



**17th**  
**International Heat Transfer Conference**

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Cape Town International Convention Centre,  
Cape Town, South Africa

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**14 - 18 August 2023**

# **DRAFT CONFERENCE PROGRAM**

**A FINAL VERSION OF THE PROGRAM WILL BE MADE AVAILABLE SHORTLY**

**Organised by HEFAT under the auspices of The Assembly for International Heat Transfer Conferences (AIHTC). Supported by the South African Institution of Mechanical Engineers, the International Center for Heat and Mass Transfer (ICHMT) and the American Society of Thermal and Fluids Engineers (ASTFE).**

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President of AIHTC  
President of SAIMEchE  
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Executive Mayor of Cape Town  
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# WELCOME FROM THE CONFERENCE CHAIR



On behalf of the organizing committee, it is with great pleasure and excitement that I welcome you to the International Heat Transfer Conference in the beautiful city of Cape Town!

As the Chair of this prestigious conference, I am honoured to host this gathering of brilliant minds from around the world, all dedicated to advancing the field of heat transfer. With its stunning landscapes, rich cultural heritage, and warm hospitality, Cape Town provides a perfect backdrop for our esteemed conference.

Over the next few days, we will have the opportunity to engage in enriching discussions, share cutting-edge research findings, and foster collaborations among experts in the field of heat transfer. From fundamental principles to practical applications, our conference program promises to be a stimulating and insightful experience for all participants.

I am confident that this conference will not only provide a platform for exchanging knowledge and expertise, but also inspire new ideas, spark innovative research, and foster lifelong connections among the global heat transfer community. It is my hope that our discussions and interactions during this conference will pave the way for breakthroughs that will contribute to solving the world's most pressing challenges related to heat transfer in various industries and applications.

In addition to the engaging technical sessions, we have also lined up social events and networking opportunities to create a conducive environment for camaraderie and friendship among colleagues. Cape Town, with its diverse culture, natural beauty, and vibrant city life, offers a plethora of activities and experiences that will make your stay here truly memorable.

I would like to express my deepest appreciation to our sponsors, exhibitors, and partners for their invaluable support in making this conference a reality. I also extend my heartfelt thanks to the organizing committee, volunteers, and staff for their unwavering dedication and hard work in planning and organizing this conference.

Once again, a warm welcome to all our distinguished guests. I look forward to meeting each and every one of you and engaging in meaningful discussions that will shape the future of heat transfer research. Let us come together to learn, share, and inspire each other in the breath taking surroundings of Cape Town.

**Prof. Josua Meyer**

IHTC-17 Conference Chair

Vice-President: Assembly for International Heat Transfer Conferences

Stellenbosch University, South Africa

# WELCOME FROM THE PRESIDENT OF THE AIHTC



The origin of the International Heat Transfer Conferences (IHTCs) was the IMechE/ASME General Discussion on Heat Transfer held in London and Atlantic City in 1951. The Assembly for International Heat Transfer Conferences (AIHTC) founded in Chicago became the organizer of the quadrennial IHTCs in 1966 and continues to provide a worldwide forum for the discussion of future directions and priorities in the various domains of thermal science and engineering. Along with its delegates and 23 member national organizations, AIHTC is delighted to welcome all the participants from around the world to the 17th International Heat Transfer Conference in Cape Town, South Africa. And we thank the South African Institution of Mechanical Engineers, the International Center for Heat and Mass Transfer and the American Society of Thermal and Fluids Engineers for their support.

South Africa has been a member of AIHTC for many years, with this being its first opportunity to host the International Heat Transfer Conference in Cape Town. This 17th IHTC is a testament to the vitality of the international thermal science and engineering community. With IHTC-17, we not only look forward to many high-level academic exchanges concerning heat and mass transfer, but also want to ask some important questions about how to develop and expand our research, how to make it original, useful, and surprising, and how to make this world a better place. We all look forward to exciting new ideas, closer collaboration, and many multidisciplinary exchanges.

We are excited to welcome you to an outstanding IHTC-17 with good science, invigorating friendships, and infinite hope!

**Prof. Xing Zhang**

President: Assembly for International Heat Transfer Conferences  
Tsinghua University, China

# WELCOME FROM THE PRESIDENT OF SAIMechE



Welcome to the 17th International Heat Transfer Conference (IHTC-17) hosted in Cape Town, South Africa! It gives me great joy to witness a coming together of scientists, engineering professionals, researchers and industry colleagues to share knowledge and advance research in the field of heat transfer.

The South African Institute of Mechanical Engineering (SAIMechE) is a voluntary association of Mechanical Engineering Professionals representing the discipline of mechanical engineering in South Africa. SAIMechE is over a century old and originated as the South African Association of Engineers and Architects, established in 1892.

The Institution publishes a magazine "The SA Mechanical Engineer" and is the host for the Research and Development Journal. The journal provides an opportunity to publish papers on research and development in the fields of Mechanical and Mechatronic engineering. The R&D Journal is a peer reviewed engineering science journal, the first issue of which was published during 1985. The Journal is presently fully accredited as a subsidised research journal with the South African State Department of Higher Education. Primarily the authors are from South Africa and Africa at large, but papers from any origin are welcomed.

The program for the conference is a fantastic one and provides all attendees with an opportunity to learn and advance their knowledge in any field of practice requiring knowledge of heat transfer. I hope each and every attendee will participate in the discussions and provide insights into how we can better serve society and make this world a better place for all people.

SAIMechE would like to thank the organizers and supporters of this conference for living by the institutions' motto of "Scientia Progredimur" – By Knowledge We Advance."

## **Prof. Sewela Portia Moketla**

President of The South African Institution of Mechanical Engineering (SAIMechE)  
Komatsu Mining Corporation, South Africa

# WELCOME FROM THE PREMIER OF THE WESTERN CAPE GOVERNMENT



It is my honour and privilege to welcome all those taking part in this global conference.

The heat and transfer mass industry operates in a space that is very close to my heart: innovation.

Through innovation – a key value of the Western Cape Government – we are often able to think and work our way out of complex challenges. Doing things the same way over and over again only works to a certain point. We cannot, often, go back to the normal way of how we did things. The Covid-19 pandemic showed us that by innovating and thinking on our feet we were able to endure that calamity. You eventually have to not just think outside the box, but do away with the box altogether; start afresh and look at challenges from a different perspective to achieve your objectives.

It is through this approach – embracing and enhancing innovation – that my team at the provincial government and I are tackling the energy crisis. Heat and mass transfer underscores energy production and along with most sectors of our country's economy, yours is also feeling the pain brought on by this devastating crisis. This crisis is by far the most pressing our country has had to face in decades. But through partnerships and embracing innovation, like we did in battling Covid-19, I have no doubt we will prevail.

I wish you all attending this conference the best.

Mr. Alan Winde  
Premier of the Western Cape  
Western Cape Government, South Africa

# WELCOME FROM THE EXECUTIVE MAYOR OF CAPE TOWN



It is my honour to welcome delegates of the 17th International Heat Transfer Conference to Cape Town. We are delighted that you chose the Mother City for your conference, and I hope we will live up to our reputation as one of the world's foremost events and conferencing destinations.

The crucial work performed around the world by the heat and mass transfer community touches lives in ways that most people will never even realise. This "invisible hand" that constantly improves our production lines, our transport systems, our energy production and many other aspects of our daily lives is strengthened by the kind of cooperation and sharing of knowledge that is only possible through events such as this.

In choosing Cape Town and our world-class International Conference Centre for the seventeenth instalment of the "Heat Transfer Olympics", you have certainly given your conference the best possible start. I am told that this event has been a fixture in the calendar of the scientific and engineering community for over 70 years now. I hope that Cape Town 2023 proves to be the best one to date.

But I also hope you find a little time to enjoy Cape Town beyond the conference itself. We have one of the world's best hospitality industries, with hundreds of incredible restaurants and wine producers waiting to show you just why Cape Town is such a highly regarded travel destination. Not to mention the spectacular array of sights and natural scenery, all within a stone's throw of the city. You will see why most visitors return here.

I wish your conference much success, and I hope you have a wonderful stay in Cape Town.

Mr. Geordin Hill-Lewis  
Executive Mayor  
City of Cape Town, South Africa

# ACKNOWLEDGMENTS

## ORGANIZER & HOST

International Conference on Heat Transfer, Fluid Mechanics & Thermodynamics

## UNDER THE AUSPICES OF

The Assembly for International Heat Transfer Conferences

## SUPPORTING & HOST ORGANIZATIONS

South African Institution of Mechanical Engineers (SAIMechE)

International Center for Heat and Mass Transfer

American Society of Thermal and Fluids Engineers

## PROFESSIONAL CONFERENCE ORGANISERS

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# GENERAL INFORMATION

## REGISTRATION, NAME BADGES, TICKETS

The *Registration & Hospitality Desk* is in Building 2 of the Cape Town International Convention Centre, on the level 2 foyer (outside Hall 9 & 10) during the following times:

Sunday, 13 August 2023	13H00 – 19H00
Monday, 14 August 2023	07H30 – 18H00
Tuesday, 15 August 2023	07H30 – 18H00
Wednesday, 16 August 2023	07H30 – 18H00
Thursday, 17 August 2023	07H30 – 19H00
Friday, 18 August 2023	07H30 – 17H00

## ON-SITE REGISTRATION FEES

Delegates registering and making payment onsite will not be permitted to present at the conference, nor will their work appear in the conference proceedings.

- Standard Registration - \$ 900.00
- Student (without paper) - \$ 600.00
- Accompanying Person - \$ 115.00

## NAME BADGE

Each delegate registered for IHTC-17 will receive a name badge at the registration desk. Admission to all conference functions is via the official IHTC-17 badge only. Please always wear your name badge.

- BLUE - General Registrants
- GREEN - Student Registrants
- ORANGE - Keynote Speakers
- PURPLE - AIHTC Members
- RED – ICHMT Members
- PINK – Sponsors & Exhibitors

## WELCOME RECEPTION

Sunday, 13 August 2023, 19H00 - 21H00, Hall 9 on the 2<sup>nd</sup> floor of CTICC 2.

Everybody with a name badge is welcome. Accompanying Persons will require a ticket. A light meal (canapes) will be provided.

## OPENING CEREMONY

Monday, 14 August 2023, 08H30 - 09H00, Hall 10 on the 2<sup>nd</sup> floor of CTICC 2.

Everybody with a name badge is welcome.

### CONFERENCE BANQUET

Thursday, 17 August 2023, 19H00 - 22H00, Hall 9 on 2<sup>nd</sup> floor of CTICC 2.

Everybody with a name badge is welcome. Accompanying Persons will require a ticket.

A substantial meal (plated dinner) will be provided.

### CLOSING CEREMONY

Friday, 18 August 2023, 15H20 - 15H40, Hall 10 on the 2<sup>nd</sup> floor of CTICC 2.

Everybody with a name badge is welcome.

### LUNCHES & COFFEE BREAKS

Lunches and tea/coffee breaks will be served in Hall 9 on the 2<sup>nd</sup> floor of CTICC 2 as follows:

DATE	BREAK 1	LUNCH	BREAK 2
Monday, 14 August 2023	10H40 – 11H00	13H00 – 14H00	14H40 – 15H00
Tuesday, 15 August 2023	10H00 – 10H20	13H00 – 14H00	14H40 – 15H00
Wednesday, 16 August 2023	10H00 – 10H20	12H20 – 13H20	N/A
Thursday, 17 August 2023	10H00 – 10H20	13H00 – 14H00	14H40 – 15H00
Friday, 18 August 2023	10H00 – 10H20	12H20 – 13H20	N/A

### SMOKING

Smoking is strictly prohibited anywhere inside the Cape Town International Convention Centre buildings. Please only smoke in designated smoking areas found outside.

### WIFI

A free, high speed Wi-Fi connection is available throughout CTICC 1 and CTICC 2 for visitors to use. This Wi-Fi is great for emails, internet browsing and social media. There is no password protection.

### CONFERENCE PROCEEDINGS

The full conference proceedings are downloadable on the IHTC-17 website's *PROGRAM* → *PROCEEDINGS* page.

### IHTC DIGITAL LIBRARY (IDL)

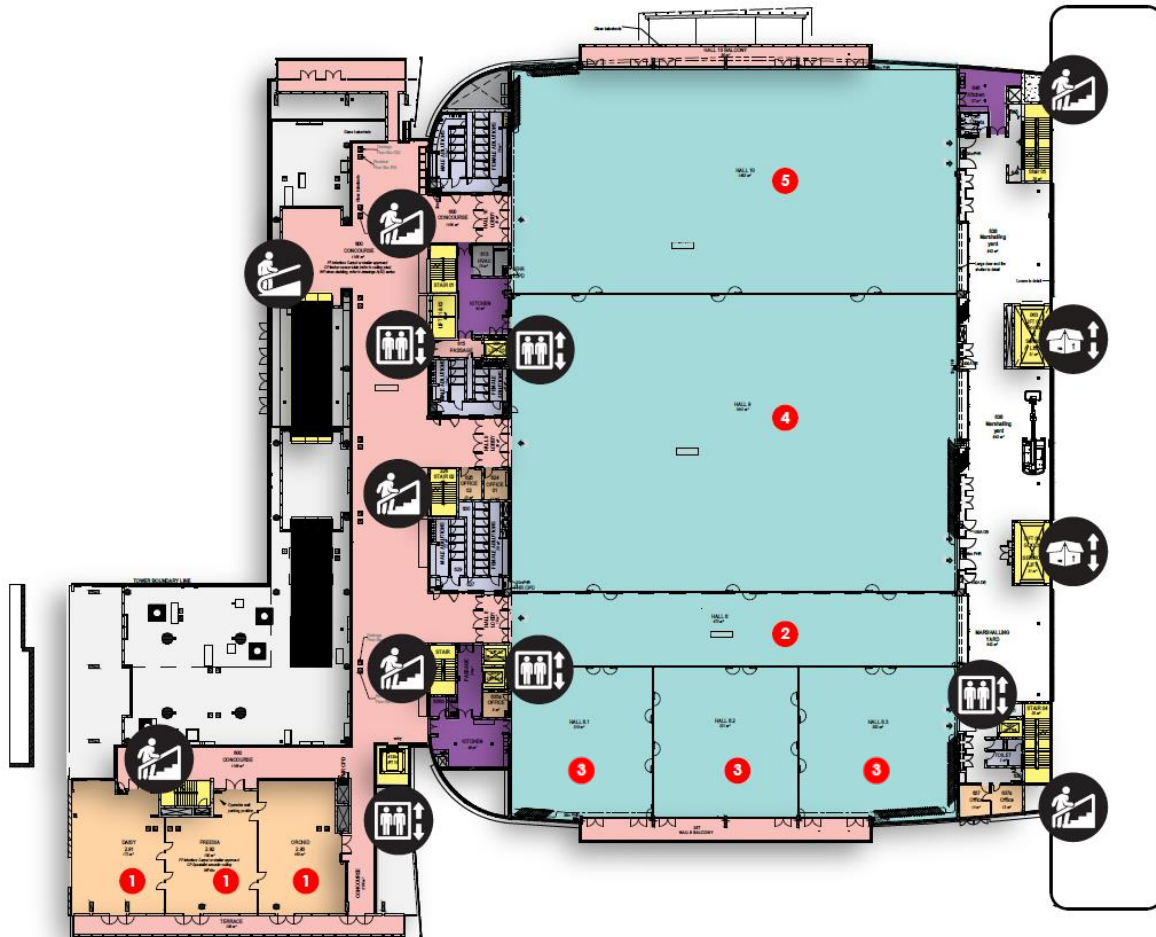
AIHTC and Begell House have agreed to establish an IHTC Digital Library (IDL). The IDL is an online archival library with an interactive web interface and advanced search engine for the use of active researchers and engineers. The library contains past Proceedings of the International Heat Transfer Conferences held under the auspices of the AIHTC and all papers presented at IHTC-17 will be uploaded and included in the IDL. <http://ihtcdigitallibrary.com/>

### IHTC LOGO

A special logo for the IHTC was authorized by the AIHTC on October 16, 2013, and introduced in 2014 to celebrate the conference being held since 1951. The logo offers a metaphorical expression of multi-modal and multi-scale heat transfer phenomena. The center sphere with the small sphere on a ring stands for the sun and the earth, or a molecule with an orbiting electron, while the outer arcs represent flames, thermal conduction, and radiation.

This logo is now used on the conference homepage, conference program, documents and other related items and by the IHTC Digital Library that Begell House has established.

## CTICC 2 FLOOR PLAN – LEVEL 2



- 5. Plenary Venue** – Opening/Closing Ceremonies, Plenary Lectures & Panel Discussions  
Hall 10
- 4. Catering & Exhibition Venue** – Used for Catering & Social Functions  
Hall 9
- 3. Breakaway Venues** – Used for *Keynote Presentations & Poster Sessions*  
Hall 8.1 | Hall 8.2 | Hall 8.3
- 1. Meeting Rooms** – Used for Invite-Only Meetings  
Orchid | Freesia

# SCHEDULE AT A GLANCE

SUNDAY, 13 AUGUST 2023

START	LEVEL 2 FOYER	HALL 9
13H00	REGISTRATION & EXHIBITION SETUP	
14H30		
15H00		
16H00		
17H00		
18H00		
19H00		WELCOME FUNCTION
20H00		
21H00	END OF DAY	

MONDAY, 14 AUGUST 2023

START	HALL 10	HALL 9	HALL 8.1	HALL 8.2	HALL 8.3
08H30	OPENING CEREMONY				
09H00	FOURIER LECTURE				
09H50	LUIKOV MEDAL LECTURE				
10H40		BREAK			
11H00			POSTER 1	POSTER 2	POSTER 3
12H00	PANEL DISCUSSION 1				
13H00		LUNCH			
14H00			KN01	KN02	KN03
14H40		BREAK			
15H00			POSTER 4	POSTER 5	POSTER 6
16H00					
17H00	END OF DAY				

## MEETINGS (BY INVITATION ONLY)

### Begell House Reception

Monday, 14 August 2023 | 18h00 - 21h00 | Venue: Refer to Invitation.

**TUESDAY, 15 AUGUST 2023**

START	HALL 10	HALL 9	HALL 8.1	HALL 8.2	HALL 8.3
08H30	WILLIAM BEGELL MEDAL AWARD LECTURE				
09H20			KN04	KN05	KN06
10H00		BREAK			
10H20			POSTER 7	POSTER 8	POSTER 9
11H20	PANEL DISCUSSION 2				
12H20			KN07	KN08	KN09
13H00		LUNCH			
14H00			KN10	KN11	KN12
14h40		BREAK			
15H00			POSTER 10	POSTER 11	POSTER 12
16H00	PANEL DISCUSSION 3				
17H00	END OF DAY				

MEETINGS (BY INVITATION ONLY)

**ICHMT Scientific Committee & General Assembly Meeting**

Tuesday, 15 August 2023 | 15h30 - 17h00 | Venue: Freesia

**ICHMT Executive Committee Meeting**

Tuesday, 15 August 2023 | 17h30 - 19h00 | Venue: Freesia

**WEDNESDAY, 16 AUGUST 2023**

START	HALL 10	HALL 9	HALL 8.1	HALL 8.2	HALL 8.3
08H30	NUKIYAMA MEMORIAL AWARD LECTURE				
09H20			KN13	KN14	KN15
10H00		BREAK			
10H20			POSTER 13	POSTER 14	POSTER 15
11H20	PANEL DISCUSSION 4				
12H20		LUNCH			
13H20	END OF DAY				

MEETINGS (BY INVITATION ONLY)

**AIHTC Committee Meeting**

Wednesday, 16 August 2023 | 14h00 - 18h00 | Venue: Orchid

**AIHTC-ICHMT Joint Dinner**

Wednesday, 16 August 2023 | 18h30 - 21h00 | Venue: Orchid

**THURSDAY, 17 AUGUST 2023**

START	HALL 10	HALL 9	HALL 8.1	HALL 8.2	HALL 8.3
08H30	AUTSE YOUNG SCIENTIST AWARD LECTURE 1				
09H20			KN16	KN17	KN18
10H00		BREAK			
10H20			POSTER 16	POSTER 17	POSTER 18
11H20	PANEL DISCUSSION 5				
12H20			KN19	KN20	KN21
13H00		LUNCH			
14H00			KN22	KN23	KN24
14H40		BREAK			
15H00			POSTER 19	POSTER 20	POSTER 21
16H00	PANEL DISCUSSION 6				
17H00	BREAK				
19H00	BANQUET & AWARDS DINNER [HALL 9]				
22H00	END OF DAY				

**FRIDAY, 18 AUGUST 2023**

START	HALL 10	HALL 9	HALL 8.1	HALL 8.2	HALL 8.3
08H30	AUTSE YOUNG SCIENTIST AWARD LECTURE 2				
09H20			KN25	KN26	
10H00		BREAK			
10H20			POSTER 22	POSTER 23	POSTER 24
11H20	PANEL DISCUSSION 7				
12H20		LUNCH			
13H20			POSTER 25	POSTER 26	POSTER 27
14H20					
15H20	CLOSING CEREMONY				
15H40	END OF CONFERENCE				

MEETINGS (BY INVITATION ONLY)

**Elsevier Editorial Board Meeting: Applied Thermal Engineering**

Friday, 18 August 2023 | 16h00 - 18h30 | Venue: Freesia

# PLENARY LECTURES

## PLENARY LECTURE AT A GLANCE

Lecture	Presenter	Venue	Date	Time (GMT+2)
Fourier Lecture	Prof. Xing Zhang	Hall 10	Monday, 14 August 2023	09H00 - 09H50
Luikov Medal Award Lecture	Prof. Renato Machado Cotta	Hall 10	Monday, 14 August 2023	09H50 - 10H40
William Begell Medal Award Lecture	Prof. Chang-Ying Zhao	Hall 10	Tuesday, 15 August 2023	08H30 – 09H20
Nukiyama Memorial Award Lecture	Prof. Junichiro Shiomi	Hall 10	Wednesday, 16 August 2023	08H30 – 09H20
AUTSE Young Scientist Award Lecture	Dr. Aoran Fan	Hall 10	Thursday, 17 August 2023	08H30 – 09H20
AUTSE Young Scientist Award Lecture	Dr. Yutaku Kita	Hall 10	Friday, 18 August 2023	08H30 – 09H20

## FOURIER LECTURE

Monday, 14 August 2023 | Hall 10 | 09H00 – 09H50

### NANOSCALE THERMAL MEASUREMENTS -- NEW CHALLENGES AND NEW OPPORTUNITIES

Prof. Xing Zhang

Tsinghua University, Beijing, China



#### Abstract:

Since the end of the 18th century, when Benjamin Thompson Rumford and Humphry Davy proved the theory of thermal dynamics through experiments, experimentation and measurements have become important approaches in thermal science research, especially for new phenomena, new concepts, and new technical challenges. More than 200 years have passed with many significant scientific and technological developments and core engineering problems undergoing a remarkable transformation of scale. Nanotechnology, as an emerging area, has started a new revolution for fabrication, measurement, and manipulation of materials on nanometer scales. This led to great challenges for thermal science research, requiring nanoscale experimentation and measurements. Due to their size and surface effects, nanomaterial properties differ significantly from bulk values with the small sample sizes precluding the use of classical measurement methods. This has made the development of nanoscale measurement methods an urgent issue in heat transfer research with many researchers undertaking fundamental studies.

This Fourier lecture will briefly review the development of nanoscale thermal measurement techniques and use the speaker's research experience to describe in detail several representative nanoscale thermal measurement methods. Contact measurement methods include the original and present T-type methods (proposed in 1998), the H-type method (proposed in 1998), and the microfabricated suspended device method (proposed in 2001). With more than 20 years of development, these three contact measurement methods, which were originally developed to measure the thermophysical properties of carbon nanotubes, have provided many types of data. The T-type method can provide automatic, integrated measurements of nine thermal, electrical and thermoelectric parameters from one sample. The H-type method and the microfabricated suspended device method can

achieve the same goal in different ways. They both use microfabrication to produce integrated H shaped microdevices. Furthermore, the H-type method has high measurement sensitivity and tunable heating and measuring modes that can synchronously measure the electrical and thermal rectification of some in-plane asymmetric monolayer materials and heterostructures. This method has been successfully applied to develop monolayer lateral heterojunctions with both high electrical and thermal rectification ratios, 104 for electrical and 96% for thermal rectification, respectively. Such new heterojunction rectifiers provide new guidance for the thermal design of nanoscale electronic devices.

Furthermore, non-contact methods including transient thermosreflectance method and the Raman spectroscopy method have been explored. The transient thermosreflectance method was proposed in 1983, with the development of femtosecond lasers giving new potential to the method. This method has played an important role in the detection of the thermophysical properties of nanofilms in recent years, especially for ultrafast dynamic characteristics. Raman-based nanoscale thermophysical property measurements have been carried out since 2008 with rapid new developments in the past decade. The Raman method (Dual-wavelength flash Raman, DFR) modulating the heating laser and the probing laser with different wavelengths, has been applied to measure the thermophysical properties of suspended and supported 0-D, 1-D, 2-D, and anisotropic nanomaterials with high spatial and temporal resolution. The Raman method combining modulated pico/femto-second lasers (Energy transport state-resolved Raman, ET-Raman) can be used to analyze phonon heat transport. Since these measurements are based on the variation of the inherent Raman peak of the sample, the Raman method can be extended to many other fields for in-situ, non-contact, and non-destructive measurements. For instance, the DFR method has been used to measure and optimize the temperature and stress distributions in electronic devices, to detect the interfacial characteristics of all-solid-state lithium batteries, and even in life science research.

This lecture shows that nanoscale thermal measurements are not only a challenging heat transfer field but also an opportunity for heat transfer researchers to extend their research across many other disciplines. Ground-breaking work in these fields is expected to rapidly expand and lead to many new and exciting developments.

## 2022 LUIKOV MEDAL AWARD LECTURE

Monday, 14 August 2023 | Hall 10 | 09H50 – 10H40

HYBRID NUMERICAL-ANALYTICAL APPROACH IN TRANSPORT PHENOMENA: BRIDGING THE BEST OF BOTH WORLDS

Prof. Renato Machado Cotta

Federal University of Rio de Janeiro – POLI & COPPE, UFRJ | General Directorate of Nuclear & Technological Development, Brazilian Navy, Rio de Janeiro, Brazil



### Abstract:

Since the publication of J.B. Fourier's treatise "Théorie Analytique de la Chaleur" in 1822, heat transfer fundamentals evolved along the 19th and first half of the 20th centuries, closely linked to the advancement of analytical mathematical methods for partial differential equations, forming the basis of the modern mathematical physics field. With a considerable time shift, an article published at the Transactions of the Royal Society London by L.F. Richardson in 1911, introduced the use of finite differences in solving differential equations, but it wasn't until the advent of digital computers that this and other numerical methods became more usable and useful, accelerating developments in engineering sciences in general, and more specifically in heat and fluid flow, especially along the second half of the 20th century till the present days. Such disruptive developments have occurred within different moments in time and progressed within different communities and application niches. Along these two hundred years, a lot has been discussed and described in terms of relative merits and advantages of each class of approach, analytical or numerical, for convection-diffusion problems, but there were only a few attempts to merge and benefit the advantages of the two types of mathematical tool. As an example of such a hybrid method development, in 1994, at the Brighton, UK, 10th IHTC Conference, the invited keynote lecture entitled "The Integral Transform Method in Computational Heat and Fluid Flow", presented and reviewed the so called Generalized Integral Transform Technique (GIT), as a flexibilization of the classical integral transform method to deal with a priori non-transformable problems, which combines analytical eigenfunction expansions with the numerical solution of a transformed coupled system of ordinary differential equations. This lecture provides an overview of such hybrid numerical-analytical developments along these last thirty years since IHTC-10, with particular emphasis on fundamental nonlinear problems and applications in different engineering disciplines. New perspectives for future developments are also briefly discussed.

**WILLIAM BEGELL MEDAL AWARD LECTURE**  
**Tuesday, 15 August 2023 | Hall 10 | 08H30 – 09H20**

MICRO/NANOSCALE THERMAL RADIATION: FUNDAMENTALS AND APPLICATIONS ABSTRACT

Prof. Chang-Ying Zhao  
Shanghai Jiao Tong University, Shanghai, China



**Abstract:**

Due to the rapid development of nanofabrication and characterization technologies, the study of micro/nanoscale thermal radiation has been growing very fast in the past decade. It has not only led to a renewed fundamental understanding of the interaction between thermal radiation and matter, but also provided a versatile platform for tailoring thermal radiative properties in a variety of aspects like amplitude, phase or polarization, offering great opportunities for emerging technologies of energy conversion and thermal management. Beginning with an introduction of basic theories of micro/nanoscale thermal radiation, this lecture will first elaborate on the mechanisms and manipulation methods of micro/nanoscale thermal radiation from two basic perspectives, that is, phase control and wave vector control. Based on these fundamental principles, a series of metamaterial devices for energy applications including near-field thermal radiation device, colorful radiative coolers, thermophotovoltaic emitters, nonreciprocal thermal emitters/absorbers, etc. will also be discussed in this lecture. Finally, a brief outlook on the development prospects of micro/nanoscale thermal radiation will be given.

## NUKIYAMA MEMORIAL AWARD LECTURE

Wednesday, 16 August 2023 | Hall 10 | 08H30 – 09H20

### EXPLORING THERMAL FUNCTIONAL MATERIALS THROUGH MASSIVE PARAMETER-SPACE SEARCH

Prof. Junichiro Shiomi  
University of Tokyo, Tokyo, Japan



#### Abstract:

Over the last decades, a great advance has been made in the development of thermal function material through nanostructuring. For lattice heat conduction, nanostructures with length scale comparative to or smaller than the characteristic length of phonon transport can greatly reduce thermal conductivity, which is useful for thermoelectrics and thermal insulators. When considering phonon as a particle, the characteristic length is the intrinsic mean free path of incoherent particles collision, and extrinsic collision with surfaces and interfaces of nanostructure shortens the effective mean free path. On the other hand, when considering phonon as a wave, the characteristic length is the coherence length of phonon wave, and interfaces of nanostructure, when their roughness is smaller than the phonon wavelength, can give rise to interference and impede propagation of phonon. These effects of nanostructure on phonon transport clearly depend on the frequency, wavevector, and polarization of phonon, leading to spectral controllability of heat conduction. For thermal radiation, the picture is less complicated because its wavelength and coherence length are much larger, and coherent and spectral control of photon transport can be realized by larger structures. Whether it is lattice heat conduction or thermal radiation, nanostructuring massively broadens the structure degrees-of-freedom, and the challenge is to identify the optimal nanostructure to maximize the figure of merit (FoM) of interest. This is where materials informatics (MI), which is to develop or study materials with an aid of informatics or machine learning, becomes useful. Use of MI for heat transfer and thermal functional materials started later than other fields but now there are growing number of reports showing good compatibility. A typical approach is to train a black box model that relates basic descriptors (structure, composition, etc) and FoM (target properties) and predict or design a material with largest FoM. At Thermal Energy Engineering Lab at University of Tokyo, together with the collaborators, we have been working on MI for heat transfer since 2015. One of the initial works was to design binary multilayered nanostructure to minimize or maximize thermal conductance by coupling thermal transport calculation and Bayesian optimization, which showed excellent efficiency. Later, the search space has been greatly expanded by utilizing quantum annealing. We have applied the methodology to computationally design and experimentally realize aperiodic superlattice that optimally

impedes coherent thermal transport and multilayer metamaterial with wavelength-selective thermal radiation. Recently this has evolved to autonomous MI experiments. In the talk, I will introduce these progresses and discuss the capability of MI for heat transfer and remaining challenges for further development.

**AUTSE YOUNG SCIENTIST AWARD LECTURE**  
**Thursday, 17 August 2023 | Hall 10 | 08H30 – 09H20**

**IN-SITU MULTI-PHYSICAL FIELD MEASUREMENT AND MULTIDISCIPLINARY OPTIMIZATION  
FOR POWER DEVICES**

Dr. Aoran Fan  
Tsinghua University, Beijing, China



**Abstract:**

Power devices are the core components of power equipment and electronic equipment. In order to improve energy conversion efficiency and information transmission capacity, power devices need high power and operate at a higher frequency, significantly increasing heat generation. Thus, the cooling problem has become a critical bottleneck to be broken through, while the most common solution is to optimize the device design. However, effective optimization is based on a precise evaluation through the design parameters of the device and the physical properties of the semiconductor, which will be influenced by multiple physical fields and must be accurately determined. Unfortunately, the physical field inside the power device is complex and its performance is controlled by many factors. The optimization considering only one factor is difficult to effectively improve the device performance. Therefore, it is necessary to develop an overall optimization scheme considering multi-disciplines, multi-factors, and multi-performance, and the in-situ integrated characterization of the multiple physical fields in the device has become the premise of the overall optimization.

However, the in-situ integrated measurement of multiple physical fields is still challenging. Raman spectroscopy method is the most promising approach to in-situ simultaneously obtaining multiple physical fields, while high-precision decoupling of the influence of multiple physical parameters, such as temperature and stress, is still a difficult problem. The spatial and temporal resolution of the traditional Raman method also limits its application in miniaturized, integrated, and high-frequency power devices. To solve this problem, we built a temperature stress coupling model, deduced the relationship between the measured effective Raman temperature coefficient with the structural constraints in the devices, and determined the influence proportion of temperature and thermal stress in a single Raman peak shift when the local temperature rises. Based on the above analysis, we developed a method to realize the integrated measurement of multiple physical fields with only one

Raman peak position, which significantly decreases the measurement uncertainty compared with the previous multi-peak decoupling method by avoiding using the Raman peaks with low signal-to-noise. On this basis, we developed a Gaussian inversion algorithm to increase the spatial resolution of Raman spectral measurements from the optical diffraction limit to 100 nm. Furthermore, we propose an electro-optical synchronous modulation flash measurement method, to determine the transient fluctuation of the physical quantity in the device with 100 ps temporal resolution. It was found that the transient temperature difference in one period of the amplitude modulation device (3V/10V, 0.1kHz) can reach 20K, and the frequency varies from 0.1 kHz to 1000 kHz can lead to a temperature rise of 160K. The transient measurement results of devices under different heat dissipation conditions show that the relative transient temperature difference in one period can be regarded as a new index to evaluate the heat dissipation performance of devices.

Based on the in-situ integrated characterization method, we proposed the comprehensive performance evaluation and multidisciplinary integration optimization principle of power devices. The coupling influences of multiple physical fields were considered in the evaluation and optimization. Through in-situ stress measurement, we evaluated the possible burnout position of a GaN-based HEMT device, which is not a central position but a tensile stress concentration point in the boundary, and this evaluation result is completely consistent with the burnout failure test result. Optimization simulation analysis shows that, by regulating the normal (1/10 to 10 times) and in-plane stresses (-3% to 3%), the interface thermal resistance and thermal conductivity of the semiconductor layer in GaN-based devices will significantly change, and the temperature variation of the device hot spot can decrease 50 K. This result strongly shows the necessity and importance of multidisciplinary integration optimization.

**AUTSE YOUNG SCIENTIST AWARD LECTURE**  
**Friday, 18 August 2023 | Hall 10 | 08H30 – 09H20**

PREDICTING SPRAY QUENCHING: PROGRESS AND CHALLENGES

Dr. Yutaku Kita  
King's College London, London, United Kingdom



**Abstract:**

Spray cooling offers an exceptional cooling performance due to the continuous impact of cold droplets and evaporation. This technique has been used in steel industry and emergency cooling for nuclear power plants, while other potential applications include thermal management for electronics, lasers and motors. However, some challenges remain — due to the complex nature of spray cooling, the prediction of heat transfer characteristics remains highly challenging. More specifically, the onset of quench i.e. the transition of boiling regimes (from film boiling to nucleate boiling) has been a long-standing question. In this talk, I will present some of our work on spray cooling and droplet impingement to better understand the mechanism of quenching and will attempt to pose remaining problems to further investigate.

# PANEL DISCUSSIONS

## PANEL DISCUSSIONS AT A GLANCE

Panel Discussion	Venue	Date	Time (GMT+2)
MULTIPHASE FLOW FOR ENERGY SYSTEMS	Hall 10	Monday, 14 August 2023	12H00 - 13H00
TOWARDS THE NEXT-LEVEL THERMAL ENGINEERING OPTIMIZATION	Hall 10	Tuesday, 15 August 2023	11H20 - 12H20
GREEN TRANSFORMATION (GX) FOR CARBON NEUTRALITY	Hall 10	Tuesday, 15 August 2023	16H00 – 17H00
AI APPLICATIONS TO HEAT TRANSFER	Hall 10	Wednesday, 16 August 2023	11H20 – 12H20
BATTERY THERMAL MANAGEMENT - RECENT TRENDS AND FUTURE CHALLENGES	Hall 10	Thursday, 17 August 2023	11H20 – 12H20
THERMAL MANAGEMENT	Hall 10	Thursday, 17 August 2023	16H00 – 17H00
HEAT AND MASS TRANSFER NEEDS IN NEXT GENERATION SOLAR ENERGY	Hall 10	Friday, 18 August 2023	11H20 - 12H20

## PANEL DISCUSSION 1 | MULTIPHASE FLOW FOR ENERGY SYSTEMS

Monday, 14 August 2023 | Hall 10 | 12H00 – 13H00



Moderator: Prof. Angela O. Nieckele, Pontifical Catholic University of Rio de Janeiro, Brazil



Prof. Gherhardt Ribatski, University of São Paulo, Brazil



Prof. Peter Stephan, Technical University of Darmstadt, Germany



Prof Marco Marengo, University of Pavia, Italy



Prof Lounès Tadrist, Aix-Marseille Université, France

Multiphase flow is present in a large number of power generation industries such as nuclear, solar, and oil/gas. With regard to heat transfer applications in the presence of multiphase flows, the spectrum is very large, from systems such as refrigeration, heat pipes and transport (automotive, aeronautical, marine) to environment. Understanding all aspects related to mass, momentum and energy transfer in the presence of flows with dispersed or continuous phases, liquid-gas, liquid-solid, gas-solid, flows in porous media and boiling phenomena are essential for efficient energy generation.

For years to come, traditional energy will still be used to support investment in new renewable energy systems. Therefore, performance evaluation of multiphase phase flow in both traditional and renewable energy applications is key to making these systems more efficient and less expensive. To this end, accurate flow predictions are necessary to improve equipment design and operation.

Experimental data and experimental techniques developed for challenging conditions can aid in the validation and development of accurate and robust numerical models.

In this panel, expert researchers in the multiphase field will discuss both experimental and numerical techniques developed to analyze multiphase-phase flow, providing an overview of the state of the art for multiphase flow applications.

**PANEL DISCUSSION 2 | TOWARDS THE NEXT-LEVEL THERMAL ENGINEERING  
OPTIMIZATION**

**Tuesday, 15 August 2023 | Hall 10 | 11H20 – 12H20**



Moderator: Prof. Qun Chen, Tsinghua University, China



Prof. Yuying Yan, University of Nottingham, UK



Prof. Min Soo KIM, Seoul National University, South Korea



Prof. Gerardo Maria Mauro, Università degli Studi del Sannio, Italy



Prof. Sarit K. Das, Indian Institute of Technology Madras, India

Thermal engineering has been and will still be one of the most important subjects to human being. The challenge of climate change and the ambitious carbon neutrality vision further underlines its optimization. The community of this field has flourished unprecedentedly and been producing significant studies that have contributed much not only to our fundamental understanding of thermal science but also to cutting-edge applications.

The two wings of thermal engineering optimization, thermodynamics and heat transfer, tightly twine in practice, as heat-work conversion and heat transfer processes are always coupled. However, the community have been split and debating on the methodology for a long time. Some researchers prefer the nonequilibrium thermodynamics for all cases universally, while some other researchers are more cautious and open to other possible methodologies. We organize this panel discussion to further exchange ideas, promote understanding on this topic in the community, and to address important issues critical in the field to help the development of a sustainable future.

The panelists will first give a very brief talk on a specific topic based on his area which will present the state-of-the-art of our research, existing problems and challenges, and future works. What follows is a discussion among the panelists on several current topics. The third part will be a discussion among the panelists and audiences. We welcome all participants in this field to the panel and look forward discussions. We hope that this panel will inspire new ideas and lead to innovations for all researchers in this field.

**PANEL DISCUSSION 3 | GREEN TRANSFORMATION (GX) FOR CARBON NEUTRALITY**  
**Tuesday, 15 August 2023 | Hall 10 | 16H00 – 17H00**



Moderator: Prof. Yukitaka Kato, Tokyo Institute of Technology, Japan



Prof. Yoichi Murakami, Tokyo Institute of Technology, Japan



Prof. Koji Miyazaki, Kyushu University, Japan



Dr. Sylvie Lorente, Villanova University, USA



Prof. Min Soo Kim, Seoul National University, South Korea



Prof. Jaap Hoffmann, Stellenbosch University, South Africa

Green Transformation (GX) is defined as the direction in the further development of the world for establishment of Carbon Neutrality (CN). GX involves the development of green technologies and the creation of legal regulations for saving energy and reducing the emissions of greenhouse gases.

GX based on heat transfer technologies could be contribute on energy transfer, storage and transformation from primary energy of zero-carbon emission energy to consumption sides for establishment of CN and Climate Change Mitigation. This session aims to share the possibility of GX technologies including zero-carbon energies, energy transfer, electric and thermal energy storage, energy carrier and CO<sub>2</sub> capture and managements. Although we might have different standpoints on GX each other, it is nice if we could discuss our technological potentials for GX for CN and climate change mitigation.

## PANEL DISCUSSION 4 | AI APPLICATIONS TO HEAT TRANSFER

Wednesday, 16 August 2023 | Hall 10 | 11H20 – 12H00



Moderator: Dr. Francesco Coletti, Hexxcell Ltd. & Brunel University London, United Kingdom



Prof. Srinivas Garimella, Georgia Institute of Technology, United States of America



Prof. Matteo Bucci, Massachusetts Institute of Technology, United States of America



Prof. Vikrant C. Aute, University of Maryland, United States of America



Prof. Simone Mancin, University of Padova, Italy

This panel discussion aims to explore the current and potential applications of artificial intelligence (AI) in heat transfer. Experts in the field will share their experiences and insights on how AI is being used to enhance the understanding of heat transfer processes, improve their efficiency, and address the challenges faced by the industry. The discussion will cover the use of AI in data regression, simulation, optimization, control, predictive maintenance and anomaly detection of heat transfer systems and the future potential of AI in this field. The panellists will provide an overview of the state of the field, the advancements made so far, and the opportunities and challenges that lie ahead. This discussion will be of interest to engineers, researchers, and industry professionals working in the field of heat transfer and those interested in learning about the role of AI in this area.

**PANEL DISCUSSION 5 | BATTERY THERMAL MANAGEMENT - RECENT TRENDS AND FUTURE CHALLENGES**

**Thursday, 17 August 2023 | Hall 10 | 11H20 – 12H20**



Moderator: Prof. Chakravarthy Balaji, Indian Institute of Technology Madras, India



Prof. Arvind Pattamatta, Indian Institute of Technology Madras, India



Prof. Yuying Yan, University of Nottingham, UK



Prof. Xiaoze Du, Lanzhou University, China



Prof. June Kee Min, Pusan National University, South Korea



Dr. Srikanth Rangarajan, Binghamton University, USA

There is a broad consensus that electrification holds the key to realizing a decarbonizing society. Even so, the increasing power densification in battery systems (high C-Rates) necessitates the demonstration and scale-up of innovative and robust thermal management technologies. Most electric vehicle operating environments are transient, thereby demanding the need to have a paradigm shift in our approach to thermal management. This panel discussion will focus on the recent trends and future challenges in battery thermal management. More specifically, the discussion aims at highlighting the latest developments in battery thermal management, including new materials, form factors, advances in modeling, measurements and simulation, machine learning-assisted optimization and constraints, In situ parameter estimation techniques, and emerging regulatory and safety issues. The panel will also highlight the critical challenges in battery thermal management, including managing heat generation, distribution, and dissipation for optimal battery performance, ranging from cell level to system level.

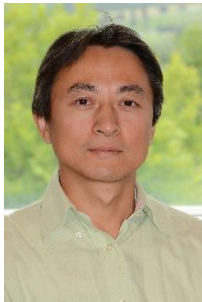
Each panelist will present a succinct summary of their research findings to date. Furthermore, the panelists will discuss the potential of emerging technologies, such as solid-state batteries, and their impact on battery thermal management. In addition to gathering insights from individual panelists, the discussion seeks to collaboratively generate ideas for future road mapping and advancing sustainable battery thermal management technologies. As the demand for electric vehicles and renewable energy storage systems grows, ensuring the safety of these systems is of utmost importance. Therefore, panelists will also provide insights into the latest regulatory developments and safety standards in thermal management perspectives that are being developed to ensure the safe and reliable operation of battery systems. The panel will allocate generous time for audience participation and discussion.

Finally, the discussion will be concluded by the session chair highlighting the key points of the discussion and action items for developing sustainable battery thermal management systems.

**PANEL DISCUSSION 6 | THERMAL MANAGEMENT**  
**Thursday, 17 August 2023 | Hall 10 | 16H00 – 17H00**



Moderator: Prof. Dominic Groulx, Dalhousie University, Canada



Dr. Sunny Ri Li, University of British Columbia, Canada



Prof. Marco Marengo, Universita di Pavia, Italy & University of Brighton, UK



Dr. Yuwen Zhang, University of Missouri, USA



Prof. Jader R. Barbosa Jr, Federal University of Santa Catarina, Brazil



Prof. Jungho Lee, Ajou University, South Korea

Applications of heat transfer and thermodynamics are numerous, but were used early on for thermal management, being for human comfort or making sure industrial processes would operate at their design temperatures. The continuing transformation of our society towards electrified and digital technologies is allowed partly by the cost-effective, environmentally friendly and ever-improving thermal management solutions.

From ensuring our smartphones are not overheating in our hands, new electric vehicles can draw power from their batteries and recharge those batteries rapidly without reaching dangerous temperatures, to keeping the ever-increasing number of data farms cool and making sure the electronics on space probes survives to extremely cold or extremely warm environment, thermal management is now central to our technologies driven by heat generating electronics. Heat transfer is fundamental to these thermal management problems. However, these thermal management problems also require complete engineering solutions, taken into account, for example, system integration (where can the thermal management solution be added in an 8-mm thin tablet?), acoustic issues (how loud can a fan be, or should be, in a laptop or desktop computer?), energetic (can data farm be cooled using ambient “free” energy?), and as always, cost (typical thermal management solutions in laptop today only cost a few dollars to produce).

Moore’s law, the doubling of transistors per chip roughly every two years, or in heat transfer terms, the ever increasing density of heat generating devices in electronics systems will require more efficient and/or novel thermal management strategies moving forward. More research is being done high heat flux devices thermal management, for example looking at immersed cooling with dielectric liquids, engineering of higher thermal conductivity materials, non-traditional shape of heat sinks through additive manufacturing, or optimization of thermal management system based on duty cycle usage.

This panel, composed of active researchers in the field of thermal management, will provide an opportunity to get an overview of current research work done in the field, and engage in a discussion, as a community, on various questions/problematics related to thermal management.

## PANEL DISCUSSION 7 | HEAT AND MASS TRANSFER NEEDS IN NEXT GENERATION SOLAR ENERGY

Friday, 18 August 2023 | Hall 10 | 11H20 – 12H20



Moderator: Dr. Todd Otanicar



Dr. Leyla Amiri, Université de Sherbrooke, Canada



Dr. Liu Dong, Nanjing University of Science and Technology, China



Dr. Tariq Shamim, Northern Illinois University, United States of America



Dr. Prabal Talukdar, Indian Institute of Technology Delhi, India



Dr. Tiejun "TJ" Zhang, Khalifa University of Science and Technology, United Arab Emirates

Solar energy is one of the fastest growing sustainable energy generation technologies worldwide. Solar energy can produce electricity directly using photovoltaics, or be converted into thermal energy. In either case, heat transfer plays a critical role to system performance and life. Solar thermal energy encompasses processes from solar hot water heating all the way through high temperature reactions for solar fuel production.

Because of the wide-ranging operational temperatures and complex processes in solar energy, most areas of heat transfer research have impact on solar energy efficiency. Radiation heat transfer is critical for high temperature solar thermal energy, and the production of receivers for thermochemical reactors. Convection and conduction heat transfer is critical in energy storage applications, heat exchangers, and solar receiver design. In addition, solar energy is highly transient in nature and is now seeing many applications with advanced materials, porous media, and chemical reactions resulting in a need for complex heat transfer understanding.

This panel includes the leading researchers across many topics in solar energy, who will gather to discuss the technical challenges in next generation solar thermal energy and how heat transfer can be used to help solve some of these problems. The discussions will focus on next generation materials, enhancing thermal transport, understanding high temperature properties of materials, and cutting-edge solar energy systems.

# KEYNOTE LECTURES

## KEYNOTE LECTURES AT A GLANCE

Keynote	Presenter	Venue	Date	Time (GMT+2)
KN01	Prof. Sergey Alekseenko	Hall 8.1	Monday, 14 August 2023	14H00 - 14h40
KN02	Prof. Aleksey Nenarokomov	Hall 8.2	Monday, 14 August 2023	14H00 - 14h40
KN03	Prof. Han Young Yoon	Hall 8.3	Monday, 14 August 2023	14H00 - 14h40
KN04	Prof. Josua Meyer	Hall 8.1	Tuesday, 15 August 2023	09H20 - 10H00
KN05	Prof. Jungho Lee	Hall 8.2	Tuesday, 15 August 2023	09H20 - 10H00
KN06	Prof. Gherhardt Ribatski	Hall 8.3	Tuesday, 15 August 2023	09H20 - 10H00
KN07	Prof. Christos Markides	Hall 8.1	Tuesday, 15 August 2023	12H20 - 13H00
KN08	Prof. Jader R Barbosa Jr.	Hall 8.2	Tuesday, 15 August 2023	12H20 - 13H00
KN09	Prof. Kyle Daun	Hall 8.3	Tuesday, 15 August 2023	12H20 - 13H00
KN10	Prof. Sanjeev Chandra	Hall 8.1	Tuesday, 15 August 2023	14H00 - 14h40
KN11	Prof. Guillaume Castanet	Hall 8.2	Tuesday, 15 August 2023	14H00 - 14h40
KN12	Prof. Sebastian Volz	Hall 8.3	Tuesday, 15 August 2023	14H00 - 14h40
KN13	Dr. Benjamin Dietrich	Hall 8.1	Wednesday, 16 August 2023	09H20 - 10H00
KN14	Prof. Shuisheng He	Hall 8.2	Wednesday, 16 August 2023	09H20 - 10H00
KN15	Prof. Wilko Rohlf	Hall 8.3	Wednesday, 16 August 2023	09H20 - 10H00
KN16	Prof. Gary Rosengarten	Hall 8.1	Thursday, 17 August 2023	09H20 - 10H00
KN17	Prof. Hosei Nagano	Hall 8.2	Thursday, 17 August 2023	09H20 - 10H00
KN18	Prof. Yukitaka Kato	Hall 8.3	Thursday, 17 August 2023	09H20 - 10H00
KN19	Dr. Lena Schnabel	Hall 8.1	Thursday, 17 August 2023	12H20 - 13H00
KN20	Prof. Sandra Boetcher	Hall 8.2	Thursday, 17 August 2023	12H20 - 13H00
KN21	Prof. Sylvie Lorente	Hall 8.3	Thursday, 17 August 2023	12H20 - 13H00
KN22	Prof. Matteo Fasano	Hall 8.1	Thursday, 17 August 2023	14H00 - 14h40
KN23	Prof. Xuehu Ma	Hall 8.2	Thursday, 17 August 2023	14H00 - 14h40
KN24	Prof. Qiuwang Wang	Hall 8.3	Thursday, 17 August 2023	14H00 - 14h40
KN25	Prof. Mohsen Sharifpur	Hall 8.1	Friday, 18 August 2023	09H20 - 10H00
KN26	Prof. Chakravarthy Balaji	Hall 8.2	Friday, 18 August 2023	09H20 - 10H00

## KEYNOTE KN01

Monday, 14 August 2023 | Hall 8.1 | 14H00 – 14H40

WAVES AND RIVULET FORMATION IN ISOTHERMAL AND HEATED FALLING LIQUID FILMS



Prof. Sergey Alekseenko

Kutateladze Institute of Thermophysics, Novosibirsk, Russia

The flow of a thin liquid layer over a solid surface is realized in various technological equipment for the intensification of heat and mass transfer processes. A flowing layer of liquid bounded by contact lines is called a rivulet. In the isothermal case, rivulet-like flows can be observed as a sequence of solitary waves or, for example, when a liquid layer flows down the lower surface of an inclined tube. In the case of a liquid film flowing on a heated wall, the formation of rivulets occurs due to the Marangoni instability. An analysis of the literature shows that many works have been published on the Marangoni instability and the formation of rivulets, mainly for small values of the Reynolds number and for local heat source. The rivulet flow is unstable, as a result of which nonlinear three-dimensional waves develop, significantly affecting the processes of heat transfer. However, the description of nonlinear wave formation in rivulets is practically absent in the literature. The purpose of the work is formulated as follows:

- Theoretical description of the formation of rivulet structures in uniformly and locally heated vertically falling liquid films due to thermocapillary instability at moderate Reynolds numbers.
- Theoretical description of the nonlinear instability of rivulets falling down a vertical plate and an inclined cylinder.

For the theoretical description of the dynamics of a non-isothermal flowing film, the equations of the Integral Boundary Layer (IBL) model modified taking into account the thermocapillary effect are applied. The formation of rivulets in the heated film occurs under the action of tangential stress due to the temperature gradient of the interfacial surface in the transverse direction. A linear analysis of the stability of the heated film with respect to disturbances in the direction transverse to the flow is carried out and a spatial growth rate of these disturbances is obtained. A small transverse perturbation with a given wavelength evolves into a three-dimensional rivulet-like structure. The formation of a three-dimensional stationary rivulet-like structure in a uniformly heated film, as well as in a locally heated film, is simulated numerically.

Numerical simulation of linear and nonlinear three-dimensional excited waves in a rectilinear rivulet flowing down a vertical plate is carried out. The Kapitsa-Shkadov model is used to describe the rivulet wave flow. In numerical calculations, the characteristics of linear and nonlinear regular waves are obtained depending on the forcing frequency at different values of the Reynolds number and the wetting angle. The results of calculations are compared with the available experimental data. The comparison showed that the model used as a whole adequately describes the shape of the wave surface of the rivulet. A semi-analytical model has also been developed for the study of nonlinear waves in a single rectilinear rivulet.

Nonlinear wave modes of rivulet flow are also investigated for a rivulet falling down the lower surface of an inclined cylinder. In this case, the processes occurring during the liquefaction of natural gas are modeled. The research was done within the framework of two differently posed problems, namely, the problems of stationary traveling waves with a given wavelength and the problems of spatial development of excited waves with a given frequency. The presence of waves of two different families was revealed. The results of the calculations are in good agreement with the experimental data.

The results obtained make it possible to understand and predict the processes occurring in such film apparatuses as contact heat exchangers, distillers, absorbers, natural gas liquefiers, etc.

## KEYNOTE KN02

Monday, 14 August 2023 | Hall 8.2 | 14H00 – 14H40

### INVERSE HEAT TRANSFER PROBLEMS AND ITS APPLICATION FOR TESTING OF AEROSPACE STRUCTURES



Prof. Aleksey V. Nenarokomov

National Research University, Moscow, Russia

Research of the Sun, planets and small bodies of the Solar System with the help of automatic interplanetary probes and descent vehicles is one of the priority areas of international fundamental space research. Modern space technology is characterized by structures operating under conditions of intense, often extreme, thermal influences. The general trend in the development of technology is associated with an increase in the number of critical heat-loaded technical objects, with a tightening of the conditions for their thermal loading with a simultaneous increase in reliability and resource and a decrease in material consumption. For spacecraft and planet probes, the maintenance of thermal conditions is one of the most important task of the design, which determines the main structure solutions. The characteristic features of modern heat-loaded structures of space technology are nonstationarity, nonlinearity, multidimensionality and the conjugate nature of heat and mass transfer processes. These features limit the possibility of using many traditional computational and experimental research methods. Thermal Protection Systems (TPS) of re-entry vehicles and Thermal Control Systems (TCS) of spacecraft function under significant thermal loads, therefore, it must be optimally designed both in terms of technology and in terms of mass characteristics. The development of TPS and TCS is a complex scientific and technical problem, since the thermal regime of a spacecraft determines the reliability of the structure and onboard systems and significantly affects the success of the entire scientific mission. Already at the initial design stage, it is necessary to solve a set of problems associated with stringent requirements to minimize their weight costs of. The design of such systems involves the widespread use of methods of mathematical modeling. However, mathematical modeling is impossible without reliable information about the characteristics (properties) of the analyzed materials and heat transfer processes. In most practical cases, direct measurement of the thermal and radiative properties of materials (especially of complex composition) is impossible. The only way to overcome these difficulties is indirect measurements. A mathematically similar approach is usually formulated as a solution to the inverse problem: by direct measurements of the state of the system (in particular, temperature), determine the properties of the analyzed system, for example, the thermal and radiative, characteristics of materials, heat transfer coefficients etc, Violation of causal relationships in the formulation of such problems leads to their ill-posedness in the mathematical sense (i.e., the lack of existence and / or uniqueness and / or stability of the solution). Therefore, to solve such problems, special methods are being developed, usually called regularizing ones. The aim of this work is to develop a set of experimental and mathematical means of a system for identifying the mathematical models of Heat Transfer in Thermal Protection of re-entry vehicles and Thermal Control Systems of spacecraft. And a new technique of thermal analysis of aerospace structure being developed is a combination of sufficiently accurate measurements and ultimately correct mathematical treatment of experimental data based on the theory of inverse problems.

### KEYNOTE KN03

Monday, 14 August 2023 | Hall 8.3 | 14H00 – 14H40

MULTI-SCALE TWO-PHASE FLOW SIMULATION FOR NUCLEAR REACTOR SAFETY



Prof. Han Young Yoon

Korea Atomic Energy Research Institute, Daejeon, Korea

Reliable analysis models are crucial for the prediction of a wide range of hypothetical accident scenarios of nuclear reactors. However, an accurate simulation of a nuclear reactor transient is very challenging since it involves a large number of heat transfer models accompanied with complicated gas-liquid two-phase flows appearing in many different flow patterns under various operating and accident conditions. For example, the system pressure falls from 150 bars to the atmospheric pressure within a minute following a loss of coolant accident of a pressurized water reactor (PWR), resulting a dramatic phase change. Gas-liquid interface heat transfer plays an important role to determine the phase change rate. When the reactor coolant is exhausted, the fuel rod is heated up to over 1000 degrees Celsius until it is cooled down by a cold water injected by a safety system. Relevant wall heat transfer models for the two-phase flows are very important to secure the integrity of a fuel rod exposed to over-heating. Furthermore, the nuclear reactor system is very big and complicated. The reactor vessel is about 10 meters in height and having around 50 thousand fuel rods for a typical PWR. Thus, the conventional analysis model of a nuclear reactor usually adopted simplified 1-dimensional (1D) models. Recently, with the advances in high performance computers (HPC), more advanced model and simulation technology is being applied for the nuclear reactor performance and safety analysis.

As an advanced model and simulation technology, a multi-scale and multi-physics simulation method is presented for a high-fidelity simulation of the nuclear reactor. In the multi-scale analysis of nuclear reactors, the length scales are usually defined as local ( $\sim 10^{-3}$  m), component ( $\sim 10^{-1}$  m), and system ( $\sim 100$  m) scales, where relevant physical models for each analysis scale need to be developed. The multi-scale simulation can be a separate or a simultaneous calculation. In a separate calculation, the simulation result of the fine scale code is used to develop a physical model of the coarse scale code. For the simultaneous multi-scale calculation, a 3-dimensional (3D) high-resolution two-phase flow analysis code was developed for the nuclear reactor application and it was coupled with a 1D nuclear thermal hydraulics code for a multi-scale simulation of the whole nuclear reactor system.

The reactor vessel which includes all the fuel rods are resolved with the 3D simulation and the remaining systems such as the coolant piping and the steam generator are calculated using the 1D analysis code. Different physical models are applied for the 3D refined and the 1D simplified codes. For instance, for the condensate heat transfer at a wall, a boundary layer resolved model and a lumped parameter model are applied for the 3D and 1D calculation domains, respectively.

Nuclear reactor simulation also involves different physics such as the neutron kinetics for the reactor core power generation, the fuel structure mechanics for the heat transfer from the fuel rod to the coolant, and the thermal hydraulics for the reactor coolant flow. Simultaneous multi-physics simulation is available with the advanced HPC, and this can help greatly reduce the prediction uncertainty. Practical application of the multi-physics simulation to the nuclear reactor safety analysis will be demonstrated and the benefit of this simulation is discussed.

Special focus will be given to the limitation and prospect of the heat transfer models important for the nuclear reactor application. Recent thermal hydraulics issues will be also introduced related to the development of new advanced nuclear reactors.

## KEYNOTE KN04

Tuesday, 15 August 2023 | Hall 8.1 | 09H20 – 10H00

### FUNDAMENTAL ERRORS IN HISTORICAL STUDIES ON LAMINAR INTERNAL CONVECTION IN CIRCULAR TUBES WITH A UNIFORM HEAT FLUX: NEW PERSPECTIVES



Prof. Josua Meyer  
Stellenbosch University, Stellenbosch, South Africa

In most previous research on internal laminar and transitional forced convection, most measurements (temperatures and pressure drops) have been conducted on the walls of tubes to prevent internal disturbances in the flow field. Together with fundamental analytical equations, which used many simplifying assumptions, solutions have been developed describing the flow field, heat transfer coefficients and friction factors. CFD analyses have revealed much more high-resolution detail that was challenging to obtain experimentally. Therefore, the purpose of this paper was to generate CFD data and use this data complementary to data obtained from experimental measurements. All this data made it possible to identify and quantify several important flow phenomena that have not been identified before. This was done by comparing experimental data with CFD data for water flowing from a square-edged inlet through a 4mm circular tube at different Reynolds numbers and heat fluxes. The most important phenomena that were identified for the first time were (1) the wall temperature distribution for the simultaneously developing hydrodynamic and thermal boundary layers, (2) a tube recirculation region at the tube inlet, (3) a non-linear fluid temperature gradient for developing flow, (4) and the necessity for a new definition of “fully developed flow”.

## KEYNOTE KN05

Tuesday, 15 August 2023 | Hall 8.2 | 09H20 – 10H00

### ROLE OF BUBBLE PUMPING ON HEAT TRANSFER ENHANCEMENT OF BOILING-DRIVEN HEAT SPREADER



Prof. Jungho Lee  
Ajou University, Gyeonggi-do, Korea

The role of microporous coating on boiling heat transfer enhancement is investigated to enhance the thermal performance of the boiling-driven heat spreader, a thermal ground plane. Typical passive heat transfer devices like thermosyphon and heat pipes have been used in wick structures due to their evaporative heat transfer mechanism and working fluid circulation. However, these wick structures have fundamental disadvantages; (1) The maximum heat flux attainable in a heat spreader is determined by the capillary force and pressure loss in the structures, and the heat flux for capillary-driven heat spreaders is smaller than required for advanced thermal management in electronics about 50 W/cm<sup>2</sup>. (2) The thermal performance of a heat spreader depends on its orientation because of the low amount of the working fluid and restricted working fluid circulation pathway. The heat transfer is significantly governed by a bubble pumping in which the boiling heat transfer can be enhanced with a microporous coating inside a heat spreader. With microporous coating on metal surfaces, more nucleation cavities are making it possible to enhance boiling heat transfer, so earlier boiling incipience can be made with a relatively small wall superheat. In the present study, the main concerns related to the working principle of a boiling-driven heat spreader are investigated as follows; (1) effect of movement of working fluid on the heat transfer characteristics of the heat spreader, (2) effect of orientation on the bubble pumping mechanism, and (3) effect of internal passage design on the circulation of the working fluid. So, this study proposes a new boiling-driven heat spreader with improved thermal performance and high heat dissipation of up to 200 W/cm<sup>2</sup>. Furthermore, the working principles of the boiling-driven heat spreader with a fluid circulation mechanism are confirmed by the high-speed visualization of the heat spreader and by their thermal performance testing results. In addition, a boiling-driven heat spreader is designed and fabricated using a wickless and passive-flow-controlled internal passage. The optimized bubble pumping design increases the maximum heat dissipation of the heat spreader through passive flow control. Therefore, the advanced boiling-driven heat spreader can

provide valuable insights into thermal management for high-heat-flux applications in power semiconductors and laser diodes.

## KEYNOTE KN06

Tuesday, 15 August 2023 | Hall 8.3 | 09H20 – 10H00

THE ROLE OF THE LIQUID FILM CHARACTERISTICS ON THE HEAT TRANSFER PROCESS DURING FLOW BOILING AND CONVECTIVE CONDENSATION



Prof. Gherhardt Ribatski  
University of Sao Paulo, Sao Paulo, Brazil

The liquid-film thickness behavior is a key parameter defining the heat transfer process during flow boiling and convective condensation, affecting the heat transfer coefficient and dryout incipience. Hence, a deep knowledge regarding its transient characteristics is relevant to the development of phenomenological models for the dryout and the heat transfer coefficient in annular flows. In this context, the present lecture describes the results of liquid-film thickness measurements performed during flow boiling and convective condensation of R600a, R290, R1270, and the mixtures R600a/R290 and R600a/R1270 in a horizontal tube (9.43 mm internal diameter) for vapor qualities ranging from 0 to 1. The reported experimental data comprises results for the instantaneous liquid film thickness, the interfacial wave velocity and frequency (ripple and disturbance waves) and the intermittent dryout-rewetting phenomenon. The liquid-film thickness measurements were obtained simultaneously to high-speed images of the flow and local heat transfer coefficient measurements. Therefore, care is exercised in the discussions presented in the lecture in order to establish a strong link between liquid film characteristics and the associated heat transfer behaviors.

## KEYNOTE KN07

Tuesday, 15 August 2023 | Hall 8.1 | 12H20 – 13H00

### OPTICAL MEASUREMENT TECHNIQUES FOR SPATIOTEMPORALLY-RESOLVED MULTIPHYSICS INFORMATION IN MULTIPHASE FLOWS WITH PHASE CHANGE



Prof. Christos Markides  
Imperial College London, London, United Kingdom

Multiphase flows in the presence of heating, cooling and phase change phenomena are a broad class of flows encountered in many important applications including, amongst other, in heat exchangers, condensers, evaporators, absorbers and reactors in diverse industrial processes, as well as in the natural environment across a wide range of scales.

Despite the numerous well-performed experimental studies on these flows over the years, the availability of detailed, spatiotemporally-resolved simultaneous information on the multiple underlying physical processes in different flows remains limited. This limitation is linked inherently to the many challenges that arise when performing these measurements. Two-phase flows, in particular, present the experimentalist with a unique set of characteristics, including restricted (often sub-mm) fluid domains, moving and complex interfaces, and phases with large density and refractive index changes that render the extraction of reliable information challenging.

Experimental techniques based on optical measurement principles have experienced significant growth in recent decades. They can provide information with high spatiotemporal resolution on important scalar (e.g., temperature, concentration, phase) and vector (e.g., velocity) fields in different flows, as well as interfacial characteristics and dynamics. This has been instrumental to step-changes in our fundamental understanding of these flows, and to the development and validation of advanced models with ever-improving predictive accuracy and reliability. Relevant techniques rely upon optical methods such as direct photography, laser-induced fluorescence, laser or phase Doppler velocimetry, particle image or tracking velocimetry, and variants thereof.

In this talk, we will discuss recent efforts to develop and apply a range of infrared, laser-based and other optical diagnostic techniques to multiphase flows with phase change, including flow boiling and solidification. We will cover the deployment of simultaneous techniques for the generation of multiphysics and multiscale information, and discuss the specific challenges faced when attempting to perform such measurements in selected flows. We will also present a future outlook for these methods that will enable an increasingly

complete fundamental understanding of relevant phenomena, and the design of improved devices, technologies and systems.

## KEYNOTE KN08

Tuesday, 15 August 2023 | Hall 8.2 | 12H20 – 13H00

### COOLING WITH MAGNETS: DEVELOPING NEAR ROOM-TEMPERATURE MAGNETIC REFRIGERATORS



Prof. Jader R Barbosa Jr.  
Federal University of Santa Catarina, Florianópolis, Brazil

The magnetocaloric effect (MCE) is the thermal response of a magnetic material subjected to a changing magnetic field. Magnetic refrigeration (MR) harvests the MCE by transferring heat from a low-temperature heat source to a high-temperature heat sink through magnetic work in the active magnetic regenerator (AMR) cycle. Some advantages of MR in comparison with other cooling technologies are (i) the reversibility of the MCE in some materials, (ii) the recovery of magnetization work with the use of permanent magnets and (iii) the absence of harmful substances (e.g., global-warming or flammable gases).

Recent results on the design, commissioning and testing of two TRL-6 magnetic cooling prototypes, namely a 30-bottle wine cooler and a 9000-BTU/h magnetic air conditioner, are discussed, focusing on:

- Developing high-fidelity, artificial intelligence-based methods to design and optimize magnetic circuit-AMR assemblies;
- Designing, optimizing and integrating ancillary sub-systems, such as heat exchangers, insulated cabinets and hydraulic management systems (flow-magnetic field synchronization and control);
- Proposing thermodynamic performance evaluation criteria (1st and 2nd-law based) and test procedures for magnetic refrigerators based on standards and test methods for conventional systems.

## KEYNOTE KN09

Tuesday, 15 August 2023 | Hall 8.3 | 12H20 – 13H00

### MEASURING GAS-PHASE AND PARTICULATE EMISSIONS FROM OIL AND GAS FLARES USING THERMAL RADIATION



Prof. Kyle Daun

University of Waterloo, Waterloo, Canada

The oil and gas industry uses flaring to convert hydrocarbon by-products of oil extraction and petroleum processing, into more environmentally-benign products, chiefly CO<sub>2</sub>, which has a lower global warming potential. While this process is assumed to be 98% efficient, emerging evidence suggests this may not be the case, due mainly to suboptimal flare operations (e.g., air and steam over-assist) and environmental factors (e.g., crosswinds). The difference between assumed and true carbon efficiency represents emissions of between 3-9 million cars annually, accounting for flaring from upstream oil and gas operations in the United States alone. Black carbon emissions are also a concern, particularly as oil and gas operations expand in Arctic latitudes, since these particles produce the “Arctic haze” effect, and deposited BC increases the solar albedo of snow and ice.

Accordingly, there is an urgent need for instrumentation to conduct fence-line measurements of flare combustion efficiency and particulate emissions, in order to fully-understand their impact on climate change. This talk describes how thermal radiation may be exploited to carry out these measurements, using newly-developed imaging Fourier transform spectrometers (IFTSs) that operate over the mid-wavelength infrared (MWIR) spectrum. While normal MWIR cameras generate a single image integrated over a detection band, IFTSs generate a datacube of thousands of nearly-simultaneous images, each at a discrete wavelength. This resolution is sufficient to fingerprint gases and determine the temperature of gas-phase and particulate species. Spectrally-resolved emission from the flare is used to infer the species concentration and temperature distributions along each pixel line-of-sight using a spectroscopic model, which is then post-processed into column densities for all carbon-containing species. The column densities are then combined with intensity-weighted velocities fields inferred from successive infrared images to produce mass flow rates. The performance of this technique is demonstrated on several upstream and downstream oil and gas flares.

## KEYNOTE KN10

Tuesday, 15 August 2023 | Hall 8.1 | 14H00 – 14H40

### ADDITIVE MANUFACTURING OF ELECTRONIC COOLING DEVICES USING THERMAL SPRAY



Prof. Sanjeev Chandra  
University of Toronto, Toronto, Canada

Increasing power dissipation by electronic devices requires significant improvements in the technologies used to cool them. Thermal management systems for electric vehicles must also be compact and lightweight since on-board space is limited. Topology optimization software can be used to design high-efficiency heat sinks and cold plates with complex geometries, but these are difficult to manufacture using traditional methods. Additive manufacturing techniques such as Selective Laser Sintering have been employed, but these are slow and expensive. Thermal spray is a process in which a coating material (metal, ceramic or polymer) is melted in a high velocity gas jet and sprayed onto a surface. It is widely used to apply protective coatings but can also be used as an additive manufacturing technique to make devices for electronic cooling including heat sinks, cold plates and heat pipes.

Composite heat sinks were made by spraying thin metal layers on polymer scaffoldings, producing lightweight devices that use only a minimal amount of metal where required. A novel, large flat plate copper heat pipe (180 mm x 180 mm x 3 mm) was made with a porous copper wick fabricated by spraying a mixture of copper and aluminium powders onto a copper plate. The resultant coating was treated with sodium hydroxide solution to dissolve the aluminium and create a porous layer. A second copper plate was placed on top of the coated surface and their edges brazed to form a sealed enclosure. The enclosed volume was evacuated and partially filled with water to form a heat pipe which was shown to be effective in spreading heat over a large area.

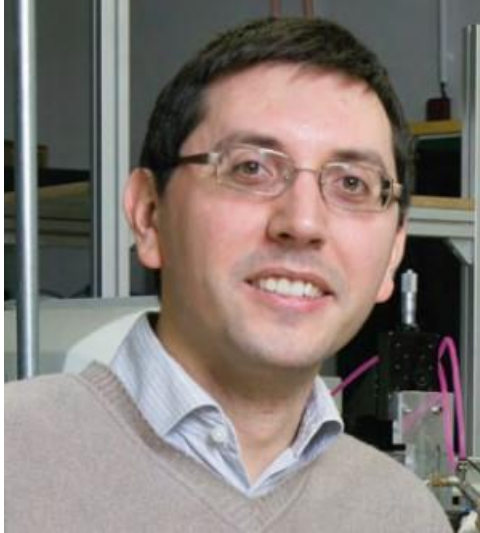
Liquid-cooled heat sinks were made with channel dimensions on the sub-millimetre scale. A topology optimization model was developed in COMSOL to generate a non-traditional internal geometry that minimizes the temperature non-uniformity for a prescribed pressure drop. A polymer mask was made by 3D printing with openings where the topology optimization model placed structures in the flow path. The mask was placed in a 86 mm x

63mm x 1 mm recess machined in an aluminum plate and aluminum sprayed over it. The mask was removed and the sprayed structures in the recess ground to a uniform height of 0.75 mm. A lid was placed over the recess and sealed in place to form a flow passage in the cold plate. Tests showed that when a heat flux was applied the temperature non-uniformity across the cold plate was much lower than it was for a conventional cold plate with parallel channels. This method has been used to make custom cold plates for electric vehicle charger circuits, optimized for any given distribution of heat sources on a circuit board.

## KEYNOTE KN11

Tuesday, 15 August 2023 | Hall 8.2 | 14H00 – 14H40

### HEAT AND MASS TRANSFERS IN DROPLET FLOWS: FROM ADVANCED MEASUREMENTS TO MODELS



Prof. Guillaume Castanet  
Université de Lorraine & CNRS  
Nancy  
France

Many technological applications in energy (spray cooling, fuel sprays in internal combustion engines...) and industrial processes (spray drying, droplet-based manufacturing of small objects...) rely to a large extent on transport processes and phase change phenomena in droplets and sprays. Heat and mass transfers in droplet-laden flows constitute a vast field of study in which much remains to be explored and which presents important challenges for the modelling and the experimentation.

Complex phenomena such as liquid atomization, wake effects between closely spaced droplets, turbulent transport, droplet/wall interactions, dramatically affect the dynamic behaviour of droplets. The modelling of the heat and mass transfers is therefore closely related to the study of the droplet dynamics. Different phase transitions (evaporation, freezing, melting...) can be involved depending on the cold or hot environment, in which the droplets evolve. Multi-scale interactions are also implicated in the transfers. It is necessary to go down to the scale of individual droplets or even smaller to deal with the interfacial transfers at the droplets' surface. Much larger scales such as the characteristic length between neighbored droplets, or the perimeter of the spray must be considered for the interactions between neighbouring droplets, and the global heat transfer to the gas phase or the solid surface impinged by the droplets.

From an experimental point of view, the characterization of droplet systems is usually done by observing the dynamic behaviour of the droplets (mainly by measuring their sizes and velocities). However, properties closely linked to the heat and mass transfers such as the temperature and the composition of the liquid inside the droplets are seldom addressed. Their measurements required the development of specific non-intrusive optical techniques.

Recent progresses in laser-induced fluorescence (LIF) techniques make it possible to reconstruct the temperature fields within moving droplets even when they undergo severe deformations of their shape. LIF techniques can be used to evidence phase change phenomena such as the formation of ice when droplets are freezing in supercooled environments. To gain more insights into the transfer phenomena, LIF techniques can be associated with other techniques, which aims at measuring the droplet size in the case of vaporizing droplets or the wall heat flux when droplets are impinging onto a heated solid surface. Such associations of experimental techniques are usually fruitful to evaluate the various heat fluxes involved in the energy balance.

To illustrate the progress made in the recent years, several examples will be presented: the heat convection inside moving and vaporizing droplets, the cooling by droplets of superheated walls, and the icing of supercooled droplets impinging on subcooled surfaces. For each of these examples, the characterization of the heat and mass transfers can significantly improve our understanding of the phenomena and their physical modelling.

## KEYNOTE KN12

Tuesday, 15 August 2023 | Hall 8.3 | 14H00 – 14H40

THERMAL POLARITONICS, A FOURTH HEAT TRANSFER MODE?



Prof. Sebastian Volz  
University of Tokyo, Tokyo, France

Phonons are the quasiparticles of lattice vibrations and represent the primary heat carriers in bulk dielectric materials. The thermal conductivity of dielectric membranes is thus typically driven by acoustic phonons that is usually assimilated to a gas of particles, and generally reduces with the membrane thickness due to the increasing frequency of surface scattering events. In the light of the ever-increasing miniaturization of devices with enhanced rates of operation, this reduction in the thermal conductivity causes overheating, low reliability, and reduced lifetime of electronic components.

Yet, while the thermal transport via acoustic phonons might be at the limit, the heat dissipation might be enhanced via optical phonons coupled with surface electromagnetic waves.

Over the past decade, substantial research efforts have been devoted to the study of these surface waves, because the surface effects predominate over the volumetric ones in nanostructures with high surface-to-volume ratio. Some types of surface electromagnetic waves may even carry heat and thus improve the thermal performance and stability of nanoscale devices.

One type of such surface waves is the surface phonon-polaritons (SPhPs), which occurs as a hybrid of optical phonons and surface electromagnetic waves. The SPhPs are essentially evanescent waves that propagate along the surface of polar dielectric membranes. We will first demonstrate the existence and the properties of those SPhPs in thin SiO<sub>2</sub> films and especially uncover that the propagation lengths of those waves reach the range of hundreds of micrometers, which is orders of magnitude longer than the typical mean free path of acoustic phonons. Theoretical models predict that such a long propagation length enables SPhPs to conduct more thermal energy than phonons when the membrane thickness is reduced below 100 nm.

We will then corroborate the significant contribution of SPhPs to heat flux in silica membranes, in a restricted temperature range and also, in a wide temperature range, in silicon nitride membranes where SPhP thermal conductivity becomes predominant at 800K. An additional confirmation was finally provided by showing the size dependence of thermal conductivity due to the ballistic contribution of SPhP.

## KEYNOTE KN13

Wednesday, 16 August 2023 | Hall 8.1 | 09H20 – 10H00

### HYDRODYNAMICS AND HEAT TRANSPORT IN HIGHLY POROUS OPEN-CELLED STRUCTURES



Prof. Benjamin Dietrich

Karlsruher Institute for Technology, Karlsruhe, Germany

In process engineering, structured elements or specially shaped internals are often used to intensify heat or mass transfer processes in an apparatus with an acceptable increase in pressure drop (e.g. compact heat exchanger, carrier for catalysts, ...). A special group of such internals are open-celled structures with continuous solid and fluid phases. A distinction is made between stochastically random and geometrically regular forms, the former being called sponge or open-cell foam and the latter periodic open cellular structure (POCS).

Due to the bi-continuous structure, a flowing fluid can penetrate the porous medium on all sides, with thermal energy being transported by a combination of convective transport in the fluid phase and thermal conduction in both phases. Thus, compared to other more established internals, such as honeycomb structures or packed beds, improved heat transfer can be achieved with the same installation space requirements or pressure drop. The reason for this is that the advantages of these two established internals are combined in network structures and the disadvantages are largely eliminated. Honeycombs have no cross-mixing due to the channel shape and packed beds have thermal contact resistances due to the point contacts between the individual elements. In the case of network structures, there is - depending on the type of structure - good cross-mixing and heat conduction in the solid phase is significantly increased due to the continuous structure, since there are no contact resistances. Both sponges and POCS can be made from a variety of different metal and ceramic materials providing a wide range of thermal and mechanical properties. They can be specifically designed in terms of their porosity, cell density, cell size and specific surface area, which is the ratio of the available solid surface area to the total volume of the porous structure. In this context, the design space is significantly larger in the case of POCS. Since these are additively manufactured geometries (e.g., by 3D printing), countless unit cell types with very different thermal and hydrodynamic properties can be realized. For these reasons, POCS represent a promising structural class in process engineering apparatus in the future. The possibilities of additive manufacturing methods thus lead to the overall goal of deriving correlations for the calculation of hydrodynamics and heat transport, which allow to specifically determining the best possible design for the corresponding technical application in order to obtain the highest efficiencies in terms of heat and mass transport. For this to

succeed, these correlations must be applicable to any unit cell type, which is the main challenge for the derivation of a reliable model.

This contribution focuses on the characterization and modelling of the pressure drop, the convective heat transfer coefficient and the overall heat transfer coefficient of POCS. The latter quantity considers the impact of thermal resistances within the solid structure on the conjugate heat transfer problem (combination of heat transfer in solid and fluid phases). To establish a reliable database, various experimental and numerical works have been carried out in the past. Results based on sponges complement the data and are used for comparison. Significant findings have been made in the relationship between geometry parameters and thermal-hydraulic properties (e.g. with increasing porosity the pressure drop and the heat transfer coefficient decrease) and in the characterization of flow effects. It was shown, among other things, that for a hydro-dynamically and thermally fully developed flow the boundary layer within the structures is continuously disturbed and thus reformed, which has a significant effect on momentum and heat transfer.

Using highly porous (80-95%) cubic, Kelvin and diamond cells as examples, a methodology is presented, which allows the determination of the above-mentioned quantities on the basis of the geometric parameters of the porous structures. Here, the struts are assumed to be the smallest structure-forming unit, since it has been shown that the thermo-fluid-dynamic effects during the flow through POCS and, consequently, the heat transfer and the pressure drop can be described as a superposition of the contributions of the individual elements. The presented methodology is based on a bottom-up approach: unit cells are generated step-by-step, starting with the single struts, via simple combinations up to the entire complex structure. During this process, the influence of different geometric parameters (strut cross-section, length, alignment to neighboring struts, distance to neighboring struts, etc.) can be systematically tested at each level of complexity. This results in the possibility of a more unambiguous assignment of thermo-fluid-dynamic effects to geometric changes of the structures and, based on this, an unambiguous identification of correlations between the same in contrast to the approaches described in the literature. With the methodology presented here, one comes a significant step closer to the challenge described above. Thus, the pressure drop as well as the heat transfer coefficient can be described across cells for different types of POCS and it will be possible to design and manufacture additively a network structure specifically according to the specific requirements of a technical application.

## KEYNOTE KN14

Wednesday, 16 August 2023 | Hall 8.2 | 09H20 – 10H00

### NEW INSIGHT INTO HEAT TRANSFER DETERIORATION



Prof. Shuisheng He  
University of Sheffield, Sheffield, United Kingdom

Heat transfer deterioration (HTD) may be encountered in forced or mixed convection when the heat transfer effectiveness is significantly lower than expected based on the Reynolds number of the flow. Such phenomena have become a new focus of recent investigations in pursuit of designing new efficient thermal systems, which make use of supercritical fluids (in power cycles), or very high heat flux conditions (in electronics, space, and nuclear fusion systems), or uncommon cooling media, such as liquid metals and molten salts. Under such conditions, strong variations of thermal physical properties of the fluid and non-uniform body forces, such as buoyancy and magnetohydrodynamic forces, may cause flow laminarisation and deterioration of heat transfer. This may not only reduce the efficient of the system but potentially result in safety risks under certain conditions. Despite it being a classical problem, the predictions of HTD remain a challenge in both engineering calculations using correlations and numerical simulations with CFD.

In this talk, we will discuss some new understanding of HTD phenomena recently established with the aid of direct numerical simulation (DNS), which leads to improved predictions of HTD, including the estimations of friction factor and Nusselt number of strongly heated pipe flows, for example. First, we will consider the effect of body forces (such as buoyancy) on turbulence in an isothermal flow. In contrast to the common understanding, it will be shown that applying such a force does not in fact cause significant changes to the key turbulence characteristics (including mixing) when the pressure force is kept unchanged, that is, when the analysis is based an Equal Pressure Gradient reference framework. The so-called flow laminarization, which is implicitly based on an Equal Flow Rate reference, can now be explained by the reduction of a newly-defined Apparent Reynolds Number (ARN). This concept is then applied to strongly heated air flow in a pipe. The ARN is used to produce a Reynolds number/Grashof number map to display the flow laminarisation (severe HTD) and recovery regimes, which agrees well with DNS data. Furthermore, the ARN predicts the presence of a bi-state region where the flow may be

turbulent or laminar-like (corresponding to mild or severe HTD), which is also observed in the DNS results. This finding can be used to explain some of the large scatters in experimental Nusselt numbers in the strong HTD region. Next, we analyse a strongly-heated supercritical fluid flow in which severe HTD occurs due to complex reasons. The application of the ARN led to the establishment of a unified explanation for HTD mechanisms due to the variations of thermal properties, flow acceleration due to heating and buoyancy, all of which are treated as pseudo-body forces. The theory also explains the effect of spatial flow development on turbulence using pseudo-body forces. Finally, we demonstrate how the ARN can be used to predict friction factor and Nusselt number as well as turbulent shear stresses and temperature profiles in laminarised/HTD flows.

## KEYNOTE KN15

Wednesday, 16 August 2023 | Hall 8.3 | 09H20 – 10H00

### EXPLORING HEAT TRANSFER MECHANISMS IN LAMINAR FLOWS: FROM JET IMPINGEMENT TO MICRO-SCALE PHENOMENA



Prof. Wilko Rohlf's  
University of Twente, Enschede, Netherlands

The miniaturization and increase in power density of electrical components has led to an increasing need for efficient small-scale heat removal techniques. These conditions often result in laminar flow scenarios in which convective heat transfer is governed by wall-parallel flows with reduced mixing. The focus of this talk is to provide an in-depth examination of some interesting phenomena occurring in laminar flows, using a combination of fully resolved numerical simulations and experimental validation. The flow conditions examined include: 1) Jet impingement with local flow acceleration, and the presentation of a unified scaling law for stagnation-point heat transfer. 2) The thermal enhancement due to micro- and nano-particles in strong shear flow. 3) Scaling laws for heat and mass transfer in laminar channel flows with obstacles within steady and unsteady flow regimes. The goal of this talk is to provide a comprehensive understanding of some interesting flow phenomena and the impact of regime transitions on scaling laws, through the examination of physical insights into heat transfer mechanisms in laminar flows.

## KEYNOTE KN16

Thursday, 17 August 2023 | Hall 8.1 | 09H20 – 10H00

### THE UNSOLVED ROLE OF SURFACES ON DROPLET AND SPRAY IMPACT DYNAMICS AND HEAT TRANSFER



Prof. Gary Rosengarten  
RMIT University, Melbourne, Australia

Droplet/surface interactions are fundamental in a plethora of critical processes. These range from designed engineered process, like for example spray coating or spray cooling, to those processes that occur naturally such as infrastructure fouling from rain, and the deposition and evaporation of pathogen containing human sputum droplets on surfaces. While we have empirical correlations for most single droplet heat transfer and evaporation process, such correlations remain elusive when the process occurs on complex surfaces, due to the sheer number of variables that need to be considered. These include surface roughness, the height and shape of the features, the size of the features relative to the droplets, the liquid surface energy (or wettability) and the difference between the surface temperature and the liquid saturation temperature. Sprays are significantly more complicated due to droplet/droplet interactions and polydispersity.

In this presentation I will outline the status of our understanding, unpack some of the unsolved issues, including relevance to real world applications. I will explain the experimental that work that we have been working on. I will particularly focus on the role of surfaces on the droplet dynamics, from fundamental single droplet impingement to multiple droplets, and all the way to spray impingement. Single droplet impingement is a necessary starting point in the understanding of spray impingement, but it is not a realistic model for the spray process that includes droplets of different sizes, moving at different velocities and possibly at different directions, and that impact surfaces that may be partially wetted. I will make recommendations as to what research is needed to be able to optimise the heat flux from sprays. As spray cooling offers the highest heat transfer rate of any convective process, it will be needed for future ultra-high-flux cooling applications. Systems with requirements for particularly high heat transfer are coming to the fore in power electronics as we transition towards electrifying our energy supply. Finally, I will discuss how surface hydrophobicity inherently effects the evaporation rate of small droplets, and the effect this may have on surface borne pathogens.

## KEYNOTE KN17

Thursday, 17 August 2023 | Hall 8.2 | 09H20 – 10H00

### DEVELOPMENT OF LOOP HEAT PIPE BASED ON VISUALIZATION AND MODELING IN MICROSCALE POROUS STRUCTURE



Prof. Hosei Nagano

Nagoya University, Nagoya, Japan

Two-phase heat transfer devices based on capillary action in micro-scale porous structures such as loop heat pipes (LHPs) are promising heat transport technologies. This is because the LHP has a higher heat transfer capacity and a longer heat transfer distance than conventional heat pipes. Additionally, LHP does not require electrical power to operate. As a result of its capillary forces, LHPs can operate in zero or anti-gravity conditions, making LHPs applicable to a variety of thermal applications such as cooling or heat utilization in automobiles, electronic devices, and spacecraft. The thermal performance of LHPs is governed by the thermos-fluid behavior of microscale porous structures called wicks. Therefore, understanding the behavior of wicks is essential to develop higher performing LHPs.

In this study, microscale visible and infrared imaging was used to observe and model the thermal-fluid behavior of porous material surfaces. For visualization, an observation system that can observe thermal fluid properties in micro-scale micropore structures in the infrared and visible regions have been developed. Infrared observations reveal the relationship between the temperature field, maximum heat flux and evaporative heat transfer. Visible observations show vapor-liquid interfaces, thin film evaporation, and nucleate boiling. The possibility of improving the heat transfer characteristics by improving the wettability of the heating surface and increasing the three-phase contact area around evaporating region was also verified. The capability of the heat transfer enhancement by increasing of wettability and the length of triple phase contact area on the heating surface were also evaluated. Utilizing this knowledge, the optimal porous structure for LHP was proposed.

In LHP development, an LHP analysis model based on the knowledge of basic research was constructed. Using the constructed LHP analytical models, LHPs of various scales were designed, fabricated, and evaluated. For microscale LHPs, a 0.3mm thick LHP for mobile device has been developed and a heat transfer capacity of 10W or more was demonstrated. The possibility of flexible LHPs for wearable devices based on MEMS technology was also

evaluated. In the large-scale LHP, a long-distance LHP with a total length of 28 m for heat transport was developed for the purpose of energy utilization. In addition, the largest LHP is being developed with a heat transfer capacity of 10 kW in a single LHP. Furthermore, the large LHP with a heat transfer capacity of 10 kW per LHP has been developed for the purpose of thermal management in automobiles and waste heat utilization in factories.

## KEYNOTE KN18

Thursday, 17 August 2023 | Hall 8.3 | 09H20 – 10H00

### ENERGY STORAGE TECHNOLOGIES FOR GREEN TRANSFORMATION



Prof. Yukitaka Kato

Tokyo Institute of Technology, Tokyo, Japan

In order to realize the global carbon neutrality (CN), green transformation (GX, changes in industrial and social structures according to CN) is indispensable. Innovation of materials and processes for energy systems will act as key technologies for GX realization and contribute on the construction of a society that coexists with the global environment. For establishment of GX with carbon dioxide (CO<sub>2</sub>) emission mitigation, renewable energies are the most important zero-carbon energy resources. However, photo voltaic and wind electric power productions are intermittent, and induce large amount of power production curtailment occasionally in all the world. Electric storage by electric battery is a reliable choice, however, the risk of resource constraint of materials of lithium, cobalt and so fourth, and the lack of inertial force of power generation should be counted. Thermal and chemical energy storage technologies for unstable renewable energies would be required more for future energy system. Thermal energy storages by using sensible, latent and thermochemical state changes are being developed. Thermochemical energy storage (TCES) has potential to store heat with relatively higher energy density and longer storage period, and can upgrades heat output temperature by its chemical hear pump ability than sored heat temperature. TCES needs enhancement both kinetic reactivity and thermal conductivity under keeping enough energy storage density. Then a composite with higher chemical reactivity material and superior thermal connectivity one under optimized conditions will be required. Power to gas (P2G), at which electricity is generally used for hydrogen production by water electrolysis, is also one of counter measure as a chemical energy storage. Electrolysis thermodynamic efficiency (ratio between the reaction's Gibbs free energy change and enthalpy change) of hydrogen production from water is 82%. The value of carbon monoxide from CO<sub>2</sub> of 91% is superior to hydrogen production. The design of the electrolysis reactor needs chemical, thermal and electric management based on thermal science with innovation for material composite and reaction process. For energy storage in future, we need to remember not only conventional energy storage technologies, but there is large potential for new choices. It is a time for innovation of energy storage technologies for GX.

## KEYNOTE KN19

Thursday, 17 August 2023 | Hall 8.1 | 12H20 – 13H00

### REFRIGERANT CHARGE REDUCTION IN HEAT PUMPS WITH PROPANE AND THE INFLUENCE ON HEAT TRANSFER AND HEAT EXCHANGER DESIGN



Dr. Lena Schnabel

Fraunhofer Institute for Solar Systems, Freiburg, Germany

R290 (propane) is recently understood as the most promising refrigerant for domestic heat pump applications. Propane has a Global Warming Potential (GWP) of 3 and attractive thermodynamic properties allowing energy-efficient and climate-friendly cycles designs. However, R290 is flammable, and the use of charge-reduced components and designs should be the first central step to reduce safety risks.

Within the research project LC150 (low charge heat pump 150g) the existing scientific knowledge on charge reduction was intensified by analyzing more than 30 refrigerant cycles. To understand the influence of the main components (compressor, evaporator and condenser) on refrigerant charge, efficiency and heating capacity those were combined differently. The cycles were evaluated at different refrigerant charges, heat and sink temperatures, superheats and compressor speeds by experiment and simulation. All measurements are done with compact plate-to-plate refrigerant circuits. The results show that one significant part of the charge is defined by the compressor and the amount and kind of oil, and the second part is defined by the design and operation of the heat exchangers.

The heating capacity reaches up to 12.85kW using 124g R290. The current best solution achieves a specific heating capacity <math><10 \text{ g/kW}</math> with a SCOP (ErP) >4.5.

The presentation will give an overview on the methodology used to analyze the refrigerant cycles and discuss the results. This will be followed by a deeper discussion on refrigerant charge estimation in brazed plate heat exchangers (BPHE), which is not sufficiently precise in prediction for low charge systems. For this infrared thermography, thermo-hydraulic measurements, geometrical analyses, and simulations of brazed plate heat exchangers (BPHE) will be presented and discussed.

## KEYNOTE KN20

Thursday, 17 August 2023 | Hall 8.2 | 12H20 – 13H00

### SHIFTING THE PARADIGM OF LATENT HEAT THERMAL ENERGY STORAGE SYSTEMS THROUGH ADDITIVE MANUFACTURING



Prof. Sandra Boetcher

Embry-Riddle Aeronautical University, Daytona Beach, USA

Enhancing the thermal performance of phase-change materials (PCMs) for thermal energy storage and management has been a subject of great interest since the energy crisis of the 1970s. PCMs are materials that can absorb (solid to liquid) and release (liquid to solid) significant amounts of energy during the phase transition. However, the low thermal conductivity of PCMs hinders their effective heat transfer, despite their high latent heats of fusion. To address this issue, recent studies have focused on improving the thermal conductivity of PCMs through the addition of additives or other means. Nevertheless, the efficient distribution of these materials through additive manufacturing in a compact heat exchanger with a high surface-area-to-volume ratio and thin walls can mitigate the need to increase thermal conductivity. It is worth noting that the thickness of a material also plays a crucial role in determining its thermal resistance. Prior studies have demonstrated the successful stabilization of PCMs with appropriate polymers through methods such as injection molding, extrusion, and casting. Alternatively, microencapsulation of PCMs in compatible materials allows them to blend with otherwise non-compatible host polymers, thereby expanding the range of 3D-printable composite materials. This presentation aims to provide an overview of polymer heat exchangers, shape-stabilized PCMs, and advances in additive manufacturing for the creation of next-generation thermal energy storage devices.

## KEYNOTE KN21

Thursday, 17 August 2023 | Hall 8.3 | 12H20 – 13H00

LITHIUM-ION BATTERY CELLS, FROM CHARACTERIZATION TO THERMAL MANAGEMENT.



Prof. Sylvie Lorente  
Villanova University, Villanova, United States of America

While interest over electric vehicles is growing worldwide, comes the question of the thermal management of their battery pack. This requires a detailed knowledge of the electrical behavior of the battery cells and the corresponding temperature evolution during charge and discharge. After this necessary step, cooling solutions can be proposed in order to maintain (i) satisfying operating temperature conditions for the cells, and (ii) admissible temperature differences on each cell of the electric vehicle battery pack.

This talk focuses on two main aspects: the experimental characterization of a Li-ion battery cell during charging/discharging cyclic operations and the design of a solution for advanced thermal management at cell level.

Experiments are conducted in the absence of cooling aid system and provide thermal and electrical insights. We show the impact of charging and discharging conditions together with the ambient conditions on the battery cell, both in terms of electrical response and thermal behavior.

We develop numerical models describing the voltage changes and the corresponding generated heat. After validation with the experimental results, we propose thermally efficient solutions consisting in inserting cold plates between the cells. We show that canopy-to-canopy configurations allow to extract most of the non-uniformly generated heat by the battery cell with a small mass flow rate.

## KEYNOTE KN22

Thursday, 17 August 2023 | Hall 8.1 | 14H00 – 14H40

### MODELLING HEAT AND MASS TRANSFER PHENOMENA IN NANOSTRUCTURED MATERIALS FOR ENERGY APPLICATIONS



Prof. Matteo Fasano  
Department of Energy, Torino, Italy

The unique heat and mass transfer properties of nanostructured materials result from a combination of various phenomena across multiple time and space scales. While these modern materials offer precision in performance for specific applications, their complexity in material design also increases. To bring these materials from laboratory to mass production in various industries, predicting quickly their heat and mass transfer properties becomes crucial.

In this presentation, we will examine recent advancements in the study of the coupled heat and mass transfer phenomena in such nanostructured materials, with a specific emphasis on energy applications. Using polymer nanocomposites, nanoporous materials and nanocolloids as case studies of materials for enhanced heat transfer/storage with nanoscale solid-solid and solid-liquid interfaces, we will explore how atomistic and mesoscopic simulations can provide insight into their underlying heat and mass transfer mechanisms. We will also discuss the potential for combining multi-scale simulations with data-driven approaches to enhance both prediction accuracy and speed of the thermal properties of nanostructured materials.

In summary, this talk will provide an overview of current research on the use of atomistic and mesoscopic simulations to study nanoscale heat and mass transfer phenomena in nanostructured materials for energy applications, as well as the potential for multi-scale and data-driven approaches as next-generation tools for improved predictions.

## KEYNOTE KN23

Thursday, 17 August 2023 | Hall 8.2 | 14H00 – 14H40

### NOVEL ENHANCEMENT PROTOCOLS FOR VAPOR-LIQUID PHASE CHANGE HEAT TRANSFER ON SUPER-WETTING STRUCTURES



Prof. Xuehu Ma

Dalian University of Technology, Dalian, China

Vapor-liquid phase change heat transfer is a ubiquitous phenomenon and crucial in versatile industrial applications, such as water harvesting, power generation, thermal management and seawater distillation. With progress on material science and technology, artificial micro/nano hierarchical structures have been comprehensively developed for this objective.

For the condensation and boiling/evaporation, this keynote will focus on the advances in novel heat transfer enhancement and the underlying mechanism exploitation for the specified Macro/Micro/Nano super-hydrophilic/superhydrophobic hierarchical nanowire surfaces.

From the viewpoint of the trade-off between the capillary driving force and flow resistance on the super-hydrophilic hierarchical nanowire surface composed of hollow nanowire bundles and microscale V-groove, the preferential capillary pumping was identified using Confocal Laser Scanning Fluorescence Microscopy. This unique phenomenon could provide strong capillary pressure to achieve twice capillary spreading rate. Consequently, the ultra-thin liquid film would be regulated as expected protocols for higher evaporation rate. For example, at wall temperature of 60 °C, the evaporation rate on this surface is 12 times of that on the conventional hydrophilic surface. The novel evaporation protocol was designed to dominate evaporation by the hollow nanowire bundles and the liquid supply by the microscale V-groove.

For the steam dropwise condensation on superhydrophobic surfaces, there is remaining the challenge of tackling the condensate flooding due to the high nucleation density and condensing rate. Herein, we fabricate the specific superhydrophobic hierarchical nanowire surface with microscale V-groove. The preferential nucleation around the top of nanowire bunches was found from the ESEM observation. The experiments obviously illustrated the

reversible wetting transition process from Wenzel state to Cassie state with the surface subcooling degree increasing and decreasing, and the resultant condensation heat transfer coefficient is increased by 21%-221%. The maximum heat transfer flux of jumping-droplet condensation is 1.06 MW/m<sup>2</sup>, which is the highest value reported in literature so far.

Considering the largely unexplored macrotextures, it was found the water vapor concentration and diffusion flux gradients can be substantially altered in the macrotextures, which strongly affects the wetting gradient along the groove height. As a consequence, the relay droplet jumping on superhydrophobic macro-textured groove arrays (MGAs) was observed experimentally. The results showed that MGAs can promote the mobility of large condensate droplets and prevent flooding condensation under high surface subcooling. The condensation performance was enhanced by a maximum of ~240% compared with that of the above flat surface.

Finally, we designed and fabricated a *R. purpurascens*-inspired porous surface (RIPS) consisting of a three-level wetting gradient from the upside through the hole to the downside. The novel RIPS can allow easy nucleation, rapid condensate transport and well-defined droplet shedding size through the continuous and directional suction flow of condensate. Hence, the overall water collection performance was increased by maximum of ~160%.

## KEYNOTE KN24

Thursday, 17 August 2023 | Hall 8.3 | 14H00 – 14H40

### THERMAL RESISTANCE TARGET-CONTROLLING FOR HEAT TRANSFER PROCESSES: PRINCIPLE AND APPLICATIONS



Prof. Qiuwang Wang  
Xi'an Jiaotong University, Xi'an, China

Thermoelectric analogy method and the concept of thermal resistance are widely used in analyzing heat transfer problems to simplify the analysis process of complex heat transfer network. Traditional thermal resistance is only applicable to the case of one-dimensional, steady-state, and no internal heat source. However, most heat transfer processes are multi-dimensional, unsteady-state and with internal heat source in the fields of energy, power, petrochemical industry, metallurgy, refrigeration, aerospace and so on. For these problems, numerical simulation methods are commonly adopted and occupied a large amount of computing resources, in addition, the traditional thermal resistance analysis method still exists some gaps. This report presents a generalized establishment method and target-controlling principle of thermal resistance network for multi-dimensional, unsteady-state heat transfer process with internal heat source. The practicability and advancement of the generalized establishment method of thermal resistance network is illustrated by two examples. One is the thermal resistance control method of local thermal resistance ratio and local total thermal resistance for two-side heat transfer process, applying to the thermal design of complex heat exchangers (fluid-fluid and particles-fluid). The other is the thermal resistance control method of transient thermal resistance in energy storage, especially the solid-liquid phase change process. The proposed generalized establishment method and target-controlling principle of thermal resistance network are of great significance to simplify the analysis process and provide guidance for the regulation and optimization of thermal processes.

## KEYNOTE KN25

Friday, 18 August 2023 | Hall 8.1 | 09H20 – 10H00

### COMMON MISTAKES IN CONVECTIVE NANOFLUID RESEARCH



Prof. Mohsen Sharifpur  
University of Pretoria, Pretoria, South Africa

The main goal of this keynote is to provide researchers with a guideline for avoiding common mistakes in convective nanofluid research. Nanofluids are engineered colloidal suspensions of nanoparticles in a base fluid. Research in convective nanofluids is one of the most attractive research areas in the field of heat transfer. Although thermal conductivity has received the most attention, many researchers have recently attempted to study different heat transfer characteristics of nanofluids. Therefore, nanofluids appear to be in the spotlight for various applications. However, the field's progress is hampered by (i) a lack of consensus amongst researchers' findings; (ii) poor characterization of dispersion and stability; (iii) lack of hybrid theoretical models; (iv) wrong publications due to a lack of knowledge and/or citing wrong published information. This keynote provides a straightforward way to evaluate experimental and numerical publications on convective nanofluids research until such time that researchers no longer make these common mistakes. This also helps the reviewers of journals make more accurate decisions while evaluating the journal content.

## KEYNOTE KN26

Friday, 18 August 2023 | Hall 8.2 | 09H20 – 10H00

### THERMAL ENERGY STORAGE - PATHWAY TO ENERGY EFFICIENT ELECTRONICS AND BATTERY SYSTEMS



Prof. Chakravarthy Balaji  
Indian Institute of Technology Madras, Chennai, India

In the present-day context, electronics and batteries form the backbone of many mission-critical applications, demanding safe operation, reliability, long life besides sustainability and eco- friendly. Electrification is crucial to decarbonizing society but increasing power densification in electronics (high heat flux) and battery systems (high C-Rates) necessitates innovative and robust thermal management technologies.

The energy efficiency of electronics and battery systems and the accompanying safety and reliability are strong functions of the operating temperature. Unlike electronics, which have only an upper-temperature limit for a safe operation, batteries have both upper and lower temperature bounds for their safe operation. Furthermore, most electronics and electric vehicle operating environments are transient. Yet, conventional thermal management solutions have been traditionally designed to meet the peak load conditions with steady-state designs that often lead to overdesign with increased size, weight and cost.

All of the factors mentioned above warrant novel thermal management strategies to handle bursts of peak fluxes and a baseline mean heat flux and it is here that phase change materials (PCMs) offer a lot of promise as a candidate solution for electronics and batteries. The key advantage a PCM offers is the ability to store or release the latent heat of the material during the power spikes. Strategies for PCM development have generally focused on augmenting the inherently low thermal conductivity of the material. This keynote will walk the audience through the evolution of the PCM-based heat sink technology, the current state of the art, and prospects.

The first part of the lecture aims at providing a historical perspective of fundamental research in this rapidly growing field. With the advent of more applied research in portable and high-power-density electronics, initial efforts aimed to explore various PCMs for applications involving transient operations. To a considerable extent, the lecture is based on the work of the author's research group and several recent publications from our laboratory. Without much deviation from "the big picture," the focus of the talk is also

dedicated to numerous intricate details of today's growing power demands in real-time applications, which can significantly affect the PCM-based heat sink design and are frequently overlooked.

The second part of this lecture gives a critical perspective on the efficacy of different thermal conductivity enhancement techniques in PCMs. The outcome of our nearly fifteen-year research from our research group on novel thermal conductivity enhancers (TCEs) in the form of metal foams, fins, heat pipes, expanded graphite (EG), and metal matrix to mitigate the poor thermal conductivity of a PCM will be discussed and highlighted. The performance of the PCM-based heat sink was first evaluated based on the time to reach a set point temperature during the melting cycle. A performance enhancement factor of 18 was observed for a heat sink with TCE over a heat sink with no TCE. However, more specifically, our research concluded that the performance of the PCM-based heat sink filled with metal foam was superior to that of the PCM-based finned heat sinks. This conclusion motivated future studies incorporating metal foams with porosity and PPI (pores per inch) density gradients. The results from the studies concluded that the case of non-uniform PPI density (increasing from the bottom to the top) with constant porosity is 45 % superior compared to the case with uniform PPI density in the charging cycle.

A significant part of the objective of this lecture is to also showcase that the figure of merit to evaluate a PCM-based composite performance has evolved in time and continues to be redefined even today. In the past, efforts on optimization to arrive at the best design for PCM-based composite heat sinks have been dedicated to only the charging or the melting cycle. For the first time in the literature, our group's research efforts demonstrated the importance of considering the discharging cycle as one of the objective functions to optimize.

The third part of the lecture will emphasize the importance of decreasing the discharging time (PCM resolidifies to take on the next heat duty in this period) and discuss a specific case study of a multi-objective optimization framework, assisted by machine learning algorithms like neural networks, to design robust heat sinks for cooling electronics that involve not only fixed heating but also pulsating heat loads and sudden surges. A short discussion on a recent invention of a novel design of a rotating heat sink that has been proven to be thermodynamically superior in minimizing the discharging cycle time will be an adjunct to the lecture.

The final part of the lecture will highlight the recent contributions to the thermal management of Lithium-ion batteries, including the introduction of PCM and pin fin designs. The results from an in-house study on the thermal behavior of the Panasonic NCR18650BD battery at discharge rates higher than its specified limit using high accurate Newman P2D model by matching up the model first with in-house measurements for lower discharge rates will also be presented. A key finding from this research indicated that the heat sinks with 260 fins and 70% eicosane (PCM) - 30% EG outperform all other combinations. Ultimately, what is now urgently required is a readily available guidelines to quickly arrive at the optimal design (including choice of PCM, size, weight, and geometry) of PCM heat sinks for a very specific power intense application. To address this requirement, this talk will

provide some insights into design and optimization guidelines for the future PCM-based composite heat sinks design.

The lecture will conclude by pointing out potential future "thermal threats" posed to researchers in this field, which must be gracefully and steadfastly resolved to sustain the technological progress of human civilization.

# POSTER SESSIONS

ABBREVIATION	SESSION SUBJECT/NAME
ACR	AIR CONDITIONING & REFRIGERATION
ADS	ADSORPTION & DESORPTION
BMA	BIO & MEDICAL APPLICATIONS
CDS	CONDENSATION
CMB	COMBUSTION
CND	CONDUCTION
CNV	CONVECTION
CPM	COMPUTATIONAL METHODS
ECS	ENERGY STORAGE & CONVERSION
EEC	ELECTRONIC EQUIPMENT COOLING
EEF	ENERGY EFFICIENCY
EVP	EVAPORATION, DROPLET/SPRAY/LIQUID FILM
FBL	FLOW BOILING
FCL	FUEL CELL
FCV	FORCED CONVECTION
FLM	FILM
GTB	GAS TURBINE
HEX	HEAT EXCHANGER
HPP	HEAT PIPE
HTE	HEAT TRANSFER ENHANCEMENT
INV	INVERSE PROBLEMS
IPJ	IMPINGING JET
MCV	MIXED CONVECTION
MIN	MEASUREMENT AND INSTRUMENTATION
MLT	MOLECULAR TRANSPORT
MNF	MANUFACTURING
MTR	MASS TRANSFER & DRYING
NCV	NATURAL CONVECTION
NMM	NANO/MICRO SCALE MEASUREMENT & SIMULATION
NMS	NEMS/MEMS
NMT	NEW MATERIALS
NSM	NUMERICAL SIMULATION
PBL	POOL BOILING
PLS	PLASMA
PMD	POROUS MEDIA
PPE	PHOTON, PHONON & ELECTRON TRANSPORT
RAD	RADIATION
RNE	RENEWABLE ENERGY
SAT	SPRAY & ATOMIZATION
SOL	SOLAR ENERGY
TBF	TWO-PHASE, BUBBLE FLOW & WATER FILM
TDY	THERMODYNAMICS
TEL	THERMOELECTRIC DEVICES
TMG	THERMAL MANAGEMENT
TPA	TWO-PHASE, APPLICATION
TPB	TWO-PHASE, BOILING/CONDENSATION
TPM	TWO-PHASE/MULTIPHASE FLOW
TPN	TWO-PHASE, NUMERICAL SIMULATION
TPP	THERMOPHYSICAL PROPERTIES
TPS	TWO-PHASE, SPRAY/DROPLET
TST	THERMAL STORAGE
TTR	TURBULENT TRANSPORT

## KEYWORD-CODES FOR POSTER SESSIONS

## POSTER SESSIONS AT A GLANCE

Session	Keywords (Codes)	Venue	Date	Time (GMT+2)
Poster 1	HTE	Hall 8.1	Monday, 14 August 2023	11H00 - 13H00
Poster 2	NSM / CPM	Hall 8.2	Monday, 14 August 2023	11H00 - 13H00
Poster 3	ECS / TST	Hall 8.3	Monday, 14 August 2023	11H00 - 13H00
Poster 4	HTE	Hall 8.1	Monday, 14 August 2023	15H00 - 17H00
Poster 5	TMG	Hall 8.2	Monday, 14 August 2023	15H00 - 17H00
Poster 6	NSM / CPM	Hall 8.3	Monday, 14 August 2023	15H00 - 17H00
Poster 7	CNV / MCV	Hall 8.1	Tuesday, 15 August 2023	10H20 - 12H20
Poster 8	ECS / TST	Hall 8.2	Tuesday, 15 August 2023	10H20 - 12H20
Poster 9	SOL / RNE	Hall 8.3	Tuesday, 15 August 2023	10H20 - 12H20
Poster 10	CND / NCV / RAD / FCV	Hall 8.1	Tuesday, 15 August 2023	15H00 - 17H00
Poster 11	TBF / TPA / TPS / TPM / TPN / CDS	Hall 8.2	Tuesday, 15 August 2023	15H00 - 17H00
Poster 12	HEX / HPP / EEF	Hall 8.3	Tuesday, 15 August 2023	15H00 - 17H00
Poster 13	TBF / TPA / TPS / TPM / TPN / CDS	Hall 8.1	Wednesday, 16 August 2023	10H20 - 12H20
Poster 14	CND / NCV / RAD / FCV	Hall 8.2	Wednesday, 16 August 2023	10H20 - 12H20
Poster 15	FBL / TPB / EVP / PBL	Hall 8.3	Wednesday, 16 August 2023	10H20 - 12H20
Poster 16	HEX / HPP / EEF	Hall 8.1	Thursday, 17 August 2023	10H20 - 12H20
Poster 17	FBL / TPB / EVP / PBL	Hall 8.2	Thursday, 17 August 2023	10H20 - 12H20
Poster 18	EEC / TEL / NMS	Hall 8.3	Thursday, 17 August 2023	10H20 - 12H20
Poster 19	TBF / TPA / TPS / TPM / TPN / CDS	Hall 8.1	Thursday, 17 August 2023	15H00 - 17H00
Poster 20	HEX / HPP / EEF	Hall 8.2	Thursday, 17 August 2023	15H00 - 17H00
Poster 21	FBL / TPB / EVP / PBL	Hall 8.3	Thursday, 17 August 2023	15H00 - 17H00
Poster 22	TDY / TPP / PPE / MLT	Hall 8.1	Friday, 18 August 2023	10H20 - 12H20
Poster 23	NMM / MIN	Hall 8.2	Friday, 18 August 2023	10H20 - 12H20
Poster 24	ACR / ADS / MTR / FLM	Hall 8.3	Friday, 18 August 2023	10H20 - 12H20
Poster 25	PMD / FCL / NMT	Hall 8.1	Friday, 18 August 2023	13H20 - 15H20
Poster 26	CMB / GTB / MNF / IPJ / TTR	Hall 8.2	Friday, 18 August 2023	13H20 - 15H20
Poster 27	INV / BMA / SAT / PLS	Hall 8.3	Friday, 18 August 2023	13H20 - 15H20

## POSTER SESSION 1

Subject: Heat Transfer Enhancement (HTE)

Monday, 14 August 2023 | Hall 8.1 | 11H00 - 13H00

Time	ID	Title, Author(s), Affiliation(s) - *Presenting Author
11H00 - 11H02	34	<b>ENHANCED HEAT TRANSFER BY BURST-MODE ACTUATION OF DIELECTRIC-BARRIER-DISCHARGE PLASMA ACTUATOR IN MICROCHANNEL FLOW AT LOW REYNOLDS NUMBER</b> Kenta Emori*, Emi Takahashi, Jumpei Niida, Shigeharu Yamagami, Akihiko Mitsuishi, Hiroyuki Nishida, Kaoru Iwamoto Nissan motor co. ltd, Japan
11H03 - 11H05	42	<b>CFD OPTIMIZATION OF FAN RADIATOR DESIGN: A NOVEL HYDRONIC TERMINAL FOR SPACE CONDITIONING</b> Nicola Bianco, Andrea Fragnito, Marcello Iasiello, Gerardo Maria Mauro* Università degli Studi del Sannio, Italy
11H06 - 11H08	63	<b>RESONANT THERMAL TRANSPORT ENABLED BY HYBRIDIZED GUIDED MODES IN A CYLINDRICAL CAVITY</b> Jose Ordonez-Miranda*, Masahiro Nomura, Sebastian Volz LIMMS-CNRS/IIS-University of Tokyo, Japan
11H09 - 11H11	67	<b>EXPERIMENTAL COMPARISON OF TWO FIN GEOMETRIES FOR CAST IRON AIR PREHEATERS</b> Xander van Heule*, Thomas Schoonjans, Elias Vieren, Willem Faes, Daan Beets, Max Bijnsens, Michel De Paepe Ghent University, Belgium
11H12 - 11H14	69	<b>ENHANCING HEAT TRANSFER IN MINI-SCALE LIQUID-COOLED HEAT SINKS BY FLOW OSCILLATION</b> James Hockaday*, Richard Law Newcastle University, United Kingdom
11H15 - 11H17	80	<b>TOPOLOGICALLY OPTIMIZED LIQUID-COOLED HEAT SINKS FABRICATED USING THERMAL SPRAY</b> Joshua Palumbo*, Omri Tayyara, Cristina Amon, Sanjeev Chandra University of Toronto, Canada
11H18 - 11H20	114	<b>HEAT TRANSFER ENHANCEMENT OF TURBULENT CONVECTIVE FLOW THROUGH A NOVEL RIBBED CHANNEL ARRANGEMENT</b> Auronil Mukherjee, Arnab Chakraborty, Alankrita Singh* Indian Institute of Technology Roorkee, India
11H21 - 11H23	121	<b>SORBENT HEAT SINKS FOR ENHANCED THERMOELECTRIC POWER GENERATION</b> Ahmet Alperen Gunay*, Yuto Sugamoto, Sohei Kito, Sivasankaran Harish, Junichiro Shiomi Middle East Technical University, Turkey
11H24 - 11H26	129	<b>FLOW FIELD SYNERGY PRINCIPLE BASED OPTIMIZATION OF DEFLECTORS INSIDE LARGE-SCALE DRY COOLING SYSTEM</b> Huimin Wei, Jingyao Wang*, Zhihua Ge, Lijun Yang, Xiaoze Du NORTH CHINA ELECTRIC POWER UNIVERSITY, China
11H27 - 11H29	195	<b>FLUID-THERMAL DESIGN OPTIMIZATION OF A HIGH POWER DENSITY ELECTRIC MOTOR</b> Samuel Borges*, Jurandir Itizo Yanagihara WEG Motors, Brazil
11H30 - 11H32	220	<b>IMPROVEMENT IN THE DIRECTIONAL THERMAL CONDUCTIVITY OF A THIN HEAT SPREADER BASED ON A COMPOSITE MATERIAL SHEET FOR ELECTRONIC COOLING</b> Seok Hwan Moon*, Sol Yee Lim Electronics and Telecommunications Research Institute, South Korea

11H33 - 11H35	229	<b>HEAT TRANSFER DURING PHASE SEPARATION OF PARTIALLY MISCIBLE LIQUID-LIQUID SYSTEMS IN MINI-CHANNELS</b> Daniel Trestman, Irina Vishnevetsky, Wei Xing, Yoav Peles, Neima Brauner, Amos Ullmann* School of Mechanical Engineering, Tel Aviv University, Israel
11H36 - 11H38	234	<b>HEAT TRANSFER ENHANCEMENT IN LIQUID METALS BY STATIC AND ROTATING MAGNETIC FIELDS</b> Semion Sukoriansky*, Eli Barami, Kfir Barda Ben-Gurion University of the Negev, Israel
11H39 - 11H41	265	<b>EXPERIMENTAL AND NUMERICAL INVESTIGATION OF FLOW INSTABILITIES IN OFFSET STRIP FIN HEAT EXCHANGER GEOMETRIES</b> Stefan Roesler* Esslingen University of Applied Sciences, Germany
11H42 - 11H44	288	<b>ANALYSIS OF IRREVERSIBLE DISSIPATION AND OPTIMIZATION ON SWALLOW TAIL LONGITUDINAL SWIRL GENERATORS FOR LAMINAR FLOW</b> Yongji Wang*, Zhichun Liu, Wei Liu Huazhong University of Science and Technology, China
11H45 - 11H47	289	<b>EXPERIMENTAL INVESTIGATION OF THERMAL CONTACT CONDUCTANCE AT CARBIDE-STEEL INTERFACES AT HIGH LOADS</b> Tim Göttlich* Institute of Heat and Mass Transfer, RWTH Aachen University, Germany
11H48 - 11H50	300	<b>HEAT AND MASS TRANSFER IN THE STEAM METHANE REFORMING PROCESS</b> Dmitry Pashchenko* Guangdong Technion - Israel Institute of Technology, China
11H51 - 11H53	315	<b>THERMAL CONVECTION ENHANCEMENT OF LAMINAR PARTICLE-LADEN FLOW IN A SQUARE DUCT: FULLY RESOLVED NUMERICAL INVESTIGATION</b> QIYA SHU*, MANUEL RIETZ, REINHOLD KNEER, WILKO ROHLFS INSTITUTE of HEAT and MASS TRANSFER, RWTH AACHEN UNIVERSITY, Germany
11H54 - 11H56	343	<b>USING SIMILARITY OF HEAT AND MASS TO CALCULATE THE HEAT TRANSFER COEFFICIENT IN THE GILLS OF FISH WITH APPLICATION TO SKIPJACK TUNA</b> Mahmoud Rasti, JEONG JI HWAN*, HYOIN LEE Pusan national university, South Korea
11H57 - 11H59	353	<b>MULTI-OBJECTIVE ADJOINT-BASED SHAPE OPTIMIZATION OF HEAT TRANSFER SURFACES IN TURBULENT FLOWS WITH DNS-RANS HYBRID APPROACH</b> Yukinori Kametani*, Sho Watanabe, Yosuke Hasegawa Meiji University, Japan

## POSTER SESSION 2

Subject: Numerical Simulation (NSM) & Computational Methods (CPM)

Monday, 14 August 2023 | Hall 8.2 | 11H00 - 13H00

Time	ID	Title, Author(s), Affiliation(s) - *Presenting Author
11H00 - 11H02	12	<b>THERMAL AND ACOUSTIC EFFECTS IN A SILENCER CHAMBER</b> Michael Lucidi, Bakhtier Farouk* Drexel University, United States
11H03 - 11H05	38	<b>TOPOLOGY OPTIMIZATION TO DESIGN INNOVATIVE HIGHTHERMAL- RESISTANCE 3D PRINTED WALLS</b> Andrea Fragnito*, Marcello Iasiello, Gerardo Maria Mauro, Costantino Menna, Casper Schousboe Andreasen Università degli Studi di Napoli Federico II, Italy
11H06 - 11H08	182	<b>TAILORING THE SPECTRAL PROPERTIES OF RADIATIVE HEAT TRANSFER IN DISORDERED MANY-NANOPARTICLE SUSPENSIONS</b> Cédric Blanchard*, Jean-François Guerra, Applicant 2: Timothée González de Arrieta, Applicant 3: Iñigo Rozenbaum, Applicant 4: Olivier CNRS-CEMHTI, France
11H09 - 11H11	208	<b>ONE-DIMENSIONAL NETWORK MODELLING OF A VHTR PRISMATIC BLOCK FUEL ASSEMBLY</b> Charl Du Toit* North-West University, South Africa
11H12 - 11H14	330	<b>NUMERICAL SIMULATION OF MOLTEN GLASS FLOW FROM A DISCHARGE NOZZLE OF A MELTER FOR THE TREATMENT OF HIGH-LEVEL LIQUID WASTE FROM REPROCESSING OF SPENT NUCLEAR FUELS</b> Shunji Homma*, Ryoya Koyama, Iku Miyasaka, Hiroshi Ikai Saitama University, Japan
11H15 - 11H17	339	<b>NUMERICAL ANALYSIS ON PERFORMANCE CHARACTERISTICS OF AN EJECTOR</b> Waseem Raza, Gang Soo Ko, Youn Cheol Park* Jeju National University, South Korea
11H18 - 11H20	372	<b>NUMERICAL AND EXPERIMENTAL INVESTIGATION OF TEMPERATURE FLUCTUATION ON THE PLATE SURFACE INDUCED BY A COAXIAL JET FLOW</b> Xing Luo*, Guo-Yan Zhou, Xue-Yao Xiong, Stephan Kabelac, Shan-Tung Tu Institute of Thermodynamics, Leibniz University Hannover, Germany
11H21 - 11H23	391	<b>LARGE EDDY SIMULATION OF CONVECTIVE HEAT TRANSFER AROUND HUMAN BODY IN OUTDOOR ENVIRONMENTS</b> Haobin Liang, Yichen Yu*, Jianlei Niu The Hong Kong Polytechnic University, China
11H24 - 11H26	451	<b>OPTIMISATION OF VORTEX TUBE THERMAL PERFORMANCE BY CFD SIMULATION</b> Quynh Trang Pham*, Bénédicte Champel, Quentin Sorel CEA, France
11H27 - 11H29	476	<b>A NUMERICAL INVESTIGATION OF HEAT TRANSFER AND FLOW REDISTRIBUTION IN A 7X7 BALLOONED ROD BUNDLE</b> Bo Liu*, Charles Moulinec, Wei Wang, Shuisheng He, Juan Uribe Science and Technology Facilities Council Daresbury Laboratory, United Kingdom
11H30 - 11H32	600	<b>BASED-DATA DRIVEN RECONSTRUCTION USING LOW FIDELITY SIMULATION FOR COMPRESSIBLE FLOW PREDICTIONS IN CONVERGENT-DIVERGENT NOZZLES</b> Daniel Dezan*, Wallace Gusmão Ferreira, Allan Moreira de Carvalho Federal University of ABC, Brazil

11H33 - 11H35	605	<b>NUMERICAL PREDICTIONS OF LAMINAR FULLY DEVELOPED FLUID FLOW AND HEAT TRANSFER IN STRAIGHT DUCTS WITH AXIALLY UNIFORM INJECTION THROUGH THE SIDE WALLS</b> James I. Medvescek, Nirmalakanth Jesuthasan, Laurent Mydlarski, Bantwal R. (Rabi) Baliga* McGill University, Canada
11H36 - 11H38	13	<b>NUMERICAL SIMULATIONS ON THE EFFECT OF AN ELECTRIC FIELD ON VAPOR BUBBLE GROWTH IN MICROGRAVITY</b> Johannes Kind*, Axel Sielaff, Peter Stephan Technical University of Darmstadt, Germany
11H39 - 11H41	47	<b>SEMI MESH-LESS MODEL FOR COMBINED CONDUCTION-CONVECTION-RADIATIVE HEAT TRANSFER : APPLICATION TO POROUS HEAT EXCHANGER</b> RAJ NARAYAN KONDURU*, Gilles PARENT, Olivier FARGES, Vincent SCHICK University of Lorraine, France
11H42 - 11H44	117	<b>THE PATH TRAVERSAL METHOD FOR THE ORIENTATION INFORMATION OF FILLERS IN COMPOSITES</b> Xinfeng Zhang*, Yiwen Fan, Xuan Yang, Linyi Xiang, Guanying Xing, Run Hu, Xiaobing Luo Huazhong University of Science and Technology, China
11H45 - 11H47	146	<b>HYPersonic FLOW AND HEAT TRANSFER CHARACTERISTICS OVER AN AIRFOIL</b> Bakhtier Farouk*, Hussein Bassindowa Drexel University, United States
11H48 - 11H50	174	<b>A DETAILED CFD MODEL OF HEAT AND MASS TRANSFER AROUND PLANTS</b> Toon Demeester*, Wito Plas, Michel De Paepe Ghent University, Belgium
11H51 - 11H53	332	<b>THE TEMPERATURE DECOMPOSITION METHOD FOR PERIODIC THERMAL FLOW SIMULATIONS</b> Junfeng Zhang* Laurentian University, Canada
11H54 - 11H56	404	<b>DEVELOPMENT AND VALIDATION OF A NOVEL SOLID COLLISION OPERATOR IN IB-LB FRAMEWORK FOR SIMULATION OF THERMAL FLOWS</b> SAMBIT MAJUMDER, DIPANKAR N BASU*, GANESH NATARAJAN INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI, India

### POSTER SESSION 3

Subject: Energy Storage & Conversion (ECS) & Thermal Storage (TST)

Monday, 14 August 2023 | Hall 8.3 | 11H00 - 13H00

Time	ID	Title, Author(s), Affiliation(s) - *Presenting Author
11H00 - 11H02	155	<b>EICOSANE LIQUID FRACTION EXPERIMENTAL MEASUREMENT BASED ON COMPUTED TOMOGRAPHY</b> Dario Guarda*, Benjamin Fenk, Damian Gwerder, Jorge Martinez-Garcia, Anastasia Stamatiou, Jörg Worlitschek, Simone Mancin, Philipp Schuetz Università degli Studi di Padova, Italy
11H03 - 11H05	256	<b>HEAT TRANSFER COEFFICIENT FOR RANDOMLY PACKED ELLIPSOIDS SUBJECT TO A CONSTANT HEAT FLUX</b> Jaap Hoffmann*, Jordan Rayner Stellenbosch University, South Africa
11H06 - 11H08	269	<b>ENHANCED OUTPUT ELECTRICITY OF COUPLED PCM AND THERMOELECTRIC GENERATOR SYSTEM WITH OPTIMIZED COLD-END TEMPERATURE</b> Yuanyuan Wang*, Xiaojun Zhao, Lan Dong, Zihua Wu, Huaqing Xie Shanghai Polytechnic University, China
11H09 - 11H11	278	<b>BIMODAL PARTICLE MIXTURES FOR ENHANCED THERMAL CONDUCTIVITY IN PACKED BED ENERGY STORAGE APPLICATIONS</b> Dallin Stout, Nirmala Kandadai, Todd Otanicar* Boise State University, United States
11H12 - 11H14	435	<b>CFD STUDY OF THERMOCLINE FORMATION IN STRATIFIED WATER STORAGE: CONSIDERATION OF A SECOND-ORDER BOUSSINESQ APPROXIMATION TO MODEL BUOYANCY EFFECTS AND ITS APPLICATION TO ASSES THE IMPACT OF OPERATING CONDITIONS</b> Alexis Ferré*, Jérôme Pouvreau, Sylvain Serra, Rémi Manceau, Arnaud Bruch CEA, France
11H15 - 11H17	469	<b>A NOVEL WASTE FOUNDRY SAND BASED COMPOSITE PHASE CHANGE MATERIAL FOR MEDIUM AND HIGH TEMPERATURE WASTE HEAT RECOVERY APPLICATIONS</b> Argyrios Anagnostopoulos* University of Birmingham, United Kingdom
11H18 - 11H20	512	<b>PHASE-CHANGE MATERIAL SUSPENSION IN PHOTOCURABLE RESIN FOR LIQUID CRYSTAL DISPLAY 3D PRINTING OF THERMAL ENERGY STORAGE COMPOSITES</b> Isabel Melendez*, Casey Troxler, Rafael Rodriguez, Sandra Boetcher Embry-Riddle Aeronautical University, United States
11H21 - 11H23	513	<b>HEAT TRANSFER THROUGH PACKED BED OF PARTICLES FOR HIGH-GRADE THERMAL ENERGY STORAGE</b> Hamidreza Ermagan, Nicholas Annejohn, Leyla Amiri*, Reza Lotfalian, Agus Sasmito Sherbrooke university, Canada
11H24 - 11H26	94	<b>STUDY ON THEORETICAL DESIGN METHOD AND SCALING-ANALYSIS OF HOT WATER STORAGE TANK</b> Huimin Wei*, Yuelong Cui, Chong Wang, Zhihua Ge, Xiaoze Du NORTH CHINA ELECTRIC POWER UNIVERSITY, China
11H27 - 11H29	160	<b>PHASE CHANGE FRONT MOVEMENT CHARACTERIZATION OF A TUBE IN TUBE PHASE CHANGE MATERIAL HEAT EXCHANGER</b> Maité Goderis*, Kenny Couvreur, Julie Van Zele, Wim Beyne, Michel De Paepe Ghent University, Belgium

11H30 - 11H32	162	<b>AN IMPROVED CHARGING TIME ENERGY FRACTION MODEL FOR LATENT THERMAL STORAGE HEAT EXCHANGERS</b> Kenny Couvreur*, Maité Goderis, Wim Beyne, Michel De Paepe Ghent University, Belgium
11H33 - 11H35	271	<b>HEAT EXTRACTION CHARACTERISTICS OF A SMALL SCALE METALLIC LATENT HEAT THERMAL ENERGY STORAGE SYSTEM</b> Frank Nees*, Julius Feine, Anastasios Katourtzidis, Veronika Stahl, Werner Kraft German Aerospace Center (DLR), Germany
11H36 - 11H38	276	<b>PREDICTING THERMOPHYSICAL PROPERTIES OF DEEP EUTECTIC SOLVENT NANOFLUIDS USING MACHINE LEARNING APPROACH</b> Sarit K. Das*, Pyarimohan Dehury, Shahil Chaudhari, Tamal Banerjee IIT Madras, India
11H39 - 11H41	302	<b>THE MELTING TIME LIQUID FRACTION METHOD FOR CHARACTERIZING MELTING IN RECTANGULAR LATENT THERMAL ENERGY STORAGE HEAT EXCHANGERS</b> Robin Tassenoy*, Wim Beyne, Wout De Keyser, Xander van Heule, Michel De Paepe Ghent University, Belgium
11H42 - 11H44	334	<b>HEAT TRANSFER CHARACTERISTICS OF PHASE CHANGE MATERIAL EMULSIONS</b> Takashi Morimoto*, Kumano Hiroyuki Aoyama Gakuin University, Japan
11H45 - 11H47	342	<b>PREDICTING THE OUTPUT OF A LATENT THERMAL ENERGY STORAGE HEAT EXCHANGER BY DECOMPOSITION INTO A SERIES CONNECTION OF HEAT EXCHANGERS WITH AN ANALYTICAL SOLUTION</b> Wim Beyne*, Maité Goderis, Victor Van Riet, Michel De Paepe Ghent University, Belgium
11H48 - 11H50	351	<b>CHARACTERIZATION OF A SMALL-SCALE PCM-HEAT EXCHANGER: IMPACT OF PCM SELECTION</b> Ryan Callaghan, Elisangela D'Oliveira, Dominic Groulx*, Carolina Costa Pereira Mechanical Engineering/Dalhousie University, Canada

## POSTER SESSION 4

Subject: Heat Transfer Enhancement (HTE)

Monday, 14 August 2023 | Hall 8.1 | 15H00 - 17H00

Time	ID	Title, Author(s), Affiliation(s) - *Presenting Author
15H00 - 15H02	367	<b>HEAT TRANSFER ENHANCEMENT ANALYSIS OF A SOLAR AIR HEATER CHANNEL WITH MOUNTED LOUVERED-WINGLET VORTEX GENERATORS</b> Wallace Gusmão Ferreira, Daniel Dezan*, Rafael Módolo Dias Duarte Federal University of ABC, Brazil
15H03 - 15H05	487	<b>ON THE REFRIGERATION PERFORMANCE OF COOLING PLATES WITH DIFFERENT CHANNEL SHAPES</b> José Félix Guil-Pedrosa*, Luis Miguel García-Gutiérrez, Mariano Rubio-Rubio, Antonio Soria-Verdugo Universidad Carlos III de Madrid, Spain
15H06 - 15H08	498	<b>INFLUENCE OF CURVATURE VARIATIONS IN THE HEAT TRANSFER OF AN UNSTEADY GOERTLER FLOW</b> Leandro Souza*, Josuel Rogenski University of Sao Paulo, Brazil
15H09 - 15H11	511	<b>ADJOINT SENSITIVITY ANALYSIS FOR HEAT TRANSFER ENHANCEMENTS IN STRUCTURED CHANNELS</b> David Müller*, Yukinori Kametani, Yosuke Hasegawa, Alexander Stroh KIT - ISTM, Germany
15H12 - 15H14	596	<b>NUMERICAL STUDY AND OPTIMIZATION ON THE BIFURCATED ARC PIPES IN A CIRCULAR TUBE UNDER THE LAMINAR FLOW</b> Qinglin Du*, Zhichun Liu, Wei Liu Huazhong University of Science and Technology, China
15H15 - 15H17	628	<b>HEAT TRANSFER ENHANCEMENT IN LAMINAR CHANNEL FLOW BY MACHINE LEARNING GUIDED SHAPE OPTIMIZATION OF WALL GEOMETRY</b> Arjun John Kaithakkal*, Matthias Schniewind, Pascal Friederich, Alexander Stroh, Yuri Koide Karlsruhe Institute of Technology, Germany
15H18 - 15H20	688	<b>HEAT TRANSFER ENHANCEMENT OF CERAMIC FOAM FOR MOLTEN SALT-BASED PHASE CHANGE MATERIAL</b> Yuying Yan* University of Nottingham, United Kingdom
15H21 - 15H23	693	<b>EFFECT OF TWISTED TAPES IN A CIRCUMFERENTIAL RECTANGULAR CHANNEL OF AUTOMOTIVE MANUFACTURING MACHINERY</b> Refiya Hussain*, K Arul Prakash Indian Institute of Technology, Madras, India
15H24 - 15H26	726	<b>MOLECULAR DYNAMICS SIMULATION OF CALCIUM CARBONATE FOULING INHIBITION BY CARBOXYMETHYL DEXTRAN WITH DIFFERENT DEGREE OF POLYMERIZATION</b> Hao Zhang*, Zhiming Xu, Yu Zhao, Jingtao Wang, Bingbing Wang Northeast Electric Power University, China
15H27 - 15H29	835	<b>AN INNOVATIVE HEAT SINK INTEGRATED WEARABLE THERMOELECTRIC GENERATOR FOR A BODY HEAT HARVESTING</b> Salman Khan*, JIYONG KIM, Eun Kyu Kim, Sungjin Park, Junyoung Yoon, Woochul Kim Yonsei University, South Korea
15H30 - 15H32	917	<b>APPLICATION OF FLUIDIC OSCILLATORS FOR GENERATION OF LONGITUDINAL VORTEX STRUCTURES IN SLOT CHANNELS</b> Maxim Shestakov* Kutateladze Institute of Thermophysics, Siberian Branch of RAS, Russia

15H33 - 15H35	972	<b>NUMERICAL STUDY ON HEAT TRANSFER ENHANCEMENT IN PLATE FIN HEAT SINK OF SIC MOSFET POWER INVERTER FOR ELECTRIC VEHICLE APPLICATIONS.</b> MUDDADA GANAPATHI, Sai Bhargav Pochinapeddi, K. Arul Prakash* Indian Institute of Technology Madras, India
15H36 - 15H38	1105	<b>SINGLE PHASE THERMAL AND HYDRAULIC PERFORMANCE OF A HYBRID PIN FIN AND SCHOEN-G TPMS ARCHITECTURE COLD PLATE FOR ELECTRONICS THERMAL MANAGEMENT</b> Ahmet Mete Muslu, Yogendra Joshi* Georgia Institute of Technology, United States
15H39 - 15H41	1107	<b>ASSESSMENT OF THE USE OF TRIPLY PERIODIC MINIMAL SURFACES AS HEAT SINKS FOR MW/M2-HEAT FLUX CLASS COMPONENTS</b> Eleonora Gajetti*, Luca Marocco, Laura Savoldi Politecnico di Torino, Italy
15H42 - 15H44	1122	<b>NUMERICAL SIMULATION OF HEAT TRANSFER IN TERMITE MOUNDS</b> Ali Bayat*, Sebastian Oberst, Joseph Lai University of Technology Sydney, Australia
15H45 - 15H47	1127	<b>HEAT TRANSFER ENHANCEMENT VIA BULK FLOW STRUCTURE MANIPULATION IN THERMAL CONVECTION</b> Keqing Xia*, Zhang Lu Southern University of Science and Technology, China
15H48 - 15H50	1140	<b>STUDY ON THE SPATIAL ARRANGEMENT AND MORPHOLOGY IN MANIFOLD MICRO PIN-FIN HEAT SINK</b> Qian Liu*, Qianlei Shi, Xiaole Yao, Chao Xu, Xing Ju North China Electric Power University, China

## POSTER SESSION 5

Subject: Thermal Management (TMG)

Monday, 14 August 2023 | Hall 8.2 | 15H00 - 17H00

Time	ID	Title, Author(s), Affiliation(s) - *Presenting Author
15H00 - 15H02	65	<b>THERMAL PREDICTION FOR TWO-PHASE IMMERSION COOLED DATA CENTRES BASED ON CNN-LSTM ENCODER-DECODER NETWORKS</b> Pratheek Suresh*, Chakravarthy Balaji INDIAN INSTITUTE OF TECHNOLOGY. MADRAS, India
15H03 - 15H05	88	<b>A HIGH FLOW RATE PIEZOELECTRIC MICROPUMP FOR MINIATURE LIQUID COOLING SYSTEM</b> Yiwen Fan*, Xinfeng Zhang, Guanying Xing, Linyi Xiang, Run Hu, Xiaobing Luo Huazhong University of Science and Technology, China
15H06 - 15H08	97	<b>SELF-ASSEMBLED TI3C2TX MXENE/PVDF-HFP JANUS FILM WITH REVERSIBLE SOLAR HEATING AND RADIATIVE COOLING FOR MULTIFUNCTIONAL THERMAL MANAGEMENT</b> Huatian Zhai*, Desong Fan, Qiang Li Nanjing university of science and technology, China
15H09 - 15H11	116	<b>TIME-DEPENDENT TEMPERATURE DISTRIBUTION IN SLOWLY COOLED MOLTEN SLAG SIMULATED BY SOLIDIFICATION PROCESS AND HEAT TRANSFER MODEL USING PROPERTIES ESTIMATED BY DEEP NEURAL NETWORK</b> Takao Nakagaki*, Jun Sasagawa, Hikaru Akutsu, Corey Myers Waseda University, Japan
15H12 - 15H14	140	<b>PORE-SCALE STUDY ON TEMPERATURE CONTROL OF GRAPHENE COMPOSITE PHASE CHANGE MATERIALS IN PERIODIC POWER DEVICES</b> Tao Lai*, ZhiGuo Qu Xi'an Jiaotong University, China
15H15 - 15H17	202	<b>STUDY ON INTERNAL REACTIONS RELATED TO THERMAL RUNAWAY OF LITHIUM-ION BATTERY</b> Dong Kyu Kim*, Ryanghun Kim Chung-Ang University, South Korea
15H18 - 15H20	248	<b>THE EFFECT OF HOLE SHAPE ON THE CLOAKING PERFORMANCE OF POROUS THERMAL CLOAK AND ITS MECHANISM</b> Hao-Chun Zhang*, Jian Zhang Harbin Institute of Technology, China
15H21 - 15H23	259	<b>A HIGHLY INTEGRATED POWER ELECTRONICS SOLUTION – CONCEPTS AND NUMERICAL MODELING</b> Feng Zhou*, Jae Lee Toyota Research Institute of North America, United States
15H24 - 15H26	322	<b>THERMAL MANAGEMENT OF ELECTRONICS WORKING ON CYCLIC HEAT LOADS: AN EXPERIMENTAL STUDY</b> SAYAN MAJUMDER*, Rajesh Akula, Balaji Chakravarthy INDIAN INSTITUTE OF TECHNOLOGY, MADRAS, India
15H27 - 15H29	394	<b>THERMAL COMFORT AND PERFORMANCE OF SUBSIDY HOUSING IN SOUTH AFRICA</b> Michael Owen, Cameron Nel* Stellenbosch University, South Africa
15H30 - 15H32	414	<b>EXPERIMENTAL PARAMETER STUDY ON MULTI-SCALE HEAT TRANSFER AT NON-CONFORMING ROUGH SURFACES</b> Thorsten Helmig*, Tim Göttlich, Reinhold Kneer Institute of Heat and Mass Transfer, RWTH Aachen University, Germany

15H33 - 15H35	471	<b>EFFECT OF POROSITY VARIATION ON THE HEAT TRANSFER PERFORMANCE OF A CHANNEL WITH POROUS RIB: PORE-SCALE SIMULATION</b> Surendra Singh Rathore*, Balkrishna Mehta, Mohammad Asfer, Pradeep Kumar IIT Bhilai, India
15H36 - 15H38	474	<b>A COMPARISON OF THE THERMOHYDRAULIC PERFORMANCE OF VARIOUS ROTOR COOLING TECHNIQUES FOR AN IPMSM</b> Jasper Nonneman*, Thomas Schoonjans, Ilya T'Jollyn, Bart Peremans, Branimir Mrak, Stephan Schlimpert, Steven Vanhee, Michel De Paepe Ghent University, Belgium
15H39 - 15H41	551	<b>PARAMETRIC DESIGN OF AN END-WINDING COOLING METHOD FOR A PERMANENT MAGNET SYNCHRONOUS MOTOR</b> Paula Cunha, Pedro Coelho*, António Luís Moreira Instituto Superior Técnico, Universidade de Lisboa, Portugal
15H42 - 15H44	642	<b>INVESTIGATION OF THERMAL MANAGEMENT DURING CHEMICAL MECHANICAL POLISHING PROCESS</b> Taesung Kim*, Minsung Kim* Sungkyunkwan University, South Korea and Chung-Ang University, South Korea
15H45 - 15H47	660	<b>OBSERVATION OF SUPERDIFFUSIVE HEAT TRANSFER ACROSS A ONE-DIMENSIONAL HETEROJUNCTION: A MOLECULAR DYNAMICS STUDY</b> Renjie Hua*, Yunlei Jiang, Lei Shi, Yuan Dong, Guojin Chen, Yingru Song Hangzhou Dianzi University, China
15H48 - 15H50	755	<b>THERMAL RUNAWAY WARNING OF BATTERY PACK BASED ON DATA-DRIVEN AND DYNAMIC THRESHOLD</b> Zhaoran Li*, Yusong Zhou, Qian Fu, Xun Zhu, Qiang Liao, Min Cheng ChongQing University, China

## POSTER SESSION 6

Subject: Numerical Simulation (NSM) & Computational Methods (CPM)

Monday, 14 August 2023 | Hall 8.3 | 15H00 - 17H00

Time	ID	Title, Author(s), Affiliation(s) - *Presenting Author
15H00 - 15H02	664	<b>A NUMERICAL ESTIMATION FOR THERMAL PERFORMANCE OF AN OUTER-ROTATING MOTOR FOR A PERSONAL AIR VEHICLE</b> Sungjin Yang, Jongrak Choi, Jung-Moo Seo*, Hyuk Jung Kim, Yongwoo Shin, Gihun Son Korea Electronics Technology Institute, South Korea
15H03 - 15H05	700	<b>THERMAL AND FLOW ANALYSIS OF A HOT AIR CURTAIN SYSTEMS FOR THE CASE OF DUST FLOW SUPPRESSION THROUGH A SEMI-ENCLOSED HOUSING</b> Ockert J. Kotzé*, Mostafa Mahdavi, Mohsen Sharifpur, Josua P Meyer University of Pretoria, South Africa
15H06 - 15H08	724	<b>DEM ANALYSIS OF HEAT TRANSFER IN THE BULK BED OF ROTARY KILNS</b> Fabian Herz*, Elisabeth Kleiber, Lanyue Zhang, Fabian Weigler, Xiaoyan Liu Anhalt University of Applied Sciences, Germany
15H09 - 15H11	792	<b>EFFECT OF VISCOUS DISSIPATION ON FLOW FIELD AND AERODYNAMIC HEATING IN AERODYNAMIC BEARING COUPLED WITH AERO-THERMO-ELASTIC</b> Renxuan Wang, Jing-yang Zhang*, Yuan-we Lyu Nanjing University of Aeronautics and Astronautics, China
15H12 - 15H14	861	<b>AN OPTIMIZATION TECHNIQUE TO IDENTIFY SIMULATION ASSUMPTIONS FOR VARIOUS NANOFUIDS USING MACHINE LEARNING</b> Ekene Jude Onyiriuka, Daniel R.E. Ewim*, Sogo Mayokun Abolarin Department of Mechanical Engineering, Durban University of Technology, Durban, South Africa, South Africa
15H15 - 15H17	946	<b>DEVELOPMENT AND DESIGN OF A LOX/LNG THRUST CHAMBER BY USING COMPUTER-AIDED OPTIMIZATION METHODS</b> Jan Haemisch*, Kai Dresia, Dmitry Suslov, Günther Waxenegger-Wilfing German Aerospace Center (DLR), Germany
15H18 - 15H20	981	<b>NUMERICAL SIMULATION OF SUPERSONIC BOUNDARY LAYER RECEPTIVITY TO ENTROPY DISTURBANCES</b> Natalia Palchekovskaya* Moscow Institute of Physics and Technology, Russia
15H21 - 15H23	1102	<b>A 0D APPROACH FOR EXTENDED OPERATIONAL MODELING OF AIR EJECTORS IN THERMAL SYSTEMS</b> Eugenio Schillaci*, Carles Oliet, Jagadish Babu Vemula, Matthieu Duponcheel, Yann Bartosiewicz, Philippe Planquart Polytechnic University of Catalonia (UPC), Spain
15H24 - 15H26	1120	<b>NUMERICAL INVESTIGATIONS OF CLIMATE MONITORING IN A NEONATAL INTENSIVE CARE UNIT (NICU)</b> Jianfei Xie*, Olivia Wood University of Derby, United Kingdom
15H27 - 15H29	1129	<b>MICROWAVE HEATING OF A THREE PHASES SPHERICAL SYSTEM WITH THEIR THERMAL PROPERTIES AND MICROWAVE VOLUMETRIC FLOW AS A FUNCTION OF TEMPERATURE, POSITION AND TIME</b> Carlos Rodrigo Correa Cely*, Iván Amaya, Jorge Cruz Universidad Industrial de Santander, Colombia

15H30 - 15H32	1147	<b>EVALUATION OF DETERMINISTIC AND PROBABILISTIC MODELS FOR PREDICTING COVID-19 TRANSMISSION IN AIRLINER CABINS</b> Qingyan Chen* Hong Kong Polytechnic University, France
15H33 - 15H35	405	<b>STABILITY ANALYSIS OF COUPLED NAVIER-STOKES SOLVER IN TRANSIENT PROBLEMS OF INCOMPRESSIBLE FLOW</b> Zhaoren Li*, Guohui Ou, Zihan Wang, Wentao Ji, Wenquan Tao Xi'an Jiaotong University, China
15H36 - 15H38	464	<b>TOWARD A MULTI-SCALE MODELLING APPROACH OF THE THERMAL PERFORMANCES OF LATENT HEAT STORAGES WITH RADIAL FINS</b> Teddy Chedid*, Erwin Franquet, Jérôme Pouvreau, Pierre Garcia, Jean-Pierre Bédécarrats CEA France, France
15H39 - 15H41	489	<b>SIMULATION AND NUMERICAL STUDY OF COMPOSITE FUEL COMBUSTION IN A BURNER</b> Ruslan Fedorov, Vladislav Kovalnogov, Dmitry Generalov*, Usama Mizher Ulyanovsk State Technical University, Russia
15H42 - 15H44	748	<b>A NEW EFFICIENT CONSERVATION-BASED METHOD FOR IMPLEMENTING POD-GALERKIN PROJECTION</b> Xiang-You Feng*, Fan Bai, Wen-Quan Tao Xi'an Jiaotong University, China
15H45 - 15H47	791	<b>MODELING AND SCALE-UP APPROACH FOR HYDRODYNAMICS AND DRYING KINETICS OF A FLUIDIZED BED DRYER</b> Sameera Sansare, Hossain Aziz, Bodhisattwa Chaudhuri* University of Connecticut, United States
15H48 - 15H50	1007	<b>RESOLUTION OF CONDUCTIVE-RADIATIVE HEAT TRANSFER IN A SEMI-TRANSPARENT MEDIUM: FUNCTIONAL ESTIMATION OF THE RADIATIVE SOURCE TERM WITH MONTE CARLO METHOD</b> Léa Penazzi*, Olivier Farges, Vincent Schick, Johann Meulemans, Yves Jannot LEMTA, Université de Lorraine, France
15H51 - 15H53	1096	<b>SURROGATE-ASSISTED MULTI-OBJECTIVE DESIGN OPTIMIZATION-UNDER-UNCERTAINTY OF A U-BEND SUBJECTED TO PHASE CHANGE</b> Jolan Wauters* Ghent University, Belgium

**POSTER SESSION 7**

Subject: Convection (CNV) &amp; Mixed Convection (MCV)

Tuesday, 15 August 2023 | Hall 8.1 | 10H20 - 12H20

Time	ID	Title, Author(s), Affiliation(s) - *Presenting Author
10H20 - 10H22	27	<b>SINGLE-PHASE CONVECTIVE HEAT TRANSFER ON SPRAY COOLED PLAIN SURFACES WITH HIGHLY VISCOUS COOLANTS</b> Jonas Bender*, Konrad Dubil, Felix Hoffmann, Benjamin Dietrich, Thomas Wetzels, Martin Doppelbauer Karlsruher Institute of Technology - Institute of Thermal Process Engineering, Germany
10H23 - 10H25	39	<b>PINNS APPLICATION TO THE HEAT FLOW IN CZ-SI GROWTH FOR DIGITAL TWIN DEVELOPMENT</b> Yuto Takehara, Yasunori Okano*, Sadik Dost Osaka University, Japan
10H26 - 10H28	71	<b>DEVELOPMENT OF A GENERAL HEAT TRANSFER CORRELATION FOR SUPERCRITICAL LOW GWP REFRIGERANTS UNDER HEATING CONDITIONS</b> Jera Van Nieuwenhuysse*, Stijn Van Isterdael, Steven Lecompte, Michel De Paepe Ghent University, Belgium
10H29 - 10H31	84	<b>A NUMERICAL STUDY OF NATURAL CONVECTIVE HEAT TRANSFER ACROSS A BOTTOM HEATED, TOP COOLED HORIZONTAL RECTANGULAR ENCLOSURE WHEN THE TOP AND BOTTOM SURFACES ARE INCLINED</b> Nesrin Ozalp*, Patrick Oosthuizen Purdue University Northwest, United States
10H32 - 10H34	85	<b>UNSTEADY NATURAL CONVECTIVE HEAT TRANSFER FROM THIN TWO-SIDED HORIZONTAL CIRCULAR AND SQUARE PLATES DUE TO SUDDEN HEATING OF THE PLATE SURFACES</b> Patrick Oosthuizen*, Koustav Bandyopadhyay Queen's University, Canada
10H35 - 10H37	181	<b>AN INNOVATIVE EXPERIMENTAL SETUP FOR ACHIEVING UNIFORM WALL TEMPERATURES IN SIMULTANEOUSLY DEVELOPING FLOW THROUGH A CIRCULAR TUBE</b> Josua P. Meyer* Stellenbosch University, South Africa
10H38 - 10H40	327	<b>SURFACE TEMPERATURE UNIFORMITIES OF DEVELOPING FLOW THROUGH A SMOOTH HORIZONTAL TUBE WITH A UNIFORM WALL TEMPERATURE BOUNDARY CONDITION</b> Mark Coetzee, Marilize Everts* University of Pretoria, South Africa
10H41 - 10H43	390	<b>EFFECT OF MULTI-SCALE ROUGH SURFACES ON HEAT TRANSFER MECHANISM AND FLOW STRUCTURES IN TURBULENT RAYLEIGH-BÉNARD CONVECTION</b> Arnab Kumar De*, Mukesh Sharma, Krishan Chand Indian Institute of Technology Guwahati, India
10H44 - 10H46	622	<b>EFFECT OF VORTEX GENERATORS AND ROOF STRUCTURES ON PASSIVE COOLING OF ROOFTOP PV MODULES IN FREE CONVECTION CONDITIONS</b> Svetlana Tkachenko*, Zibo Zhou, Asavari Hari, Prateek Bahl, Charitha de Silva, Victoria Timchenko, Martin Green University of New South Wales, Australia
10H47 - 10H49	626	<b>DIRECT NUMERICAL SIMULATION ON CONVECTIVE HEAT TRANSFER CHARACTERISTICS OF CROSS FLOW OVER INLINE TUBE BUNDLES</b> Xiaoyang Xie*, Yanjun Tong, Houjian Zhao, Xiaowei Li, Xinxin Wu Tsinghua University, China
10H50 - 10H52	858	<b>HEAT TRANSFER UNDER LAMINARIZATION CONDITION IN A SMALL SUPERSONIC NOZZLE</b> Nikolay Kiselev*, Nikolay Malastowski, Andrey Zditovets, Yurii Vinogradov Lomonosov Moscow State University Institute of Mechanics, Russia

10H53 - 10H55	859	<b>INFLUENCE OF VISCOUS DISSIPATION AND RADIATION ON TRANSIENT HEAT AND MASS TRANSFER ACROSS A PERMEABLE FLAT PLATE EMBEDDED IN POROUS MEDIA SATURATED WITH NANOFLUID</b> Shobha Bagai*, Mridu Sharma Cluster Innovation Center, India
10H56 - 10H58	900	<b>DEVELOPMENT AND THERMODYNAMIC MODELLING OF A NATURAL CIRCULATION AIR-COOLED CLOSED-LOOP TWO-PHASE THERMOSYPHON</b> Taneha Mae Hans*, Robert Thomas Dobson Stellenbosch University, South Africa
10H59 - 11H01	958	<b>IDENTIFICATION OF HEAT TRANSFER PARAMETERS FOR COMPRESSIBLE GAS FLOW IN A SMALL SIZE SUPERSONIC NOZZLE</b> Nikolay Malastowski*, Nikolay Kliselev, Andrey Zditovets, Yurii Vinogradov Lomonosov Moscow State University Institute of Mechanics, Russia
11H02 - 11H04	971	<b>MODEL RESEARCH OF MIXED CONVECTION IN MOLTEN SALTS FLOW WITH INFLUENCE OF DIFFERENT FORCES</b> Natalia Pyatnitskaya*, Ivan Belyaev, Ekaterina Belavina, Yaroslav Listratov Joint Institute for High Temperatures, Russia
11H05 - 11H07	1055	<b>CONJUGATE HEAT TRANSFER WITH HEAT GENERATION IN BOTH SOLID AND FLUID DOMAINS</b> Micah Best, Benjamin Collins, Mark Kimber* Texas A&M University, United States
11H08 - 11H10	170	<b>LIQUID METAL MIXED CONVECTION IN A VERTICAL DUCT</b> Ivan Belyaev*, Nikita Luchinkin, Egor Sheniagin JIHT RAS, Russia
11H11 - 11H13	277	<b>NUMERICAL INVESTIGATION OF TRANSITIONAL MIXED CONVECTION FOR BUOYANCY-ASSISTING AND OPPOSING FLOWS IN A VERTICAL TUBE</b> Somenath Gorai*, Devranjan Samanta, Sarit K. Das Indian Institute of Technology Ropar, India
11H14 - 11H16	744	<b>NEW UNDERSTANDING OF HEAT TRANSFER DETERIORATION DUE TO BUOYANCY</b> Zewen Zou*, Jundi He, Elena Marensi, Shuisheng He The University of Sheffield, United Kingdom

## POSTER SESSION 8

Subject: Energy Storage & Conversion (ECS) & Thermal Storage (TST)

Tuesday, 15 August 2023 | Hall 8.2 | 10H20 - 12H20

Time	ID	Title, Author(s), Affiliation(s) - *Presenting Author
10H20 - 10H22	554	<b>CALCIUM HYDROXIDE-EMBEDDED SILICON CARBIDE HONEYCOMB FOR THERMOCHEMICAL ENERGY STORAGE</b> Shigehiko Funayama*, Takahiro Furuya, Soichiro Tamano, Takashi Kato, Hiroki Takasu, Yukitaka Kato Tokyo Institute of Technology, Japan
10H23 - 10H25	674	<b>CHARACTERIZATION OF THERMAL PROPAGATION RATES BETWEEN ADJACENT LITHIUM-ION POUCH CELLS: EFFECTS OF THERMAL BARRIERS</b> Ofodike Ezekoye*, Robert Kennedy Univ. of Texas at Austin, United States
10H26 - 10H28	739	<b>INNOVATIVE COOLING TECHNIQUES FOR THERMAL MANAGEMENT AND TEMPERATURE UNIFORMITY IMPROVEMENT OF LITHIUM-ION BATTERIES</b> Yuwen Zhang* University of Missouri, United States
10H29 - 10H31	920	<b>HEAT TRANSFER ANALYSIS OF A VERTICAL AND HORIZONTALLY ORIENTED LATENT HEAT THERMAL ENERGY STORAGE SYSTEM USING SUNRISE AND SUNSET TRANSIENT TEMPERATURE MODEL</b> Raymond Ojonugwa Ikeleji* University of Cape Town, South Africa
10H32 - 10H34	1031	<b>RESEARCH ON FLOW/HEAT TRANSFER AND SINKING MOTION COUPLING MECHANISM OF SOLID-LIQUID PHASE CHANGE BY EULER-LAGRANGE ITERATION ALGORITHM</b> Ziliang Zhu*, Dongjun Xu, Shuang Wang, Mei Lin, Qiuwang Wang Xi'an Jiaotong Univeristy, China
10H35 - 10H37	1032	<b>THE INVESTIGATION OF METHANE STEAM REFORMING ABOUT THE EFFECTS OF DIFFERENT GEOMETRY PARAMETERS IN THE PACKED BEDS WITH INTERNAL HELICAL HEAT FINS</b> Zhihong Wu*, Jian Yang, Zhigang Guo, Qiuwang Wang Xi'an Jiaotong University, China
10H38 - 10H40	1065	<b>DESIGN AND TESTING OF A LABORATORY-SCALE PROTOTYPE ULTRAHIGH TEMPERATURE THERMAL ENERGY STORAGE SYSTEM</b> Kyle Buznitsky* Massachusetts Institute of Technology, United States
10H41 - 10H43	1172	<b>DESIGN AND MODELING OF A NOVEL PHASE CHANGE MATERIAL-BASED HEAT CAPACITOR FOR NANOSATELLITE THERMAL CONTROL USING ADDITIVE MANUFACTURING</b> Michael Koenig, Lior Avivi*, Elad Mograbi Rafael Advanced Weapons Systems, Israel
10H44 - 10H46	431	<b>STUDY OF THE THERMAL DYNAMIC BEHAVIOR OF A TES SYSTEM WITH PCM IN A RECTANGULAR ENCLOSURE</b> Abderrahmane EL HANAFI*, Nicolas BLET, Abdelhamid KHEIRI, Benjamin REMY Université de Lorraine, France
10H47 - 10H49	625	<b>CFD MODELLING OF SOLIDIFICATION AND MELTING IN THE EXPERIMENTAL SHELL-AND-TUBE LATENT HEAT STORAGE</b> Konstantin Zaynetdinov*, Markku Nikku, Tero Tynjälä Lappeenranta-Lahti University of Technology LUT, Finland

10H50 - 10H52	777	<b>THERMAL AND MECHANICAL DESIGN, ANALYSIS AND EVALUATION OF MOLTEN SALT TANKS FOR CONCENTRATING SOLAR POWER PLANTS</b> Zhiyi Tang*, Wen-quan Tao School of Future Technology, Xi'an Jiaotong University, China
10H53 - 10H55	782	<b>NEEDLE-BASED MICROFLUIDIC PRODUCTION OF MICROENCAPSULATED PHASE CHANGE MATERIAL FOR SOLAR ENERGY STORAGE</b> Yong Ren*, Yanhong Guo University of Nottingham Ningbo China, China
10H56 - 10H58	837	<b>COMPLETENESS OF SOLID-LIQUID PHASE CHANGE PROCESS IN A SQUARE CAVITY UNDER A PERIODIC WALL TEMPERATURE</b> Hasan Celik, Moghtada Mobedi*, Shogo Tomita Shizuoka University, Japan
10H59 - 11H01	952	<b>MODELING AND TECHNO-ECONOMIC ANALYSIS OF THERMAL ENERGY STORAGE SYSTEM INTEGRATED WITH A POWER TOWER CONCENTRATED SOLAR POWER SYSTEM</b> Giorgio Baldinelli, Eid Gul, Tariq Shamim* Northern Illinois University, United States
11H02 - 11H04	1052	<b>PREPARATION AND CHARACTERIZATION OF SHAPE-STABLE METALLIC MICROENCAPSULATED PHASE CHANGE MATERIAL COMPOSITES</b> Kaichen Wang*, Keyu Tao, Mengdi Yuan, Tianying Zhang, Boxu Yu, Chao Xu, Feng Ye, Zhirong Liao North China Electric Power University, China
11H05 - 11H07	1058	<b>DESIGN AND PERFORMANCE TESTING OF A STRUCTURED PACKING FOR THERMAL ENERGY STORAGE APPLICATIONS</b> Liam Chad Snyman*, Craig McGregor Stellenbosch University, South Africa
11H08 - 11H10	1181	<b>CALIBRATED MODELS OF SHALLOW GROUND THERMAL ENERGY STORAGE FOR HEATING AND COOLING APPLICATIONS</b> Fabian Eze*, Wang-Je Lee, Youngsub An, Hongjin Joo, Kyoung-ho Lee, Julius Mwabora, Julius Ogola University of Nairobi, Kenya

## POSTER SESSION 9

Subject: Solar Energy (SOL) & Renewable Energy (RNE)

Tuesday, 15 August 2023 | Hall 8.3 | 10H20 - 12H20

Time	ID	Title, Author(s), Affiliation(s) - *Presenting Author
10H20 - 10H22	6	<b>THERMAL LARGE EDDY SIMULATIONS FOR HIGH TEMPERATURE SOLAR RECEIVERS</b> Adrien Toutant*, Martin David, Yanis ZATOUT, Francoise Bataille, Lionel Mathelin, Onofrio Semeraro PROMES-CNRS (UPR 8521), University of Perpignan, France
10H23 - 10H25	75	<b>MECHANISM OF BROAD SPECTRUM SOLAR ENERGY CAPTURE BY PHOTONIC NANOFUIDS</b> Jia Zeng*, Yimin Xuan Nanjing University of Science and Technology, China
10H26 - 10H28	113	<b>DIRECT ABSORPTION SOLAR COLLECTOR BASED ON AN ORGANIC NANOFUID. FIELD STUDY AND PERFORMANCE ANALYSIS</b> Boris Balakin*, Pavel Struchalin Western Norway University of Applied Sciences, Norway
10H29 - 10H31	171	<b>META-FOAM NUMERICAL OPTIMIZATION FOR SURFACE-ENHANCED SOLAR STEAM GENERATION</b> Lan Gao, Elyes Nefzaoui*, Yamin Leprince-Wang, Tarik Bourouina ESYCOM Lab., Univ Gustave Eiffel, CNRS, France
10H32 - 10H34	249	<b>COUPLED OPTICAL-THERMAL MODELING OF SOLAR PARABOLIC DISH COLLECTOR FOR CORRUGATION CAVITY RECEIVER</b> Abhinav Rajan, K.S. Reddy* Indian Institute of Technology Madras, India
10H35 - 10H37	323	<b>PRINCIPAL COMPONENT ANALYSIS FOR THE CHARACTERISATION OF SPATIOTEMPORAL VARIATIONS OF THE SOLAR RESOURCE IN URBAN ENVIRONMENTS</b> Martin Thebault, Cyril Caliot, Guillaume Le Gall*, Julien Ramousse LOCIE (USMB - CNRS), France
10H38 - 10H40	346	<b>A REDUCED ORDER MODELLING METHODOLOGY FOR CONCENTRATED SOLAR POWER EXTERNAL CYLINDRICAL RECEIVERS</b> James Michael Heydenrych*, Pieter Rousseau, Colin du Sart ATProM Research Unit, University of Cape Town, South Africa
10H41 - 10H43	370	<b>SURROGATE-BASED OPTIMIZATION OF PARABOLIC TROUGH COLLECTORS OPERATING UNDER DIFFERENT GEOMETRIC AND ENVIRONMENTAL CONDITIONS</b> Daniel Dezan*, Felipe Pelissari, Wallace Gusmão Ferreira, José Carlos da Costa Filho Federal University of ABC, Brazil
10H44 - 10H46	416	<b>HEAT DISSIPATION FACTORS FOR BUILDING-ATTACHED PV MODULES</b> Michael Owen, Johannes Pretorius*, Cameron Nel, Brendan Buitendag Stellenbosch University, South Africa
10H47 - 10H49	462	<b>DIRECT SOLAR THERMAL DISTILLATION WITH FLOWER-MIMICKED VAPOR GENERATOR FOR FRESHWATER COLLECTION</b> Mohamed Abdelsalam, Muhammad Sajjad*, Aikifa Raza, Hongxia Li, Faisal Almarzooqi, TieJun Zhang Khalifa University, United Arab Emirates
10H50 - 10H52	590	<b>ENERGY FLOW ANALYSIS ON A PHOTOTHERMAL REACTOR FOR METHANE DRY REFORMING</b> Bingxin Liu*, Hao Feng, Ying Zhang, Dong Liu, Qiang Li Nanjing University of Science and Technology, China

10H53 - 10H55	802	<b>DEVELOPMENT OF ARTIFICIAL NEURAL NETWORK MODEL FOR THERMO-HYDRAULIC PERFORMANCE PREDICTION OF POROUS VOLUMETRIC SOLAR RECEIVERS</b> Prabal Talukdar*, Sonika Sharma Indian Institute of Technology Delhi, India
10H56 - 10H58	822	<b>PROCEEDINGS FULL PAPER TEMPLATE EFFECTS OF ARRANGEMENTS OF THE PARTICLE CURTAINS ON THE HEAT TRANSFER PERFORMANCE IN THE FALLING PARTICLE SOLAR RECEIVER</b> Yun Liu*, Lun Qi, Wenzhao Wang Yun Liu, Associate professor and North China Electric Power University, China
10H59 - 11H01	826	<b>EFFECT OF SOLAR IRRADIANCE ON THE COOLING EFFECT OF THE PV-PCM SYSTEM</b> XU Zhiming, Kong Qinglu, Qu Hongwei* Northeast Electric Power University, China
11H02 - 11H04	377	<b>ANALYSIS OF THERMAL MANAGEMENT STRUCTURE ON DYNAMIC CHARACTERISTICS OF METAL HYDRIDE TANK BASED ON REDUCED MODEL</b> Jiaxuan Liu*, Fusheng Yang, Zhen Wu, Zaoxiao Zhang Xi'an Jiaotong University, China
11H05 - 11H07	399	<b>SIMULATION OF A NOVEL SOLAR THERMAL WATER DISTILLATION AND ENERGY CO-GENERATION SYSTEM</b> Michael Owen, Michael Reed* Stellenbosch University, South Africa
11H08 - 11H10	712	<b>EFFECTS OF MULTI-LAYER INSULATION DESIGN ON THE INSULATION PERFORMANCE OF A LIQUID HYDROGEN STORAGE TANK USING AN INTEGRATED THERMAL MODEL</b> Min Soo Kim*, Byeonghyun Kang, Jejun Choi Seoul National University, South Korea
11H11 – 11H13	915	<b>CRYOGENIC LIQUID HYDROGEN (LH2) SYSTEM FOR REFUELING AN AIRPLANE, AND USE FOR OTHER MOBILE OR STATIONARY APPLICATIONS</b> Birgit Gobereit* DLR, Germany
11H14 – 11H16	1094	<b>POWER BUOY – AI-BASED APPROACH FOR DETERMINING OPTIMAL POSITIONS</b> Dirk Herbert Hübner*, Frank Ulrich Rückert, Norbert Burkart, Harald Orwtig, Michael Sauer, Andreas Weiten Saarbrücken University of Applied Sciences, Germany

**POSTER SESSION 10**

Subject: Conduction (CND), Natural Convection (NCV), Radiation (RAD) &amp; Forced Convection (FCV)

Tuesday, 15 August 2023 | Hall 8.1 | 15H00 - 17H00

Time	ID	Title, Author(s), Affiliation(s) - *Presenting Author
15H00 - 15H02	124	<b>THERMAL CONTACT CONDUCTANCE OF BOLTED JOINT</b> E Kishor, E Ajul*, Samarjeet Chanda, Sovan Lal Das IIT Palakkad, India
15H03 - 15H05	128	<b>HEATQUIZ: COMBINING FLIPPED-CLASSROOM, GAME-BASED LEARNING, AND SYSTEMATIC PROBLEM ANALYSIS IN HEAT TRANSFER EDUCATION</b> Wilko Rohlf*, C.H. (Kees) Venner, Mohannad Alarouri, Daan Kuiphuis, Reinhold Kneer University of Twente, Netherlands
15H06 - 15H08	383	<b>TEMPERATURE-DEPENDENT ELASTIC MODULUS PREDICTION BASED ON THERMAL CONDUCTIVITY OF SILICA AEROGELS</b> Chenbo He*, Cheng Bi, Guihua Tang MOE Key Laboratory of Thermo-Fluid Science and Engineering, School of Energy and Power Engineering, Xi'an Jiaotong University, China
15H09 - 15H11	429	<b>A SEMI-ANALYTICAL MODEL OF THERMAL CONDUCTION OF A MOSFET TRANSISTOR USING THE THERMAL QUADRUPOLES METHOD</b> Ali El arabi*, Nicolas BLET, Benjamin Remy, Denis Maillet Université de Lorraine, France
15H12 - 15H14	18	<b>ASSESSMENT OF A SPECTRAL VANISHING VISCOSITY LES MODEL FOR 3D RAYLEIGH-BÉNARD CONVECTION IN A CUBIC CELL</b> Maxime Delort-Laval*, Laurent Soucasse, Philippe Rivière, Anouar Soufiani CentraleSupélec, Université Paris-Saclay, France
15H15 - 15H17	90	<b>TRANSIENT EQUIVALENT THERMAL NETWORK MODEL DEVELOPMENT AND NUMERICAL STUDY ON THE NATURAL CONVECTION PHENOMENA OF A VERTICAL CYLINDER WITH MULTIPLE BAFFLES IN AN ENCLOSURE FOR A STACKED PLANAR BATTERY</b> Jae Sung Yang, June Kee Min*, Choongmo Yang, Keeyoung Jung Pusan National University, South Korea
15H18 - 15H20	122	<b>1D AND 3D CO-SIMULATION OF A REACTOR CAVITY COOLING SYSTEM EXPERIMENTAL FACILITY</b> Peter Francke Niemand*, Charl Gabriel du Toit M-Tech Industrial, South Africa
15H21 - 15H23	198	<b>SIDEWALL THERMAL CONDUCTANCE IN TURBULENT RAYLEIGH-BÉNARD CONVECTION: EFFECT OF UNINSULATED SIDEWALLS</b> Gyanesh Kumar, Parvez Alam, Umesh Madanan* Indian Institute of Technology Kanpur, India
15H24 - 15H26	61	<b>BROADBAND EFFICIENT RADIATIVE COOLING FILM BASED ON ROD-LIKE DIELECTRIC PARTICLES</b> Zhen Yan*, Muxing Zhang, Qiang Li, Desong Fan Nanjing University of Science and Technology, China
15H27 - 15H29	137	<b>EFFICIENT MONTE CARLO RAY TRACING FOR APPARENT CAVITY BEHAVIOR</b> Ernest Lee, Ehsan Mofidipour, Matthew Jones, Brian Iverson* Brigham Young University, United States
15H30 - 15H32	273	<b>NUMERICAL INVESTIGATION OF THE RADIATIVE PROPERTIES OF FULLY RESOLVED POLYDISPERSE PARTICLE CLOUDS</b> Matthias Koch*, Stefan Pielsticker, Reinhold Kneer, Jochen Ströhle Institute of Heat and Mass Transfer, RWTH Aachen University, Germany

15H33 - 15H35	292	<b>GREATLY ENHANCED RADIATIVE HEAT TRANSFER IN HYPERBOLIC MATERIALS</b> Xianfan Xu* Purdue University, United States
15H36 - 15H38	40	<b>SCALING OF TURBULENT HEAT TRANSFER OVER SINUSOIDAL ROUGH SURFACES</b> Yusuke Kuwata*, Wataru Yagasaki, Kazuhiko Suga Osaka Metropolitan University, Japan
15H42 - 15H44	333	<b>CONSIDERATION OF FACTORS THAT CAUSE HEAT TRANSFER ENHANCEMENT BY SWIRLING THE IN-PIPE FLOW IN THE TRANSITION REGIME</b> Hajime Nakamura*, Yoshinori Sugawara, Shunsuke Yamada, Yuki Funami National Defense Academy of Japan, Japan
15H45 - 15H47	336	<b>3D ANALYSIS OF FORCED LAMINAR FLOWS IN PIPES SUBJECTED TO ASYMMETRIC EXTERNAL CONDITIONS. THE HEATT® PLATFORM FOR ONLINE SIMULATIONS</b> Mariano Alarcón*, Manuel Seco-Nicolás, Juan Pedro Luna-Abad University of Murcia, Spain
15H48 - 15H50	479	<b>DNS-BASED THERMOHYDRAULIC ASSESSMENT OF ARTIFICIAL ROUGHNESS SURROGATES</b> Jiasheng Yang, Juan Velandia, Stephan Bansmer, Alexander Stroh*, Pourya Forooghi Karlsruher Institut für Technologie, Germany
15H51 - 15H53	548	<b>PHYSICAL FIELD RECONSTRUCTION OF COMPLEX OBJECT BASED ON DEEP LEARNING WITH A SMALL DATASET: A CASE STUDY OF LAMINAR FLOW IN A TUBE WITH RANDOM INSERTS</b> Pan Cui*, Chunyu Shi, Yuntao Zou, Wei Liu, Zhichun Liu Huazhong University of Science and Technology, China

## POSTER SESSION 11

Subject: TWO-PHASE, BUBBLE FLOW & WATER FILM (TBF), TWO-PHASE, APPLICATION (TPA), TWO-PHASE, SPRAY/DROPLET (TPS), TWO-PHASE/MULTIPHASE FLOW (TPM), TWO-PHASE, NUMERICAL SIMULATION (TPN) & CONDENSATION (CDS)

Tuesday, 15 August 2023 | Hall 8.2 | 15H00 - 17H00

Time	ID	Title, Author(s), Affiliation(s) - *Presenting Author
15H00 - 15H02	378	<b>STATE SENSING OF BUBBLE JET FLOW BASED ON ACOUSTIC IDENTIFICATION OF DEEP LEARNING</b> Nao Mikami, Yoshitaka Ueki, Masahiko Shibahara*, Kosuke Aizawa, Kuniaki Ara Osaka University, Japan
15H03 - 15H05	215	<b>SIMULATION OF A THERMAL RUNAWAY SCENARIO OF A CELL IN A BATTERY MODULE</b> Nadia Caney*, Robin Lioger--Arago, Pierre Coste, Mohamad Ismail CEA, France
15H06 - 15H08	514	<b>VISUALIZATION OF VAPOR MORPHOLOGY AND MOTION FROM AN ENGINEERED SURFACE IN MICROGRAVITY</b> Sushil Bhavnani*, Vinod Narayanan, Karthekeyan Sridhar Auburn University, United States
15H09 - 15H11	301	<b>HEAT FLUX DENSITY IN THE CONTACT LINE OF THE HEATED SESSILE DROPLET DURING COALESCENCE PHENOMENA</b> Cheverda Vyacheslav*, Somwanshi Praveen, Karchevsky Andrey, Marchuk Igor, Kabov Oleg Institute of thermophysics SB RAS, Russia
15H12 - 15H14	30	<b>INTERPLAY OF PERIODIC THERMAL AND WALL-SLIP STIMULI ON THE MIXING PERFORMANCE OF A MICROFLUIDIC TERNARY-LIQUID SYSTEM</b> Shubham Agrawal*, Prashanta K Das, Purbarun Dhar Indian Institute of Technology, India
15H15 - 15H17	152	<b>BLOCKAGES OF THE ORIFICE IN A HORIZONTAL COHESIVE SLURRY FLOW</b> Pavel Struchalin, Pawel Kosinski, Alex Hoffmann, Boris Balakin* Western Norway University of Applied Sciences, Norway
15H18 - 15H20	184	<b>MASS AND HEAT TRANSFER MODELLING OF SOIL IN SCREW HEAT EXCHANGERS USING CFD</b> Victor Van Riet*, Toon Demeester, Kenny Couvreur, Zaaquib Ahmed, Mathieu Vervaecke, Joris Degroote, Michel De Paepe Ghent University, Belgium
15H21 - 15H23	189	<b>THERMAL CHARACTERISATION OF A FLEXIBLE PULSATING HEAT PIPE IN DIFFERENT GRAVITY CONDITIONS</b> Francois Clemens*, Nicolas Miché*, Guillaume De Sercey, Ali Alqahtani, Volfgango Bartola, Marco Marengo Brighton University, United Kingdom
15H24 - 15H26	99	<b>BUBBLE DYNAMICS OF AN ISOLATED VAPOR BUBBLE IN A TWO-DIMENSIONAL MICROCHANNEL UNDER HIGH FLIGHT ACCELERATION</b> Fan Zhou*, Qiang Li, Dinghua Hu, Yang Zhao Nanjing University of Science and Technology, China
15H27 - 15H29	373	<b>EFFECT OF OIL VISCOSITY ON THE PERFORMANCE OF FWKO</b> Hyeon-Jun Yang, Hyun-Su Kang, Youn-Jea Kim* Sungkyunkwan University, South Korea
15H30 - 15H32	677	<b>NUMERICAL STUDY ON SEPARATION CHARACTERISTICS OF MICRO-AND NANO- PARTICLES USING PHOTOTHERMAL EFFECT</b> Zhibin Wang* Guangdong University of Technology, China

15H33 - 15H35	697	<b>NUMERICAL INVESTIGATION OF BUBBLE DYNAMICS AND FLOW BOILING HEAT TRANSFER IN CYLINDRICAL MICRO PIN FIN HEAT EXCHANGERS</b> Ismail El Mellas*, Mirco Magnini, Matteo Icardi University of Nottingham, United Kingdom
15H36 - 15H38	33	<b>CONTROL OF VAPOR FILM COLLAPSE BY CLOUD POINT PHENOMENON FOR STEAM EXPLOSION RETARDANT</b> Masahiro Furuya*, Takahiro Arai Waseda University, Japan
15H39 - 15H41	45	<b>CONDENSATION OF WATER ON PDMS-COATED COPPER SURFACES</b> Till Pfeiffer*, Michael Kappl, Hans-Jürgen Butt, Peter Stephan, Tatiana Gambaryan-Roisman Institute for Technical Thermodynamics, Germany
15H42 - 15H44	56	<b>THERMORESPONSIVE PHASE VARIANT SLIPPERY LIQUID INFUSED POROUS SURFACES FOR CONTROLLED CONDENSATION HEAT TRANSFER</b> Marri Girish Kumar*, Nirbhay Kumar, Jasafa Showket, Soumyadip Sett Indian Institute of Technology Gandhinagar, India
15H45 - 15H47	448	<b>ENHANCING WATER COLLECTION WITH DROPWISE CONDENSATION IN AIR GAP MEMBRANE DISTILLATION</b> Hongxia Li, Abubaker Omer, Faisal AlMarzooqi, TieJun Zhang* Khalifa University, United Arab Emirates
15H48 - 15H50	461	<b>NANOHERARCHICAL METAL-ORGANIC FRAMEWORKS FOR ENHANCED DEW HARVESTING EFFICIENCY</b> Vikaramjeet Singh, Prasenjit Kabi*, Priya Mandal, Jianhui Zhang, Simrandeep Bahal, Manish K. Tiwari University College London, United Kingdom

## POSTER SESSION 12

Subject: Heat Exchanger (HEX), Heat Pipe (HPP) & Energy Efficiency (EEF)

Tuesday, 15 August 2023 | Hall 8.3 | 15H00 - 17H00

Time	ID	Title, Author(s), Affiliation(s) - *Presenting Author
15H00 - 15H02	132	<b>NUMERICAL ANALYSIS OF GENERATION OF COLBURN 'J' FACTOR AND FANNING FRICTION FACTOR 'F' FOR PLAIN TRIANGULAR FINS OF A COMPACT HEAT EXCHANGER USING CFD APPROACH.</b> Pankaj Kumar, Chennu Ranganayakulu* BITS Pilani, India
15H03 - 15H05	148	<b>CFD-BASED DEHUMIDIFICATION PERFORMANCE MODELING OF SHAPE-OPTIMIZED, NON-ROUND TUBE BUNDLES IN AIR-TO-REFRIGERANT HEAT EXCHANGERS</b> James Tancabel, Vikrant Aute*, Daniel Bacellar University of Maryland, United States
15H06 - 15H08	149	<b>MANIFOLD OPTIMIZATION FOR EFFICIENT FLOW DISTRIBUTION IN CERAMIC HEAT EXCHANGERS AT EXTREME CONDITIONS</b> Chad Wilson*, Xiangyu Li, Jeffrey Youngblood, Rodney Trice, Evelyn Wang MIT, United States
15H09 - 15H11	257	<b>THERMAL-HYDRAULIC PERFORMANCE OPTIMIZATION OF PLATE-FIN HEAT EXCHANGER APPLIED IN A LIQUEFACTION PROCESS: HEAT TRANSFER AND FRICTION INVESTIGATION</b> Ali A. Bidgoli, Jurandir Itizo Yanagihara* Department of Mechanical Engineering, Polytechnic School, University of São Paulo, Brazil
15H12 - 15H14	291	<b>IMPACT OF INTEGRATING A SUPERCRITICAL-CO<sub>2</sub> HEAT EXCHANGER WITHIN AN EXISTING BIOMASS-FIRED BOILER OF A HEAT AND POWER STEAM CYCLE</b> Rashid Ahmed Haffejee*, Pieter Rousseau, Ryno Laubscher University of Cape Town, South Africa
15H15 - 15H17	331	<b>PRACTICAL RECOMMENDATIONS FOR TESTING PERFORMANCE OF FIXED-BED REGENERATORS (FBRs) FOR ENERGY RECOVERY IN BUILDINGS APPLICATIONS</b> Hadi Ramin*, Easwaran Krishnan, Carey Simonson University of Saskatchewan, Canada
15H18 - 15H20	357	<b>MODULAR COOLING SYSTEM BASED ON MICROCHANNELS HEAT SINKS FOR THERMAL MANAGEMENT OF CBRN EQUIPMENT</b> Miguel Fernandes, Miguel Mendes, Ana Moita* Academia MilitarIIN+ IST, Portugal
15H21 - 15H23	398	<b>RECONSTRUCTION OF THREE-DIMENSIONAL FROST STRUCTURE UNDER FORCED CONVECTION BY REPLICA METHOD</b> Katsuhiko Nishimura*, Anna Sciazko, Jinchen Tang, Takao Okabe, Naoki Shikazono The University of Tokyo, Japan
15H24 - 15H26	133	<b>DYNAMIC LEE MODEL FOR TWO-PHASE CLOSED THERMOSYPHON (TPCT) SIMULATION</b> Liang Ding, Wei Wang*, Mengke Niu, Bingrui Li, Bingxi Li Harbin Institute of Technology, China
15H27 - 15H29	142	<b>THE EFFECT OF A GROOVED CHANNEL ON THE THERMAL PERFORMANCE OF A PULSATING HEAT PIPE</b> Sung Jin Kim, Young Jong Lee* KAIST (Korea Advanced Institute of Science and Technology), South Korea
15H30 - 15H32	228	<b>TOWARD LOW EARTH ORBIT (LEO) APPLICATIONS: THE SCIENTIFIC JOURNEY OF THE "SPACE PULSATING HEAT PIPE" EXPERIMENTS</b> Marco Marengo*, Mauro Abela, Lucio Araneo, Vincent Ayel, Yves Bertin, Fabio Bozzoli, Luca Cattani, Anselmo Cecere, Sauro Filippeschi, Anastasios Georgoulas University of Brighton, United Kingdom

15H33 - 15H35	294	<b>PERFORMANCE INVESTIGATION ON DIFFERENT FORM FACTOR EMBEDDED HEAT PIPE AND PULSATING HEAT PIPE HEAT SPREADERS</b> Sai Kiran Hota* Advanced Cooling Technoloiges, United States
15H36 - 15H38	424	<b>THERMAL PERFORMANCE ASSESSMENT OF A COMPACT FLAT THERMOSYPHON WITH WETTABILITY MODIFICATIONS</b> Praveen Dhanalakota*, Hemanth Dileep, Laxman Kumar Malla, Pallab Sinha Mahapatra, Arvind Pattamatta Indian Institute of Technology Madras, India
15H39 - 15H41	428	<b>PERFORMANCE OF A FLAT PLATE PULSATING HEAT PIPE USING ACETONE MIXTURES FOR BATTERY APPLICATION</b> Hemanth Dileep*, Praveen Dhanalakota, Laxman Kumar Malla, Pallab Sinha Mahapatra, Arvind Pattamatta Indian Institute of Technology Madras, India
15H42 - 15H44	569	<b>STUDY ON WETTABILITY AND HEAT TRANSFER CHARACTERISTICS OF HEAT EXCHANGERS WITH ENHANCED SURFACES FOR ABSORPTION COOLING APPLICATIONS</b> JungSoo Ok*, YongTae Kang, JinHee Jung, HyunJin Doo Korea University, South Korea
15H45 - 15H47	321	<b>SIMULATION OF A ROOFTOP PHOTOVOLTAIC SYSTEM: A FOCUS ON THE ENERGY PERFORMANCE OF THE BUILDING</b> Thomas VILLEMIN, Alex ROYER, Rémy CLAVERIE, Olivier FARGES*, Gilles PARENT Université de Lorraine, France
15H48 - 15H50	345	<b>INVESTIGATION OF SUPERIMPOSED EFFECTS OF DEAD VOLUMES AND FRICTIONAL PRESSURE LOSSES OF RECUPERATORS IN ISOBARIC EXPANSION ENGINES</b> Nils Muegge, Alexander Kronberg, Maxim Glushenkov, Eugeny Y. Kenig* Paderborn University, Germany
15H51 - 15H53	508	<b>HEAT TRANSFER ANALYSIS OF MICROWAVE IRRADIATION IN ROCK GRAIN MINERALS</b> Adel Ahmadihosseini*, Agus Sasmito, Ferri Hassani McGill University, Canada

### POSTER SESSION 13

Subject: TWO-PHASE, BUBBLE FLOW & WATER FILM (TBF), TWO-PHASE, APPLICATION (TPA), TWO-PHASE, SPRAY/DROPLET (TPS), TWO-PHASE/MULTIPHASE FLOW (TPM), TWO-PHASE, NUMERICAL SIMULATION (TPN) & CONDENSATION (CDS)

Wednesday, 16 August 2023 | Hall 8.1 | 10H20 - 12H20

Time	ID	Title, Author(s), Affiliation(s) - *Presenting Author
10H20 - 10H22	703	<b>ADVANCED SIMULATION OF NITROGEN COOLING IN EXTRUSION OF LIGHT ALLOYS</b> Paolo E. Santangelo*, Riccardo Pelaccia, Gabriele Rinaldi, Barbara Reggiani, Leonardo Orzi Università degli Studi di Modena e Reggio Emilia, Italy
10H23 - 10H25	966	<b>THE FABRICATION AND APPLICATION OF WATER SUBLIMATOR HEAT DISSIPATION SYSTEM IN CHANG'E 5 LUNAR PROBE</b> Yuying WANG*, Xianwen NING, Wei LYU, Chang LIU, Jianyin MIAO Beijing Institute of Spacecraft System Engineering, China
10H26 - 10H28	319	<b>EXPERIMENTAL RESEARCH OF COOLING THE SURFACE BY MEANS OF A SUPERSONIC AIR-DROPLET FLOW</b> Sergey Popovich*, Alexander Leontiev, Andrey Zditovets, Nickolay Kiselev, Yuriy Vinogradov Lomonosov Moscow State University, Russia
10H29 - 10H31	329	<b>HEAT TRANSFER IN A SOLID WALL AFTER AN IMPACT OF A LIQUID DROP OR SOLID PARTICLE</b> J. Benedikt Schmidt, Louis Reitter, Ilia Roisman*, Jeanette Hussong Technische Universität Darmstadt, Germany
10H32 - 10H34	240	<b>EXPERIMENTAL DEMONSTRATION OF THE REASON BEHIND THE HIGHER REPLACEMENT EFFICIENCY INTO GAS HYDRATES WHEN USING DEPRESSURIZATION INSTEAD OF THERMAL STIMULATION IN CONFINED EXPERIMENTS</b> Alberto Maria Gambelli*, Federico Rossi University of Perugia, Italy
10H35 - 10H37	247	<b>FLOW PATTERNS OF LIQUID-LIQUID FLOWS IN MICROCHANNELS: DIMENSIONAL ANALYSIS AND NEURAL NETWORK APPROACH</b> Anna Yagodnitsyna*, Ivan Plohih, Alexander Kovalev, Artur Bilsky Kutateladze Institute of Thermophysics SB RAS, Russia
10H38 - 10H40	349	<b>CFD MODELLING OF JET IMPINGEMENT BOILING USING SWIRL</b> Ken Craig*, Daniell Wright, Jesse Quick, Prashant Valluri, Josua Meyer University of Pretoria, South Africa
10H41 - 10H43	468	<b>SUBLIMATION OF A DRY ICE SPHERE IN A CONTROLLED AMBIENT</b> Srinivas Vanapalli*, Abhishek Sharad Purandare University of Twente, Netherlands
10H44 - 10H46	705	<b>NUMERICAL INVESTIGATION ON STEAM INJECTION INTO SUBCOOLED WATER THROUGH AN OPPOSITE NOZZLE AT LOW MASS FLUX</b> HaiTao Ren, Dingding Liang, Tao Lu*, Jie Wang Beijing University of Chemical Technology, China
10H47 - 10H49	752	<b>NUMERICAL SIMULATION OF ACOUSTIC DROPLET VAPORIZATION NEAR A DEFORMABLE WALL</b> Gihun Son* Sogang University, South Korea
10H50 - 10H52	753	<b>MODEL OF HEAT TRANSFER PROCESS DURING DRY SURFACE FORMATION BY SPONTANEOUS NUCLEATION NEAR LIQUID-SOLID INTERFACE</b> Niro Nagai*, Kaito Asakura, Arata Shimazaki University of Fukui, Japan

10H53 - 10H55	797	<b>THREE-DIMENSIONAL NUMERICAL SIMULATION OF PARTICLE MOTION AND HEAT TRANSFER IN PHASE CHANGE OF PARAFFIN</b> Ming Zhang, Baoming Chen* Shandong Jianzhu University, China
10H56 - 10H58	480	<b>THE INFLUENCE OF HOMOGENEOUS NUCLEATION ON THE FLOW OF VAPOUR NEAR THE EVAPORATION SURFACE</b> Vyacheslav Mayorov*, Vladimir Levashov, Alexei Krukov Lomonosov Moscow State University, Institute of Mechanics, Russia
10H59 - 11H01	563	<b>VAPOR VELOCITY AND DROPLET DYNAMICS DURING DROPWISE CONDENSATION OF STEAM FLOWING OVER HYDROPHILIC SURFACES</b> Marco Tancon*, Matteo Mirafiori, Stefano Bortolin, Maria Basso, Elena Colusso, Alessandro Martucci, Davide Del Col University of Padova, Italy
11H02 - 11H04	584	<b>LIQUID FILM AND INTERFACE CHARACTERISTICS DURING CONDENSATION IN VERTICAL DOWNFLOW</b> Arianna Berto*, Marco Azzolin, Stefano Bortolin, Pascal Lavieille, Marc Miscevic, Davide Del Col University of Padova, Italy
11H05 - 11H07	662	<b>CHARACTERISTICS OF LAMINAR FILM CONDENSATION OF PURE VAPOR FLOW IN A VERTICAL TUBE</b> Kentaro Kanatani* Fukuyama University, Japan
11H08 - 11H10	683	<b>AN ANALYTICAL STUDY ON THE MECHANISM OF LAMINAR FILM CONDENSATION OF STEAM INSIDE A TUBE</b> Yuqian Wang, Weiliang Wang*, Chang Huang Jinan University, China

**POSTER SESSION 14**

Subject: Conduction (CND), Natural Convection (NCV), Radiation (RAD) &amp; Forced Convection (FCV)

Wednesday, 16 August 2023 | Hall 8.2 | 10H20 - 12H20

Time	ID	Title, Author(s), Affiliation(s) - *Presenting Author
10H20 - 10H22	941	<b>EFFECTIVE THERMAL CONDUCTIVITY MODEL OF THE PARTICLE-FILLED SPHERE WITH DISTRIBUTED INNER HEAT SOURCES</b> Jun Sun* Tsinghua University, China
10H23 - 10H25	1041	<b>THERMAL CONDUCTIVITY OF A PRINTED THERMOELECTRIC FILM</b> Koji Miyazaki*, Kosuke Watanabe, Asuka Miura, Tomohide Yabuki Kyushu University, Japan
10H26 - 10H28	1097	<b>NUMERICAL STUDY ON THERMAL CONTACT RESISTANCE OF METALS</b> Bo Zhang*, Lei Cheng, Yuguang Jiang, Zhen Li TsingHua University, China
10H29 - 10H31	316	<b>HYBRID NODAL-INTEGRAL/FINITE-ELEMENT METHOD (NI-FEM) FOR 2D NATURAL CONVECTION PROBLEMS</b> Sundar Namala, Rizwan Uddin* University of Illinois at Urbana-Champaign, United States
10H32 - 10H34	411	<b>EXPERIMENTAL ANALYSIS OF NATURAL CONVECTION IN A DIFFERENTIALLY HEATED CAVITY</b> Tommaso Carlesi*, Delphine Laboureur, Philippe Planquart, Katrien Van Tichelen, Julio Pacio, Patrice M�egret Von Karman Institute / SCK CEN, Belgium
10H35 - 10H37	529	<b>GEYSERING IN A TWO-PHASE NATURAL CIRCULATION LOOP WITH ARTIFICIAL SEAWATER</b> Yuanjie Li, Syed Waqar Ali Shah, Chin Pan* City University of Hong Kong, Hong Kong
10H38 - 10H40	553	<b>EFFECTING PARAMETERS ON CAVITY FLOW NATURAL CONVECTION BY NANOFUIDS</b> Mohsen Sharifpur*, Suseel Jai Krishnan, Solomon Giwa University of Pretoria, South Africa
10H41 - 10H43	975	<b>NATURAL CONVECTION MELTING OF A PHASE CHANGE MATERIAL IN AN ELECTRONIC CABINET WITH A LOCAL HEATER AND POROUS INSERTION</b> Nadezhda Bondareva, Mikhail Sheremet* Tomsk State University, Russia
10H44 - 10H46	341	<b>NEAR-FIELD RADIATIVE HEAT TRANSFER BETWEEN CONDUCTIVE POLYMERS FOR ORGANIC PLASMONICS</b> Wenbin Zhang*, Changying Zhao* Shanghai Jiao Tong University, China
10H47 - 10H49	545	<b>IN-SITU MEASUREMENT OF EMISSIVITY IN CRYSTAL GROWTH FURNACES</b> Sepehr Foroushani*, Arved Wintzer, Kaspars Dadzis Leibniz Institute for Crystal Growth, Germany
10H50 - 10H52	547	<b>ANGLE-TOLERANT COLORED SUB-AMBIENT RADIATIVE COOLING COATING DESIGNED BY MIXED-INTEGGER MEMETIC ALGORITHM</b> Qiangshun Guan, Aikifa Raza*, Samuel Mao, Lourdes Vega, TieJun Zhang Khalifa University, United Arab Emirates

10H53 - 10H55	645	<b>MAXIMUM, MINIMUM AND DAILY TEMPERATURE RANGE TRENDS AS AN INDICATION OF GLOBAL CLIMATE CHANGE; BEER SHEVA ISRAEL.</b> Avraham Kudish*, Efim Evseev Ben-Gurion University of the Negev, Israel
10H56 - 10H58	767	<b>OBJECT LOCATION IN DIFFUSION OPTICAL TOMOGRAPHY BY MACHINE LEARNING: A CASE STUDY</b> Wenjun Jiang*, Sunil Kumar New York University Abu Dhabi, United Arab Emirates
10H59 - 11H01	601	<b>NUMERICAL STUDIES ON HEAT TRANSFER CHARACTERISTICS OF SYNTHETIC JET OVER DIMPLED TOPOLOGIES</b> SAMPATH KUMAR CHINIGE*, Rakesh Meena NATIONAL INSTITUTE OF TECHNOLOGY WARANGAL, India
11H02 - 11H04	667	<b>STABILITY AND PROXIMITY LIMITS TO PREDICTABLE LAMINAR JET IMPINGEMENT HEAT TRANSFER</b> Herman Haustein*, Avishai Oved Tel Aviv University, Israel
11H05 - 11H07	912	<b>EXPERIMENTAL STUDY OF ENERGY SEPARATION IN A AIR CROSS FLOW AROUND A PAIR OF SIDE-BY-SIDE CIRCULAR CYLINDERS</b> Andrey Zditovets*, Yurii Vinogradov, Nickolay Kiselev, Sergey Popovich Lomonosov Moscow State University Institute of Mechanics, Russia
11H08 - 11H10	943	<b>NEW FRICTION FACTOR AND NUSSOLT NUMBER CORRELATIONS FOR TURBULENT CONVECTION OF GAS WITH VARIABLE PROPERTIES</b> Houjian Zhao*, Xiaowei Li, Zhiyi Peng, Xinxin Wu North China Electric Power University, China
11H11 – 11H13	1131	<b>AN INVESTIGATION INTO THE EVAPORATION PROCESS IN THE PRESENCE OF AN ELECTROMAGNETIC FIELD USING A COMPUTATIONAL FLUID DYNAMIC AND DEEP LEARNING</b> mehrdad mesgarpour*, Somchai Wongwises, Mostafa Safdari Shadloo King Mongkut's University of Technology Thonburi (KMUTT), Thailand

## POSTER SESSION 15

Subject: Flow Boiling (FBL), Two-Phase, Boiling/Condensation (TPB), Evaporation, Droplet/Spray/Liquid Film (EVP) & Pool Boiling (PBL)

Wednesday, 16 August 2023 | Hall 8.3 | 10H20 - 12H20

Time	ID	Title, Author(s), Affiliation(s) - *Presenting Author
10H20 - 10H22	26	<b>FLOW BOILING OF R450A AND R515B INSIDE A 5.0 MM OD MICROFIN TUBE</b> Andrea Diani*, Yuce Liu, Luisa Rossetto University of Padua, Italy
10H23 - 10H25	76	<b>EXPERIMENTAL STUDY ON SATURATED FLOW BOILING IN A HORIZONTAL CYLINDER UNDER TEMPORALLY VARYING HEAT LOADS</b> Jana Rogiers*, Andrew Martin, Jaco Dirker, Michel De Paepe Ghent University, Belgium
10H26 - 10H28	96	<b>FLOW BOILING CHARACTERISTICS IN MINIGAP CHANNELS FILLED WITH METAL FOAMS AT HIGH HEAT FLUXES</b> Yu Zhu*, Yunjia Liu, Mubarak Salisu, Shixue Wang Tianjin University, China
10H29 - 10H31	108	<b>EXPERIMENTAL STUDY OF FLOW BOILING PATTERNS IN A VERTICAL RECTANGULAR CHANNEL UNDER HIGH-PRESSURE CONDITIONS</b> Shuqi JIN*, Yujie Chen, Kong Ling, Yuan Zhou, Wenquan Tao Xi'an Jiaotong University, China
10H32 - 10H34	169	<b>FLOW BOILING OF FC-72 IN A FLAT MICROCHANNEL</b> Fedor Ronshin*, Yuriy Dementyev, Evgeny Chinnov Kutateladze Institute of Thermophysics SB RAS, Russia
10H35 - 10H37	217	<b>EXPERIMENTAL ASSESSMENT OF THE REWETTING PHENOMENON AFTER CHF UNDER PROTOTYPICAL LWR CONDITIONS</b> Tiago Moreira*, Keegan Murray, Mark Anderson University of Wisconsin-Madison, United States
10H38 - 10H40	8	<b>MODELLING AND MEASUREMENT OF VAPOUR BUBBLE GROWTH IN POOL BOILING OF WATER AT ATMOSPHERIC PRESSURE</b> Giovanni Giustini*, Surya N. L. Narayan, Atul Srivastava The University of Manchester, United Kingdom
10H41 - 10H43	35	<b>X-RAY CT MEASUREMENT OF VOID REDISTRIBUTION BEHAVIOR DOWNSTREAM OF SPACER WITH SWIRL VANES IN ROD BUNDLE</b> Takahiro Arai*, Atsushi Ui, Masahiro Furuya, Riichiro Okawa, Tsugumasa Iiyama, Shota Ueda, Kenetsu Shirakawa Central Research Institute of Electric Power Industry, Japan
10H44 - 10H46	66	<b>EXPERIMENTAL COMPARISON OF TWO-PHASE AND SINGLE-PHASE COOLING METHODS OF A POWER MODULE</b> Ilya T'Jollyn*, Jasper Nonneman, Wim Beyne, Michel De Paepe Ghent University, Belgium
10H47 - 10H49	68	<b>HEAT TRANSFER IN SINGLE BUBBLE NUCLEATE BOILING WITHIN THE MULTISCALE BOILING PROJECT ONBOARD THE INTERNATIONAL SPACE STATION</b> Martin Schinnerl*, Axel Sielaff, Peter Stephan Technical University of Darmstadt, Germany
10H50 - 10H52	77	<b>THE EFFECT OF CIRCUMFERENTIAL NON-UNIFORM HEAT FLUXES ON FLOW BOILING OF R245FA IN A CIRCULAR HORIZONTAL TUBE</b> Andrew Martin, Jaco Dirker* University of Pretoria, South Africa

10H53 - 10H55	87	<b>DECREASE IN THE ONB OF HFE-7100 USING A POROUS PLATE WITH A HEATED FINE WIRE</b> Feifei Wu, Tsutomu Hisano, Yutaro Umehara, Shoji Mori* Kyushu University, Japan
10H56 - 10H58	15	<b>EVAPORATION AND RESIDUE FORMATION OF DIMETHYL CARBONATE DROPLETS ON HOT WALLS</b> Olaf Schumacher*, Axel Sielaff, Peter Stephan Technical University of Darmstadt, Germany
10H59 - 11H01	19	<b>OBLIQUE IMPACT OF A SINGLE DROPLET ON SUPERHYDROPHOBIC SURFACE WITH RANDOMLY DISTRIBUTED ROUGH STRUCTURES: A LATTICE BOLTZMANN STUDY.</b> Li-Zhi Zhang, Shushen Zhang* South China University of Technology, China
11H02 - 11H04	120	<b>EQUILIBRIUM CLUSTERS OF LEVITATING SALLT WATER DROPLETS: EXPERIMENTAL FINDINGS AND PHYSICAL MODELING</b> Leonid Dombrovsky*, Alexander Fedorets, Dmitry Medvedev, Vladimir Levashov Joint Institute for High Temperatures (RAS), Russia
11H05 - 11H07	134	<b>NUMERICAL STUDY ON THE INFLUENCE OF INLET TEMPERATURE AND LIQUID LEVELS ON HEAT AND MASS TRANSFER IN FLOWING FLASH EVAPORATION</b> Bingrui Li*, Bingbing Peng, Liang Ding, Wei Wang, Bingxi Li Harbin Institute of Technology, China
11H08 - 11H10	9	<b>THE REDUCTION OF REFRIGERANT BOILING DRYOUT ON FALLING FILM EVAPORATOR TUBES THROUGH NANOSTRUCTURES, COMMERCIAL MICROSTRUCTURES AND MULTISCALE ENHANCEMENTS</b> Bradley Bock*, Dian Dickson, John Thome University of Pretoria, South Africa
11H11 – 11H13	21	<b>EXPERIMENTAL INVESTIGATION ON THE INFLUENCE OF WATER/ETHANOL MIXTURES ON MICROSTRUCTURE SURFACES DURING NUCLEATE BOILING</b> Panagiota Xanthopoulou* TU Darmstadt Institut für Technische Thermodynamik, Germany
11H14 – 11H16	60	<b>POOL BOILING HEAT TRANSFER ENHANCEMENT BY SURFACE MODIFICATION USING THE MICRO-THICK METALLIC FOAM</b> Hyunmuk Lim*, Su-Yoon Doh, Seung M You, Jungho Lee Ajou University, South Korea

## POSTER SESSION 16

Subject: Heat Exchanger (HEX), Heat Pipe (HPP) & Energy Efficiency (EEF)

Thursday, 17 August 2023 | Hall 8.1 | 10H20 - 12H20

Time	ID	Title, Author(s), Affiliation(s) - *Presenting Author
10H20 - 10H22	542	<b>HEAT TRANSFER ENHANCEMENT OF BENT OFFSET STRIP FIN IN FUEL CELL COOLING</b> Gyeongryun Kim*, Taehyun Kim, Jeonghun Heo, Hyung Hee Cho Yonsei University, South Korea
10H23 - 10H25	624	<b>ARTIFICIAL 3-D FROST STRUCTURE RECONSTRUCTION BY GENERATIVE ADVERSARIAL NETWORK</b> Anna Sciazko, Katsuhiko Nishimura, Masahiro Takayashiki, Takao Okabe, Naoki Shikazono* The University of Tokyo, Japan
10H26 - 10H28	651	<b>HEAT TRANSFER PERFORMANCE OF FIN-AND-TUBE HEAT EXCHANGERS COATED WITH CARBON NANOTUBES UNDER VARIOUS COATING CONDITIONS</b> Changho Han*, Sewon Lee, Jinyoung Kim, Minwoo Lee, Yongchan Kim Korea University, South Korea
10H29 - 10H31	666	<b>COMPARISON OF THERMAL PERFORMANCE AND THERMAL RESISTANCE OF TWO DIFFERENT TYPES OF SINGLE U-TUBE GROUND HEAT EXCHANGERS</b> Saqib JAVED, Jeffrey Spitler* Oklahoma State University, United States
10H32 - 10H34	696	<b>STUDY ON PARTICLE DEPOSITION CHARACTERISTICS ON THE OUTER SURFACE OF TUBE BUNDLE HEAT EXCHANGER</b> Jinhui Li*, Zhiming Xu, Zhimin Han Northeast Electric Power University, China
10H35 - 10H37	729	<b>DEVELOPMENT OF A RECUPERATOR FOR A SOLAR HYBRID MICRO GAS TURBINE SYSTEM</b> Massimiliano Francesco Afeltra, Sybrand Johan van der Spuy*, Jaap Hoffmann Stellenbosch University, South Africa
10H38 - 10H40	780	<b>A NUMERICAL STUDY OF THERMOHYDRAULIC PERFORMANCE OF A FINED TUBE HEAT EXCHANGER USING AN AQUEOUS SOLUTION OF CARBOXYMETHYL CELLULOSE AND RECTANGULAR AND WINGLET PAIR</b> Amaresh Dalal*, Dheeraj Kumar Indian Institute of Technology Guwahati, India
10H41 - 10H43	788	<b>MULTI-OBJECTIVE OPTIMIZATION OF AN EVAPORATOR FEATURED BY ACTIVE VAPOR-LIQUID ADJUSTMENT</b> Junjie Li, Xiaobin Zheng, Kunteng Huang, Jianyong Chen*, Ying Chen*, Xianglong Luo Guangdong University of Technology, China
10H44 - 10H46	570	<b>NUMERICAL INVESTIGATION OF LOOP HEAT PIPE SYSTEM PERFORMANCE AND ITS OPERATIONAL LIMITS</b> Xu Huang*, Geert Buckinx, M. Rosaria Vetrano, Martine Baelmans KU Leuven, Belgium
10H47 - 10H49	635	<b>GEYSER BOILING IN TWO-PHASE CLOSED THERMOSYPHON WITH SMALL DIAMETER</b> JinHyeuk Seo*, Sukkyung Kang, Jungho Lee Ajou university, South Korea
10H50 - 10H52	636	<b>EFFECT OF INNER DIAMETER ON THE THERMAL PERFORMANCE OF TWO-PHASE CLOSED THERMOSYPHON</b> Sukkyung Kang*, JinHyeuk Seo, Jungho Lee Ajou university, South Korea

10H53 - 10H55	806	<b>THE EFFECT OF THE START-UP PROCESS OF A PULSATING HEAT PIPE WITH DOUBLE-ROW PIPES AT HORIZONTAL AND VERTICAL ANGLES</b> Shilong Fan* Northeast Electric Power University, China
10H56 - 10H58	844	<b>EXPERIMENTAL STUDY OF AN ULTRA-THIN VAPOR CHAMBER WITH ETCHING MICRO-STRUCTURE COMPOSITE WICK FOR ELECTRONICS HEAT DISSIPATION</b> Shuangfeng Wang*, Wentao Yan School of Chemistry and Chemical Engineering, South China University of Technology, China
10H59 - 11H01	856	<b>EXPERIMENTAL STUDY ON HEAT TRANSFER PERFORMANCE OF TEMPERATURE ADAPTIVE OSCILLATING HEAT PIPE</b> Yulong Ji, Lanxing Xu*, Chunrong Yu, Zhang Liu, Yan Zhang Dailan Maritime University, China
11H02 - 11H04	892	<b>DESIGN, FABRICATION, AND TESTING OF AN ULTRA-THIN LOOP HEAT PIPE WITH A THICKNESS OF 0.3 MM FOR SMALL ELECTRONIC DEVICES</b> Jun Sasaki*, Noriyuki Watanabe, Shinobu Aso, Kazuki Sadakata, Shigeyuki Tanabe, Hosei Nagano Nagoya University, Japan
11H05 - 11H07	579	<b>POWER GENERATION SYSTEM BASED ON COAL GASIFICATION IN SUPERCRITICAL WATER: A THERMODYNAMIC STUDY</b> Yuhao Tian, Hao Feng, Ying Zhang, Dong Liu*, Qiang Li Nanjing University of Science and Technology, China
11H08 - 11H10	594	<b>HYBRID SOLAR ENERGY AND NATURAL GAS SYSTEM: A THERMODYNAMIC STUDY</b> Kailun Yu, Hao Feng*, Ying Zhang, Dong Liu, Qiang Li Nanjing University of Science and Technology, China

## POSTER SESSION 17

Subject: Flow Boiling (FBL), Two-Phase, Boiling/Condensation (TPB), Evaporation, Droplet/Spray/Liquid Film (EVP) & Pool Boiling (PBL)

Thursday, 17 August 2023 | Hall 8.2 | 10H20 - 12H20

Time	ID	Title, Author(s), Affiliation(s) - *Presenting Author
10H20 - 10H22	344	<b>EXPERIMENTAL STUDY OF R1233ZD(E) FLOW BOILING HEAT TRANSFER AT QUASI-CRITICAL TEMPERATURE IN A HORIZONTAL MICRO-SCALE CHANNEL</b> Daniel Borba Marchetto*, Rémi Revellin, Romuald Rullière, Gherhardt Ribatski University of São Paulo, Brazil
10H23 - 10H25	421	<b>SPECIAL FEATURES OF NUCLEATE BOILING UNDER THE ABRUPTLY ESCALATING HEAT INPUT IN SUBCOOLED FLOW</b> Anatoliy Levin*, Polina Khan Energy Systems Institute, Russian Academy of Sciences, Russia
10H26 - 10H28	465	<b>HIGH SPATIO-TEMPORAL RESOLUTION MEASUREMENT OF FLOW BOILING HEAT TRANSFER IN A RECTANGULAR MINICHANNEL VIA A VISIBLE-LIGHT TRANSPARENT HEATER WALL</b> Masaki Yoshida*, Shunsuke Yamada, Yuki Funami, Hajime Nakamura National Defense Academy, Japan
10H29 - 10H31	572	<b>VAPOUR BUBBLE FORMATION IN SUBCOOLED FLOW BOILING THROUGH A VERTICAL CHANNEL</b> Suryanarayan Lakshminarayan* Imperial College London, United Kingdom
10H32 - 10H34	733	<b>EFFECT OF SURFACE MODIFICATION ON FLOW AND POOL BOILING OF ORGANIC LIQUIDS IN A WIDE RANGE OF REDUCED PRESSURES</b> Aleksandr Belyaev, Maksim Filippov*, Nikita Sidel'nikov, Alexey Dedov The National Research University "MPEI", Russia
10H35 - 10H37	742	<b>THERMAL ENVIRONMENT PREDICTION AND PROTECTION DESIGN FOR HIGH TEMPERATURE SUPERSONIC COMBUSTION TUNNEL</b> Liu Zhao-Jun*, Wen-Quan TAO, Tian Ning, Zhao Ling Xi'an Jiaotong University, China
10H38 - 10H40	102	<b>EXPERIMENTAL HEAT TRANSFER COEFFICIENT AND PRESSURE DROP OF ALTERNATIVE REFRIGERANT BLENDS INSIDE HORIZONTAL MULTI-PORT MINI-CHANNELS TUBE</b> Hieu Hoang, Nurlaily Agustiarini, Jong-Taek Oh* Chonnam National University, South Korea
10H41 - 10H43	144	<b>EXPERIMENTAL STUDY ON HEAT TRANSFER CHARACTERISTICS OF PHASE CHANGE CHAMBERS WITH DIFFERENT CONDENSATION TO BOILING AREA RATIOS</b> Yurong Yang*, Shixue Wang, Yu Zhu Tianjin University, China
10H44 - 10H46	219	<b>SUBCOOLED FLOW BOILING OF HFE-7000 UNDER ELECTRIC FIELD</b> Ichiro Kano* Yamagata university, Japan
10H47 - 10H49	246	<b>FLOW BOILING IN A MICROGAP AND MICRO MULTI-CHANNEL HEAT EXCHANGER</b> Ali H. Al-Zaidi*, Mohamed M. Mahmoud, Atanas Ivanov, Tassos Karayiannis University of Misan, Iraq
10H50 - 10H52	366	<b>LIQUID-VAPOR INTERFACE CHARACTERIZATION FOR STRATIFIED-WAVY FLOW CONDITIONS OF R134A, R600A, R290 AND R1270</b> Ana Luiza Guerreschi Kohlmann, Roberta Neumeister*, Tiago Augusto Moreira, Gherhardt Ribatski University of São Paulo, Brazil

10H53 - 10H55	528	<b>EFFECT OF LIQUID SUBCOOLING ON BOILING SOUND IN SUBCOOLED POOL BOILING</b> Noriyuki Unno*, Kazuhisa Yuki, Shin-ichi Satake, Koichi Suzuki Sanyo-Onoda City University, Japan
10H56 - 10H58	241	<b>EVAPORATIVE HEAT FLUX MEASUREMENT AND MODELING IN AN AIR-WATER SYSTEM WITHIN A CIRCULAR ENCLOSURE</b> Muralidhar Krishnamurthy*, Manish Bhendura, Atif Husain Indian Institute of Technology Kanpur, India
10H59 - 11H01	253	<b>NUMERICAL INVESTIGATION OF LOCAL HEATING EFFECT ON PARTICLE DEPOSITION IN AN EVAPORATING SESSILE DROPLET</b> Mebrouk AIT SAADA, Salah CHIKH, Lounès TADRIST* Aix-Marseille Université, France
11H02 - 11H04	380	<b>NATURAL CONVECTIVE EVAPORATION STUDY OF SESSILE DROPLETS</b> Juan Diego Pelaez Restrepo*, Gary Rosengarten, Petros Lappas RMIT University, Australia
11H05 - 11H07	481	<b>INTELLIGENT OIL AND WATER SEPARATION BY SELECTIVELY AND REGIONALLY PRE-WETTING IN-AIR SUPERAMPHIPHOBIC COPPER FOAMS</b> Long Jiao* Zhejiang University of Technology, China
11H08 - 11H10	318	<b>BOILING HEAT TRANSFER AND FLUID BEHAVIOR ON A CONCENTRIC DOUBLE CIRCULAR SURFACE WITH A NARROW RADIAL GAP AND A COMMON HEATED BASE</b> Yoshihiko Haramura* Kanagawa University, Japan
11H11 - 11H13	328	<b>EFFECTS OF SURFACE WETTABILITY AND INCLINATION ON BUBBLE BEHAVIORS AND POOL BOILING HEAT TRANSFER</b> Yakang Xia, Ri Li* The University of British Columbia, Canada
11H14 - 11H16	433	<b>INFLUENCE OF WALL MATERIAL ON HEAT TRANSFER IN NUCLEATE POOL BOILING OF REFRIGERANTS</b> Matthias Welzl*, Florian Heberle, Dieter Brüggemann University of Bayreuth, Germany

**POSTER SESSION 18**

Subject: Electronic Equipment Cooling (EEC), Thermoelectric Devices (TEL) & NEMS/MEMS (NMS)

Thursday, 17 August 2023 | Hall 8.3 | 10H20 - 12H20

Time	ID	Title, Author(s), Affiliation(s) - *Presenting Author
10H20 - 10H22	131	<b>EXPERIMENTAL INVESTIGATION ON THERMO-HYDRAULIC PERFORMANCE OF 3-D MANIFOLD MICROCHANNEL FOR HIGH HEAT FLUX ELECTRONICS</b> Young Jin Lee, Sung Jin Kim* Korea Advanced Institute of Science and Technology, South Korea
10H23 - 10H25	235	<b>A DEVICE-LEVEL COMPACT THERMAL MODEL FOR FAST PREDICTING THE SKIN TEMPERATURE OF LAPTOPS</b> Haoran Liu*, Ruzhu Wang Institute of Refrigeration and Cryogenics, Shanghai Jiao Tong University, China
10H26 - 10H28	307	<b>PCM-BASED HEAT SINK FOR PASSIVE COOLING OF ELECTRONIC COMPONENTS: NUMERICAL AND EXPERIMENTAL STUDY</b> Elad Koronio*, Gennady Ziskind Ben Gurion University, Israel
10H29 - 10H31	317	<b>AN ANALYSIS OF LIQUID METAL COOLING OF ELECTRICAL MACHINES WITH WINDINGS INTEGRATED CHANNELS</b> Thomas Werner*, Zaynah Ahmad, Rafal Wrobel, Volker Pickert Newcastle University, United Kingdom
10H32 - 10H34	337	<b>THERMAL MANAGEMENT OF ELECTRONIC CHIPS USING MINICHANNEL BASED HYBRID COOLING SYSTEM FOR POWER SURGE HEAT LOADS.</b> NAGA VASISTA KASAVAJHULA* INDIAN INSTITUTE OF TECHNOLOGY MADRAS, India
10H35 - 10H37	347	<b>INVESTIGATION OF DESIGN FRAMEWORK OF FORCED CONVECTION HEAT TRANSFER PERFORMANCE IN A THIN COOLING JACKET BASED ON FLOW AND THERMAL RESISTANCE NETWORK MODEL</b> Yuhri Teramoto*, Takashi Fukue, Noboru Takizawa, Shiho Arimoto Kanazawa Institute of Technology, Japan
10H38 - 10H40	361	<b>COMPARING MICROCHANNELS, IMPINGING JETS AND SPRAY EVAPORATORS IN A REFRIGERATION SYSTEM FOR HIGH-HEAT FLUX THERMAL MANAGEMENT</b> Marcus Vinicius Carneiro, Jader Barbosa Jr.* Federal University of Santa Catarina, Brazil
10H41 - 10H43	386	<b>NUMERICAL INVESTIGATION ON EFFECTIVE PULSATING FLOW CONDITIONS TO IMPROVE HEAT TRANSFER EFFICIENCY IN A NARROW FLOW PASSAGE WITH A SQUARE PROJECTION</b> Takashi Fukue*, Hidemi Shirakawa Kanazawa Institute of Technology, Japan
10H44 - 10H46	452	<b>EFFECTS OF NANOPARTICLE SHAPES ON HEAT TRANSFER AND PRESSURE DROP IN AN OPEN MICROCHANNEL HEAT SINK WITH VARIOUS PIN-FIN SHAPES</b> Ann Lee*, Abdolvahab Ravanji, Javad Mohammadpour, Shaokoon Cheng, Dezheng Darson Li Macquarie University, Australia
10H47 - 10H49	587	<b>HIGH-RESOLUTION TOPOLOGY OPTIMIZATION OF HEAT SINKS FOR MICROELECTRONICS AND BENCHMARK AGAINST CONVENTIONAL DESIGNS</b> Bruno Barroca*, Maarten Blommaert, Geert Buckinx, Mattias Schevenels, Martine Baelmans KU Leuven, Belgium

10H50 - 10H52	715	<b>EFFECT OF THICKNESS AND PORE DIAMETER OF LOTUS-TYPE POROUS COPPER ON BREATHING PHENOMENON FOR IMPROVING HEAT TRANSFER PERFORMANCE OF SATURATED POOL BOILING</b> Kohei Yuki*, Kazuhisa Yuki, Noriyuki Unno, Risako Kibushi, Tetsuro Ogushi, Masaaki Murakami, Tomiyuki Numata, Takuya Ide Sanyo-Onoda City University, Japan
10H53 - 10H55	716	<b>SATURATED POOL BOILING HEAT TRANSFER ENHANCEMENT UTILIZING MULTI-LAYERS HYDROPHILIZED FREE-PARTICLE BED</b> Kohei Yuki*, Kazuhisa Yuki, Noriyuki Unno Sanyo-Onoda City University, Japan
10H56 - 10H58	1024	<b>A NUMERICAL AND EXPERIMENTAL STUDY ON THE COOLING PERFORMANCES AFFECTED BY THE GEOMETRICAL SHAPES WITHIN A MOTOR FOR ELECTRIC AIR VEHICLES</b> Sungjin Yang, Jongrak Choi*, Yongwoo Shin, Gihun Son Korea Electronics Technology Institute, South Korea
10H59 - 11H01	1051	<b>NUMERICAL STUDY ON MANIFOLD DESIGN BASED ON THE INTERDIGITATED MICROSTRUCTURES HEAT SINKS</b> Qianlei Shi, Qian Liu, Xiaole Yao, Chen Sun, Xing Ju*, Chao Xu, Feng Ye North China Electric Power University, China
11H02 - 11H04	1103	<b>EXPERIMENTAL INVESTIGATION AND MODELLING OF HEAT TRANSFER CHARACTERISTICS OF ELECTRICAL INSULATION SYSTEMS IN ELECTRIC MOTORS FOR HEAVY-DUTY VEHICLES</b> Mohammad Roozbahani, Eugenio Schillaci*, Anders Thibblin, Joaquim Rigola, Fabrice Lemoine, Heathcliff Demaie Polytechnic University of Catalonia, Spain
11H05 - 11H07	81	<b>NUMERICAL CALCULATION AND EXPERIMENTAL RESEARCH ON A NOVEL KIND OF HYDRAULIC LEVITATION MICROPUMP FOR LIQUID COOLING SYSTEM</b> Guanying Xing*, Tao Hong, Song Xue, Huaiyu Zuo, Xiaobing Luo Huazhong University of Science and Technology, China
11H08 - 11H10	891	<b>NUMERICAL INVESTIGATIONS OF THERMO-FLUIDICS IN THE INTER-ELECTRODE CHANNEL OF FORCED-FLOW THERMOCELLS</b> Yoichi Murakami*, Yutaka Ikeda Tokyo Institute of Technology, Japan

## POSTER SESSION 19

Subject: TWO-PHASE, BUBBLE FLOW & WATER FILM (TBF), TWO-PHASE, APPLICATION (TPA), TWO-PHASE, SPRAY/DROPLET (TPS), TWO-PHASE/MULTIPHASE FLOW (TPM), TWO-PHASE, NUMERICAL SIMULATION (TPN) & CONDENSATION (CDS)

Thursday, 17 August 2023 | Hall 8.1 | 15H00 - 17H00

Time	ID	Title, Author(s), Affiliation(s) - *Presenting Author
15H00 - 15H02	1153	<b>EXPERIMENTAL RESEARCH OF FLOW PATTERNS AND ITS TRANSITION OF FALLING FILM FLOW BETWEEN HORIZONTAL TUBES</b> Shun Hu, Xingsen Mu*, Yang Liu, Shengqiang Shen Dalian University of Technology, China
15H03 - 15H05	445	<b>INFLUENCE OF INDUSTRIAL LUBRICANT ADDITION ON COOLING REGIMES DURING SINGLE DROP IMPACT</b> Marija Gajevic Joksimovic*, Ilia Roisman, Jeanette Hussong, Cameron Tropea Institute for Fluid Mechanics and Aerodynamics, Technical University of Darmstadt, Germany
15H06 - 15H08	580	<b>THEORETICAL ANALYSIS OF CLOUD AND MIST DROPLETS WITH RADIATION</b> Marcus Brewster* University of Illinois, United States
15H09 - 15H11	501	<b>RADIATIVE HEAT TRANSFER IN GASIFIERS FOR CLEAN HYDROGEN PRODUCTION</b> Gautham Krishnamoorthy* University of North Dakota, United States
15H12 - 15H14	517	<b>LIQUID FILM CHARACTERISTICS IN VERTICAL ANNULAR FLOW OF HFC134A GAS AND ETHANOL AQUEOUS SOLUTION</b> Huacheng Zhang* Kyushu University, Japan
15H15 - 15H17	603	<b>EFFECT OF PARTICLE SIZE ON VISCOSITY OF PARAFFIN MICROCAPSULE SUSPENSION DURING PHASE TRANSITION</b> Lisi Jia*, Baohu Chang, Ying Chen Guangdong University of Technology, China
15H18 - 15H20	834	<b>LSTF INTERMEDIATE BREAK LOCA ANALYSIS USING SPACE CODE</b> CHIWOONG CHOI*, Byunghyun Yoo, Seungwook Lee Korea Atomic Energy Research Institute, South Korea
15H21 - 15H23	857	<b>DEVELOPMENT AND VALIDATION OF A SIMULATION METHOD FOR A TWO-PHASE EJECTOR WITH REFRIGERANT</b> Hiroaki Nakanishi*, Yoshiteru Komuro, Yoshiyuki Kondo, Koichi Tanimoto Mitsubishi Heavy Industries, Ltd., Japan
15H24 - 15H26	945	<b>A NUMERICAL MODEL OF TRANSIENT ULTRASONICALLY INDUCED CAVITATION ACCOUNTING FOR HOMOGENEOUS NUCLEATION</b> Chiara Canciani*, Alberto Ceschin, Paolo Guida, William Roberts King Abdullah University of Science and Technology, Saudi Arabia
15H27 - 15H29	1148	<b>NUMERICAL SIMULATION OF HEAT TRANSFER CHARACTERISTIC OF FALLING FILM OUTSIDE HORIZONTAL TUBE UNDER COUNTER-CURRENT AIR FLOW</b> Shengqiang Shen, Yali Guo, Luyuan Gong, Qinggang Qiu* Dalian University of Technology, China
15H30 - 15H32	698	<b>APPLICATION OF MACHINE LEARNING ALGORITHMS TO PREDICT THE CONDENSATION HEAT TRANSFER COEFFICIENT INSIDE MICROFIN TUBES</b> Simone Mancin, José Loyola-Fuentes, Emilio Díaz-Bejarano, Francesco Coletti* Hexxcell Ltd., United Kingdom

15H33 - 15H35	741	<p><b>ON THE POSSIBILITY OF CONTROLLING THE PROCESS OF BULK CONDENSATION IN A DUSTY VAPOR-GAS FLOW</b></p> <p>Naum Kortsenshteyn*, Leonid Petrov, Arseniy Yastrebov  Joint Institute for High Temperatures of the Russian Academy of Sciences, Russia</p>
15H36 - 15H38	906	<p><b>EXPERIMENTAL SETUP FOR THE MEASUREMENT OF CONDENSATION HEAT TRANSFER COEFFICIENTS ON STRUCTURED TESTING SURFACES</b></p> <p>Sebastian Wendt*, Mehmet Ali Gümüşkesen, Stephan Kabelac, Thomas Gimpel  Institute of Thermodynamics, Leibniz University Hannover, Germany</p>
15H39 - 15H41	1076	<p><b>A PREDICTION OF HEAT TRANSFER ENHANCEMENT OF CONDENSATION FOR NEW FLUIDS ON PIN-FIN TUBE.</b></p> <p>Ahmad Obeidat*, Hafiz Muhammad Ali  King Fahd University of Petroleum and Minerals, Saudi Arabia</p>
15H42 - 15H44	1145	<p><b>VAPOR CONDENSATION HEAT TRANSFER ON TWO-TIER HIERARCHICAL MICROSTRUCTURED SURFACE: A 3D LBM STUDY</b></p> <p>Xiangwei Yin, Jiajun Wang, Tianjiao Wang, Gangtao Liang*  Dalian University of Technology, China</p>

**POSTER SESSION 20**

Subject: Heat Exchanger (HEX), Heat Pipe (HPP) &amp; Energy Efficiency (EEF)

Thursday, 17 August 2023 | Hall 8.2 | 15H00 - 17H00

Time	ID	Title, Author(s), Affiliation(s) - *Presenting Author
15H00 - 15H02	884	<b>ACCURATE REDUCED-ORDER MODELLING OF PLATE-FIN HEAT EXCHANGERS</b> Mattia Grespan*, Luigi Calò, Adriano Leonforte, Marco Cavazzuti, Diego Angeli Università degli studi di Modena e Reggio Emilia, Italy
15H03 - 15H05	965	<b>EXPERIMENTAL INVESTIGATION OF ADDITIVELY MANUFACTURED HEAT EXCHANGERS FOR HIGH-TEMPERATURE APPLICATIONS</b> Marco Fuchs*, Nico Lubos, Wolfgang Bender, Philipp Schwarz, Stephan Kabelac Leibniz University Hannover, Germany
15H06 - 15H08	1049	<b>INVESTIGATION ON SECONDARY FLOW AND THERMAL IRREVERSIBILITY OF LBE IN THE REACTOR FUEL ASSEMBLY</b> Hao-Chun Zhang, Dong Zhang* Harbin institute of technology, China
15H09 - 15H11	1068	<b>ANALYSIS OF MICROCHANNEL DELUGEABLE TUBE BUNDLE THERMAL PERFORMANCE</b> Ester Angula* University of Namibia, Namibia
15H12 - 15H14	1080	<b>MULTI-OBJECTIVE OPTIMIZATION OF SOME HEAT EXCHANGERS</b> Karvinen Reijo* Tampere University, Finland
15H15 - 15H17	1154	<b>EXTERNAL THERMAL RESISTANCE OF A CONDENSER WITH A POROUS MEDIA USING EVAPORATIVE COOLING</b> Sung Jun Park*, Seo Yeon Kang, Seok Pil Jang* Korea Aerospace University, South Korea
15H18 - 15H20	1169	<b>EXTREME COOLING VIA SWEEPING GAS MEMBRANE DISTILLATION</b> David Warsinger*, Waqas Alam, Mojtaba Zarei, Abdulaziz Alkandari, Khalid Alhammadi, Anand Balaraman, Hamid Juybari, Tian Li, Liang Pan Purdue University, United States
15H21 - 15H23	894	<b>STUDY OF HEAT TRANSFER PERFORMANCE OF DUAL HEAT SOURCE OSCILLATING HEAT PIPE BASED ON TOPOLOGY OPTIMIZATION</b> Yan Zhang, Chunrong Yu, Zhang Liu, Lanxing Xu, Long Bai, Yulong Ji* Dalian Maritime University, China
15H24 - 15H26	898	<b>A THREE-DIMENSIONAL OSCILLATING HEAT PIPE WITH UNEVEN TURN FOR GRAVITY-INDEPENDENT</b> Zhang Liu*, Chunrong Yu, Long Bai, Yulong Ji Dalian Maritime University, China
15H27 - 15H29	913	<b>NUMERICAL SIMULATION STUDY ON THE START-UP AND HEAT TRANSFER PERFORMANCE OF A FLATE-PLATE PULSATING HEAT PIPE</b> Yulong Ji, Yukun Yang*, Huaqiang Liu, Mengke Wu, Yanmin Feng, Chunrong Yu, Xin Yang, Yadong Li Dailan Maritime University, China
15H30 - 15H32	927	<b>HEAT TRANSFER STUDY ON A TWO-PHASE LOOP THERMO-SYPHON WITH AN ELECTRODEPOSITED POROUS COPPER EVAPORATOR</b> Dong-Chuan Mo*, Yu-feng Chen, Zhi-Wen Zhu, Shu-shen LYU School of Materials, Sun Yat-sen University, China

15H33 - 15H35	1003	<b>INVESTIGATION OF MECHANISMS THAT GOVERN PERFORMANCE TRENDS IN OSCILLATING HEAT PIPES</b> Max Pawlick* Georgia Institute of Technology, United States
15H36 - 15H38	1077	<b>PHYSICAL DEALLOYING TOWARDS PULSATING HEAT PIPES PERFORMANCE ENHANCEMENT</b> Artem Nikulin*, Artem Nikulin, Marco Bernagozzi, Nicolas Miche, Yaroslav Grosu, Marco Marengo, Elena Palomo del Barrio CIC energiGUNE, Spain
15H39 - 15H41	1132	<b>A BIOMIMETIC CONCEPT FOR THE DESIGN OF NASA'S DEEP SPACE-FLIGHT RADIATORS</b> ASHOK GHOSH*, Owen Telford New Mexico Tech, United States
15H42 - 15H44	614	<b>AN ACCURATE, EFFICIENT, AND ROBUST SOLUTION ALGORITHM BASED ON GENERALIZED BENDERS DECOMPOSITION FOR THERMAL SYSTEMS</b> Yonglin Xin, Qun Chen, Tian Zhao, Qinghan Sun*, Xia Li Tsinghua University, China
15H45 – 15H47	847	<b>A STUDY ON THE ENERGY-EFFICIENT PUMP SYSTEM OPERATION POLICY BASED ON THE SURROGATE MODELING</b> Yongwoo Shin*, Sungjin Yang, Jongrak Choi Korea Electronics Technology Institute, South Korea
15H48 – 15h50	1099	<b>EXPERIMENTAL STUDY OF AN ULTRASONIC SPRAY ATOMISER AS AN EVAPORATIVE COOLER FOR HVAC APPLICATIONS</b> Javier Ruiz Ramírez*, Pedro Martínez Martínez, Manuel Lucas Miralles, Pedro Navarro Cobacho, Jonás Pérez Marco, Alberto Rodríguez Martínez Miguel Hernández University of Elche, Spain

## POSTER SESSION 21

Subject: Flow Boiling (FBL), Two-Phase, Boiling/Condensation (TPB), Evaporation, Droplet/Spray/Liquid Film (EVP) & Pool Boiling (PBL)  
Thursday, 17 August 2023 | Hall 8.3 | 15H00 - 17H00

Time	ID	Title, Author(s), Affiliation(s) - *Presenting Author
15H00 - 15H02	851	<b>A STUDY ON THE COOLING PERFORMANCE OF FRACTAL MICROCHANNELS WITH METAL ADDITIVE MANUFACTURING IN HOT STAMPING</b> Sewon Lee*, Changho Han, Jinyoung Kim, Junho Kwon, Changhyun Baek, Yongchan Kim Korea University, South Korea
15H03 - 15H05	868	<b>EFFECT OF TWO-PHASE MIXING AND BACKFLOW INHIBITION ON FLOW BOILING IN HIGH L/DH SAW-LIKE COPPER MICROCHANNELS</b> Wenming Li*, Yongping Chen, Chengbin Zhang, Qun Han Southeast University, China
15H06 - 15H08	877	<b>THERMAL CHARACTERISTICS OF FLOW BOILING OF HFE-7000 IN HIGH ASPECT RATIO MICROCHANNELS WITH THE EFFECT OF FLOW ORIENTATION</b> Arif Widyatama* The University of Edinburgh, United Kingdom
15H09 - 15H11	979	<b>INVESTIGATION OF CHAOTIC FLOW BOILING DYNAMICS USING REFLECTED LASER PROBING NEAR MICROSTRUCTURED SURFACE</b> Alexander Ustinov, Dmitry Ustinov, Victor Ustinov* Dr. Ustinov Ingenieurbuero, Germany
15H12 - 15H14	1106	<b>REDUCTION OF INSTABILITY DURING FLOW BOILING IN MICROCHANNEL HEAT SINK USING FLOW RESTRICTOR AT INLET PLENUM</b> Hemant Mehta, Nishant Shah*, Jyotirmay Banerjee Sardar Vallabhbhai National Institute of Technology, India
15H15 - 15H17	1136	<b>FLOW BOILING HEAT TRANSFER AND CHF IN FLAT MINICHANNELS WITH INTENSE LOCAL HEATING</b> Dmitry Zaitsev*, Valentin Belosludtsev, Oleg Kabov Kutateladze Institute of Thermophysics, Siberian Branch of the Russian Academy of Sciences, Russia
15H18 - 15H20	573	<b>EXPERIMENTAL ANALYSIS OF QUASI-LOCAL NON-EQUILIBRIUM BOILING HEAT TRANSFER WITH R1234ZE(E) IN A PLATE HEAT EXCHANGER</b> Xiaosheng Zheng*, Martin Ryhl Kærn, Ji Zhang, Fredrik Haglind Technical University of Denmark, Denmark
15H21 - 15H23	574	<b>A NEW PREDICTION METHOD FOR SUBCOOLED CONDENSATION CONSIDERING NON-EQUILIBRIUM EFFECTS</b> Xiaosheng Zheng*, Martin Ryhl Kærn, Ji Zhang, Fredrik Haglind Technical University of Denmark, Denmark
15H24 - 15H26	591	<b>INTERFACIAL HEAT TRANSFER DURING THE LATERAL GROWTH OF HYDRATE FILMS</b> Muhammad Kamel, Aleksei Lobasov, Surya Narayan, Konstantin Pervunin, Christos Markides* Imperial College London, United Kingdom
15H27 - 15H29	617	<b>EFFECT OF ADDITIVE MANUFACTURED MICROCHANNELS OVER POOL BOILING HEAT TRANSFER IN A DIELECTRIC LIQUID</b> Tolga Emir, Mehmet Arik* Auburn University, United States
15H30 - 15H32	673	<b>A MACHINE LEARNING APPROACH TO THE PREDICTION OF HEAT TRANSFER COEFFICIENTS IN MICROCHANNELS</b> Tullio Traverso*, Francesco Coletti, Luca Magri, Tassos Karayiannis, Omar K. Matar The Alan Turing Institute, United Kingdom

15H33 - 15H35	1125	<b>NOVEL APPROACH FOR IDENTIFYING EVAPORATING AND CONDENSING ATOMS AT THE ARGON LIQUID SURFACE IN MOLECULAR DYNAMICS SIMULATIONS</b> Gediminas Skarbalius*, Algis Džiugys, Edgaras Misiulis, Robertas Navakas Lithuanian Energy Institute, Lithuania
15H36 - 15H38	634	<b>EXPERIMENTAL INVESTIGATION OF DROPLET EVAPORATION ON NANOSCALE PERIODIC CUBIC-PILLAR SURFACES</b> Yoshitaka Ueki*, Hayata Shiga, Masahiko Shibahara Osaka University, Japan
15H39 - 15H41	711	<b>DROPLET EVAPORATION ON THE SUPERHYDROPHOBIC SURFACE WITH MICROPILLARS CAUSED BY LOCALIZED PHOTOTHERMAL EFFECT</b> Dongliang Li, Yuanpeng Lei, Rong Chen*, Xun Zhu, Dingding Ye, Yang Yang, Qiang Liao Chongqing University, China
15H42 - 15H44	1115	<b>AN EXPERIMENTAL INVESTIGATION OF THE EFFECT OF SURFACE ROUGHNESS ON SESSILE DROPLET EVAPORATION</b> Zhihao Zhang*, Yuying Yan, Mirco Magnini University of Nottingham, United Kingdom
15H45 - 15H47	1116	<b>MOLECULAR DYNAMIC SIMULATION OF SUBSTRATE WETTABILITY AND SPREADING DYNAMICS OF NANODROPLETS</b> Chenyue Zhu*, Yuying Yan, Mark Alston University of Nottingham, United Kingdom
15H48 - 15H50	447	<b>COMBINED EFFECTS OF CHANNEL DEPTH AND SUBCOOLING ON POOL BOILING HEAT TRANSFER FROM VERTICALLY ORIENTATED SURFACES</b> RAJESH KUMAR*, B. Premachandran Indian Institute of Technology Delhi, India
15H51 – 15H53	639	<b>EXPERIMENTAL STUDY ON THE BOILING HEAT TRANSFER OF DIELECTRIC FLUID NOVEC 7100 UNDER LOW SATURATION TEMPERATURES</b> Zhihao Chen*, Xuhao Jin, Yinghui Li, Jiatong Yu, Yoshio Utaka* Tianjin University, China
15H54 – 15H56	896	<b>EXPERIMENTAL INVESTIGATION OF BUBBLE GROWTH ON A SINGLE ARTIFICIAL NUCLEATION SITE IN MICROGRAVITY CONDITIONS: INFLUENCE OF THE LIQUID SUBCOOLING AND NON-CONDENSABLE RESIDUALS</b> Fedor Ronshin, Oleg Kabov, Alexey Rednikov*, Lounes Tadrist Université Libre de Bruxelles, Belgium

## POSTER SESSION 22

Subject: Thermodynamics (TDY), Thermophysical Properties (TPP), Photon, Phonon & Electron Transport (PPE) & Molecular Transport (MLT)

Friday, 18 August 2023 | Hall 8.1 | 10H20 – 12H20

Time	ID	Title, Author(s), Affiliation(s) - *Presenting Author
10H20 - 10H22	371	<b>NUMERICAL EVALUATION OF THE TRANSPORT PHENOMENA AND THERMODYNAMIC STATE RELATIONS THAT GOVERN WAX DEPOSITION PHENOMENON</b> Ivan Ibanez, Angela Nieckele*, Luis Fernando Azevedo Pontifical Catholic University of Rio de Janeiro, PUC-Rio, Brazil
10H23 - 10H25	576	<b>NONCLASSICAL HEAT TRANSFER IN NONEQUILIBRIUM FLOWS</b> Vladimir Aristov* Federal Research Center "Computing Science and Control" of Russian Academy of Sciences, Russia
10H26 - 10H28	168	<b>QUANTUM CONVECTION FROM DETERMINISTIC QUANTUM MECHANICS LEADING TO RADIATION HEAT TRANSFER</b> Peter Vadasz* Northern Arizona University, United States
10H29 - 10H31	209	<b>INFLUENCE OF BIAS-DEPENDENT HEAT GENERATION ON NON-FOURIER THERMAL SPREADING PROCESS IN GAN HEMTS</b> Yang Shen*, Xue-Song Chen, Yu-Chao Hua, Han-Ling Li, Lan Wei, Bing-Yang Cao Tsinghua University, China
10H32 - 10H34	376	<b>NONRECIPROCAL AND SEMITRANSSPARENT THERMAL ABSORBERS BASED ON ASYMMETRIC QUASI-BOUND STATES IN THE CONTINUUM</b> Mengqi Liu*, Boxiang Wang, Shenghao Jin, Fan Yi, Changying Zhao Shanghai Jiao Tong University, China
10H35 - 10H37	1013	<b>IMPROVEMENT OF CRYSTALLINITY OF PHOTON UPCONVERSION ORGANIC FILMS FORMED ON A SUBSTRATE UNDER A CONTROLLED TEMPERATURE GRADIENT</b> Riku Enomoto*, Yoichi Murakami Tokyo Institute of Technology, Japan
10H38 - 10H40	196	<b>ASYMPTOTIC MODEL FOR THE THERMAL-MECHANICAL EFFECT OF 1-D SUPERCRITICAL FLUID NEAR ITS GAS-LIQUID CRITICAL POINT WITH DIFFERENT THERMOPHYSICS PROPERTIES MODELS</b> Rui Zhang, Lin Chen*, Yuki Kanda, Atsuki Komiya, Haisheng Chen Institute of Engineering Thermophysics, Chinese Academy of Sciences, China
10H41 - 10H43	260	<b>ANALYSIS OF LOCAL-GLOBAL ENTROPY GENERATION IN AN ELECTROCHEMICAL SYSTEM</b> Mehrzaad Alizadeh*, Patcharawat Charoen-amornkitt, Takahiro Suzuki, Shohji Tsushima Osaka University, Japan
10H44 - 10H46	282	<b>AN INTEGRATED PEDAGIGICAL FRAMEWORK FOR TEACHING THERMOFLUID SYSTEMS ANALYSIS</b> Nicol Basson*, Pieter Rousseau, Wilko Rohlf University of Twente, Netherlands
10H47 - 10H49	745	<b>AN APPLICATION OF MODULATED PHOTOTHERMAL RADIOMETRY FOR NUMERICAL THERMAL ANALYSIS OF COMPLEX MATERIALS</b> Javier Corona, Dallin Stout, Todd Otanicar, Nirmala Kandadai* Oregon State University, United States
10H50 - 10H52	836	<b>A 3-D TRANSIENT NUMERICAL SIMULATION OF RECTANGULAR SINGLE-PHASE CIRCULATION LOOP</b> Yiguo Mei, Keneng Qian, Jingyu Li, Weixiong Chen* Xi'an Jiaotong University, China

10H53 - 10H55	914	<b>FEASIBILITY STUDY OF A SUPERCRITICAL CARBON DIOXIDE BRAYTON RECOMPRESSION CYCLE COOLED BY A VAPOR COMPRESSION REFRIGERATION CYCLE.</b> MUBENGA CARL TSHAMALA*, Micheal Trevor Foxwell Owen, Craig McGregor, Tanatswa Moyo Stellenbosch University, South Africa
10H56 - 10H58	11	<b>IDENTIFICATION OF THE THERMOPHYSICAL PROPERTIES OF POLYMER AND COMPOSITE MATERIALS DURING THEIR TRANSFORMATION</b> Rita Moussallem*, Jean-Luc Bailleul, Elissa El Rassy, Jalal Faraj Nantes Université, France
10H59 - 11H01	268	<b>HIGH-TEMPERATURE THERMAL CONDUCTIVITY MEASUREMENTS OF MACRO-POROUS GRAPHITE</b> Shomik Verma*, Mary Foxen, Bryan Sperry, Michael Adams, Shannon Yee, Asegun Henry Massachusetts Institute of Technology, United States
11H02 - 11H04	350	<b>DEVELOPMENT OF THERMOPHYSICAL MEASUREMENT TECHNIQUE OF CERAMIC COATING USING PHOTOACOUSTIC METHOD</b> Atsumasa Yoshida*, Kakeru Kagata, Shinichi Kinoshita Osaka Metropolitan University, Japan
11H05 - 11H07	387	<b>EVALUATION OF SEDIMENTATION STABILITY OF AL<sub>2</sub>O<sub>3</sub> NANOFUIDS BY USING THE 3Ω METHOD</b> Ho-Sung Kim, Dong-Wook Oh* University of Chosun, South Korea
11H08 - 11H10	783	<b>PRELIMINARY STUDY ON THERMAL CONDUCTIVITY OF COCRFENICU HIGH-ENTROPY ALLOY</b> Fan Liu*, Jiang Xi Zhuo Northeastern University, China

## POSTER SESSION 23

Subject: Nano/Micro Scale Measurement & Simulation (NMM) & Measurement & Instrumentation (MIN)

Friday, 18 August 2023 | Hall 8.2 | 10H20 – 12H20

Time	ID	Title, Author(s), Affiliation(s) - *Presenting Author
10H20 - 10H22	22	<b>MEASUREMENTS OF TEMPERATURE AND EMISSIVITY OF OPAQUE MATERIALS USING MULTI-SPECTRAL METHODS</b> Kamal Ennass*, Benjamin Remy, Vincent Schick, Johann Meulemans Saint-Gobain, France
10H23 - 10H25	197	<b>CHARACTERIZATION OF INTERFACIAL PHASE BEHAVIORS IN SUPER/TRANS-CRITICAL JET MIXING PROCESSES</b> Dong Yang*, Lin Chen Institute of Engineering Thermophysics, Chinese Academy of Sciences, China
10H26 - 10H28	437	<b>MEASUREMENTS OF DIFFUSION COEFFICIENT IN TRANSPARENT LIQUID MIXTURES USING NEW MODIFICATIONS OF BACKGROUND ORIENTED SCHLIEREN TECHNIQUE</b> Nikolay Vinnichenko*, Yulia Plaksina, Alexei Pushtaev, Alexander Uvarov Lomonosov Moscow State University, Russia
10H29 - 10H31	484	<b>A NEW SETUP TO IDENTIFY THE RADIATIVE PROPERTIES OF ABSORBING-SCATTERING MATERIALS AT HIGH TEMPERATURES</b> Vadim Allheily* French-German Research Institute, France
10H32 - 10H34	486	<b>VALIDATION OF HIGH-DEFINITION FIBER OPTIC SENSORS FOR TEMPERATURE AND LOCAL HEAT TRANSFER COEFFICIENT MEASUREMENTS OF SYMMETRICALLY HEATED, SINGLE-PHASE INTERNAL FLOW</b> Lindsey Randle*, Brian Fronk The Pennsylvania State University, United States
10H35 - 10H37	31	<b>LASER HEATING AND MELTING OF METALS ON NANOSCALE: BREAKUP OF METAL FILAMENTS</b> Lou Kondic*, Linda Cummings, Ryan Allaire New Jersey Institute of Technology, United States
10H38 - 10H40	53	<b>IN-SITU THERMAL TRANSPORT MEASUREMENTS OF ONE-DIMENSIONAL MATERIALS IN THE SCANNING ELECTRON MICROSCOPE</b> Dawei Li*, Qin-Yi Li, Tatsuya Ikuta, Koji Takahashi Kyushu University, Japan
10H41 - 10H43	119	<b>MEASUREMENT OF TEMPERATURE EFFECTS ON VOID GENERATION IN ELECTROMIGRATION USING THERMO-REFLECTANCE IMAGING</b> KAZUYA TATSUMI*, KENGO ARAKI, KANJI TAMAI, REIKO KURIYAMA, KAZUYOSHI NAKABE KYOTO UNIVERSITY, Japan
10H44 - 10H46	125	<b>METHOD FEASIBILITY OF MICRO-CT INVESTIGATION INTO FROST FORMATION</b> Austin Labuschagne*, Hidde van der Bijl, Tingting Zhu, Wilko Rohlfes University of Twente, Netherlands
10H47 - 10H49	158	<b>MEASUREMENT OF NEAR-WALL LIQUID TEMPERATURE BASED ON TOTAL INTERNAL REFLECTION FLUORESCENCE MICROSCOPY</b> Reiko KURIYAMA*, Keita UEDA, Kazuya TATSUMI, Kazuyoshi NAKABE Kyoto University, Japan
10H50 - 10H52	227	<b>STUDY OF SOLID-SOLID INTERFACE HEAT TRANSPORT MECHANISM OF NANOMATERIALS</b> Yufeng Zhang*, Aoran Fan*, Weigang Ma, Haidong Wang, Xing Zhang* Tsinghua University, China

10H53 - 10H55	236	<b>THERMOREFLECTANCE THERMAL IMAGING INVESTIGATION ON NON-FOURIER HEAT CONDUCTION IN GAN TRANSISTORS</b> Zhi-Ke Liu*, Han-Ling Li, Bing-Yang Cao Tsinghua University, China
10H56 - 10H58	582	<b>MOLECULAR DYNAMICS STUDIES ON MICROSCOPIC PROPERTIES OF FORCES FROM ICE SOLIDIFICATION INTERFACE ACTING ON SILICA SURFACES</b> Shota Uchida*, Kunio Fujiwara, Masahiko Shibahara SCREEN Holdings Co., Ltd., Japan
10H59 - 11H01	738	<b>INTERPLAY OF INTERFERENCE AND NONLINEARITY IN PHONON ENERGY TRANSPORT THROUGH ARRAYS OF TWO-PATH ANHARMONIC ATOMIC DEFECTS IN LATTICES AND THROUGH TWO-PATH ANHARMONIC ATOMIC-SCALE JUNCTIONS</b> Yury Kosevich*, Irina Koroleva (Kikot) Institute of Industrial Science, The University of Tokyo, Japan
11H02 - 11H04	936	<b>FLUORESCENCE ANISOTROPY FOR ADVANCED MICROFLUIDIC TEMPERATURE MEASUREMENT</b> Masahiro Motosuke*, Ryosuke Yamaguchi, Yoshiyasu Ichikawa Tokyo University of Science, Japan

## POSTER SESSION 24

Subject: Air Conditioning & Refrigeration (ACR), Adsorption & Desorption (ADS), Mass Transfer & Drying (MTR) & Film (FLM)  
Friday, 18 August 2023 | Hall 8.3 | 10H20 – 12H20

Time	ID	Title, Author(s), Affiliation(s) - *Presenting Author
10H20 - 10H22	147	<b>EFFECT OF POLYMER NETWORK ON SORPTION MASS TRANSFER IN HYGROSCOPIC HYDROGELS</b> Carlos Díaz-Marín*, Kezia Hector, Zhengmao Lu, Gustav Graeber, Xinyue Liu, Leon Gaugler, Lenan Zhang, Bachir El Fil, Jeffrey Grossman MIT, United States
10H23 - 10H25	255	<b>NTU-MODEL FOR DESCRIBING THE COUPLED HEAT AND MASS TRANSFER IN OPEN ABSORPTION DEHUMIDIFICATION SYSTEMS</b> Thomas Meyer* Technische Universität Berlin, Germany
10H26 - 10H28	499	<b>HEAT AND MASS TRANSFER IN DESICCANT WHEELS WITH MULTIPLE AIRSTREAMS</b> Leandro Alcoforado Sphaier*, Mauricio de Souza Maciel, Carlos Eduardo Leme Nóbrega Universidade Federal Fluminense, Brazil
10H29 - 10H31	1022	<b>THERMODYNAMIC LIMITS OF SORPTION-BASED ATMOSPHERIC WATER HARVESTING USING HYGROSCOPIC HYDROGELS</b> Adela Chenyang Li*, Lenan Zhang, Yang Zhong, Carlos Díaz-Marín, Bachir El Fil, Evelyn Wang Massachusetts Institute of Technology, United States
10H32 - 10H34	205	<b>ADVANCED EDDY-VISCOSITY TURBULENCE MODELLING FOR THE CAR CABIN THERMAL COMFORT ANALYSIS</b> Mirza Popovac* AIT - Austrian Institute of Technology, Austria
10H35 - 10H37	393	<b>PERFORMANCE EVALUATION OF A LOW-COST STANDING WAVE THERMOACOUSTIC REFRIGERATOR</b> Michael Owen, Tamara Allen* Stellenbosch University, South Africa
10H38 - 10H40	409	<b>EXPERIMENTAL STUDY OF EVAPORATION LOCAL HEAT TRANSFER CHARACTERISTICS OF CF3I IN PLATE HEAT EXCHANGER</b> Djiby Bal, Md. Mahbubur Rahman, Keishi Kariya, Akio Miyara* Saga University, Japan
10H41 - 10H43	427	<b>NOVEL DESIGN OF AN AIR HANDLING SYSTEM FOR SUB SAHARAN AFRICA USING CONTROLLED LATENT LOAD.</b> Hugo Monteyne*, Michel De Paepe, Tunde Bello-Ochende University Ghent Belgium, Belgium
10H44 - 10H46	506	<b>THE INFLUENCE OF AMBIENT TEMPERATURE AND FAN SPEED ON THE OPERATING CONDITIONS OF AN OPEN-LOOP HEAT PUMP DRYING SYSTEM</b> Solomzi Marco Ngalonkulu*, Zhongjie Huan Tshwane University of Technology, South Africa
10H47 - 10H49	575	<b>INFLUENCE OF HEAT DISSIPATION ON THE PERFORMANCE OF A THERMOELECTRIC MODULE</b> Majed Alrefae* Yanbu Industrial College, Saudi Arabia
10H50 - 10H52	1054	<b>EXPERIMENTAL ANALYSIS OF A HEAT RECOVERY SYSTEM BETWEEN CAPILLARY TUBE AND COMPRESSOR SUCTION LINE IN AN R290 REFRIGERATION CYCLE</b> Bruno Marangolo, Leonardo Bernardini, Alekos Ioannis Garivalis, Paolo Di Marco* University of Pisa, Italy

10H53 - 10H55	24	<b>RIVULET STRUCTURES FORMATION, INTERACTION AND HEAT TRANSFER IN THE FALLING LIQUID FILMS</b> Evgeny Chinnov* Kutateladze Institute of Thermophysics, Russia
10H56 - 10H58	731	<b>LEIDENFROST DROPLET DYNAMICS ON A SUPERHEATED LIQUID GALLIUM POOL</b> Adrian Jonas, Khellil Sefiane*, Daniel Orejon Mantecon The University of Edinburgh, United Kingdom
10H59 - 11H01	78	<b>SIMULATING LEAF TRANSPIRATION FROM THE STOMATAL LEVEL USING CFD</b> Wito Plas*, Toon Demeester, Michel De Paepe Ghent University, Belgium
11H02 - 11H04	410	<b>MODELING THE CHEMICAL REACTION AND HEAT FLOW OF HYDROGEN AND AIR MIXTURES ON THE SURFACE OF A VERTICAL PLATE CATALYST</b> Dae hyun Kim*, Dong-Wook Oh Chosun university, South Korea
11H05 - 11H07	536	<b>THE APPLICABILITY OF THE STEADY-STATE APPROXIMATION IN THE ECAPORATION OF SESSILE LIQUID DROPLETS</b> Longfei Xu*, Xuefeng Xu Beijing Forestry University, China
11H08 - 11H10	619	<b>WETTING AND INITIAL STAGES OF EVAPORATION OF BINARY MIXTURE DROPLETS ON HYDROPHOBIC MICRO-DECORATED SURFACES</b> Khaloud Mousa Al Balushi, Gail Duursma, Prashant Valluri, Khellil Sefiane, Daniel Orejon* The University of Edinburgh, United Kingdom
11H11 - 11H13	864	<b>ACCURATE MEASUREMENT FOR TRANSIENT HEAT AND MASS TRANSFER IN THE VICINITY OF GAS-LIQUID INTERFACE DURING ACETONE VAPORIZATION UTILIZING THE PHASE-SHIFTING INTERFEROMETER</b> Yuki Kanda*, Ryuhi Mukai, Yingxue Hu, Lin Chen, Atsuki Komiya Tohoku University, Japan

**POSTER SESSION 25**

Subject: Porous Media (PMD), Fuel Cell (FCL) &amp; New Materials (NMT)

Friday, 18 August 2023 | Hall 8.1 | 13H20 – 15H20

Time	ID	Title, Author(s), Affiliation(s) - *Presenting Author
13H20 - 13H22	141	<b>THERMAL MANAGEMENT CHARACTERISTICS OF A COMMERCIAL-SIZE PROTON EXCHANGE MEMBRANE FUEL CELL CONSIDERING VARIOUS COOLANT FLOW PARAMETERS</b> Ning Wang*, ZhiGuo Qu, Guobin Zhang Xi'an Jiaotong University, China
13H23 - 13H25	401	<b>QUANTIFICATION OF BIMODAL PORE STRUCTURE IN SOLID OXIDE FUEL CELL ANODES AND ITS EFFECTS ON PERMEABILITY</b> Kohei Yamazaki, Masashi Kishimoto, Hiroshi Iwai* Kyoto University, Japan
13H26 - 13H28	840	<b>A HIERARCHICAL MODEL FOR PLANAR SOFC BASED ON DECOUPLING OF FLUID TOPOLOGY AND ELECTROCHEMICAL REACTION</b> Zheng Liang*, Tian Zhao, Qun Chen* Tsinghua University, China
13H29 - 13H31	254	<b>GRAPHENE OXIDE/POLYURETHANE-BASED COMPOSITE SOLID-SOLID PHASE CHANGE MATERIALS WITH ENHANCED PHOTOTHERMAL AND ENERGY STORAGE PROPERTIES</b> HUAQING XIE*, JIAWEI WANG, YUANYUAN WANG, ZIHUA WU Shanghai Polytechnic University, China, China
13H32 - 13H34	550	<b>STUDY ON THERMAL CONDUCTIVITY OF LIQUID METAL THERMAL INTERFACE MATERIALS DOPED WITH MICRO/NANOPARTICLES</b> Xu-Dong Zhang*, Bing-Yang Cao Tsinghua University, China
13H35 - 13H37	659	<b>SUPERHYDROPOBIC ANTI/DE-ICING COATINGS WITH PHOTOTHERMAL EFFECT</b> Zhuo Li* Tongji University, China
13H38 - 13H40	1010	<b>TEMPERATURE DEPENDENCE OF THE CRYSTAL GROWTH OF IMINE-BONDED 3-DIMENSIONAL COVALENT ORGANIC FRAMEWORK (3D-COF)</b> Xiaohan Wang*, Yoichi Murakami Tokyo Institute of Technology, Japan
13H41 - 13H43	48	<b>FOCUSING, GUIDING, COLLIMATING, AND SPLITTING OF THERMAL FLUXES USING RAY PHONONICS</b> Roman Anufriev*, Dhanishtha Singh, Masahiro Nomura The University of Tokyo, Japan
13H44 - 13H46	64	<b>ASSESSMENT OF THE HEAT TRANSFER ENHANCEMENT POTENTIAL OF PERIODIC OPEN CELLULAR STRUCTURES (POCS)</b> Katharina Knapp*, Konrad Dubil, Thomas Wetzels, Benjamin Dietrich Karlsruhe Institute of Technology, Institute of Thermal Process Engineering (TVT), Germany
13H47 - 13H49	93	<b>HEAT TRANSFER CHARACTERIZATION OF TRIPLY PERIODIC MINIMAL SURFACE BASED POROUS STRUCTURES</b> Zhilong Cheng*, Song Li, Qiuwang Wang Xi'an Jiaotong University, China
13H50 - 13H52	231	<b>COOLING DEVICE BASED ON EVAPORATION THROUGH A POROUS SUBSTRATE</b> Dror Nissan, Neima Brauner*, Amos Ullmann, Israel Schnitzer Tel-Aviv University, Israel

13H53 - 13H55	243	<b>NUMERICAL INVESTIGATION OF TURBULENT CONVECTION HEAT TRANSFER IN POROUS MEDIA COMPOSED OF ROUGH SOLID OBSTACLES</b> Vishal Srikanth, Andrey Kuznetsov* North Carolina State University, United States
13H56 - 13H58	274	<b>DECONTAMINATION OF POROUS SURFACES: HIGH PÉCLET NUMBER SURFACE-WASHING FLOW OVER A WET POROUS SUBSTRATE IN THE PRESENCE OF A PASSIVE TRACER</b> Francesco Paolo Conto*, Emily Butler, Merlin Etzold, Julien Landel, Stuart Dalziel University of Cambridge, United Kingdom
13H59 - 14H01	656	<b>DECONTAMINATION-INDUCED CONTAMINANT REDISTRIBUTION IN POROUS MEDIA</b> Emily Charlotte Butler*, Francesco Paolo Contò, Merlin Aragon Etzold, Stuart Dalziel, Julien Landel University of Manchester, United Kingdom
14H02 - 14H04	801	<b>EXPERIMENTAL STUDY ON SOLIDIFICATION PROCESS OF PHASE CHANGE MATERIALS WITH GRADIENT SKELETONS</b> Rongzhen Shang*, Baoming Chen Shandong Jianzhu University, China
14H05 - 14H07	948	<b>A NEW PHASE-CHANGE MODEL BASED ON THE ENTHALPY-POROSITY CONCEPT</b> Marcelo J.S. de Lemos* INSTITUTO TECNOLÓGICO DE AERONÁUTICA - ITA, Brazil
14H08 - 14H10	1047	<b>EFFECT OF DIFFERENT CONSTANT WALL TEMPERATURES ON THE MELTING FRONT EVOLUTION OF A PHASE CHANGE MATERIAL INSIDE A METAL FOAM</b> Leonardo Bernardini, Alekos Ioannis Garivalis*, Mauro Mamei, Sauro Filippeschi, Paolo Di Marco University of Pisa, Italy

## POSTER SESSION 26

Subject: Combustion (CMB), Gas Turbine (GTB), Manufacturing (MNF), Impinging Jet (IPJ) & Turbulent Transport (TTR)

Friday, 18 August 2023 | Hall 8.2 | 13H20 – 15H20

Time	ID	Title, Author(s), Affiliation(s) - *Presenting Author
13H20 - 13H22	503	<b>CO-COMBUSTION CHARACTERISTIC OF LOW-RANK COAL WITH RICE HUSK AND RDF IN FLUIDIZED BED FURNACE</b> Gea Fardias Mu'min* Institute Technology of Bandung, Indonesia
13H23 - 13H25	526	<b>EFFECTS OF SURFACE REACTIVITY AND PRESSURE ON COOL FLAME IGNITION CHARACTERISTICS</b> Minhyeok Lee*, Gengyu Li, Tomotaka Mizuno, Yuji Suzuki The University of Tokyo, Japan
13H26 - 13H28	779	<b>THERMOELECTRIC POWER GENERATION DIRECTLY-HEATED BY CATALYTIC COMBUSTION</b> Yuji Suzuki*, Minyeok Lee, Gyeonghun Yoo The University of Tokyo, Japan
13H29 - 13H31	916	<b>STUDY ON THE COMBUSTION OF A HIGH ASH SINGLE COAL PARTICLE ON A FLAT FLAME BURNER SIMULATING THE THERMAL AND CHEMICAL ENVIRONMENT IN A OXYFUEL FLUIDIZED BED</b> Sachin K S* Indian Institute of Science, India
13H32 - 13H34	1100	<b>COMBUSTION MODELLING OF A SOPHISTICATED WASTE INCINERATION PLANT</b> Somrat Kerdsuwan* King Mongkut's University of Technology North Bangkok, Thailand
13H35 - 13H37	1133	<b>HEAT TRANSFER DURING IGNITION OF THE GAS HYDRATE POWDER FLOW IN THE REACTOR</b> Olga Gaidukova, Pavel Strizhak*, Dmitriy Antonov Tomsk Polytechnic University, Russia
13H38 - 13H40	368	<b>EFFECTS OF GAS RADIATION AND THERMAL BARRIER COATING ON THE FILM COOLING PERFORMANCE OF AN ANNULAR COMBUSTOR</b> Ananda Prasanna Revulagadda*, C Balaji, Arvind Pattamatta Indian institute of Technology Madras, India
13H41 - 13H43	408	<b>EFFECT OF UPSTREAM MISALIGNMENT ON FILM COOLING EFFECTIVENESS WITH PURGE FLOW OF THE NOZZLE ENDWALL</b> Jeongwon Lee*, Hyung Hee Cho, Hee Seung Park, Hee Jae Lee, Ju Hyun Im Yonsei University, South Korea
13H44 - 13H46	535	<b>COOLING PERFORMANCE IN GAS TURBINE BLADE TIP WITH ADVANCED SLOT COOLING</b> Hee Jae Lee*, Hee Seung Park, Taehyun Kim, Jeonghun Heo, Yumin Kim, Hyung Hee Cho Yonsei University, South Korea
13H47 - 13H49	799	<b>EFFECT OF CONJUGATE HEAT TRANSFER CHARACTERISTICS ON CMAS DEPOSITION ON HIGH-TEMPERATURE BLADE</b> Yuzhang Wang, Chaoran Yang*, Kunyu Zhang, Fan Liu Shanghai Jiao Tong University, China
13H50 - 13H52	309	<b>THE DISPERSION OF A HIGH TEMPERATURE AIR JET IN A BLUFF BODY WAKE</b> Isaac Martin Stephens*, Ieuan Owen, Mark White University of Liverpool, United Kingdom
13H53 - 13H55	649	<b>NUMERICAL STUDY OF THE HEAT TRANSFER CHARACTERISTICS OF IMPINGING JETS ON A STEADY OR MOVING PLATE</b> Bruno a. c. Barata, Jorge E. P. Navalho, José C. F. Pereira*, José C.F Pereira INSTITUTO SUPERIOR TECNICO, Portugal

13H56 - 13H58	3	<b>WALL-THICKNESS AND PRESSURE-DEPEDENT INTERFACIAL HEAT TRANSFER IN SQUEEZE CASTING OF MG-AL ALLOY</b> Anita Hu, Henry Hu*, Zhizhong Sun University of Windsor, Canada
13H59 - 14H01	187	<b>DESIGN AND HEAT TRANSFER CHARACTERIZATION OF ADDITIVELY MANUFACTURED COOLING CHANNEL PROTOTYPE FOR FUSION ENERGY APPLICATIONS</b> Giacomo Favero*, Simone Mancin, Massimiliano Bonesso, Razvan Dima, Adriano Pepato, Luca Doretti, Claudio Zilio, Giulia Righetti University of Padova, Italy
14H02 - 14H04	627	<b>SURFACE ROUGHNESS EFFECT ON WATER PRESSURE DROPS OF CHANNELS MADE VIA METAL ADDITIVE MANUFACTURING</b> Simone Mancin*, Giacomo Favero, Simone Carmignato, Filippo Zanini, Massimiliano Bonesso, Adriano Pepato, Razvan Dima University of Padova, Italy
14H05 - 14H07	200	<b>WALL MODELLED LES OF TURBULENT FLOWS WITH TEMPERATURE-DEPENDENT VARIABLE VISCOSITY</b> Kazuhiko Suga* Osaka Metropolitan University, Japan

**POSTER SESSION 27**

Subject: Inverse Problems (INV), Bio &amp; Medical Applications (BMA), Spray &amp; Atomization (SAT) &amp; Plasma (PLS)

Friday, 18 August 2023 | Hall 8.3 | 13H20 – 15H20

Time	ID	Title, Author(s), Affiliation(s) - *Presenting Author
13H20 - 13H22	326	<b>EFFECTIVE HEATING SOLUTION STRATEGY FOR BUILDING UP A PAPER-BASED DNA AMPLIFICATION DETECTION DEVICE</b> Debayan Das* NIT Durgapur, India, India
13H23 - 13H25	458	<b>STATE ESTIMATION AND STOCHASTIC CONTROL OF THE BODY TEMPERATURES OF A NEONATE USING THE PARTICLE FILTER MODEL PREDICTIVE CONTROL</b> Felipe Sant'Anna Nunes, HELCIO ORLANDE*, Andrzej Nowak Federal University of Rio de Janeiro, Brazil
13H26 - 13H28	813	<b>LASER HEATING OF SPHEROIDS CONTAINING NANOPARTICLES</b> César Pacheco, HELCIO ORLANDE*, Anthony McGoron, George Dulikravich Federal University of Rio de Janeiro, Brazil
13H29 - 13H31	83	<b>NUMERICAL STUDY OF MOVING HEAT SOURCE DETECTION ON A PLATE BY INVERSE METHOD FROM SIMULATED TEMPERATURE DATA ON THE REAR FACE</b> Jean-Gabriel Bauzin, Mehdi-Belkacem Cherikh*, Najib Laraqi University Paris Nanterre, France
13H32 - 13H34	304	<b>TRANSFER FUNCTION IDENTIFICATION OF A BRAZING FURNACE AND ITS LOAD USING AUTOREGRESSIVE PARAMETRIC MODELS</b> Adrien Barthelemy*, Benjamin Remy, Vincent Schick, Celien Zacharie LEMETA - UMR 7563 CNRS - Université de Lorraine, France
13H35 - 13H37	455	<b>A SELF-DEVELOPED BAYESIAN SOLUTION FRAMEWORK FOR RECONSTRUCTION OF LOCAL HEAT FLUXES IN POOL BOILING EXPERIMENTS.</b> Chen Wang*, Yi Heng Sun Yat-sen University, China
13H38 - 13H40	456	<b>CONVOLUTIONAL NEURAL NETWORK FOR 3D TRANSIENT INVERSE SOURCE PROBLEM IN WHOLE-BODY LEVEL OF INSECTS USING INFRARED IMAGES</b> Mingming Huang*, Yinan Han, Jianghang Gu, Dongchuan Mo, Yi Heng School of Computer Science and Engineering, Sun Yat-sen University, National Supercomputing Center in Guangzhou (NSCC-GZ), Sun Yat-sen University, Guangdong Province Key Laboratory of Computational Science, China
13H41 - 13H43	467	<b>THERMAL INVERSION OF INDUSTRIAL MATERIALS AND SOILS BY IMPLEMENTING SPLINES COMPATIBLE WITH THE HEAT EQUATION</b> Jean-Claude Krapez* ONERA, France
13H44 - 13H46	491	<b>ESTIMATING OF THE GAS PROPERTIES BY MEASURING THE ABSORBED HEAT FLUX</b> Aleksy Nenarokomov, Dmitry Reviznikov*, Sergey Budnik, Daria Neverova, Alena Morzhukhina Moscow Aviation Institute, Russia
13H47 - 13H49	556	<b>KALMAN FILTER APPLICATION FOR REAL-TIME ESTIMATION OF INTERNAL HEAT FLUX ON PULSATING HEAT PIPES</b> Bruno Margotto, Carlos Kopperschmidt, Marcelo Colaco*, Wellington Silva, Luca Pagliarini, Luca Cattani, Fabio Bozzoli Federal University of Rio de Janeiro, Brazil

13H50 - 13H52	561	<b>ESTIMATION OF THERMAL CONTACT CONDUCTANCE IN DUCTS USING THE RECIPROcity FUNCTIONAL APPROACH</b> Carlos Eduardo Polatschek Kopperschmidt, Bruno Marques Margotto, Wellington Betencurte Silva*, Marcelo José Colaco UFES, Brazil
13H53 - 13H55	671	<b>AN EXPERIMENTAL THREE-DIMENSIONAL TRANSIENT AND NONLINEAR APPROACH TO SIMULTANEOUSLY ESTIMATE THERMAL PROPERTIES OF METALS</b> Mariana De Melo Antunes*, Nicolás Pinheiro Ramos, Sandro Metrevelle Marcondes de Lima e Silva Federal University of Itajuba, Brazil
13H56 - 13H58	679	<b>SYNTHESIS OF PHENOL FROM BENZENE OR TOLUENE BY PLASMA PROCESS</b> Shinfuku Nomura*, Takuro Kubota, Junichi Nakajima Ehime University, Japan
13H59 - 14H01	14	<b>MOVING PARTICLE SIMULATION (MPS) FOR OIL SPRAY COOLING ON HAIRPIN WINDINGS</b> Michele Merelli, Christophe Duwig, Mats Leksell, An Zhao* KTH, Sweden
14H02 - 14H04	17	<b>NUMERICAL SIMULATION OF A DROP TRAIN IMPACTING A SUPERHEATED WALL</b> Henrik Sontheimer*, Peter Stephan, Tatiana Gambaryan-Roisman Technical University of Darmstadt, Germany
14H05 - 14H07	280	<b>HEAT TRANSFER DURING DROPLET IMPINGEMENT ON MICROSTRUCTURED SURFACES</b> <b>JORGE DUARTE BENTHER*, GARY ROSENGARTEN, JORGE DUARTE BENTHER, PETROS LAPPAS, GARY ROSENGARTEN</b> ROYAL MELBOURNE INSTITUTE OF TECHNOLOGY, Australia
14H08 - 14H10	1135	<b>INTERACTION OF DROPS AND PARTICLES OF COMPOSITE FUELS IN A GAS ENVIRONMENT FOR THEIR AGGLOMERATION AND SECONDARY GRINDING</b> Olga Vysokomornaya, Pavel Stizhak*, Nikita Shlegel, Anastasia Islamova, Pavel Tkachenko National Research Tomsk Polytechnic University, Russia

# AWARDS

## NUKIYAMA MEMORIAL AWARD



Prof. Junichiro Shiomi  
University of Tokyo, Tokyo, Japan

Junichiro Shiomi is Professor in Institute of Engineering Innovation, School of Engineering, the University of Tokyo (UTokyo). He received B.E. (1999) from Tohoku University, and Ph. D. (2004) from Royal Institute of Technology (KTH), Sweden. Leading the Thermal Energy Engineering Lab, he has been pursuing research to advance thermal management, waste heat recovery, and energy harvesting technologies based on nano-to-macro innovation in materials, structures, and systems. Dr. Shiomi has been leading several projects including Grant-in-Aid for Scientific Research (S) (JSPS), Core Research for Evolutional Science and Technology (JST-CREST), Precursory Research for Embryonic Science and Technology (JST-PRESTO), and New Energy and Industrial Technology Development Organization (NEDO) projects. He is Fellow of Japan Society of Mechanical Engineers and Member of Science Council of Japan. He serves as an associate editor of *Nanoscale* and *Microscale Thermophysical Engineering*. He is a recipient of the Zeldovich Medal from the Committee on Space Research, the Young Scientists' Prize, the Commendation for Science and Technology by the Minister of Educational, Culture, Sports, Science and Technology, the Academic award of Heat Transfer Society of Japan, the Academic Award of Thermoelectric Society of Japan, the JSPS Award, and the Nukiyama Memorial Award.

The Nukiyama Memorial Award was established by the Heat Transfer Society of Japan in 2012 to commemorate the land-mark contributions by Shiro Nukiyama as an outstanding heat transfer scientist. Prof. Nukiyama addressed the challenges of the boiling phenomena and published an epoch-making paper, well known as the Nukiyama curve (boiling curve). The Nukiyama Memorial Award shall be bestowed to a scientist, preferably under 50 years of age, every two years in the field of Thermal Science and Engineering.

## WILLIAM BEGELL MEDAL AWARD



Prof. Chang-Ying Zhao  
Shanghai Jiao Tong University, Shanghai, China

Prof. Changying Zhao obtained his Ph.D from Xi'an Jiaotong University and Cambridge University, and then he worked at Brunel University, Xi'an Jiaotong University and Warwick University, respectively, for quite a few years before he moved to Shanghai Jiao Tong University in 2010. Currently, he is the Chair Professor, the Director of Institute of Engineering Thermophysics, and the Dean of China-UK Low Carbon College of Shanghai Jiao Tong University. Prof. Zhao's research interests mainly cover micro/nanoscale thermal radiation, heat transfer in porous media and thermal energy storage. He has published over 250 high-quality papers in prestigious journals like Physical Review Letters, Nano Letters, Physical Review B, International Journal of Heat and Mass Transfer, Annual Review of Heat Transfer, Energy and Environmental Science, Chemical Engineering Journal, etc., which are cited more than 15000 times in total. He has also been one of the Most Cited Chinese Researchers by Elsevier every year since 2014. Dr. Zhao was awarded the Shanghai Natural Science Award (First Class) in 2020 by Shanghai Municipal Government. Moreover, he was awarded twice the Best Paper Award of the ASME Micro/Nanoscale Heat and Mass Transfer International Conference held in 2013 and 2019, respectively. Prof. Zhao serves as a member of the Scientific Council of International Center for Heat and Mass Transfer (ICHMT), Founding Fellow and Executive Board Member of the Asian Union of Thermal Sciences and Engineering (AUTSE), Vice Director of Heat Transfer Society of China, as well as Board Member of the Nukiyama Memorial Award. Prof. Zhao is also the Editor-in-Chief of Carbon Neutrality, Associate Editor of Thermal Science and Engineering Progress, as well as Editorial Board Member of several other distinguished journals.

The William Begell Medal, For Excellence in Thermal Science and Engineering is being established in 2010 by Begell House Inc. The medal will be awarded to an individual, from among those selected to deliver Keynote lectures at the current IHTC Conference, who is held in high regard by the heat transfer community for his/her contributions an excellence in thermal science and technology and whose IHTC Keynote paper is judged to make a profound contribution to the thermal science and engineering literature.

## AUTSE YOUNG SCIENTIST AWARD



Dr. Aoran Fan  
Tsinghua University, China

Aoran Fan is an assistant research fellow of the Institute of Engineering Thermophysics in the School of Aerospace Engineering at Tsinghua University, Beijing, China. She received her B.E. degree and Ph.D. degree from Tsinghua University, respectively in 2015 and 2021. Her research interests focus on micro/nanoscale heat transfer, micro/nanoscale measurement technology of thermophysical properties and its application in interdisciplinary research. She proposed a dual-wavelength flash Raman method for in-situ measuring suspended and supported nanomaterials, this measurement system has a temperature time resolution of 100 ps and a spatial resolution of 50 nm, which significantly improves thermophysical properties measurement accuracy of nanomaterials. And she also developed an opto-electric Raman spectroscopy method and system for in-situ measurements of the temperatures and thermal stresses in electronic devices for thermal performance tests and evaluation. The measurement system is further extended to study all-solid-state lithium battery performance optimization, and even early cancer detection. Her research results have been published in 21 journal articles, including *Advanced Functional Materials*, *ACS Nano*, *Applied Thermal Engineering*, *International Journal of Heat and Mass Transfer*, and other leading journals in the nanoscale thermophysical properties field. And she has authorized 20 patents, including 2 Japanese patents. She received the “Young Scientist Award”, the “Best Paper Award” and the “Student Poster Award” from Asian Thermophysical Properties Conference, respectively in 2022, 2019 and 2016, the “Zhonghua Wu Excellent Postgraduate Award” and the “Buxuan Wang - Zengyuan Guo Youth Best Paper Award” from Chinese Society of Engineering Thermophysics, respectively in 2021 and 2019, the “Excellent Doctoral Dissertation” from Tsinghua University in 2021, and selected in Shuimu Tsinghua Scholar Program of Tsinghua University.

The Young Scientist Award (YSA), for excellent young scientists is being established in 2015 by the Asian Union of Thermal Science and Engineering (AUTSE: <http://autse-asia.org/>). The YSA will be awarded every two years to two or three scientists who are younger than thirty-five years old at the time of the Award Presentation and who are active and make a great contribution to the development in the field of thermal science and thermal engineering.

## AUTSE YOUNG SCIENTIST AWARD



Dr. Yutaku Kita

King's College London, London, United Kingdom

Dr Yutaku Kita is a Lecturer in Engineering at King's College London. He studied mechanical engineering at National Institute of Technology (KOSEN), Miyakonojo College and then Kyushu University. He was also a visiting student at the University of Maryland, College Park and the University of Edinburgh. He received his PhD in 2018. Prior to joining King's in 2023, he was an Assistant Professor in Kyushu University, Japan between 2019 - 2022. Yutaku is active internationally in the heat transfer community as demonstrated by being invited to seminar talks e.g. Thermal Transport Cafè and awards e.g. Young Researcher Awards from Japan Society of Mechanical Engineers and Heat Transfer Society of Japan. His recent publication in Applied Thermal Engineering was selected as Editor's Choice in 2019. His research interests include phase change heat transfer, wetting and interfacial phenomena, especially for systems involving droplets and bubbles. He is passionate in experiments and develops optical techniques coupled with image processing to capture flows and heat transfer at various time and spatial scales. He is particularly interested in fundamental problems arising from current / future industrial applications such as spray cooling in steelmaking and microelectronics / data centres, condensers in power generation, and microfluidics for bioassay.

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## **AUTSE YOUNG SCIENTIST AWARD**



**Dr. Hyeong-U Kim**

Korea Institute of Machinery & Materials, Daejeon, Republic of Korea

Hyeong-U. Kim received his B.S. from Hanyang University in 2013 and his PhD degree in 2019 from Sungkyunkwan University. He is currently a senior researcher in the Department of Plasma Engineering at the Korea Institute of Machinery & Materials (KIMM). His research field is plasma-based 2D semiconductor and heterostructure synthesis and etching for various applications.

The Young Scientist Award (YSA), for excellent young scientists is being established in 2015 by the Asian Union of Thermal Science and Engineering (AUTSE: <http://autse-asia.org/>). The YSA will be awarded every two years to two or three scientists who are younger than thirty-five years old at the time of the Award Presentation and who are active and make a great contribution to the development in the field of thermal science and thermal engineering.

## 2021 HARTNETT-IRVINE AWARD



Fan BAI

Xi'an Jiaotong University, Xi'an, China

F. Bai got his PhD degree in the discipline of Power Engineering and Engineering Thermophysics in Xi'an Jiaotong University supervised by Professor Wen-Quan Tao in September 2022. He mainly engaged in the research related to heat and mass transfer in a proton exchange membrane fuel cell (PEMFC). His research fields of interest contain: (1) transport process in proton exchange membrane fuel cell stack, (2) analysis and optimization for the anode, cathode and coolant flow-distributions of proton exchange membrane fuel cell stack, (3) digital twin technology for proton exchange membrane fuel cell, (4) semi-volatile organic compound (SVOC) transport process in indoor air, (5) heat transfer analysis for semi-transparent thermal insulation materials, (6) energy saving design for data centers, (7) graphics processing unit (GPU) high-performance computing for lattice Boltzmann method (LBM) and Direct Simulation Monte Carlo (DSMC) method, (8) advanced numerical algorithm for the computational fluid dynamic. His latest contributions to the scientific community contain: (1) attempted a multi-physics digital twin trial for PEMFC and data center thermal field using a proper orthogonal decomposition-multivariate adaptive spline regression hybrid reduced order model, (2) proposed similarity criteria and dimensionless polarization curve for the correlation analysis between PEMFC input and output parameters in the single phase isothermal working condition using similarity analysis method, (3) proposed a projection diagram method to determining PEMFC polarization curves under variation of activation criterion using similarity theory, (4) proposed an upscale strategy for predicting the detailed multi-physics distributions in a commercial-size proton exchange membrane fuel cell stack in my PhD dissertation, (5) developed a comprehensive three-dimensional non-isothermal numerical model for predicting semi-volatile organic compound transport process in a room.

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## 2021 HARTNETT-IRVINE AWARD



Renjie YIN  
XJTU, Xi'an, China

He was graduated from Energy and Power Engineering at Xi'an Jiaotong University, China in 2019, and from Génie Mécanique at l'université technologie de Troyes, France in 2022. He is majoring in Power Engineering Thermophysics, mainly investigating the numerical simulation of the proton exchange membrane cell (PEMFC) and PEMFC stack working mechanism and improvement. As a major researcher ,he participated in the project of commercial large-scale PEMFC stack gas maldistribution cooperating with Dongfang Electric (Chengdu) Hydrogen Fuel Cell Technology. Besides, he is also involved in the numerical simulation of air conditioners' outdoor units working performance. Main participant of the cooperating project with LGE and Pusan University, Korea. He has following publications: conference paper 'The performance of PEMFC with wavy gas channel' in Chinese engineering thermophysics annual conference(1st author); conference paper 'Study on the effects of geometric condition on outdoor unit performance installed in building's grooves' in the 8th Asian Symposium on Computation Heat Transfer and Fluid Flow ( First author ); conference paper 'A fast and accurate method for predicting proton exchange membrane fuel cell output characteristic' in 6th International Workshop on Heat/Mass Transfer Advances for Energy Conservation and Pollution Control(2nd author). Journal paper in Applied Energy 'three-dimensional multi-field digital twin technology for proton exchange membrane fuel cells' (3rd author).

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## 2021 HARTNETT-IRVINE AWARD



Shuqi JIN  
XJTU, Xi'an, China

She was born in 19/12/1996, now is a PhD student supervised by Professor Wen-Quan Tao, majoring in Power Engineering and Engineering Thermophysics at Xi 'an Jiaotong University from 2020. She received her master degree, specializing in mechanical engineering, from Institut National des Sciences Appliquées de Lyon (INSA-LYON), Lyon, France in 2019. Now she mainly engaged in research on airflow organization simulation and liquid cooling in data centers, covering fast prediction of thermal field in air-cooled data centers, flow boiling mechanism in mini-channels using an interface tracking method VOSET and thermal performance of immersion cooling. She has won the Keynote Delivery and best paper award as the third author at the 6th International Workshop on Heat/Mass Transfer Advances for Energy Conservation and Pollution Control (IWHT), Harbin, China, in 2021, the subject of which is a fast and accurate method to predict the output parameters in proton exchange membrane fuel cell. She has published several papers in the international journal and conference over 10 times as a co-author. The related journal and conference include but not limited to International Communications in Heat and Mass Transfer (ICHMT), International Journal of Heat and Mass Transfer (IJHMT), and The Asian Symposium on Computational Heat Transfer and Fluid Flow (ASCHT).

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## 2021 HARTNETT-IRVINE AWARD



Saijie CAI  
XJTU, Xi'an, China

He studied energy and power engineering at Xi'an Jiaotong University from 2014 to 2018, joined MOE Key Laboratory of Thermo-Fluid Science and Engineering of Xi'an Jiaotong University in September 2018, and started his doctoral study in 2021. He mainly focuses on lossy/non-destructive measurement of distribution of the internal physical parameters of PEMFC. He developed thin-film thermocouples for in-situ temperature measurement, and developed thin-film humidity sensors for in-situ humidity distribution measurement. He also developed transparent fuel cell to study the dynamic characteristics of humidity/droplet in flow channels. In addition according to the magnetic field distribution around fuel cells he proposed a non-destructive online fault detection system for fuel cells to locate local deterioration in PEMFC. At present, in order to improve the hydrothermal management of fuel cells from experimental perspective, one of his major research focus is on transparent fuel cell combined with magnetic field detection, as well as joint research and mutual verification with other test methods.

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## 2021 HARTNETT-IRVINE AWARD



Pu HE  
XJTU, Xi'an, China

He graduated from Xi'an Jiaotong University with a Ph.D. degree in Power Engineering and Thermophysics Engineering in 2022. His academic interests are mainly focused on the water and heat management of the proton exchange membrane fuel cell, complex transport processes simulation with multi-scale method, cold start of proton exchange membrane fuel cell, low carbon and energy saving technology for data center, and scenario-based application of hydrogen energy. He has published a number of papers in such authoritative journal, as Applied Energy, International Journal of Heat and Mass Transfer, International Journal of Hydrogen Energy, Energy Conversion and Management, Electrochimica Acta, Journal of Power Sources and so on. He has won the best paper award of the 2017 Annual meeting of National Engineering Thermal Physics (only 10 selected from about 900 participants of the meeting), best paper award of the 18th Asian Symposium on Computational Heat Transfer and best paper award of the 6th International Workshop on Heat-Mass Transfer Advances for Energy Conservation and Pollution Control. Based on the mechanism of heat and mass transport reaction process in fuel cell, he developed a three-dimensional multiphase non-isothermal model and proposed a method for the optimization of membrane assembly structural parameters, which provides a theoretical guidance for membrane assembly design. In terms of multi-scale numerical simulation methods for complex multi-physics fields, he developed a multiphase transport model in membrane electrodes of fuel cell on the pore-scale with Lattice Boltzmann method. By this model, he firstly studied the ice-water phase transition mechanism in membrane electrodes on pore-scale, which is important for the optimization of cold start strategy. For the fuel cell system, he proposed a new system architecture for data center power supply, which used a fuel cell power system. He obtained an optimized method for the thermoelectric coupling of hydrogen fuel cells and data centers, which is important for the energy saving and carbon reduction for data centers.

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## 2021 HARTNETT-IRVINE AWARD



Yutong MU  
XJTU, Xi'an, China

He graduated from Xi'an Jiaotong University with a Ph.D. degree in Power Engineering and Thermophysics Engineering in 2017. His academic achievements are mainly in the field of heat and mass transfer by using a multi-scale method, especially in proton exchange membrane fuel cells, nucleate boiling heat transfer, nucleate waste disposal, and indoor air quality. His research results have been published in many authoritative academic journals, including Applied Energy, Electrochimica Acta, Physical Review E, International Journal of Heat and Mass Transfer, and so on. He has won the best paper rewards at the annual conference held by the Chinese Society of Engineering Thermophysics, and the 6th International Workshop on Heat and Mass Transfer. He also received the Youth Science and Technology Award in the Environmental Protection Field of Shaanxi Province. Particularly, he has a profound theoretical basis and unique insights in the area of micro-nano scale transfer and multiphase fluid flow. He proposed a general interfacial treatment for the transport process governed by the convection-diffusion equation, together with conjugated interfaces where continuity or discontinuity interfacial conditions with regard to the physical scalar and its flux exist by using the lattice Boltzmann method. He studied the reactive transport processes in catalyst layers at the pore-scale level by fully characterizing all the components and explored the origins of the local transport resistance that resulted in the unexpected voltage loss accompanying with the platinum curtailment. He proposed a phase-change lattice Boltzmann method with conjugated heat transfer treatment and then applied it to the study of cavities behaviors for nucleation on roughened surfaces for an entire ebullition cycle without introducing any artificial disturbance. He developed a multiscale method by coupling the lattice Boltzmann method and finite volume method for the first time to investigate the emissions behaviors of volatile organic compounds with building materials.

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## 2021 HARTNETT-IRVINE AWARD



Xiaoming GONG  
XJTU, Xi'an, China

She received her Bachelor Degree of Engineering in 2018 from Department of Process Equipment and Control Engineering of Dalian University of Technology, Dalian, received her Master Degree of Engineering from Department of Architecture and Civil Engineering of Nanjing Normal University, Nanjing in 2020. She then joined the Department of Thermo-Fluid Science & Engineering of Xi'an Jiaotong University as a PhD student, supervised by Professor Wen-Quan Tao. Her research interests include: (1) experimental study of airflow organization in data centers; (2) energy conservation and design optimization of data centers; (3) server-level design and optimization of immersion liquid cooling; (4) thermal performance study of immersion liquid cooling at the cabinet level. (5) development of proper orthogonal decomposition (POD) program for data center row-level server rooms for rapid calculation of air temperature fields. She has been heavily involved in the construction of Xi'an Key Laboratory of Energy-Saving and Low-Carbon Technology of Data Centers. Her contributions include: (1) she participated in the design planning and construction of the Heating Ventilation and Air Conditioning (HVAC) system and power distribution system of the data center laboratory, and solved the problem of combining scientific research and engineering in the construction process. (2) she constructed the data collection and intelligent control system. As a principal, she designed and built a system for data acquisition and control optimization in the data center laboratory, which can be used in conjunction with AI for energy saving optimization in data centers.

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## 2021 HARTNETT-IRVINE AWARD



Wen-Quan TAO  
XJTU, Xi'an, China

Wen-Quan Tao is a Professor at Key Laboratory of Thermo-Fluids Science & Engineering of MOE, and Int. Joint Research Laboratory of Thermal Science & Engineering, Xi'an Jiaotong University, China. He was born in 1939, graduated from Xi'an Jiaotong University in 1962 and received his graduate diploma in 1966 under the supervision of Professor S.M.Yang. From 1980 to 1982 he worked with Professor E.M.Sparrow as a visiting scholar at the Heat Transfer Laboratory of University of Minnesota. He was selected as the National Outstanding Teachers in 2003 and the member of Chinese Academy of Science in 2005. He was the associate editors of the ASME Journal of Heat Transfer, and Int Journal Heat Mass Transfer. Presently he is the associate editor of the journal of Computers & Fluids. His textbook of 《Numerical Heat Transfer》 and 《Heat Transfer》 (co-authored with late Professor SM Yang) has been cited for more than 15000 times both home and abroad. He has supervised more than 160 graduate students receiving their degree. His recent research interests include multiscale simulations of fluid flow and heat transfer problems , enhancement techniques of heat transfer , improvement of hydrogen fuel cell performance, cooling techniques of data center , and energy storage technologies.

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## 2022 HARTNETT-IRVINE AWARD



Mr. Tolga Emir  
Özyegin University, Istanbul, Türkiye

Mr. Tolga Emir graduated from Ozyegin University with a degree in Mechanical Engineering. He continued his academic journey at Ozyegin University as a M.Sc. student, working under the guidance of Prof. Mehmet Arik from the Department of Mechanical Engineering at Auburn University, and Assoc. Prof. Mete Budakli from the Department of Mechanical Engineering at Ozyegin University. Since June 2018, Mr. Emir has been employed as a research assistant at the Energy Efficient Lighting Technologies Research, Development, Demonstration, and Education Center (EVATEG). His M.Sc. thesis focuses on conducting experimental investigations regarding nucleate boiling heat transfer and sustainable methods to enhance it through surface texturing. The primary objective is to identify the most practical methods applicable to various conditions such as pressure, working fluid, subcooling temperature, and operation time. These findings will facilitate the implementation of this technology in industrial applications. In this adventure, Mr. Emir cared to model distinct surface geometries and utilize innovative production methods to characterize the surfaces effectively.

As part of his bachelor's thesis, he undertook the design, construction, and commissioning of a robust boiling heat transfer setup capable of withstanding high pressures and ideal for observing bubble departures. He took this opportunity to transform the experimental setup into a fully automated version, thereby enhancing its functionality and efficiency.

Since 2018, he has become well-versed in various heat transfer mechanisms, including Frosting, Condensation, and Synthetic Jet Cooling. He has provided valuable support in constructing experimental setups for these mechanisms. During his internships, he made significant contributions to a defense project at Aselsan (Turkish: Aselsan, acronym: Askeri Elektronik Sanayi, Military Electronic Industries), specifically Aselsan A.Ş. His focus was on studying thermoelectric coolers (TECs) technology and optimizing 3D printed heat-sinks to improve cooling methods with minimal noise. Additionally, he played a pivotal role in designing pneumatic systems and developing optimal mechanisms in another company sponsored by BOSH Rexroth.

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## 2022 HARTNETT-IRVINE AWARD



Prof. Mete Budakli

Özyegin University / German Research Foundation, Istanbul, Türkiye

From 2008 - 2013, Assoc. Prof. Dr. Mete Budakli worked as a research assistant under the supervision of Prof. Dr. Peter STEPHAN and Apl. Prof. Dr. Sc. Tatiana GAMBARYAN-ROISMAN, Institute of Technical Thermodynamics, Technische Universität Darmstadt-GERMANY. His PhD-project was focused on the experimental investigation of heat transfer and hydrodynamics of gas-driven thin film flows and evaporation which can be encountered in Airblast-Atomizers used in Lean-Premixed Pre-Vaporized (LPP) Aircraft Engines. After his PhD-graduation, he joined ThyssenKrupp and worked in the R&D-department of Refinery and Petrochemicals Technology where he was involved in several projects such as for Shell, Gazprom, Tüpraş etc. Parallel to this position he was teaching Thermodynamics in the Baden-Württemberg Cooperative State University Mannheim (DHBW-Mannheim), where he still works as an adjunct Professor.

From 2016 to 2020, he was working as an Assist. Prof. Dr. at the Turkish-German University in Istanbul in Mechanical Engineering Department and was PI of a Marie Skłodowska Curie - TÜBİTAK Co-funded project from 2016 - 2017 working with Prof. Dr. Mehmet ARIK. Besides his activities in teaching and R&D he had several responsibilities such as being Vice-Head of Mechanical Engineering department, development of a Strategic Roadmap 2030 for the University, establishment of a Technopark. Since October 2020, he is Research Fellow of the German Research Foundation (Deutsche Forschungsgemeinschaft (DFG) - Funding No. 441193154) and works in the EVATEG Center, Özyegin University in Istanbul. His current research focusses on the enhancement of condensation heat transfer and surface wetting phenomenon on micro-laser-decorated surfaces with the aim to improve the thermal management in electronic systems used in avionics and satellites.

Besides, his further research fields Frosting, Icing/De-Icing, Drop impact, Phase-Change materials, and Single-Phase heat transfer.

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## 2022 HARTNETT-IRVINE AWARD



Prof. Mehmet Arik  
Auburn University, Alabama, United States of America

Dr. Mehmet ARIK completed his undergraduate education at Istanbul Technical University, Department of Mechanical Engineering. He obtained his MSc degree from University of Miami (FL). He completed his PhD studies at the Department of Mechanical Engineering of the University of Minnesota. Between 2000 and 2012, he worked at General Electric Global Research Center (GE GRC, NY) as a senior engineer and program manager. He has been a professor and director of EVATEG Center at Ozyegin University, Istanbul between 2011 and 2022. He moved to Auburn University (AL) in January 2022 as an associate professor of mechanical engineering department. He is a fellow of the American Society of Mechanical Engineers (ASME). He published over 200 refereed journal and conference papers as well as 4 books and book chapters. He owns over 100 patents related energy, photonics, defense, and medical systems. He has served as an associate editor for ASME Journal of electronics Packaging and ASME Thermal Sciences and Engineering Applications. He is serving as an associate editor for IEEE Trans. CPMT, ASME Open Journal of Engineering and Journal of Thermodynamics.

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## 2022 FELLOWSHIP AWARD



Prof. Leonid A. Dombrovsky  
Joint Institute for High Temperatures, Moscow, Russia

Leonid A. Dombrovsky is a highly regarded expert in the field of radiative transfer, specializing in the study of various scattering media as applied to power engineering, geophysics, and biomedicine. Currently holding the position of Chief Researcher at the Joint Institute for High Temperatures in Moscow, Russia, he has made significant contributions to the field over the course of his career. In 1974, Leonid Dombrovsky earned his PhD from MIPT, followed by the completion of his Doctor of Science degree in 1990. Throughout his extensive research journey, Prof. Dombrovsky has published over 300 research papers, as well as authored several books and book chapters. Of particular note are his monographs on radiative heat transfer in scattering media, which were published by Begell House (New York) in 1996 and 2010. These monographs have gained wide recognition and are extensively referenced by researchers worldwide. In recognition of his achievements in the science and art of heat and mass transfer, Prof. Dombrovsky was awarded the prestigious A.V. Luikov Medal in 2016, followed by the William Begell Medal in 2018. Leonid Dombrovsky's cooperation with esteemed colleagues from Australia, Germany, France, Israel, Russia, Sweden, Switzerland, the UK and the USA over the past 27 years has played a crucial role in enhancing the overall expertise and diversity of the physical models developed. As a result, advances have been achieved in a wide range of fields, encompassing heat transfer in rocket engines and solar thermochemical reactors, thermal processes in industrial nuclear reactors, microwave emission of foam on the ocean surface, radar remote sensing of atmospheric clouds, solar heating and melting of snow and ice, shielding of thermal radiation by evaporating or sublimating droplet and solid particle clouds, stabilization and control of droplet clusters, airborne spreading of viruses, and infrared thermal treatment of human tumors.

ICHMT fellows are elected from ICHMT members in recognition of administrative or organizational services provided to the Centre such as successful organization of International Symposia, Seminars, Advanced Courses or other scientific events, contributions to ICHMT publishing Activities or long and active service on the Executive Committee or Scientific Council. No more than two fellows can be elected each year.

## 2022 LUIKOV MEDAL



Prof. Renato Machado Cotta

Federal University of Rio de Janeiro – POLI & COPPE, UFRJ

General Directorate of Nuclear & Technological Development, Brazilian Navy  
Rio de Janeiro, Brazil

Prof. Renato M. Cotta was born in Niterói, Brazil, on March 5th, 1960. He obtained his B.Sc. in Mechanical-Nuclear Engineering, at the Federal University of Rio de Janeiro, UFRJ, Brazil, in 1981, and his PhD in Mechanical-Aerospace Eng. from North Carolina State Univ., NCSU, USA, in 1985. He became Assistant Professor at the Aeronautics Technological Institute, ITA, Brazil, 1985-1987, then Associate Prof., at UFRJ, in 1987, and Professor, at COPPE-UFRJ in 1994, and at POLI-UFRJ in 1997, until the present. Author of 600 articles, 10 books, and supervisor of 49 MSc, 39 PhD, and 18 PosDocs. He is member of 15 Editorial Boards, including Int. J. Heat & Mass Transfer, Int. Comm. Heat & Mass Transfer, Int. J. Thermal Sciences, and Editor of the Annals Braz. Academy of Sciences. Served as President of the Braz. Association of Mechanical Sciences & Engineering, ABCM, from 2000-2001, as member of the Scientific Council, International Centre for Heat & Mass Transfer, ICHMT, from 1993, of the Executive Comm. ICHMT, 2006-2022, ICHMT EC Chairman, 2017-2018, and Congress Comm., Int. Union of Theoretical & Applied Mechanics, IUTAM, 2012-2018. Served as Exec. Comm. member for the Braz. Academy of Sciences, 2012-2015. He received the ICHMT Hartnett-Irvine Award, 2009 and 2015, the ICHMT Fellowship Award, 2019, the National Order of Scientific Merit, Brazil, in 2009 (Comendador) and 2018 (Grã-Cruz), and the National Order of Naval Merit, Brazil, 2018. Member of the Brazilian Academy of Sciences, since 2009, National Engineering Academy, since 2011, and The World Academy of Sciences, TWAS, since 2012. Holds the Doctor Honoris Causa title from Université de Reims, URCA, France, 2018. President of the National Commission of Nuclear Energy, CNEN, both regulatory body and science promoter in nuclear energy in Brazil, 2015-2017. Adjunct Professor at the University of Miami, 1993-2005, and Leverhulme Trust Visiting Prof. at Univ. College London, UCL, UK. Member of the National Council of Energy Policy, CNPE, Ministry of Mines and Energy, Brazil, 2020-2022. Member of Technical Working Group (TWG) in Nuclear Desalination, IAEA, 2021-2024. Since 2017, Senior Technical Consultant (Amazul Defense Technologies), in Nuclear and Technological Development, for the Brazilian Navy.

The Luikov Medal is awarded by the International Centre for Heat and Mass Transfer (ICHMT) to one individual every two years for outstanding contributions to the science and art of heat and mass transfer and for activities in international scientific cooperation in conjunction with ICHMT programs. The award is dedicated to Aleksey Vasilievich Luikov, a renowned Russian pioneer in the field of heat transfer.

# MISCELLANEOUS TOPICS

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## BRONZE

### South African Institution of Mechanical Engineering (SAIMechE)



The South African Institution of Mechanical Engineering (SAIMechE) is the senior body representing the discipline of mechanical engineering in South Africa. It covers all fields of application as diverse as automobile, energy generation, process engineering, heavy manufacture, design, management, research, mining, and education. SAIMechE is a voluntary association of Mechanical Engineers, Technologists and Technicians that have access to various grades of membership and the associated benefits. It is recognized nationally and internationally as a representative of an engineering society in South Africa which actively promotes excellence in local industry.

SAIMechE's mission is to serve the interests and needs of its members and of the Mechanical Engineering Community, and to promote the continued supply of appropriate and sufficient Mechanical Engineering skills to meet the nation's needs, thereby enhancing the competitiveness of local industry to the benefit of all.

In addition, the SAIMechE motto is: 'Scientia Progredimur' – By Knowledge We Advance.

Email: [info@saimeche.org.za](mailto:info@saimeche.org.za)

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### VK Innovations



### VK - Innovations

Empowering Social Development

VK Innovations is a non-profit organization that partnered with the NGO Women First to begin a women's sewing initiative. The plan supports women in impoverished communities by creating economic stability using creativity and the traditional craft of stitching. Timothy Tumba created VK to use sewing to empower women in South Africa living in poverty. Women First was opened 2014 to support the educational training of the underprivileged, the rehabilitation of leprosy patients and those who are physically challenged. Timothy backpacked across South Africa 6 years ago. During his journey, he saw an opportunity to empower women in the country through vocational training. Timothy recognized that more than 50% of women in South Africa are illiterate, and only 29% are actively employed. Additionally, those who are employed are paid 46% less than men holding the same positions. VK Innovations realize that investing in women is smart economics and essential to reducing poverty. With this in mind, the initiative provides the training, financial

assistance, materials and communal space to empower women while preserving local craft traditions.

Email: [sales@vkinnovations.co.za](mailto:sales@vkinnovations.co.za)

Website: <https://vkinnovations.co.za/>

Facebook: VeggyKings

Instagram: vkinnovations

LinkedIn: vk-innovations

Twitter: @innovations\_vk

## HISTORY OF THE IHTC

The Assembly for International Heat Transfer Conferences (AIHTC) organizes the series of quadrennial International Heat Transfer Conferences (IHTCs) – the Heat Transfer Olympics – since 1966.

The origin of the IHTCs is an International Discussion on Heat Transfer held in London (Chair, O.A. Saunders) and Atlantic City (Chair, A.P. Colburn) 1951; this was regarded as IHTC-1. Ten years later, a succeeding International Heat Transfer Conference was held in Boulder 1961 and in London 1962, which was regarded as IHTC-2. After IHTC-3 held in Chicago 1966, IHTCs have been continuously held every four years having the recent one IHTC-16 held in Beijing 2018 followed by the next two in Cape Town 2022 and Rio de Janeiro 2026.

It has been organized in 17 cities of 10 countries. For over 67 years, IHTC has been the largest worldwide forum on heat transfer (HT) and thermal science and engineering (TSE), and devoted to meet the scientific and social challenges as the thermal energy usage, environmental sustainability, material processing, bio-science, etc.

The mission of IHTC has become more important with the rapid increase in the activity of human society.

IHTC History			
1	1951	London	United Kingdom
		Atlantic City	United States
2	1961	Boulder	United States
	1962	London	United Kingdom
3	1966	Chicago	United States
4	1970	Paris	France
5	1974	Tokyo	Japan
6	1978	Toronto	Canada
7	1982	München	Germany
8	1986	San Francisco	United States
9	1990	Jerusalem	Israel
10	1994	Brighton	United Kingdom
11	1998	Kyongju	Korea
12	2002	Grenoble	France
13	2006	Sydney	Australia
14	2010	Washington	United States
15	2014	Kyoto	Japan
16	2018	Beijing	China
17	2023	Cape Town	South Africa
18	2026	Rio de Janeiro	Brazil

## **MEETINGS**

Take note that all the meeting listed below are by invitation only:

### **William House Reception**

Monday, 14 August 2023 | 18h00 - 19h00 | Invitation Only

### **ICHMT Scientific Committee & General Assembly Meeting**

Tuesday, 15 August 2023 | 15h30 - 17h00 | Venue: Freesia

### **ICHMT Executive Committee Meeting**

Tuesday, 15 August 2023 | 17h30 - 19h00 | Venue: Freesia

### **AIHTC Committee Meeting**

Wednesday, 16 August 2023 | 14h00 - 18h00 | Venue: Orchid

### **AIHTC-ICHMT Joint Dinner**

Wednesday, 16 August 2023 | 18h30 - 21h00 | Venue: Orchid

### **Elsevier Editorial Board Meetings: Applied Thermal Engineering**

Friday, 18 August 2023 | 16h00 - 18h30 | Venue: Freesia