Seventh International Conference

on

Enhanced, Compact and Ultra-Compact Heat Exchangers: Science, Engineering and Technology

September 13-18, 2009

La Condesa Hotel
Heredia, Costa Rica

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SUNDAY, SEPTEMBER 13, 2009

18:00 – 19:00	Registration (Foyer of the Emperador Conference Room)
19:30 – 21:00	Dinner (Patio Los Condes Restaurant)
21:00 – 22:00	Welcome reception (Emperador Conference Room)

Notes

- All technical sessions will be held in the Emperador Conference Room.
- Meals will be in the Patio Los Condes Restaurant with the except of Thursday's banquet which will be in the El Mirador de la Cava del Conde Restaurant
- Audiotaping, videotaping and photography of presentations are strictly prohibited.
- Speakers – Please leave at least 5 minutes for questions and discussion.
- Please do not smoke at any conference functions.
- Turn your cellular telephones to vibrate or off during technical sessions.
- Be sure to make any corrections to your name/contact information on the Master Participant List or confirm that the listing is correct. A corrected copy will be sent to all participants after the conference.

MONDAY, SEPTEMBER 14, 2009

07:00 - 08:00	Breakfast
08:00 - 08:10	Welcome and Introduction
08:15 - 10:15	**Session 1: RECENT DEVELOPMENTS IN HEAT EXCHANGERS STUDIES** **Session Chair:**

Keynote Lecture
Two phase distribution issues in microchannel heat exchangers
P. Hrnjak
University of Illinois, Urbana, IL, USA

Thermal-hydraulic performance and system-level effects of Al_20_3-propanol nanofluid
A. Sommers[1], K.L. Yerkes[2] and A.R. Runyon[2]
[1]Miami University, Oxford, OH, USA , [2]Airforce Research Laboratory, Wright- Patterson AFB, OH, USA

The potential impact of nano-fluid enhancements on the design of heat exchangers,
L. Liu, E. S. Kim, Y. Park, and A. M. Jacobi,
University of Illinois, Urbana, IL, USA

10:15 – 10:45	Coffee/tea break
10:45 – 13:00	**Session 2: SINGLE-PHASE HEAT TRANSFER ENHANCEMENT– Part I** **Session Chair:**

Influence of the fin spacing on the flow field near the tube-fin junction in louvered fin compact heat Exchangers
H. Huisseune[1], C. T'Joen[1], R. De Maeseneire[1], P. De Jaeger[1,2], M. De Paepe[1]
[1]Department of Flow, Heat and Combustion Mechanics, Ghent University, Belgium; [2]NV Bekaert SA, Kortrijk, Belgium,

Mean flow behavior and resulting thermo-hydraulics of inclined louvered fins
B. T'Joen**,** H. Huisseune, P. De Jaeger, A. Willockx, M. De Paepe
Department of Flow, Heat and Combustion Mechanics, Ghent University, Belgium

A comparison of metal-foam heat exchangers to compact multi-louver designs for air-side heat transfer applications
Z. Dai, K. Nawaz, Y. Park, Q. Chen, and A. M. Jacobi
University of Illinois, Urbana, IL, USA

Foam heat exchangers: A technology assessment
A. Muley, Koch Heat Transfer, USA,
B. Kiser, Honeywell Turbo Technologies, USA,
B. Sundén, Lund Institute of Technology, Sweden, and
R.K. Shah, Energy Science and Engineering Department, IIT Bombay, India

13:00 – 14:00	Lunch
14:00 – 16:00	Free time and *ad hoc* discussions

MONDAY, SEPTEMBER 14, 2009 (continued)

16:00 – 17:30

Session 3: SINGLE-PHASE HEAT TRANSFER ENHANCEMENT– Part II
Session Chair:

Keynote Lecture
Flow field analysis of the air flowing through fin-and-tubes with Delta-Winglet Vortex Generator
S.W. Hwang and J.H. Jeong
School of Mechanical Engineering, Pusan National University, South Korea

Enhancement of heat transfer for fin-and-tube heat exchangers with Delta-Winglet Vortex Generators
Y. G. Lei, Y. L. He and W.Q. Tao
Xi'an Jiaotong University, China

17:30 – 18:00 Coffee break

18:00 – 20:00

Session 4: SINGLE-PHASE HEAT TRANSFER ENHANCEMENT– Part III
Session Chair:

Application of combined enhanced techniques for design of highly efficient air heat transfer surface
J.F. Fan, Y.L. He, W.Q. Tao
Xi'an Jiaotong University, China

Minimizing data reduction uncertainty during experiments with compact heat exchangers (oral presentation only)
A.M. Jacobi
University of Illinois, Urbana, USA

20:00 Dinner

TUESDAY, SEPTEMBER 15, 2009

07:00 – 08:00 Breakfast

08:00 – 10:00 **Session 5: COMPACT HEAT EXCHANGER DESIGN AND OPTIMIZATION - I**
Session Chair:

Keynote Lecture
Approximation assisted optimization for compact heat exchangers
O. Abdelaziz, V. Aute, S. Azarm, and R. Radermacher
Center for Environmental Energy Engineering, University of Maryland, USA

Effectiveness-thermal resistance method for heat exchanger design and analysis
Z.Y. Guo[1], X.B. Liu[1], W.Q. Tao[2], and R.K. Shah[3]
[1]Tsinghua University, China, [2]Xi'an Jiaotong University, China, and [3]Indian Institute of Technology Bombay, India,

Heat transfer and flow resistance correlations for louver fin surface
H. C. Kang[1] and G. W. Jun[2]
[1]Kunsan National University, South Korea, and [2]Halla Climate Control Co., South Korea

10:00 – 10:30 Coffee/tea break

10:30 – 12:45 **Session 6: COMPACT HEAT EXCHANGER DESIGN AND OPTIMIZATION - II**
Session Chair:

Keynote Lecture
Reliability, availability, maintainability and safety (RAMS) of high-temperature compact heat exchangers
J. Klemeš, L. Sikos and P. Varbanov
Faculty of Information Technology, University of Pannonia, Hungary

Optimization criterioa for heat exchangers with different applications
Q. Chen[1], J. Wu[1], M. Wang[2] and Z-Y. Guo[1]
[1]Tsinghua University, China, [2]Los Alamos National Laboratory, USA

Optimization of pin fin density at low Reynolds numbers in minichannels
N.K.C. Selvarasu, Danesh K. Tafti, Neal E. Blackwell
Virginia Polytechnic Institute and State University, USA

12:45 – 14:00 Lunch

14:00 – 16:00 Free time for recreation or *ad hoc* discussions

16:00 – 17:10 **Session 7: FUNDAMENTAL STUDIES AND APPLICATIONS – I**
Session Chair:

Numerical studies on a novel shell-and-tube heat exchanger with combined helical baffles
G.D. Chen, W. Wang and. M. Zeng
Xi'an Jiaotong University, China

TUESDAY, SEPTEMBER 15, 2009 (continued)

A simple effective viscosity formulation for turbulent flow and heat transfer in compact heat exchangers
S.B. Beale
National Research Council of Canada, Canada

17:10 – 17:30 Coffee break

17:30 – 19:30 **Session 8: FUNDAMENTAL STUDIES AND APPLICATIONS - II**

Modeling of air-side fouling in exhaust gas recirculators
N. Krishnamurthy, Danesh K. Tafti and Aroon K. Viswanathan
Virginia Polytechnic Institute and State University, USA

Microchannel Heat Transfer and Pressure Drop Performance: Single-Phase, Boiling and Condensation
R.K. Shah, Indian Institute of Technology Bombay, Mumbai, India

20:00 Dinner

WEDNESDAY, SEPTEMBER 16, 2009

07:00 – 08:00	Breakfast
08:00 – 10:00	**Session 9: SINGLE-PHASE HEAT EXCHANGER DEVELOPMENT & APPLICATIONS – I** **Session Chair**: **Keynote Lecture** **Are compact heat exchangers suitable for high temperature applications?** P. Stehlik Faculty of Mechanical Engineering, Brno University of Technology, Czech Republic **Keynote Lecture** **Study and design of a new type of heat exchanger** L. Cheng and W. Du Institute of Thermal Science and Technology, Shandong University, China
10:00 – 10:30	Coffee/tea break
10:30 – 13:00	**Session 10: SINGLE-PHASE HEAT EXCHANGER DEVELOPMENT & APPLICATIONS – II** **Session Chair:** **Keynote Lecture** **Research and development on heat exchangers for air conditioners with the alternative winglet**, H. Fujino Daikin Industries Ltd., Japan **Heat generation characteristics in Si mosfets for the device-level thermal management–effect of the device scaling and transport properties** Y. Yamamoto, T. Hatakeyama, K. Fushinobu and K. Okazaki Tokyo Institute of Technology, Japan, **Study on the heat sink performance for LSI packages using a thermo-siphon structure with PF-5060 refrigerants** M. Ishizuka[1], S. Nakagawa[1], T. Hatakeyama[1] and T. Tomimura[2] [1]Toyama Prefectural University, Japan, [2]Kumamoto University, Japan **A capillary pumped two loop system for cooling of electronic devices** B Schilder, W. Schuch, P. Stephan Technical University of Darmstadt, Germany
13:00 – 14:00	Lunch
14:00 – 16:00	Free time for recreation and *ad hoc* discussions

WEDNESDAY, SEPTEMBER 16, 2009 (continued)

16:00 – 17:10 **Session 11: SINGLE-PHASE HEAT EXCHANGER DEVELOPMENT & APPLICATIONS – III**
Session Chair:

Design and testing of one stage water gas shift reactors (OS-WGS) with integrated heat exchange functionality based on microchannel technology
J. Schuerer, G. Kolb, M. O'Connell, D. Tiemann
Institut für Mikrotechnik, Mainz GmbH, Germany

Application of plastic microcapillary films (MCFS) as heat exchangers in low-cost solar energy collectors
C.H. Hornung, C. Dorfling, B. Hallmark, R.J.J. Beaumont, H. Fovargue, M.R. Mackley, Department of Chemical Engineering & Biotechnology, University of Cambridge, UK,

17:10 – 17:30 Coffee break

17:30 – 19:00 **Session 12: SINGLE-PHASE AND PHASE-CHANGE HEAT EXCHANGER DEVELOPMENT & APPLICATIONS – IV**

CFD studies on multi jet ejector configuration for improvement of aircraft compact heat exchanger performance
L. Sheik Ismail, N. Govindha Rasu, Ch. Ranganayakulu, M.A. Ramaswamy Aeronautical Development Agency, India,

Joule-Thomson micro-refrigerator with flexible regenerative heat exchanger
M. Kohno, A. Widyaparaga, A. Tanabe, M. Kuwamoto, H. Kubota and Y. Takata
Kyushu University, Japan

Design and Optimization of Minichannel Parallel Flow Condensers
B. Copetti, M.H. Macagnan, C.O. Figueiredo
UNISINOS Sao Leopoldo – RS, Brazil

19:30 Dinner

THURSDAY, SEPTEMBER 17, 2009

07:00 – 08:00	Breakfast
08:00 – 16:00	Optional Excursions with Costa Rica Dream Travel
16:00 – 18:00	**Session 13: Phase Change Heat Exchanger Development & Applications – Part I** **Session Chair:** **Keynote Lecture** **Microbubble emission boiling for advanced compact heat exchangers** K. Suzuki Tokyo University of Science, Japan **Influence of vortex generator arrays on thermal–hydraulic performance of compact refrigeration evaporators under frosting conditions** A. Joardar and A.M. Jacobi Carrier Corporation, USA; University of Illinois, Urbana, IL, USA **Minimizing airside ventilation power in a plate-fin and single–row tube heat exchanger** R. Nacereddine, S. Russeil, D. Bougeard, A.G. Kanaris and J.-L. Harion Ecole des Mines de Douai, France
18:00 – 18:15	Coffee break
18:15 – 20:00	**Session 14: PHASE-CHANGE HEAT EXCHANGER APPLICATIONS – Part II** **Session Chair:** **Results of estimation of rational enhancement process of convective heat transfer by passing a section through long smooth rectangular ducts** V.Y. Vasilyev and S.G. Vinokurova Astrakhan State Technical University, Russia **Single and two phase heat transfer and pressure drop in a 0.52 mm vertical metallic tube** M.M. Mahmoud, D.B.R. Kenning, and T.G. Karayiannis, School of Engineering and Design, Brunel University, UK **A new type of bath vaporiser for air separation units - An example of development management** M. Wagner and F. Fuentes Centre de Recherche Claude Delorme, Air Liquide, France
20:00 - 20:10	Future Plans and Vote of Thanks
21:10	Conference banquet

FRIDAY, SEPTEMBER 18, 2009

07:00 – 08:00	Breakfast
	Departures