Materials

Technical Paper Publication. HT2019-3520

Yuhong Zhang, Biao Feng, Jing Tu, Liwu Fan, *Zhejiang University, Hangzhou, Zhejiang, China*

Gaseous Thermal Conductivity Investigation on Bimodal-Pore Distributed Mesoporous Silica Particles

Technical Presentation. HT2019-3523

Gaosheng Wei, Chao Huang, Feng Ye, Liu Cui, Xiaoze Du, *North China Electric Power University, Beijing, China*

Experimental and Optimization Modelling of Processing Parameter Effects on the Thermal Properties of SLM Printed 316L Stainless Steel

Technical Presentation. HT2019-3620

Nigel Amoafo-Yeboah, Stephen Akwaboa, *Southern University and A&M College, Baton Rouge, LA, United States,* Samuel Ibekwe, *Southern University and A&M College, Baker, LA, United States,* Patrick Mensah, *Southern University and A&M College, Baton Rouge, LA, United States*

High Contrast Thermal Conductivity Change in Ni-Mn-In and MnxMGe (M = Ni, Co) Alloys Near Room Temperature for Thermal Regulation

Technical Presentation. HT2019-3742

Qiye Zheng, *Lawrence Berkeley National Laboratory, Berkeley, CA, United States,* Gaohua Zhu, *Toyota Technical Center, Ann Arbor, MI, United States,* Zhu Diao, *Stockholm University, Stockholm, Sweden,* David Cahill, *University of Illinois at Urbana-Champaign, Urbana, IL, United States*

THEORY AND FUNDAMENTAL RESEARCH IN HEAT TRANSFER – K-8

Track Organizer: Amitabh Narain, *Michigan Technological University, Houghton, MI, United States*

Track Co-Organizer: Diana-Andra Borca-Tasciuc, *Rensselaer Polytechnic Institute, Troy, NY, United States,* Xiulin Ruan, *Purdue University, West Lafayette, IN, United States,* Vaibhav Bahadur, *University of Texas at Austin, Austin, TX, United States,* Navdeep Dhillon, *California State University Long Beach, Long Beach, CA, United States*

Topic 3-1
FUNDAMENTALS OF PHASE-CHANGE FLOWS, CONVECTION, AND MULTISCALE HEAT TRANSFER

3-1-7
Fundamentals of Multiscale Simulations – II
Second Floor, Regency Ballroom B 2:00PM–3:40PM

Session Organizer: Vaibhav Bahadur, *University of Texas at Austin, Austin, TX, United States*

Session Co-Organizer: Prabhakar Marepalli, *Intel Corporation, Hillsboro, OR, United States*

A Near Real-Time Solution Approach for Surface Heat Flux Estimation in One Dimensional Inverse Heat Conduction Problems With Moving Boundary

Technical Paper Publication. HT2019-3458

Obinna Uyanna, Hamidreza Najafi, *Florida Institute of Technology, Melbourne, FL, United States*

Parallel Triangular Channel System for Sensible Heat Thermal Energy Storages With External Heat Losses

Technical Paper Publication. HT2019-3607

Assunta Andreozzi, *Università degli Studi di Napoli Federico, Napoli, Italy,* Bernardo Buonomo, Davide Ercole, Oronzio Manca, *Università degli Studi della Campania "Luigi Vanvitelli", Aversa, Caserta, Italy*

Alternate Forms for Heat Conduction in Solid Matter

Technical Presentation. HT2019-3762

Daniel Nunez, *LPI, Inc., Richland, WA, United States*

HEAT TRANSFER EQUIPMENT – K-10

Track Organizer: Subramanyaravi Annapragada, *United Technologies Research, East Hartford, CT, United States*

Track Co-Organizer: Gongnan Xie, *Northwestern Polytechnical University, Xi'an, China*

Topic 5-1
HEAT TRANSFER EQUIPMENT

5-1-1
Single-Phase Enhanced Heat Transfer Equipment
Second Floor, Regency Ballroom C 2:00PM–3:40PM

Session Organizer: Zhiguo Qu, *Xi'an Jiaotong University, Xi'an, Shaanxi, China*

Session Co-Organizers: Arun Muley, *Boeing Research and Technology, Huntington Beach, CA, United States,* Marcus Richardson, *Boeing Research and Technology, Everett, WA, United States*

The Testing and Model Validation of an Additively Manufactured Twisted Tube Heat Exchanger

Technical Paper Publication. HT2019-3500

John Bernardin, Kyle Ferguson, David Sattler, *Los Alamos National Laboratory, Los Alamos, NM, United States*

Air-Side Heat Transfer and Pressure Drop for Elliptical Tubes With Modified Fins in a Confined Channel

Technical Presentation. HT2019-3506

Kieran J. Wolk, Vijay K. Dhir, *University of California, Los Angeles, Los Angeles, CA, United States*

Optimization Strategy for Contradiction Between Intermitting Oxygen Consumption in Converter Steelmaking and Continuous Oxygen Production by Air Separation Unit

Technical Paper Publication. HT2019-3654

Lige Tong, Yuxin Liu, Hao Yang, Shaowu Yin, Chuanping Liu, Li Wang, *University of Science & Technology Beijing, Beijing, China,* Raru Xie, *Hangzhou Hangyang Co., Ltd., Hangzhou, China*

Pinch Point Analysis of Air Cooler in sCO_2 Brayton Cycle Operating Over Ambient Temperature Range

Technical Paper Publication. HT2019-3725

Ankur Deshmukh, *Siemens Energy, Orlando, FL, United States,* Jayanta Kapat, *University of Central Florida, Oviedo, FL, United States*

High Temperature Centrifugal Pumps for Molten Salt

Technical Presentation. HT2019-3828

Xu Tan, Henry Asegun, Bamdad Barari, *Massachusetts Institute of Technology, Cambridge, MA, United States*

HEAT TRANSFER IN MULTIPHASE SYSTEMS – K-13

Track Organizer: Abhijit Mukherjee, *CSUN, Northridge, CA, United States*

Track Co-Organizer: Scott Thompson, *Auburn University, Auburn, AL, United States,* Vinod Srinivasan, *University of Minnesota Twin Cities, Minneapolis, MN, United States*

Topic 8-1

8-1-5
Boiling Heat Transfer on Modified Surfaces
Second Floor, Regency Ballroom E 2:00PM–3:40PM

Session Organizer: Navdeep Singh Dhillon, *California State University Long Beach, Long Beach, CA, United States*

Session Co-Organizer: Mirza Mohammed SHAH, *Engineering Research Associates, Redding, CT, United States*

Enhanced Boiling Heat Transfer on Hierarchical Surface With Patterned Carbon Nanotube Arrays

Technical Presentation. HT2019-3545

Gaohua Zhu, *Toyota, Ann Arbor, MI, United States,* Evan Fleming, Debasish Banerjee, *Toyota Research Institute of North America, Ann Arbor, MI, United States,* Jiaqi Li, Nenad Miljkovic, *University of Illinois at Urbana-Champaign, Urbana, IL, United States*

Subcooled Pool Boiling Performance of Aluminum Alloy 1D Micro-Fin Arrays Fabricated by High Throughput Roll Molding

Technical Presentation. HT2019-3489

Brendon Doran, Madison Walker, Arden Moore, *Louisiana Tech University, Ruston, LA, United States,* Kojo Asiamah Osafo, Stephen Akwaboa, Patrick Mensah, *Southern University A&M College, Baton Rouge, LA, United States,* Bin Zhang, Wen Meng, *Louisiana State University, Baton Rouge, LA, United States*

On the Role of Wickability and Bubble Dynamics on Structured-Surface-Enhanced Pool Boiling Heat Transfer

Technical Presentation. HT2019-3487

Jiaqi Li, Wuchen Fu, Nenad Miljkovic, *University of Illinois at Urbana-Champaign, Urbana, IL, United States,* Gaohua Zhu, *Toyota, Ann Arbor, MI, United States,* Debasish Banerjee, *Toyota Research Institute of North America, Ann Arbor, MI, United States*

Bubble Dynamics in Boiling on Micro-Nano Textured Surfaces

Technical Presentation. HT2019-3476

Navid Saneie, Varun Kulkarni, Sushant Anand, *University of Illinois at Chicago, Chicago, IL, United States*

VISUALIZATION OF HEAT TRANSFER – K-22

Track Organizer: Chang Choi, *Michigan Technological University, Houghton, MI, United States*

Track Co-Organizer: Jinsub Kim, *Korea Institute of Machinery & Materials, Deajeon, Korea (Republic)*

Topic 16-1

16-1-1
Photo Gallery for Heat and Mass Transport I
Second Floor, Regency Ballroom F 2:00PM–3:40PM

Session Organizer: Jinsub Kim, *Korea Institute of Machinery & Materials, Deajeon, Korea (Republic)*

Session Co-Organizer: Chang Choi, *Michigan Technological University, Houghton, MI, United States*

Visualization of Working Fluid in a Loop Heat Pipe Using Neutron Photography

Technical Paper Publication. HT2019-3638

Taotao Cheng, Xiaoyu Cui, *University of Shanghai for Science and Technology, Shanghai, China,* Rongjian Xie, Guangming Xu, Nanxi Li, *Shanghai Institute of Technical Physics of the Chinese Academy of Science, Shanghai, China,* Qi Sun, *Shanghai Institute of Technology Physics, Shanghai, China*

Visualization of Two-Phase Flow Behavior Inside the Advanced Thermosyphon With Different Working Fluids

Poster Presentation. HT2019-3555

Dong Hwan Shin, Yeonghwan Kim, Jinsub Kim, Jungho Lee, *Korea Institute of Machinery & Materials, Deajeon, Korea (Republic),* Seung M. You, *The University of Texas at Dallas, Richardson, TX, United States*

Bubble Behavior in Pool Boiling Heat Transfer Between Two Plates With a Narrow Gap

Technical Presentation. HT2019-3564

Jinsub Kim, Dong Hwan Shin, Yeonghwan Kim, Jungho Lee, *Korea Institute of Machinery & Materials, Deajeon, Korea (Republic),* Seung M. You, *The University of Texas at Dallas, Richardson, TX, United States*

Investigation of Experimental Flow Visualization and Thermal Performance of Two Turn Closed Loop Pulsating Heat Pipe

Technical Presentation. HT2019-3833

Shailesh Rajendra, *Dr. Babasaheb Ambedkar Marathwada University Aurangabad, Aurangabad, Maharashtra, India*

Endoscopic Visualization of Pool Boiling

Poster Presentation. HT2019-3835

Jiaqi Li, Wuchen Fu, Nenad Miljkovic, *University of Illinois at Urbana-Champaign, Urbana, IL, United States,* Gaohua Zhu, *Toyota Technical Center, Ann Arbor, MI, United States*

Technical Sessions – TUESDAY

HEAT TRANSFER IN ENERGY SYSTEMS – K6

Track Organizer: Nesrin Ozalp, *University of Minnesota Duluth, Duluth, MN, United States*

Track Co-Organizer: Matthew R. Jones, *Brigham Young University, Provo, UT, United States,* Alexander Rattner, *Penn State University, University Park, PA, United States*

Topic 1-8
HEAT TRANSFER IN SOLAR THERMAL AND SOLAR PV SYSTEMS

1-8-2
Heat Transfer in Solar Thermal and Solar PV Systems II
Second Floor, Regency Ballroom A 4:00PM–5:40PM

Session Organizer: Kashif Nawaz, *ORNL, Oak Ridge, TN, United States*

Session Co-Organizer: Shima Hajimirza, *Texas A&M University, College Station, TX, United States*

Study of Heat Transfer and Friction Characteristics in Roughened Modified Duct

Technical Presentation. HT2019-3748

Rajneesh Kumar, Varun Goel, Anoop Kumar, *National Institute of Technology, Hamirpur, India*

Numerical Heat Transfer and Fluid Flow Modeling of a High-Temperature Solar Air Receiver Containing Reticulated Porous Ceramic Structures Under High-Flux Solar Irradiation

Technical Presentation. HT2019-3781

Vikas R. Patil, Aldo Steinfeld, *ETH Zurich, Zurich, Switzerland*

Theoretical Study of Radiation-Induced Convection in Direct Absorption High Temperature Solar Receivers

Technical Presentation. HT2019-3801

Melanie Tetreault-Friend, *McGill University, Montreal, QC, Canada*

Local Turbulent Convective Heat Transfer in Flow Over Rectangular Cavities of Finite Width

Technical Presentation. HT2019-3594

Manish Sachdeva, *University of Minnesota, Minneapolis, MN, United States,* Vinod Srinivasan, Richard Goldstein, *University of Minnesota Twin Cities, Minneapolis, MN, United States*

Ceramic Castable Cement Tanks and Piping for Molten Salt Circulation Loop

Technical Presentation. HT2019-3827

Bamdad Barari, Henry Asegun, *Massachusetts Institute of Technology, Cambridge, MA, United States*

THERMOPHYSICAL PROPERTIES – K-7

Track Organizer: Nicholas Roberts, *Utah State University, Logan, UT, United States*

Topic 2-2
MEASUREMENTS OF THERMOPHYSICAL PROPERTIES

2-2-2
Computational Methods for Evaulating Thermophysical Properties
Second Floor, Regency Ballroom G 4:00PM–5:40PM

Session Organizer: Nicholas Roberts, *Utah State University, Logan, UT, United States*

A First-Principle Model for the Spectral Absorptivity of Gold Black in the Near Infrared

Technical Presentation. HT2019-3815

Nazia Munir, J. Robert Mahan, Mehran Yarahmadi, *Virginia Tech, Blacksburg, VA, United States,* Kory J. Priestley, *Climate Science Branch, Hampton, VA, United States*

Pressure Effects in Thin Liquid Film at a Surface Using Molecular Dynamics

Technical Presentation. HT2019-3783

An Zou, Manish Gupta, Shalabh Maroo, *Syracuse University, Syracuse, NY, United States*

Melting Behavior of Colloidal Nanocrystals

Technical Presentation. HT2019-3831

Shuang Cui, *National Renewable Energy Lab, Golden, CO, United States*

THEORY AND FUNDAMENTAL RESEARCH IN HEAT TRANSFER – K-8

Track Organizer: Amitabh Narain, *Michigan Technological University, Houghton, MI, United States*

Track Co-Organizers: Diana-Andra Borca-Tasciuc, *Rensselaer Polytechnic Institute, Troy, NY, United States,* Xiulin Ruan, *Purdue University, West Lafayette, IN, United States,* Vaibhav Bahadur, *University of Texas at Austin, Austin, TX, United States,* Navdeep Dhillon, *California State University Long Beach, Long Beach, CA, United States*

Topic 3-1
FUNDAMENTALS OF PHASE-CHANGE FLOWS, CONVECTION, AND MULTI-SCALE HEAT TRANSFER

3-1-2
Fundamentals of Convection
Second Floor, Regency Ballroom B 4:00PM–5:40PM

Session Organizer: Van P. Carey, *University of California, Berkeley, Berkeley, CA, United States*

Session Co-Organizer: Gregory J. Michna, *South Dakota State University, Brookings, SD, United States*

Magnetic Resonance Thermometry: An Emerging Three-Dimensional Temperature Diagnostic Technique

Technical Paper Publication. HT2019-3484

Michael Benson, Mattias Cooper, Bret Van Poppel, *United States Military Academy, West Point, NY, United States,* Chris Elkins, *Stanford University, Stanford, CA, United States*

The Effects of 3D Printing Parameters and Surface Roughness on Convective Heat Transfer Performance

Technical Paper Publication. HT2019-3591

Lucas Pereira, Todd Letcher, Gregory J. Michna, *South Dakota State University, Brookings, SD, United States*

Effect of Sidewall Conductance on Nusselt Number for Rayleigh-Bénard Convection: A Fin Model and Experimental Correction

Technical Presentation. HT2019-3768

Umesh Madanan, *University of Minnesota Twin Cities, Minneapolis, MN, United States,* Richard Goldstein, *University of Minnesota, Minneapolis, MN, United States*

Experimental Study on Internal Forced Convective Heat Transfer Characteristics of Nanofluids for Automotive Cooling Applications

Technical Presentation. HT2019-3689

Akash A R, Arvind Pattamatta, *Indian Institute of Technology Madras, Chennai, Tamil Nadu, India,* Sarit Kumar Das, *Indian Institute of Technology Ropar, Rupnagar, India*

Heat Transfer: The Common Source of Entropy Production

Technical Paper Publication. HT2019-3663

Yousef Haseli, *Central Michigan University, Mt. Pleasant, MI, United States*

HEAT TRANSFER EQUIPMENT – K-10

Track Organizer: Subramanyaravi Annapragada, *United Technologies Research, East Hartford, CT, United States*

Track Co-Organizer: Gongnan Xie, *Northwestern Polytechnical University, Xi'an, China*

Topic 5-1
HEAT TRANSFER EQUIPMENT

5-1-2
Multi-scale Multi-phase Heat Transfer
Second Floor, Regency Ballroom C 4:00PM–5:40PM

Session Organizer: Qun Chen, *Tsinghua University, Beijing, China*

Session Co-Organizer: Maulik Shelat, *Praxair, Williamsville, NY, United States*

A Hybrid Absorption System With Generator Level Optical Control and Variable Flow Rate

Technical Paper Publication. HT2019-3708

Gleidson Souza, *UFPR, Curitiba, Brazil,* Jose V. Vargas, *Universidade Federal Do Parana, Curitiba/Paraná, Brazil,* Wellington Balmant, Marcos Campos, Leonardo Martinez, *UFPR, Curitiba, Brazil,* Juan Ordonez, *FSU, Tallahassee, FL, United States,* Andre Mariano, *UFPR, Curitiba, Parana, Brazil*

Performance Evaluations of Extracting Water From Dry Air Using Multi-Stage Desiccant Wheels and Vapor Compression Cycle

Technical Paper Publication. HT2019-3554

Rang Tu, Lanbin Liu, *University of Science and Technology Beijing, Beijing, China*

The Effects of Nucleating Agents on Phase Transition of a Salt Hydrate Phase-Change Material for Thermal Energy Storage Heat Exchangers

Technical Paper Publication. HT2019-3582

Sarath Kannan, M.A. Jog, Raj M. Manglik, *University of Cincinnati, Cincinnati, OH, United States*

Heat Transfer Characteristics of a Phase Change Material Fluid in Microchannels Under Pulsating Flow Condition

Technical Paper Publication. HT2019-3608

Abdul A. Shuvo, AKM M. Morshed, Md. Shariful A. Emon, *Bangladesh University of Engineering & Technology, Dhaka, Bangladesh,* Amitav Tikadar, *University of South Carolina, Columbia, SC, United States,* Titan C. Paul, *University of South Carolina Aiken, Aiken, SC, United States*

Investigation of 10 Turn Closed Loop Pulsating Heat Pipe Thermal Performance With CFD Validation

Technical Presentation. HT2019-3832

Shailesh Rajendra, Babasaheb Ambedkar Marathwada, *University Aurangabad, Aurangabad, Maharashtra, India*

Technical Sessions – TUESDAY

HEAT TRANSFER IN MULTIPHASE SYSTEMS – K-13

Track Organizer: Abhijit Mukherjee, *CSUN, Northridge, CA, United States*

Track Co-Organizer: Scott Thompson, *Auburn University, Auburn, AL, United States,* Vinod Srinivasan, *University of Minnesota Twin Cities, Minneapolis, MN, United States*

Topic 8-1

8-1-6
Heat Transfer During Flow Boiling
Second Floor, Cedar Ballroom B 4:00PM–5:40PM

Session Organizer: Navdeep Singh Dhillon, *California State University Long Beach, Long Beach, CA, United States*

Session Co-Organizer: Abhijit Mukherjee, *CSUN, Northridge, CA, United States*

Heat Transfer Characteristics and Bubble Behaviors During Nucleate Flow Boiling for Sodium Chloride Solution

Technical Paper Publication. HT2019-3573

Junping Gu, Guoli Tang, Yuxin Wu, Junfu Lyu, Hairui Yang, Man Zhang, *Tsinghua University, Beijing, China,* Qinggong Wang, *Qian Xuesen Laboratory of Space Technology, Beijing, China*

Transient Subcooled Flow Boiling Phenomena in a Vertical Small Tube

Technical Paper Publication. HT2019-3699

Yuji Nakamura, Qiusheng Liu, Makoto Shibahara, Koichi Hata, Katsuya Fukuda, *Kobe University, Kobe, Hyogo, Japan*

Wick Channels for Enhanced Flow Boiling HTC and Delayed CHF

Technical Presentation. HT2019-3625

Masoud Ahmadi, Sajjad Bigham, *Michigan Technological University, Houghton, MI, United States*

VISUALIZATION OF HEAT TRANSFER – K-22

Track Organizer: Chang Choi, *Michigan Technological University, Houghton, MI, United States*

Track Co-Organizer: Jinsub Kim, *Korea Institute of Machinery & Materials, Deajeon, Korea (Republic)*

Topic 16-1

16-1-2
Photo Gallery for Heat and Mass Transport II
Second Floor, Regency Ballroom F 4:00PM–5:40PM

Session Organizer: Jinsub Kim, *Korea Institute of Machinery & Materials, Deajeon, Korea (Republic)*

Session Co-Organizer: Chang Choi, *Michigan Technological University, Houghton, MI, United States*

Quantitative Experimental Investigation on the Flow Characteristics of Nanofluids in Turbulent Flow

Technical Paper Publication. HT2019-3730

Jizu Lv, Zhenxian Zhang, Chengzhi Hu, Minli Bai, *Dalian University of Technology, Dalian, China*

“Dancing Droplets”: Partial Coalescence of Droplets on Superhydrophobic Surfaces

Technical Presentation. HT2019-3808

Xiao Yan, Lezhou Feng, Leicheng Zhang, Soumyadip Sett, Longnan Li, Nenad Miljkovic, *University of Illinois at Urbana-Champaign, Urbana, IL, United States*

Frost Halo Dynamics on Superhydrophobic Surfaces

Technical Presentation. HT2019-3814

Wei Su, Longnan Li, Xiao Yan, Nenad Miljkovic, *University of Illinois at Urbana-Champaign, Urbana, IL, United States*

Visual Investigation of Influence of Temperature on the Behavior of a Droplet’s Spreading and Penetration Through an Oil/Water Column

Poster Presentation. HT2019-3822

Wei Huo, Ce Sheng, Xi Lyu, Yanbo Liu, *Harbin Engineering University, Harbin City, Heilongjiang Province, China*

AIChE HEAT AND MASS TRANSFER IN CHEMICAL PROCESSING

Track Organizer: Joel Plawsky, *Rensselaer Polytechnic Institute, Troy, NY, United States*

Track Co-Organizers: Raj M. Manglik, *University of Cincinnati, Cincinnati, OH, United States,* Masahiro Kawaji, *City College of New York, New York, NY, United States*

Topic 18-1
HEAT AND MASS TRANSFER IN CHEMICAL PROCESSING

18-1-1
Heat and Mass Transfer in Chemical Processing
Second Floor, Regency Ballroom E 4:00PM–5:40PM

Session Organizer: Masahiro Kawaji, *City College of New York, New York, NY, United States*

Session Co-Organizer: Joel Plawsky, *Rensselaer Polytechnic Institute, Troy, NY, United States*

Comparing Three Methods for Waste Natural Gas-Based Water Production: Reverse Osmosis, Thermal Desalination, and Atmospheric Water Harvesting

Technical Presentation. HT2019-3427

Vaibhav Bahadur, *University of Texas at Austin, Austin, TX, United States*

Model and Sensitivity Analysis of the Reciprocating Biomass Conversion Reactor (RBCR)

Technical Paper Publication. HT2019-3597

Roshan Adhikari, Nick J. Parziale, *Stevens Institute of Technology, Hoboken, NJ, United States*

Effect of Bed Materials on Biomass Oxygen Rich Gasification

Technical Presentation. HT2019-3740

Tianyu Chen, Jun Cao, Songshan Cao, Baosheng Jin, *Southeast University, Nanjing, China*

Thermally Coupled Distillation Columns

Technical Presentation. HT2019-3450

Chandrakant Panchal, Blazo Ljubicic, Rachel Sturtz, Richard Doctor, *E3tec Service, LLC, Hoffman Estates, IL, United States*

Mitigation of Petroleum Fouling in Crude Pre-Heat Train

Technical Presentation. HT2019-3451

Chandrakant Panchal, *Blazo Ljubicic, E3tec Service, LLC, Hoffman Estates, IL, United States*

The Effect of Mixing and s/c Ratio on Lower Temperature Methane Steam Reforming Reaction With Waste Thermal Energy in Stationary Fuel Cell

Technical Paper Publication. HT2019-3559

Hyemin Song, Sangseok Yu, *Chungnam National University, Daejeon, Korea (Republic)*

WOMEN IN ENGINEERING

Track Organizer: Leslie Phinney, *Sandia National Laboratories, Albuquerque, NM, United States*

Topic 22-1

22-1-1
Women in Heat Transfer Panel
Second Floor, Grand Ballroom A 4:00PM–5:40PM

Session Organizer: Leslie Phinney, *Sandia National Laboratories, Albuquerque, NM, United States*

Women in Engineering Panelists

Invited Presentation. HT2019-3810

Jayathi Murthy, *University of California, Los Angeles, Los Angeles, CA, United States*

Invited Presentation. HT2019-3836

Jane Davidson, *University of Minnesota, Minneapolis, MN, United States*

Invited Presentation. HT2019-3837

Amy Betz, *Kansas State University, Manhattan, KS, United States*

Technical Sessions – WEDNESDAY

WEDNESDAY, JULY 17

HEAT TRANSFER IN ENERGY SYSTEMS – K6

Track Organizer: Nesrin Ozalp, *University of Minnesota Duluth, Duluth, MN, United States*

Track Co-Organizer: Matthew R. Jones, *Brigham Young University, Provo, UT, United States,* Alexander Rattner, *Penn State University, University Park, PA, United States*

Topic 1-3
WASTE HEAT RECOVERY AND POWER HARVESTING

1-3-1
Waste Heat Recovery and Power Harvesting I
Second Floor, Regency Ballroom A 8:30AM–10:10AM

Session Organizer: Hohyun Lee, *Santa Clara University, Santa Clara, CA, United States*

Session Co-Organizer: Matthew R. Jones, *Brigham Young University, Provo, UT, United States*

CFD Analysis and Evaluation of Heat Transfer Enhancement of Internal Flow in Tubes With 3D-Printed Complex Fins

Technical Paper Publication. HT2019-3630

Chao Wei, Gabriel Diaz, Kun Wang, *University of Arizona, Tucson, AZ, United States,* Peiwen Li, *University of Arizona, Oro Valley, AZ, United States*

A Novel Approach of Designing Aircraft Heat Exchanger for Continuous Working Conditions Using Modified Genetic Algorithm

Technical Paper Publication. HT2019-3546

Qihang Liu, Guoqiang Xu, Laihe Zhuang, Bensi Dong, Jie Wen, *Beihang University, Beijing, China,* Yanchen Fu, *BUAA, Beijing, China*

Temperature Distribution in Li-Ion Battery System Considering Conjugate Heat Transfer Condition

Technical Presentation. HT2019-3823

Asif Afzal, Ramis Moosafi Kallinkeel, *P.A. College of Engineering, Mangalore, Karnataka, India*

Performance Evaluation of Novel Air-Cooled Heat Exchangers Based on Encapsulated Phase Change Materials

Technical Presentation. HT2019-3829

Lige Zhang, Arif Rokoni, *Drexel University, Philadelphia, PA, United States,* Swanand Bhagwat, *Southwest Research Institute, San Antonio, TX, United States,* Matthew McCarthy, Ying Sun, *Drexel University, Philadelphia, PA, United States*

A Numerical Performance Comparison of Encapsulated High and Low Conductivity Phase Change Media for Energy Storage

Technical Presentation. HT2019-3790

Nithin Mallya, Sophia Haussener, *LRESE, École Polytechnique Fédérale de Lausanne, Lausanne, Switzerland*

THEORY AND FUNDAMENTAL RESEARCH IN HEAT TRANSFER – K-8

Track Organizer: Amitabh Narain, *Michigan Technological University, Houghton, MI, United States*

Track Co-Organizers: Diana-Andra Borca-Tasciuc, *Rensselaer Polytechnic Institute, Troy, NY, United States,* Xiulin Ruan, *Purdue University, West Lafayette, IN, United States,* Vaibhav Bahadur, *University of Texas at Austin, Austin, TX, United States,* Navdeep Dhillon, *California State University Long Beach, Long Beach, CA, United States*

Topic 3-1
FUNDAMENTALS OF PHASE-CHANGE FLOWS, CONVECTION, AND MULTI-SCALE HEAT TRANSFER

3-1-6
Fundamentals of Convective Systems
Second Floor, Regency Ballroom B 8:30AM–10:10AM

Session Organizer: Navdeep Dhillon, *California State University Long Beach, Long Beach, CA, United States*

Session Co-Organizer: Enakshi Wikramanayake, *The University of Texas at Austin, Austin, TX, United States*

Comparison of Model Predictions and Performance Test Data for a Prototype Thermal Energy Storage Module

Technical Paper Publication. HT2019-3512

Dre Helmns, Van P. Carey, *University of California, Berkeley, Berkeley, CA, United States,* Navin Kumar, Debjyoti Banerjee, *Texas A&M University, College Station, TX, United States,* Arun Muley, Michael Stoia, *Boeing Research and Technology, Huntington Beach, CA, United States*

Numerical Investigation on Thermal and Fluid Dynamic Analysis of a Solar Chimney in a Building Façade

Technical Paper Publication. HT2019-3612

Bernardo Buonomo, Furio Cascetta, U*niversità degli Studi della Campania "Luigi Vanvitelli", Aversa, Caserta, Italy,* Alessandra Diana, *Università degli Studi di Genova, Genova, Italy,* Oronzio Manca, Sergio Nardini, *Università degli Studi della Campania "Luigi Vanvitelli", Aversa, Caserta, Italy*

Modeling the Effect of Cooling Vest on Body Thermal Response of People With Paraplegia During Exercise

Technical Paper Publication. HT2019-3474

Farah Mneimneh, *American University of Beirut, Beirut, Lebanon,* Nesreen Ghaddar, *American University of Beirut, New York, NY, United States,* Kamel Ghali, Charbel Moussalem, Ibrahim Omeis, *American University of Beirut, Beirut, Lebanon*

HEAT TRANSFER EQUIPMENT – K-10

Track Organizer: Subramanyaravi Annapragada, *United Technologies Research, East Hartford, CT, United States*

Track Co-Organizer: Gongnan Xie, *Northwestern Polytechnical University, Xi'an, China*

Topic 5-1
HEAT TRANSFER EQUIPMENT

5-1-3
Lifecycle of Industrial Heat Exchangers: Concept to Trouble-Free Operation
Second Floor, Regency Ballroom C 8:30AM–10:10AM

Session Organizer: Maulik Shelat, *Praxair, Williamsville, NY, United States*

Session Co-Organizer: Amanie Abdelmessih, *California Baptist University, Riverside, CA, United States*

Lifecycle of Industrial Heat Exchangers: Concept to Trouble-Free Operation

Invited Presentation. HT2019-3838

Kevin Farrell, *HTRI, Navasota, TX, United States*

Invited Presentation. HT2019-3839

Francesco Coletti, *Hexxcell Ltd., Uxbridge, United Kingdom*

Invited Presentation. HT2019-3840

Richard Jibb, *McDermott, Houston, TX, United States*

Invited Presentation. HT2019-3841

Maulik Shelat, *Praxair, Williamsville, NY, United States*

Invited Presentation. HT2019-3842

Douglas Decker, *Chart Energy and Chemicals, La Crosse, WI, United States*

FIRE AND COMBUSTION – K-11

Track Organizer: Albert Ratner, *University of Iowa, Iowa City, IA, United States*

Topic 6-1
FIRE AND COMBUSTION

6-1-1
Fire and Combustion I
Second Floor, Regency Ballroom A 8:30AM–10:30AM

Session Organizer: Srinath Ekkad, *North Carolina State University, Raleigh, NC, United States*

Session Co-Organizer: Prashant Singh, *North Carolina State University, Raleigh, NC, United States*

Experimental Investigation of Crossflow Diverters in Jet Impingement Cooling

Technical Paper Publication. HT2019-3538

Srivatsan Madhavan, Kishore Ranganath Ramakrishnan, Prashant Singh, Srinath Ekkad, *North Carolina State University, Raleigh, NC, United States*

The Effect of Forced Convection on Mass and Heat Transfer During Single Coal Particle Combustion

Technical Paper Publication. HT2019-3575

Lele Feng, Yang Zhang, Yuxin Wu, `Hai Zhang, Man Zhang, Hairui Yang, *Tsinghua University, Beijing, China,* Kailong Xu, *CAEP Software Center, China, Beijing, China*

Investigation of Fuel Distribution Characteristics Under the Coupling of Transverse Fuel Jet and Flow Field of Flame Holder

Technical Paper Publication. HT2019-3678

Yuqian Chen, Yuxin Fan, Wenhui Zhai, Qixiang Han, *Nanjing University of Aeronautics and Astronautics, Nanjing, China,* Yunlei Wang, *Beijing Power Machinery Institute, Beijing, China*

PPV Effect on Smoke Movement Through a Shaft in High-Rise Fires: Experiments and CFD Simulation

Technical Paper Publication. HT2019-3733

Xiaoman Ye, *Shanghai Maritime University, Shanghai, China,* Ofodike Ezekoye, *University of Texas at Austin, Austin, TX, United States,* Qize He, *Shanghai Fire Research Institute, Shanghai, China*

HEAT TRANSFER IN MULTIPHASE SYSTEMS – K-13

Track Organizer: *Abhijit Mukherjee, CSUN, Northridge, CA, United States*

Track Co-Organizer: *Scott Thompson, Auburn University, Auburn, AL, United States,* Vinod Srinivasan, *University of Minnesota Twin Cities, Minneapolis, MN, United States*

Topic 8-1

8-1-7
Boiling and Evaporation Heat Transfer, Fundamentals II
Second Floor, Cedar Ballroom B 8:30AM–10:10AM

Session Organizer: Herman Haustein, *Tel Aviv University, Ramat Aviv, Israel*

Session Co-Organizer: Vinod Srinivasan, *University of Minnesota Twin Cities, Minneapolis, MN, United States*

Sustained Rotation of Leidenfrost Rotors on Turbine-Inspired Substrates

Technical Presentation. HT2019-3593

Prashant Agrawal, Gary Wells, Rodrigo Ledesma-Aguilar, Glen McHale, *Northumbria University, Newcastle upon Tyne, Tyne and Wear, United Kingdom,* Anthony Buchoux, Adam Stokes, Khellil Sefiane, *University of Edinburgh, Edinburgh, United Kingdom*

The Heat Transfer Under a Partially-Developed Free Surface Jet

Technical Presentation. HT2019-3604

Ron Harnik, Barak Kashi, *Tel Aviv University, Tel Aviv, Israel,* Herman Haustein, *Tel Aviv University, Ramat Aviv, Israel*

On the Evaporation Rate of Liquids on Structured Surfaces

Technical Presentation. HT2019-3619

Kazi Fazle Rabbi, Soumyadip Sett, Kalyan Boyina, Bassel Jabal, Nenad Miljkovic, *University of Illinois at Urbana-Champaign, Urbana, IL, United States*

Experimental Study of Brine Droplet Evaporation and Crystallization at Various Temperatures and Humidity Using EDB Method and Pendant Droplet Method

Technical Paper Publication. HT2019-3644

Jie Qu, Luis Escobar, Ben Xu, *University of Texas Rio Grande Valley, Edinburg, TX, United States,* Zhonghao Rao, *China University of Mining and Technology, Xuzhou, China*

Shape Optimization of Micropillar Geometry for Droplet Evaporation Based on Particle Swarm Optimization Algorithm

Technical Presentation. HT2019-3805

Junhui Li, Haotian Wu, Li Shan, Binjian Ma, Damena Agonafer, *Washington University in St Louis, St. Louis, MO, United States,* Jorge Padilla, *Google LLC, Mountain View, CA, United States*

8-1-9
Multiphase Heat Transfer II
Second Floor, Regency Ballroom E 8:30AM–10:10AM

Session Organizer: Anil Yuksel, *IBM Corporation, Austin, TX, United States*

Session Co-Organizer: Abhijit Mukherjee, *CSUN, Northridge, CA, United States*

Parametric Study of High-Temperature Thermochemical Energy Storage Using Manganese-Iron Oxide

Technical Paper Publication. HT2019-3682

Nasser Vahedi, Alparslan Oztekin, *Lehigh University, Bethlehem, PA, United States*

Confined Impinging Slot Jets in Porous Media With Nanofluids

Technical Paper Publication. HT2019-3691

Bernardo Buonomo, Anna di Pasqua, Oronzio Manca, *Università degli Studi della Campania "Luigi Vanvitelli", Aversa, Caserta, Italy,* Ghofrane Sekrani, Sebastien Poncet, *Université de Sherbrooke, Sherbrooke, QC, Canada*

Melting Patterns in a Partially Heated Vertical Pipe

Technical Presentation. HT2019-3692

Gennady Ziskind, *Ben-Gurion University of the Negev, Beer-Sheva, Israel*

On the Stefan Problem With Internal Heat Generation and Prescribed Heat Flux Conditions at the Boundary

Technical Paper Publication. HT2019-3703

Lyudmyla Barannyk, Olufolahan Irene Ogidan, John Crepeau, *University of Idaho, Moscow, ID, United States,* Sidney D.V. Williams, *Moscow High School, Moscow, ID, United States,* Alexey Sakhnov, *Kutateladze Institute of Thermophysics SB RAS, Novosibirsk, Novosibirskaya oblast', Russia*

Heat and Mass Transfer Characteristics of Vapor Permeation in Sweeping Gas Membrane Distillation Systems for Sea Water Desalination

Technical Paper Publication. HT2019-3674

Umar Alqsair, *Lehigh University, Whitehall, PA, United States,* Anas M. Alwatban, Abdullah A. Alghafis, Ahmed Alshwairekh, Alparslan Oztekin, *Lehigh University, Bethlehem, PA, United States*

COMPUTATIONAL HEAT TRANSFER – K-20

Track Organizer: Sandip Mazumder, *Ohio State University, Columbus, OH, United States*

Track Co-Organizer: Aaron Wemhoff, *Villanova University, Villanova, PA, United States*

Topic 14-1
METHODS IN COMPUTATIONAL HEAT TRANSFER

14-1-2
Novel Computational Heat Transfer Methods
Second Floor, Regency Ballroom F 8:30AM–10:10AM

Session Organizer: Columbia Mishra, *University of Texas at Austin, Hillsboro, OR, United States*

Session Co-Organizer: Shima Hajimirza, *Texas A&M University, College Station, TX, United States*

Multi-Source Thermal Model for Electrical Harness Design

Technical Paper Publication. HT2019-3516

Julien Petitgirard, *Femto-St Laboratory, Department of Energy, University of Bourgogne Franche-Comte, Belfort, France,* Philippe Baucour, Didier Chamagne, *Universite De Franche-Comte, Belfort, France,* Eric Fouillien, *PSA Groupe, Velizy-Villacoublay, France*

Extension of Green's Function Numerical Method for Solving Nonlinear Heat Transfer Problems

Technical Presentation. Ht2019-3741

Forooza Samadi, Keith Woodbury, *The University of Alabama, Tuscaloosa, AL, United States,* James V. Beck, *Michigan State University, E. Lansing, MI, United States*

Simulating Periodic Thermal Flows With General Boundary Conditions by the Temperature Decomposition Method

Technical Presentation. HT2019-3743

Ping Li, Junfeng Zhang, *Laurentian University, Sudbury, ON, Canada*

Uncertainty Quantification and Active Subspace Discovery in Molecular Dynamics Simulations of Thermal Transport

Technical Presentation. HT2019-3794

Manav Vohra, Sankaran Mahadevan, *Vanderbilt University, Nashville, TN, United States,* Jiaqi Wang, Seungha Shin, Yu-Kai Weng, *The University of Tennessee, Knoxville, Knoxville, TN, United States*

The Use of Domain Decomposition for UQ in Heat Transfer Applications

Technical Presentation. HT2019-3820

John Tencer, *Sandia National Laboratories, Albuquerque, NM, United States*

Topic 14-2
APPLICATIONS OF COMPUTATIONAL HEAT TRANSFER

14-2-3
Energy and Heat Exchanger Applications of Computational Heat Transfer
Second Floor, Regency Ballroom G 8:30AM–10:10AM

Session Organizer: Aaron Wemhoff, *Villanova University, Villanova, PA, United States*

Session Co-Organizer: Samuel Subia, *Sandia National Laboratories, Albuquerque, NM, United States*

CFD Modeling of a Counter-Current Packed Bed for an HDH Desalination Unit

Technical Presentation. HT2019-3749

Clement Roy, James Klausner, *Michigan State University, East Lansing, MI, United States*

Modeling Borehole Thermal Energy Storage to Increase the Range of Recovered Waste Heat Utilization

Technical Presentation. HT2019-3745

Genevieve Richards, Aaron Wemhoff, *Villanova University, Villanova, PA, United States*

Thermal Performance Optimisation of Multi-Jet Impingement on Pin Fin Heat Sink

Technical Presentation. HT2019-3818

Nagesh Chougule, *College of Engineering Pune, Pune, Maharashtra, India*

Multiple Time Scaling in the Lattice Boltzmann Method for the Convection Diffusion Equation

Technical Presentation. HT2019-3793

Like Li, *Mississippi State University, Mississippi State, MS, United States*

FORUM

Topic 24-1
FORUM

24-4-3
Funding Opportunities for Research in Heat/Mass Transfer and Energy Systems
Second Floor, Grand Ballroom E/F 10:30AM–12:10PM

Session Organizer: Sandra Boetcher, *Embry-Riddle Aeronautical University, Daytona Beach, FL, United States*

National Science Foundation: Funding Opportunities

Invited Presentation. HT2019-3843

Jose Lage, *National Science Foundation (on leave from Southern Methodist University), Alexandria, VA, United States*

Funding Opportunities in Energy Systems With DOE

Invited Presentation. HT2019-3847

Kyle Gluesenkamp, *Oak Ridge National Laboratory, Knoxville, TN, United States*

FIRE AND COMBUSTION SYSTEMS – K-11

Track Organizer: Albert Ratner, *University of Iowa, Iowa City, IA, United States*

Topic 6-1
FIRE AND COMBUSTION

6-1-2
Fire and Combustion II
Second Floor, Regency Ballroom A 2:00PM–3:40PM

Session Organizer: Prashant Singh

Session Co-Organizer: Srinath Ekkad, *North Carolina State University, Raleigh, NC, United States,* Xiaoman Ye, *Shanghai Maritime University, Shanghai, Shanghai, China,* Ofodike Ezekoye, *University of Texas, Austin, TX, United States,* Qize He, *Shanghai Fire Research Institute, Shanghai, Shanghai, China*

A New Accelerated Approach for Spectral Radiation Calculation Using K Distribution and Discrete Ordinate Methods With Application in Industrial Combustion Systems

Technical Paper Publication. HT2019-3636

Andrew Feldick, *Siemens Product Lifecycle Management Software Inc., North Liberty, IA, United States,* Gopalendu Pal, *Siemens Product Lifecycle Management Software Inc., Austin, TX, United States*

The Effect of Synthesis Conditions of Hydrotalcite-Like Compound (HTLs) Sorbent on Removing Hydrochloric Acid at Medium-High Temperature

Technical Presentation. HT2019-3739

Songshan Cao, Jun Cao, Tianyu Chen, Baosheng Jin, *Southeast University, Nanjing, China*

The Effect of O_2 on Calcined Ca-Mg-Al Hydrotalcites-Like Compounds (HTLs) for the Removal of HCl in Flue Gas

Technical Presentation. HT2019-3737

Jun Cao, Songshan Cao, Tianyu Chen, Baosheng Jin, *Southeast University, Nanjing, China*

HEAT TRANSFER IN MULTIPHASE SYSTEMS – K-13

Track Organizer: Abhijit Mukherjee, *CSUN, Northridge, CA, United States*

Track Co-Organizers: Scott Thompson, *Auburn University, Auburn, AL, United States,* Vinod Srinivasan, *University of Minnesota Twin Cities, Minneapolis, MN, United States*

Topic 8-1

8-1-8
Condensation Heat Transfer II
Second Floor, Cedar Ballroom B 2:00PM–3:40PM

Session Organizer: Scott Thompson, *Auburn University, Auburn, AL, United States*

Session Co-Organizer: Mirza Mohammed Shah, *Engineering Research Associates, Redding, CT, United States*

Sodium Pumping via Condensation Within a Non-Wetting Porous Structure

Technical Presentation. HT2019-3578

Alexander Limia, Peter Kottke, Andrei Fedorov, Shannon K. Yee, *Georgia Institute of Technology, Atlanta, GA, United States*

Pressure-Enhanced Condensation Heat Transfer

Technical Presentation. HT2019-3588

Ali Alshehri, Pirouz Kavehpour, Sahar Andalib, *University of California, Los Angeles, Los Angeles, CA, United States*

Engineered Surfaces for Enhanced Condensation Heat Transfer of Completely Wetting Liquids

Technical Presentation. HT2019-3627

Sajjad Bigham, Masoud Ahmadi, *Michigan Technological University, Houghton, MI, United States*

Investigation of Condensation Heat Transfer on a Tube With Wavy Fins

Technical Paper Publication. HT2019-3735

Tailian Chen, *Gonzaga University, Spokane, WA, United States*

GAS TURBINE HEAT TRANSFER – K-14

Track Organizer: Phillip M. Ligrani, *University of Alabama in Huntsville, Huntsville, AL, United States*

Track Co-Organizer: John Blanton, *Classic Engineering, LLC, Simpsonville, SC, United States*

Topic 9-1

9-1-1
Gas Turbine Heat Transfer
Second Floor, Regency Ballroom C 2:00PM–3:40PM

Session Organizer: Changmin Son, *Virginia Tech, Blacksburg, VA, United States*

Simulations of Film Cooling Flow Structure and Heat Transfer in the Near Field of Cooling Jets With a Modified DES Model

Technical Paper Publication. HT2019-3683

Feiyan Yu, *The Pennsylvania State University, State College, PA, United States,* Savas Yavuzkurt, *Penn State University, University Park, PA, United States*

Numerical Investigation on Film Cooling Efficiency for Air Supplied Into Array of a Novel Designed Double-Curvature Trench

Technical Paper Publication. HT2019-3580

Runsheng Zhang, Leping Zhou, Xiaoze Du, *North China Electric Power University, Beijing, China*

Effect of Twist Ratio on Heat Transfer Enhancement by Swirl Impingement

Technical Paper Publication. HT2019-3530

Kishore Ranganath Ramakrishnan, Srivatsan Madhavan, Prashant Singh, Srinath Ekkad, *North Carolina State University, Raleigh, NC, United States*

A Numerical Investigation of Air/Mist Cooling in a Conjugate, 3-D Gas Turbine Vane With Internal Passage and External Film Cooling

Technical Paper Publication. HT2019-3464

Ramy Abdelmaksoud, Ting Wang, *University of New Orleans, New Orleans, LA, United States*

Numerical Predictions of Flow Structures and Film Cooling Effectiveness Values of a Turbine Vane: Effects of Secondary Holes

Technical Paper Publication. HT2019-3401

Rui Zhu, Gongnan Xie, *Northwestern Polytechnical University, Xi'an, China,* Terrence Simon, *University of Minnesota, Minneapolis, MN, United States*

TRANSPORT PHENOMENA IN MATERIALS PROCESSING AND MANUFACTURING – K-15

Track Organizer: Patrick Mensah, *Southern University and A&M College, Baton Rouge, LA, United States*

Track Co-Organizer: Ying Sun, *Drexel University, Philadelphia, PA, United States,* Stephen Akwaboa, *Southern University and A&M College, Baton Rouge, LA, United States*

Topic 10-1

10-1-1
Transport Phenomena in Materials Processing and Manufacturing
Second Floor, Regency Ballroom B 2:00PM–3:40PM

Session Organizer: Ying Sun, *Drexel University, Philadelphia, PA, United States*

Session Co-Organizer: Stephen Akwaboa, *Southern University and A&M College, Baton Rouge, LA, United States*

Heat Transfer in 3-D Laser Printing of Zr-Based Bulk Amorphous Metallic Glass

Technical Presentation. HT2019-3457

Jun Zhou, Liyong Sun, *Penn State University Erie, The Behrend College, Erie, PA, United States*

An Investigation on Mechanism of Droplet Generation in High Inertial Gaseous Flow

Technical Paper Publication. HT2019-3527

Xinyu Yao, Zhenyu Liu, Huiying Wu, *Shanghai Jiao Tong University, Shanghai, China*

Comparison of Volumetric to Surface Heating for Filament-Fed Laser Heated Additive Manufacturing of Glass

Technical Paper Publication. HT2019-3634

Nicholas Capps, Jason Johnson, Robert Landers, Douglas Bristow, Edward Kinzel, *Missouri University of Science and Technology, Rolla, MO, United States,* Alexandria Marchi, John Bernardin, *Los Alamos National Laboratory, Los Alamos, NM, United States*

Heat Transfer Coefficient of a Graphite Mold Quenched by Water

Technical Paper Publication. HT2019-3731

Yi Pan, Jeffrey Thomas, Chris Propes, *Halliburton Drill Bits and Services, Conroe, TX, United States*

COMPUTATIONAL HEAT TRANSFER – K-20

Track Organizer: Sandip Mazumder, *Ohio State University, Columbus, OH, United States*

Track Co-Organizer: Aaron Wemhoff, *Villanova University, Villanova, PA, United States*

Topic 14-2
APPLICATIONS OF COMPUTATIONAL HEAT TRANSFER

14-2-2
Applications of Computational Heat Transfer on Fluid Flow Behavior
Second Floor, Regency Ballroom G 2:00PM–3:40PM

Session Organizer: Samuel Subia, *Sandia National Laboratories, Albuquerque, NM, United States*

Session Co-Organizer: Aaron Wemhoff, *Villanova University, Villanova, PA, United States*

Flow and Heat Transfer in Droplets-Film Interactions

Technical Paper Publication. HT2019-3418

Gangtao Liang, Haibing Yu, Yang Chen, Shengqiang Shen, *Dalian University of Technology, Dalian, China*

Numerical Analysis of Heat Transfer in a Laminar, Submerged, Slot Jet Impinging on an Oscillating Wall

Technical Paper Publication. HT2019-3633

Srivathsan Ragunathan, Douglas Goering, *University of Alaska, Fairbanks, Fairbanks, AK, United States*

Thermal Mixing Downstream of a 90-Degree T-Junction: Laminar and Turbulent Flows

Technical Paper Publication. HT2019-3736

Bakhtier Farouk, *Drexel University, Philadelphia, PA, United States*

Author Index

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Abassi	Shahzaib	HT2019-3799	Design of a Heat Acquisition Unit for Cascaded Thermoelectric and Thermally Activated Refrigeration Waste Heat Recovery	Heat Transfer in Energy Systems – K-6	Second Floor, Regency Ballroom A	1-4-1
Abdelmaksoud	Ramy	HT2019-3464	A Numerical Investigation of Air/Mist Cooling in a Conjugate, 3-D Gas Turbine Vane With Internal Passage and External Film Cooling	Gas Turbine Heat Transfer – K-14	Second Floor, Regency Ballroom C	9-1-1
Abdulrazzaq	Nabeel	HT2019-3628	The Effect of Chamber Pressure on the Thermal Performance of New Refrigerant R513a During Spray Cooling	Heat Transfer in Electronic Equipment – K-16	Second Floor, Regency Ballroom F	11-1-2
Abuseada	Mostafa	HT2019-3540	Heat Transfer Driven Dynamics and Control of Transient Variations in a Solar Reactor	Heat Transfer in Energy Systems – K-6	Second Floor, Regency Ballroom A	1-8-1
Acharya	Sumanta	HT2019-3532	Wettability Effects on Falling Film Heat Transfer Over Horizontal Tubes in Jet Flow Mode	Heat Transfer in Multiphase Systems – K-13	Second Floor, Regency Ballroom E	8-1-1
Adhikari	Roshan	HT2019-3597	Model and Sensitivity Analysis of the Reciprocating Biomass Conversion Reactor (RBCR)	AIChE Heat and Mass Transfer in Chemical Processing	Second Floor, Regency Ballroom E	18-1-1
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Agonafer	Damena	HT2019-3805	Shape Optimization of Micropillar Geometry for Droplet Evaporation Based on Particle Swarm Optimization Algorithm	Heat Transfer in Multiphase Systems – K-13	Second Floor, Cedar Ballroom B	8-1-7
Agrawal	Prashant	HT2019-3593	Sustained Rotation of Leidenfrost Rotors on Turbine-Inspired Substrates	Heat Transfer in Multiphase Systems – K-13	Second Floor, Cedar Ballroom B	8-1-7
Ahmadi	Masoud	HT2019-3625	Wick Channels for Enhanced Flow Boiling HTC and Delayed CHF	Heat Transfer in Multiphase Systems –K-13	Second Floor, Cedar Ballroom B	8-1-6
		HT2019-3627	Engineered Surfaces for Enhanced Condensation Heat Transfer of Completely Wetting Liquids	Heat Transfer in Multiphase Systems – K-13	Second Floor, Cedar Ballroom B	8-1-8
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3-1-1	Fundamentals of Boiling and Condensation including Micro/Nanoscale Effects-I	Enakshi	Wikramanayake	The University of Texas at Austin	Session Co-Organizer
3-1-2	Fundamentals of Convection	Van P.	Carey	University of California, Berkeley	Session Organizer
3-1-2	Fundamentals of Convection	Gregory J.	Michna	South Dakota State University	Session Co-Organizer
3-1-3	Fundamentals of Multiscale Simulations-I	Prabhakar	Marepalli	Intel Corporation	Session Organizer
3-1-3	Fundamentals of Multiscale Simulations-I	Vaibhav	Bahadur	University of Texas at Austin	Session Co-Organizer
3-1-4	Fundamentals of Boiling and Condensation including Micro/Nanoscale Effects-II (Technical)	Van P.	Carey	University of California, Berkeley	Session Organizer
3-1-4	Fundamentals of Boiling and Condensation including Micro/Nanoscale Effects-II (Technical)	Amitabh	Narain	Michigan Technological University	Session Co-Organizer
3-1-4	Fundamentals of Boiling and Condensation including Micro/Nanoscale Effects-II (Technical)	Navdeep	Dhillon	California State University Long Beach	Session Co-Organizer
3-1-5	Fundamentals of Boiling and Condensation including Micro/Nanoscale Effects-III (Technical)	Vaibhav	Bahadur	University of Texas at Austin	Session Organizer
3-1-5	Fundamentals of Boiling and Condensation including Micro/Nanoscale Effects-III (Technical)	Navdeep	Dhillon	California State University Long Beach	Session Co-Organizer

Session Organizers

Session Number	Session Name	Session Organizer First Name	Session Organizer Last Name	Session Organizer Company	Session Organizer Role
3-1-6	Fundamentals of Convective Systems	Navdeep	Dhillon	California State University Long Beach	Session Organizer
3-1-6	Fundamentals of Convective Systems	Enakshi	Wikramanayake	The University of Texas at Austin	Session Co-Organizer
3-1-7	Fundamentals of Multiscale Simulations II	Vaibhav	Bahadur	University of Texas at Austin	Session Organizer
3-1-7	Fundamentals of Multiscale Simulations II	Prabhakar	Marepalli	Intel Corporation	Session Co-Organizer
5-1-1	Single-phase Enhanced Heat Transfer Equipment	Zhiguo	Qu	Xi'an Jiaotong University	Session Organizer
5-1-1	Single-phase Enhanced Heat Transfer Equipment	Arun	Muley	Boeing Research and Technology	Session Co-Organizer
5-1-2	Multi-scale Multi-phase Heat Transfer	Qun	Chen	Tsinghua University	Session Organizer
5-1-2	Multi-scale Multi-phase Heat Transfer	Maulik	Shelat	Praxair	Session Co-Organizer
5-1-3	Lifecycle of Industrial Heat Exchangers: Concept to Trouble-Free Operation	Maulik	Shelat	Praxair	Session Organizer
5-1-3	Lifecycle of Industrial Heat Exchangers: Concept to Trouble-Free Operation	Amanie	Abdelmessih	California Baptist University	Session Co-Organizer
5-1-4	Heat Transfer Equipment	Amanie	Abdelmessih	California Baptist University	Session Organizer
5-1-4	Heat Transfer Equipment	Kevin	Anderson	California State Polytechnic University at Pomona	Session Co-Organizer
6-1-1	Fire and Combustion I	Srinath	Ekkad	North Carolina State University	Session Organizer
6-1-1	Fire and Combustion I	Prashant	Singh	North Carolina State University	Session Co-Organizer
6-1-2	Fire and Combustion II	Prashant	Singh	North Carolina State University	Session Organizer
6-1-2	Fire and Combustion II	Srinath	Ekkad	North Carolina State University	Sessiion Co-Organizer
8-1-1	Boiling and Evaporation Heat Transfer, Fundamentals I	Herman	Haustein	Tel Aviv University	Session Organizer
8-1-1	Boiling and Evaporation Heat Transfer, Fundamentals I	Vinod	Srinivasan	University of Minnesota Twin Cities	Session Co-Organizer
8-1-3	Boiling and Evaporation Heat Transfer, Applications	Anil	Yuksel	IBM Corporation	Session Organizer
8-1-3	Boiling and Evaporation Heat Transfer, Applications	Vinod	Srinivasan	University of Minnesota Twin Cities	Session Co-Organizer
8-1-4	Multiphase Heat Transfer I	Anil	Yuksel	IBM Corporation	Session Organizer
8-1-4	Multiphase Heat Transfer I	Abhijit	Mukherjee	CSUN	Session Co-Organizer
8-1-5	Boiling Heat Transfer on Modified Surfaces	Navdeep Singh	Dhillon	California State University Long Beach	Session Organizer
8-1-5	Boiling Heat Transfer on Modified Surfaces	Mirza Mohammed	Shah	Engineering Research Associates	Session Co-Organizer
8-1-2	Condensation Heat Transfer I	Scott	Thompson	Auburn University	Session Organizer
8-1-2	Condensation Heat Transfer I	Mirza Mohammed	Shah	Engineering Research Associates	Session Co-Organizer
8-1-6	Heat Transfer during Flow Boiling	Navdeep Singh	Dhillon	California State University Long Beach	Session Organizer
8-1-6	Heat Transfer during Flow Boiling	Abhijit	Mukherjee	CSUN	Session Co-Organizer
8-1-7	Boiling and Evaporation Heat Transfer, Fundamentals II	Herman	Haustein	Tel Aviv University	Session Organizer
8-1-7	Boiling and Evaporation Heat Transfer, Fundamentals II	Vinod	Srinivasan	University of Minnesota Twin Cities	Session Co-Organizer
8-1-8	Condensation Heat Transfer II	Scott	Thompson	Auburn University	Session Organizer
8-1-8	Condensation Heat Transfer II	Mirza Mohammed	Shah	Engineering Research Associates	Session Co-Organizer
8-1-9	Multiphase Heat Transfer II	Anil	Yuksel	IBM Corporation	Session Organizer
8-1-9	Multiphase Heat Transfer II	Abhijit	Mukherjee	CSUN	Session Co-Organizer
9-1-1	Gas Turbine Heat Transfer	Changmin	Son	Virginia Tech	Session Organizer
10-1-1	Transport Phenomena in Materials Processing and Manufacturing	Ying	Sun	Drexel University	Session Organizer
10-1-1	Transport Phenomena in Materials Processing and Manufacturing	Stephen	Akwaboa	Southern University and A&M College	Session Co-Organizer
11-1-1	Numerical Modeling and Simulation	Gregory J.	Michna	South Dakota State University	Session Organizer
11-1-2	Spary Cooling	Dion	Antao	Texas A&M University	Session Organizer
11-1-3	Heat Sinks and Capillary Flow	Amanie	Abdelmessih	California Baptist University	Session Organizer
11-1-3	Heat Sinks and Capillary Flow	Kashif	Nawaz	ORNL	Session Co-Organizer
12-1-1	Heat transfer related to hydrogen and space exploration	Kevin	Anderson	California State Polytechnic University at Pomona	Session Organizer
12-1-2	Heat transfer in complex systems and materials	Zhiguo	Qu	Xi'an Jiaotong University	Session Organizer
12-1-2	Heat transfer in complex systems and materials	Ridong	Wang	Iowa State University	Session Co-Organizer
13-1-1	Environmental Heat Transfer	Kashif	Nawaz	ORNL	Session Organizer
14-1-1	Deep Learning, Reduced Order Modeling, and Non-Continuum Heat Transfer	Leitao	Chen	Rice University	Session Organizer
14-1-1	Deep Learning, Reduced Order Modeling, and Non-Continuum Heat Transfer	John	Tencer	Sandia National Laboratories	Session Co-Organizer

Session Organizers

Session Number	Session Name	Session Organizer First Name	Session Organizer Last Name	Session Organizer Company	Session Organizer Role
14-1-1	Deep Learning, Reduced Order Modeling, and Non-Continuum Heat Transfer	Matthew R.	Jones	Brigham Young University	Session Co-Organizer
14-1-2	Novel Computational Heat Transfer Methods	Columbia	Mishra	University of Texas at Austin	Session Organizer
14-1-2	Novel Computational Heat Transfer Methods	Shima	Hajimirza	Texas A&M University	Session Co-Organizer
16-1-1	Photo Gallery for Heat and Mass Transport I	Jinsub	Kim	Korea Institute of Machinery & Materials	Session Organizer
16-1-1	Photo Gallery for Heat and Mass Transport I	Chang	Choi	Michigan Technological University	Session Co-Organizer
16-1-2	Photo Gallery for Heat and Mass Transport II	Jinsub	Kim	Korea Institute of Machinery & Materials	Session Organizer
16-1-2	Photo Gallery for Heat and Mass Transport II	Chang	Choi	Michigan Technological University	Session Co-Organizer
14-2-1	Industrial and Medical Applications of Computational Heat Transfer	Aaron	Wemhoff	Villanova University	Session Organizer
14-2-1	Industrial and Medical Applications of Computational Heat Transfer	Samuel	Subia	Sandia National Laboratories	Session Co-Organizer
14-2-2	Applications of Computational Heat Transfer on Fluid Flow Behavior	Samuel	Subia	Sandia National Laboratories	Session Organizer
14-2-2	Applications of Computational Heat Transfer on Fluid Flow Behavior	Aaron	Wemhoff	Villanova University	Session Co-Organizer
14-2-3	Energy and Heat Exchanger Applications of Computational Heat Transfer	Aaron	Wemhoff	Villanova University	Session Organizer
14-2-3	Energy and Heat Exchanger Applications of Computational Heat Transfer	Samuel	Subia	Sandia National Laboratories	Session Co-Organizer

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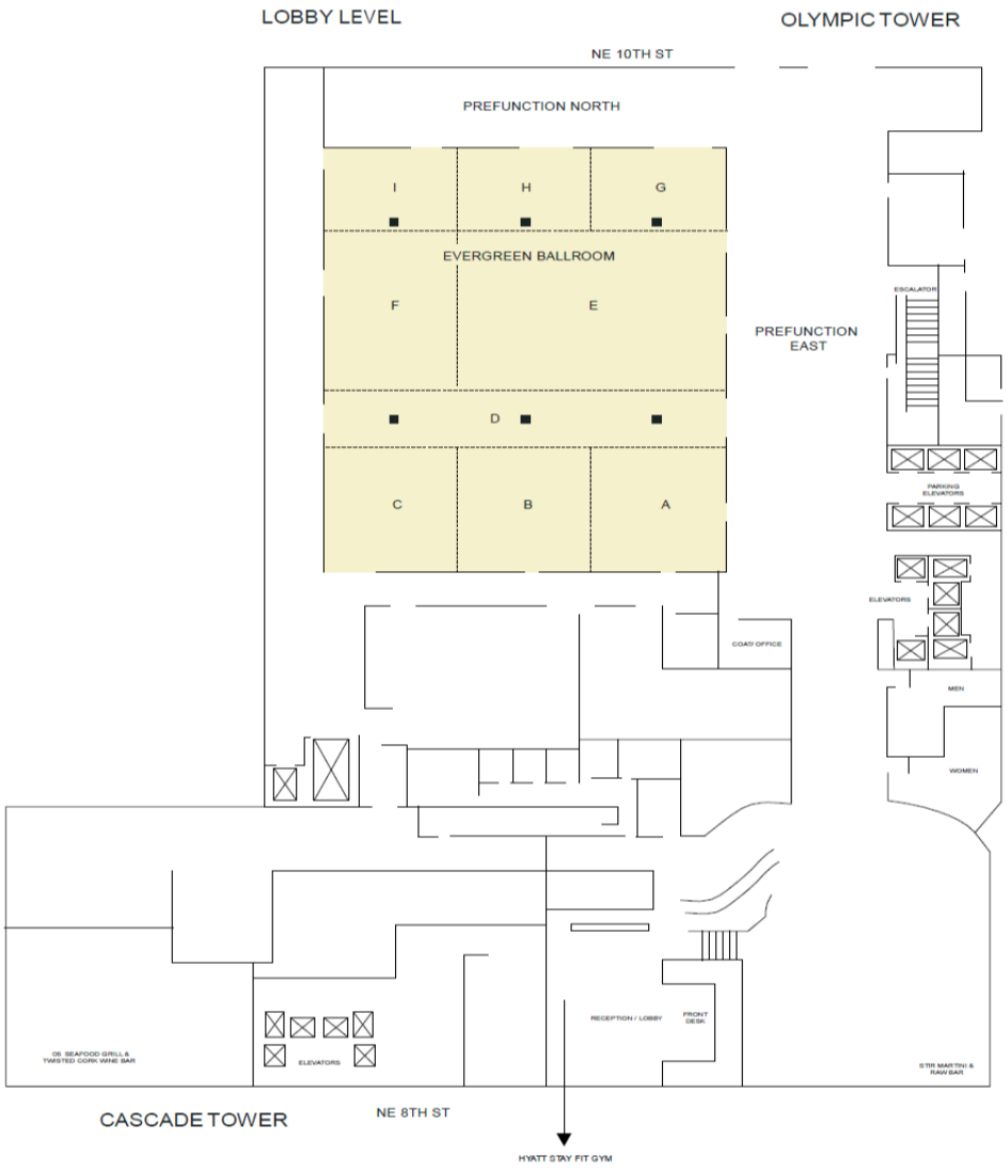

Hotel Floor Plan

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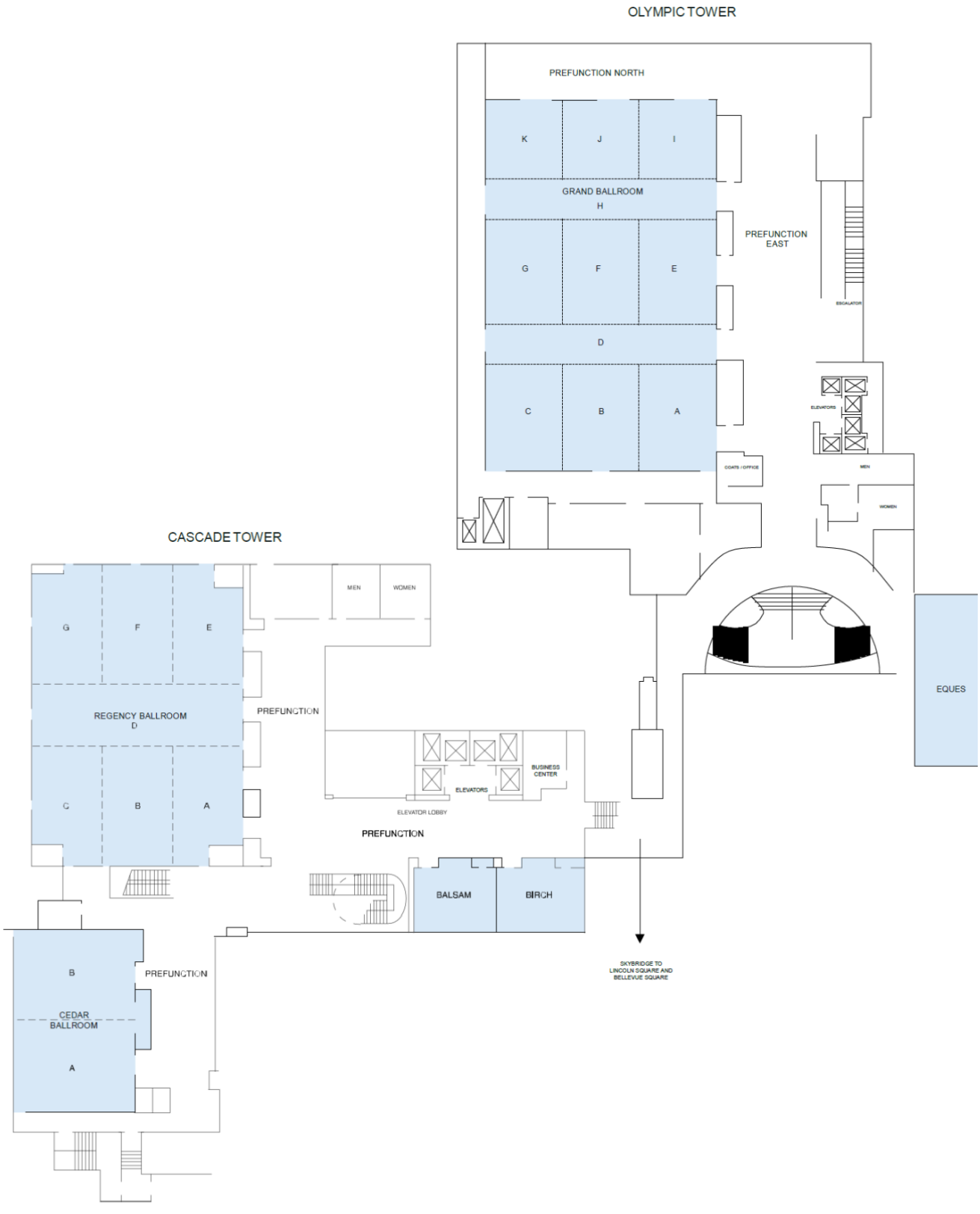
SECOND FLOOR



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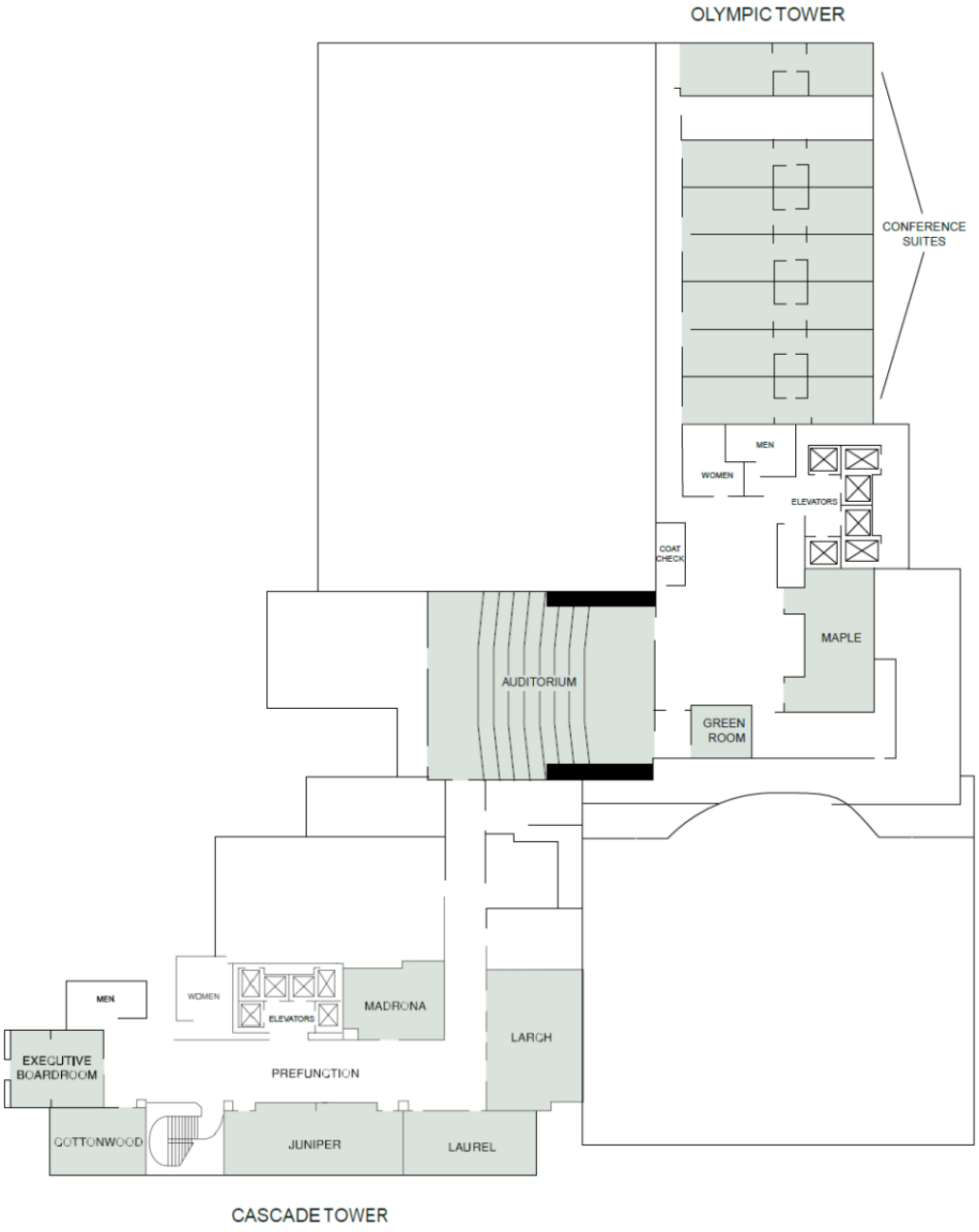
THIRD FLOOR



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