Proceedings of ASME 2023 Heat Transfer Summer Conference

(HT2023)

July 10-12, 2023
Washington, DC

Conference Sponsor
Heat Transfer Division

THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS
Two Park Avenue * New York, N.Y. 10016

© 2023, The American Society of Mechanical Engineers, 2 Park Avenue, New York, NY 10016, USA
(www.asme.org)

All rights reserved. Printed in the United States of America. Except as permitted under the United States Copyright Act of 1976, no part of this publication may be reproduced or distributed in any form or by any means, or stored in a database or retrieval system, without the prior written permission of the publisher.

INFORMATION CONTAINED IN THIS WORK HAS BEEN OBTAINED BY THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS FROM SOURCES BELIEVED TO BE RELIABLE. HOWEVER, NEITHER ASME NOR ITS AUTHORS OR EDITORS GUARANTEE THE ACCURACY OR COMPLETENESS OF ANY INFORMATION PUBLISHED IN THIS WORK. NEITHER ASME NOR ITS AUTHORS AND EDITORS SHALL BE RESPONSIBLE FOR ANY ERRORS, OMISSIONS, OR DAMAGES ARISING OUT OF THE USE OF THIS INFORMATION. THE WORK IS PUBLISHED WITH THE UNDERSTANDING THAT ASME AND ITS AUTHORS AND EDITORS ARE SUPPLYING INFORMATION BUT ARE NOT ATTEMPTING TO RENDER ENGINEERING OR OTHER PROFESSIONAL SERVICES. IF SUCH ENGINEERING OR PROFESSIONAL SERVICES ARE REQUIRED, THE ASSISTANCE OF AN APPROPRIATE PROFESSIONAL SHOULD BE SOUGHT.

ASME shall not be responsible for statements or opinions advanced in papers or . . . printed in its publications (B7.1.3). Statement from the Bylaws.

For authorization to photocopy material for internal or personal use under those circumstances not falling within the fair use provisions of the Copyright Act, contact the Copyright Clearance Center (CCC), 222 Rosewood Drive, Danvers, MA 01923, tel: 978-750-8400, www.copyright.com.

Requests for special permission or bulk reproduction should be addressed to the ASME Publishing Department, or submitted online at: https://www.asme.org/publications-submissions/journals/information-for-authors/journalguidelines/rights-and-permissions

ISBN: 978-0-7918-8716-5

TABLE OF CONTENTS

Experimental Study on the Effect of Uneven Heat Load on the Airflow Uniformity and Thermal Performance in a Small-Scale Data Center 1
Ze-Wen Chang, Chi-Chuan Wang

Experimental Performance of a Nonlinear Control Strategy to Regulate Temperature of a High Temperature Solar Reactor 6
Assaad Alsahlani, Nesrin Ozalp

Construction and Validation of a Pumped Loop Cycle for Characterizing Heat Transfer of Refrigerants and Alcohols Near Supercritical Points 14
Benjamin Pepper, Aiden Meek, Mahdi Ghorbani, Hailei Wang

Thermal and Flow Characteristics in a Tube with Helical Ridges 22
Tailian Chen

Integrated Greenhouse for Food and Water Production 29
Mahyar Abedi, Xu Tan, James Klausner, Andre Benard

Estimation of Heat Flux From Gases Released During Thermal Runaway of Lithium-Ion Batteries 38
Ala' E. Qatramez, Andrew Kurzawski, John Hewson, Daniel Foti, Alexander J. Headley

Experimental Study of Enhanced Heat Transfer in Phase Change Material Based Thermal Energy Storage in Compact Heat Exchangers 46
Sarath Kannan, Milind A. Jog, Raj M. Manglik

Composite Phase Change Material With Metal Foam in Shell and Convergent Tube Thermal Energy Storage Systems 57
Bernardo Buonomo, Maria Rita Golia, Oronzio Manca, Sergio Nardini, Renato Elpidio Plomitallo

Numerical Investigation of the Thrust Vectoring Performance of a Bypass Dual Throat Nozzle 65
Saadia Afridi, Tariq Amin Khan, Wei Li, S. A. Sherif

Performance Comparison of Thermal Management Systems for Battery Packs Based on Numerical Simulation 73
Sowmya Raghu, Roya Rajabi, Robin James, Kevin Huang, Jamil A. Khan

Approaches for Phenomenological Studies in Nucleate Boiling Using a Laser-Based Controlled Bubble Generation Technique 80
Navdeep Singh Dhillon, Dilipkumar Choudhary, Jayden Maree

Quadrature Point Selection in the Full-Spectrum K-Distribution Method for Nongray Radiation in Combustion Gases 85
Nehal Jajal, Sandip Mazumder

Thermal Conductivity Extraction From Frequency Domain Thermo-Reflectance Experiments Using the Phonon Boltzmann Transport Equation 93
Siddharth Saurav, Sandip Mazumder

An Air Conditioning Cycle Using Lower Critical Solution Temperature Mixtures 102
Jordan D. Kocher, Akanksha K. Menon, Shannon K. Yee

Use of a Genetic Algorithm to Model the Interaction of Conduction and Nucleate Boiling Mechanisms During Evaporation of Water Droplets on Superheated ZnO Nanostructured Surfaces 110
Anisa D. Silva, Van P. Carey

Time-Dependent Solution of Unsteady Flow Equations for Nanoscale Heat and Mass Transfer, Advanced Fluidics, and High Energy Blast Propagations 121
Ramlala P. Sinha

Electron-Phonon Interactions for Nanoscale Energy Transport Simulations in Semiconductor Devices 130
Michael P. Medlar, Edward C. Hensel

Thermal Transport in Thermoelectric Coupled Nanoantennas 134
Edward Kinzel, Collin Finnan, Chao Dong, David Burghoff, Stephen M. White, Hadrian Aquino, Alexei O. Orlov, Wolfgang Porod, Gary H. Bernstein, Gergo P. Szakmany

Thermal Buoyancy Effect on Wake-Induced Vibration of a Cylinder Submerged in the Wake of a Stationary Cylinder 139
Hamid H. Khan, Md. Islam, Isam Janajreh

Flow Interference Between Tandem Cylinder With Forced Convection in Staggered Position 146
Yuvraj Sarout, Md. Islam, Yap Fatt, Isam Janajreh

Thermal and Hydrodynamic Behavior of Metal Foams: Contrasting Compressed and Uncompressed Foams 155
Chaitanya Prasad Nanda, Metodi Zlatinov, Raj M. Manglik

Effect of Inner Fin Tube Structure on Comprehensive Performance of Supercritical Carbon Dioxide and Lead Bismuth Eutectic Heat Exchanger 166
Shuhan Liu, Ji'an Liu, Qingjiang Liu, Xianliang Lei

Prediction of the Inter-Tube Flow Mode Transitions in the Evaporators of Multi-Effect Thermal Desalination Plants 176
Mina M. K. Mikhaeel, Anthony M. Jacobi

Study on Ensemble Kalman Filter Based Building Fire Prediction and Dynamic Situation Awareness for Emergency Response 198
Luyao Kou, Pei Wang, Rui Ba, Jiaming Liu, Qing Deng, Hui Zhang

Flow and Heat Transfer Characteristics of Aerothermodynamic Loading on a Double Cone at Mach 12 207
Jacob Gamertsfelder, Jeremy Redding, Luis Bravo, Prashant Khare

Phase Change Materials for Absorbing Peak Heat Loads in Aircraft: An Effectiveness-NTU Model for Predicting the Performance of Compact Heat Exchanger 218
Julie Y. Frank, Duncan J. Borman, Evaldas Greiciunas, Amirul Khan, Jon Summers

Numerical Predictions of the Flow and Heat Transfer Characteristics in the Film Boiling Regime During Tube Quenching 228
Jayachandran K. Narayanan, Sonya Hylton, Mohammad Kassemi, Jason W. Hartwig, Jeffrey R. Mackey, Chirag R. Kharangate

On the Effect of Sudden Contraction of CO2 in Microchannels for Enhancing the Cooling Performance 236
Soroush Niazi, Anatoly Parahovnik, Yoav Peles

Visualization-Aided Experimental Study of Thermal and Hydraulic Characteristics of Subcooled Flow Boiling of R-134A in a Microchannel Evaporator of a Pumped Two-Phase Loop 241
Rohan Kokate, Chanwoo Park

Numerical Simulation of Particle Evolution in Spray Drying Using Droplet Drying Kinetics 254
Anurag Bhattacharjee, Aswin Gnanaskandan

Study on the Effects of Temperature Distribution and Liquid Volume on the Growth of a Deuterium-Deuterium Ice in the Cryogenic Target 263
Kewei Wu, Yina Yao, Hui Zhang, Lili Zheng

Experimental Analysis of Single Evaporation Tube Utilizing Sintered Copper Particle Wicking Structures 272
Jeremy Spitzenberger, James Hoelle, Ramy H. Mohammed, Laith Ismael, Hongbin Ma, Pengtao Wang, Stephen Kowalski, Kashif Nawaz

Spray Overlap and Heat Transfer Coefficient Uniformity in the Continuous Casting 282
Ninad Patil, Rashed Al Manasir, Armin K. Silaen, Nicholas Walla, Chenn Zhou

Experimental Study on the Flow Boiling Heat Transfer in Horizontal Tubes With Composite Structure 292
Yuhao Lin, Jacheng Wang, Xu Wang, Wei Li, S. A. Sherif

Thermal Brine Concentration Using Air-Gap Diffusion Distillation: A Coupled Heat and Mass Transport Model 301
Walter P. Parker Jr., Akanksha K. Menon

Heat Transfer Characteristics According to Inner Pipe in a Gas Turbine Vane Internal Passage 311
Jeonghun Heo, Hee Jae Lee, Taehyun Kim, Gyeongryun Kim, Changyong Lee, Hyung Hee Cho

Effects of Natural Convection Mass Transfer on Drying Aerogels With Supercritical Carbon Dioxide 322
Friday N. Abolorunke, Hy Dinh, Georgios Karamanis, Karthik Remella, Marc Hodes

Hot-Zone Design of Carbon/Carbon-Metal Sandwich Structure Composite Using CVI/CVD Material Processing 330
Xiaoqing Huang, Hui Zhang

A Co-Flow Millifluidic Device for Nanoparticle Synthesis 339
Ruibo Yang, Hongwei Sun

Volumetric Additive Manufacturing With 3D Point Cloud Projection and Single-Photon Nonlinear Polymerization 345
Aravind Jakkinapalli, Sy-Bor Wen

In-Situ Bottom-Up Temperature Measurements for Laser Powder Bed Fusion Metal Additive Manufacturing 356
Mason Pratt, Tim Ameel, Sameer Rao

Heat Transfer of Supercritical CO_2 Near the Critical Condition Inside a Microchannel 362
Pranzal Ahmed, Anatoly Parahovnik, Yoav Peles

Transient Thermal Spreading From a Circular Heat Source in Polygonal Flux Channels 368
Sahar Goudarzi, Lisa Steigerwalt Lam, Yuri Muzychka, Greg F. Naterer

Investigation of the Entropy Generation and Exergy Destruction Rates for a Novel Micro-Jet Heat Sink Working With a Nanofluid for Efficient Cooling of Motor Inverters in Electric Vehicles 374
Nima Mazaheri, Aggrey Mwesigye

Effect of Modified Fin Geometries on the Effectiveness Of a Phase Change Material Heat Sink 386
Austin Jones, Jeff Darabi

Numerical Study of Thermal Management Systems Using Phase Change Materials Integrated With Heat Sink for Wireless Super-Fast Charging Stations of EVs in Constant Heat Flux Condition 394
Mahdi Ghorbani, Hailei Wang, Nicholas Roberts

Experimental Investigation of Orientation Effects on Pseudocritical Transition Dynamics in Heated Microchannel With Side-View Schlieren Imaging 405
Trevor A. Whitaker, Sameer R. Rao

The Effect of Bending on Sintered Wicked Heat Pipes for Multiple Component Cooling 413
Eoin Guinan, Vanessa Egan, Joseph P. Mooney, Jeff Punch

Monitoring Perfusion-Based Convection in Cancer Tumor Tissue Undergoing Nanoparticle Heating by Analyzing Temperature Responses to Transient Pulsed Heating 420
Hayden Carlton, Preethi Korangath, Nageshwar Arepally, Anilchandra Attaluri, Robert Ivkov

The Effect of Immersion in Water on Internal Body Temperature Post-Mortem 427
Athena Devashish, Devashish Shrivastava

A Computational Assessment of Thermal Damage in Perfused Tissue due to Laser Irradiation 431
Rahul Goyal, Devashish Shrivastava

Using Radiant Heating System to Prevent Bridge Freezing 437
Hussein Abaza, Amaal Shenawa, Scott Semmelink

Hydrogen-Fueled Regenerative Burners in a Reheating Furnace 443
Anurag Karambelkar, Chukwunedum Uzor, Nicholas Walla, Armin Silaen, Kurt Johnson, Chenn Zhou

A 3D Heat Transfer Model of a Glass Additive Manufacturing Process 450
Zechariah Jibben, Narendran Raghavan, John Bernardin

Understanding Saline Water Droplet-Membrane Surface Interaction Using Molecular Dynamics Simulations 457
Khadije El Kadi, Mohamed I. Hassan Ali, MD Didarul Islam, Isam Janajreh

Variable Properties via Excel: Numerical and Computational Heat Transfer Methods 463
Amanie Abdelmessih

The Effect of a Pulsed Flow Inlet on Vacuum Membrane Distillation Performance 477
Justin Caspar, Guanyang Xue, Alparslan Oztekin

The Effect of Inlet and Outlet Configuration on the Performance of Hollow Fiber Direct Contact Membrane Distillation 486
Jaber M. Asiri, Justin Caspar, Guanyang Xue, Alparslan Oztekin

Numerical Study on Natural Convection With Nanofluids in Vertical Channels Asymmetrically Heated 496
Bernardo Buonomo, Oronzio Manca, Sergio Nardini, Gianluca Sarli

A Numerical Study of Refrigerant Leakage From a Propane-Based Refrigeration System 508
Mingkan Zhang, Vishaldeep Sharma, Brian A. Fricke

Heat Transfer Workshops Using the Personal Engineering Platform 515
Thomas Diller, Diana Bairaktarova

Construction of Short-Time Solutions in Heat Conduction 523
Filippo de Monte, Keith A. Woodbury, Hamidreza Najafi

Heat Flux Characterization From a Band Heater to Pipe Using Inverse Heat Conduction Problem Method 532
Ramon Peruchi Pacheco da Silva, Keith Woodbury, Forooza Samadi, Joseph Carpenter

Study of Inclusion Detection Using Bayesian Inference for an Application in Breast Tumors 541
Gabriela L. Menegaz, Cleudmar A. Araujo, Gilmar Guimaraes

Use of Artificial Intelligence Techniques, Correlation of Thermal Images and the Concept of Thermal Impedance Aiming to Estimate the Location and Size of Breast Tumours 549
Jefferson G. Nascimento, Gabriela L. Menegaz, Gilmar Guimaraes

A Bayesian Spatio-Temporal Modeling Approach to the Inverse Heat Conduction Problem 560
Ridwan Olabiyi, Hari Pandey, Han Hu, Ashif Iquebal

Improving the Accuracy of Experimentally Inferred Heat Transfer Coefficients for Hot Stamping 568
Arpan Raj Singh, Cliff Butcher, Kyle J. Daun

A Novel Approach for Solving Inverse Heat Conduction Problems Using Genetic Algorithm 575
Dominic Allard, Hamidreza Najafi

Multimodal Characterization of Steady-State and Transient Boiling Heat Transfer 582
Hari Pandey, Christy Dunlap, Amanda Williams, Jackson Marsh, Han Hu

Line Chilldown and Flow Boiling Heat Transfer Characteristics of Stainless Steel Tubes 592
Jayachandran K. Narayanan, Chinmay Shingote, Yue Qiu, Jason W. Hartwig, Jeffrey R. Mackey, Mohammad Kassemi, Chirag R. Kharangate

Hybrid Nongray Radiative Transfer Equation Solver Using Full Spectrum Correlated K-Distribution (FSCK) Method for Combustion Gases 599
Nehal Jajal, Sandip Mazumder

Remote Thermal Measurements With Regression of Acoustic Emissions 609
Christy Dunlap, Hari Pandey, Jackson Marsh, Ethan Weems, Han Hu

Measurement of the Thermal Diffusivity of Glass at High Temperatures 618
Nicholas E. Capps, Fiyinfolouwa Abioye, Edward C. Kinzel

Investigation of Universal Consolidated Database for Heat Transfer Coefficient in Flow Condensation and Machine Learning Modelling 624
Logan M. Pirnstill, Yue Qiu, Chirag Kharangate

Optimized Design and Control of a Multi-Temperature, Multi-Module Thermal Energy Storage Ensemble 632
Alanna Y. Cooney, Van P. Carey

Single Phase Immersion Cooling for Hyper Scale Data Centers: Challenges and Opportunities 643
Dereje Agonafer, Pratik Bansode, Satyam Saini, Jessica Gullbrand, Ashish Gupta

Author Index