

Program

International Conference on Heat Transfer and Fluid Flow in Microscale

*Il Ciocco Hotel and Conference Center
Castelvechio Pascoli (Tuscany), Italy
Tel: +39 0583 719 Fax: +39 0583 723 197*

25-30 September 2005

Chair

Dr. Gian Piero Celata, ENEA, Italy

Co-Chairs

Prof. **Satish Kandlikar**, Rochester Institute of Technology, USA

Prof. **Nobuhide Kasagi**, The University of Tokyo, Japan

Prof. **John R. Thome**, Ecole Polytechnique Fédérale de Lausanne, Switzerland

Scientific Secretary

Dr. Giuseppe Zummo, ENEA, Italy

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CONFERENCE OBJECTIVE

The conference objective is to address the state-of-the-art knowledge in the field of heat transfer and fluid flow in microscale. Recent development of industrial applications like microelectronics, laser systems, micro-heat exchangers, micro-devices (sensors and actuators), and power MEMS have led to studies dealing with microscopic behaviour of thermal phenomena. The conference intends to provide a forum for scientists from academia and people from industry to present and discuss recent advances in their research on thermal phenomena in microscale.

NOTES FOR CONFERENCE PARTICIPANTS

Participants should observe no smoking at ECI technical and social events.

During technical sessions please keep cell phones on vibrate or shut off. Take any telephone conversations out of the session room.

Presenters should leave time at the end of their talks for discussion.

SUNDAY, SEPTEMBER 25, 2005

17:00 - 19:30 Registration

18:30 – 19:30 Welcome reception

19:30 - 21:30 Dinner

MONDAY, SEPTEMBER 26, 2005

07:30 – 08:15 Breakfast

08:15 - 08:30 Welcome & Introduction

08:30 - 09:15 **Keynote lecture: TWO-PHASE FLOW AND BOILING IN MICROCHANNELS**

J.R. Thome

Heat and Mass Transfer Laboratory (LTCM), Ecole Polytechnique Fédérale de Lausanne (EPFL), Lausanne, Switzerland

Keynote chair: Prof. N. Kasagi

09:15 - 10:35 **Session: MEASUREMENT TECHNIQUES 1 – MT1**

Session chair: P.C. Wayner

HOT-TUBE SENSORS FOR FLOW MEASUREMENTS

V.M. Aniskin*, A.N. Shipliyuk*, A.A. Maslov*, V.V. Pay*, V.Ya. Prinz** and V.A. Seleznev**

**Institute of Theoretical and Applied Mechanics SB RAS, Novosibirsk, Russia,*

***Institute of Semiconductor Physics SB RAS, Novosibirsk, Russia*

VISCOSITY MEASUREMENTS OF DNA SOLUTION IN A MICROCHANNEL UTILISING μ -PIV AND PRESSURE MEASUREMENTS

D.M. Curtin, D.T. Newport and M.R Davies

Stokes Research Institute, University of Limerick, Ireland

MESOSCOPIC ANALYSIS OF ULTRA FAST LASER ABLATION

Y. Yamashita*, Y. Yamaguchi**, T. Yokomine***, S. Ebara*** and A. Shimizu***,

**Department of Advanced Energy Engineering Science, Interdisciplinary Graduate School of Engineering Sciences, Kyushu, Japan, **SHARP, 22-22 Nagaïke-cho,*

*Abe-no-ku, Osaka 545-8522, Japan, ***Division of Energy Engineering Science, Interdisciplinary Graduate School of Engineering Sciences, Kyushu, Japan*

TEMPERATURE MEASUREMENT IN INTERNAL MICROSCALE FLOWS USING INFRARED THERMOGRAPHY

V. Narayanan and V.A. Patil

Oregon State University, Department of Mechanical Engineering, Corvallis, USA

10:35 - 11:00 Coffee

11:00 - 12:20 **Session: FLOW BOILING 1 – FB1**

Session chair: M.E. Poniewski

EXPERIMENTAL INVESTIGATION OF R-134A AND R-245FA TWO-PHASE FLOWS IN MICROCHANNELS FOR DIFFERENT FLOW CONDITIONS

R. Revellin and J.R. Thome

Heat and Mass Transfer Laboratory (LTCM), Ecole Polytechnique Fédérale de Lausanne (EPFL), Lausanne, Switzerland

AN EXPERIMENTAL STUDY OF FLOW BOILING OF WATER IN A MICROCHANNEL

A. Pande, R. Kumar and A. Gupta

Department of Mechanical and Industrial Engineering, Indian Institute of Technology Roorkee, Roorkee, India

MONDAY, SEPTEMBER 26, 2005 (continued)

EXPERIMENTAL INVESTIGATION OF TRANSIENT BOILING HEAT TRANSFER IN MICROCHANNELS

M. Cortina Díaz and J. Schmidt
*Institute of Fluid Dynamics and Thermodynamics, Otto-von-Guericke University
Magdeburg, Germany*

MASS FLOW OF AN ADVANCED TWO-PHASE THERMOSYPHON LOOP

R. Khodabandeh, B. Palm and S. Kemper
*Royal Institute of Technology, Dept. of Energy Technology, Div. of Applied
Thermodynamics and Refrigeration, Stockholm, Sweden*

12:30 - 14:30

Lunch

14:30 - 15:15

Keynote lecture: INTERFACE EFFECTS ON FLOW AND HEAT TRANSFER AT MICROSCALE

X.G. Liang
Department of Engineering Mechanics, Tsinghua University, Beijing, China
Keynote chair: G.P. Celata

15:15 - 16:15

Session: FLUID FLOW 1 – FF1

Session chair: T. Ameel

ANALYSIS OF PRESSURE AND VELOCITY DISTRIBUTIONS OF TURBULENT ASYMMETRIC FLOW IN A SYMMETRIC FLAT DUCT WITH SUDDEN EXPANSION

Y. Salhi, M. Hammoudi, E.K. Si Ahmed, F. Aloui and M. Souhar
*Laboratoire de Mécanique des Fluides Théorique et Appliqué e Faculté de Physique
USTHB, Alger, Algeria*

ON HYDRODYNAMIC PREDICTIONS OF NEAR-WALL EFFECTS IN RAREFIED GASES: SOME PHENOMENOLOGICAL AND MODELLING APPROACHES

J.M. Reese*, D.A. Lockerby** and D.R. Emerson***
**Department of Mechanical Engineering, University of Strathclyde, Glasgow, UK,
School of Engineering and Design, Brunel University, Uxbridge, UK *Centre for
Microfluidics and Microsystems Modelling, Daresbury Laboratory, Warrington, UK*

GAS FLOW ANALYSIS THROUGH A BUNDLE OF MICROTUBES

L. Marino
Department of Mechanics and Aeronautics, University of Rome 'La Sapienza', Italy

16:15 - 16:45

Coffee

16:45 - 18:45

Session: MICROFLUIDIC SYSTEMS 1 – MFS1

Session chair: D. Poulikakos

EFFECTIVE THERMAL CONDUCTIVITY OF LOTUS-TYPE POROUS COPPER WITH DIFFERENT SHAPE PORES

T. Ogushi*, H. Chiba *, H. Nakajima**, K. Torii***, T. Tomimura**** and F. Ono*****
Advanced Technology R&D Center, Mitsubishi Electric Corporation, Amagasaki, Hyogo, **The Institute of Scientific and Industrial Research, Osaka University, Ibaraki, *Yokohama National University, ****Kyushu University, *****New Material Center, Japan*

MONDAY, SEPTEMBER 26, 2005 (continued)

EXPERIMENTAL STUDY FOR AN ACOUSTIC RADIATION FORCE ACTING ON A SMALL PARTICLE IN A PROGRESSIVE WAVE

S. Ebara*, T. Asano**, T. Yokomine* and A. Shimizu*

**Division of Energy Engineering and Science, **Department of Advanced Energy Engineering Science, Interdisciplinary Graduate School of Engineering Sciences, Kyushu University, Japan*

ENHANCED HEAT TRANSFER FOR POOL BOILING AT MICRO SCALE

C.M. Rops*, R. Lindken**, J. Westerweel** and J.F.M. Velthuis*

**TNO Science & Industry, Delft, The Netherlands, **Delft University of Technology, The Netherlands*

THERMOPHORETIC SEPARATION IN MICROFLUIDICS

P.F. Geelhoed and J. Westerweel

Delft University of Technology, Laboratory for Aero and Hydrodynamics, The Netherlands

ON THE THREE DIMENSIONAL DIVERGENCE OF STREAMLINES FOR ISOTHERMAL PRESSURE DRIVEN FLOWS IN SMALL LENGTH SCALE FLUIDIC DEVICES

P.A. Walsh, E.J. Walsh and M.R.D. Davies

Stokes Research Institute, University of Limerick, Ireland

LIQUID PROPERTIES FOR DROPLET OR PLUG-FLOW MICROFLUIDIC POLYMERASE CHAIN REACTION DEVICES

B. Barrett, N. SIRR, M. Sayers, T. Dalton and M. Davies

Stokes Research Institute, Department of Mechanical & Aeronautical Engineering, University of Limerick Limerick, Ireland

20:00

Dinner followed by Social Hour

TUESDAY, SEPTEMBER 27, 2005

07:30 – 08:30

Breakfast

08:30 - 09:15

Keynote lecture: MICRO- AND NANOSCALE HEAT TRANSFER: FROM CARBON NANOTUBES TO FUEL CELLS

D. Poulikakos

Laboratory of Thermodynamics in Emerging Technologies, Institute of Energy Technology, Department of Mechanical and Process Engineering, ETH Zurich, Switzerland

Keynote chair: L. Tadrist

09:15 – 10:15

Session: FLUID FLOW 2 – FF2

Session chair: C. Nonino

USING VISCOUS HEATING TO DETERMINE THE FRICTION FACTOR IN MICROCHANNELS – AN EXPERIMENTAL VALIDATION

G.P. Celata*, G.L. Morini**, V. Marconi*, S.J. McPhail* and G. Zummo*

**ENEA, Institute of Thermal Fluid Dynamics, Rome, Italy, **DIENCA, University of Bologna, Italy*

LOCAL PRESSURE MEASUREMENT OF NITROGEN FLOWS IN AN ALUMINUM RECTANGULAR MICROCHANNEL

D. Costaschuk, J. Elsnab, S. Petersen, J. Klewicki and T. Ameen

Department of Mechanical Engineering, University of Utah, Salt Lake City, USA

EXPERIMENTAL STUDY ON COMPRESSIBILITY EFFECTS IN MICROTUBES

G.P. Celata*, M. Cumo**, S.J. McPhail*, L. Tesfagabir* and G. Zummo*

**ENEA, Institute of Thermal Fluid Dynamics, Rome, Italy, **DINCE, University of Rome "La Sapienza", Italy*

10:15 - 10:35

Session: HEAT EXCHANGERS – HEX

Session chair: J.R. Thome

CONCEPTS AND REALIZATION OF MICRO HEAT EXCHANGERS FOR ENHANCED HEAT TRANSFER

J.J. Brandner, E. Anurjew, L. Bohn, E. Hansjosten, T. Henning, U. Schygulla, A. Wenka and K. Schubert

Forschungszentrum Karlsruhe, Institute for Micro Process Engineering IMVT, Germany

10:35 - 11:00

Coffee

11:00 - 12:20

Session: HEAT EXCHANGERS – HEX (cont.)

Session chair: J.R. Thome

MICRO-STRUCTURED HEAT-EXCHANGERS AND INTEGRATED EVAPORATORS

J. Schürer, V. Cominos, C. Hofmann, G. Kolb, D. Tiemann, Z.H. Wang, M. Wichert, V. Hessel and H. Löwe

Institut für Mikrotechnik Mainz (IMM), Germany

NEW PRINTED CIRCUIT HEAT EXCHANGER WITH S-SHAPE FINS FOR HOT WATER SUPPLIER

T.L. Ngo, Y. Kato, K. Nikitin and N. Tsuzuki

Research Laboratory for Nuclear Reactors, Tokyo Institute of Technology, Japan

TUESDAY, SEPTEMBER 27, 2005 (continued)

MODELLING COUNTER CURRENT MICRO HEAT EXCHANGERS

T. Baier and K.S. Drese
Institut für Mikrotechnik Mainz GmbH - IMM, Germany

HEAT TRANSFER AND FLUID FLOW IN A COUNTER FLOW MICRO HEAT EXCHANGER

B.A. Nichita*, F. Chiriac* and D.G. Cacuci**
**Technical University of Civil Engineering Bucharest, Romania, **Technical University Karlsruhe, Germany*

12:30 - 14:30

Lunch

14:30 - 15:15

Keynote lecture: REVIEW ON TWO-PHASE FLOW INSTABILITIES IN NARROW SPACES

L. Tadrif
IUSTI UMR CNRS, Marseille, France
Keynote chair: A. Jacobi

15:15 - 16:35

Session: MEASUREMENT TECHNIQUES 2 – MT2
Session chair: I. Catton

EFFECT OF MULTIPLE LASER IRRADIATIONS ON ABLATED HOLES

Y. Yamashita*, T. Yokomine**, S. Ebara** and A. Shimizu**
**Department of Advanced Energy Engineering Science, **Division of Energy Engineering Science, Interdisciplinary Graduate School of Engineering Sciences, Kyushu, Japan*

AN EVALUATION OF PHASE MEASUREMENT INTERFEROMETRY OBTAINING FULL-FIELD TEMPERATURE MEASUREMENTS SCALE FLUIDIC JUNCTION

P.A. Walsh, M.R.D. Davies and T. Dalton
Stokes Research Institute, University of Limerick Plassey, Ireland

ULTRA FAST HEAT TRANSPORT ANALYSIS BY MODIFIED MD APPLYING NON-FOURIER LAW TO ELECTRON HEAT CONDUCTION

Y. Yamashita*, T. Yokomine**, S. Ebara** and A. Shimizu**
**Department of Advanced Energy Engineering Science, **Division of Energy Engineering Science, Interdisciplinary Graduate School of Engineering Sciences, Kyushu, Japan*

DEVELOPMENT OF A MEASURING TECHNIQUE FOR THE LOCAL HEAT TRANSFER

C. Klein and P. Ehrhard
Forschungszentrum Karlsruhe GmbH., Institute for Nuclear and Energy Technologies, Germany

16:35 - 17:00

Coffee

17:00 - 19:00

Session: PHASE CHANGE – PC
Session chair: N. Kasagi

INERTIA-CONTROLLED REGIME OF COLLECTIVE BUBBLES GROWTH ON A FLAT MICROHEATER

E.S. Vasserman and S.I. Lezhnin
Institute of Thermophysics, Russian Academy of Sciences, Novosibirsk, Russia

TUESDAY, SEPTEMBER 27, 2005 (continued)

MICROSCALE HEAT TRANSFER IN AN EVAPORATING MOVING EXTENDED MENISCUS

S.S. Panchangam, J.L. Plawsky and P.C. Wayner, Jr.
Isermann Department of Chemical and Biological Engineering, Rensselaer Polytechnic Institute, Troy, NY, USA

BOILING ON BIPOROUS EVAPORATOR: EXPERIMENT AND MODELING

A. Vadjal, I. Catton, T. Semenic and Y.Y. Lin
Mechanical and Aerospace Department - University of California Los Angeles, USA

MICROCHANNEL MEMBRANE SEPARATION APPLIED TO CONFINED THIN FILM DESORPTION

J.D. Thorud, J.A. Liburdy and D.V. Pence
Department of Mechanical Engineering, Oregon State University, Corvallis, USA

TRANSIENT COOLING OF A VERY HOT THIN WIRE IMMERSSED INTO WATER

G. Berthoud
CEA Grenoble, France

A THERMODYNAMIC APPROACH TO THE MODELLING OF EXPLOSIVE VAPORIZATION DEVELOPMENT ON A MICROHEATER

E.S. Vasserman
Institute of Thermophysics, Russian Academy of Sciences, Novosibirsk, Russia

20:00

Dinner followed by Social Hour

WEDNESDAY, SEPTEMBER 28, 2005

07:30 – 08:30 Breakfast

08:30 - 09:15 **Keynote lecture: MODELING HEAT TRANSFER AND PRESSURE DROP FOR LIQUID-VAPOR FLOWS IN THE ELONGATED-BUBBLE FLOW REGIME**

A. Jacobi

Department of Mechanical and Industrial Engineering, University of Illinois at Urbana-Champaign, USA

Keynote chair: D. Poulikakos

09:15 - 10:35 **Session: ADIABATIC TWO-PHASE FLOW – ATPF**

Session chair: P.S. Hrnjak

FLOW PATTERNS AND PRESSURE DROP IN TWO PHASE FLOW MIXTURE OF NITROGEN AND WATER

M. Fabbri*, I. Catton** and E. Merilo***

IBM Research GmbH - Zurich, CH, **Mechanical and Aerospace Department - University of California Los Angeles, USA, *SRI, Palo Alto, California, USA*

EVALUATION OF RESIDENCE TIME DISTRIBUTION FOR BUBBLE TRAIN FLOW IN A SQUARE MINI-CHANNEL BY DIRECT NUMERICAL SIMULATION

M. Wörner, B. Ghidersa and A. Onea

Forschungszentrum Karlsruhe, IRS, Germany

NUMERICAL SIMULATION OF GAS-LIQUID TWO-PHASE CONVECTIVE HEAT TRANSFER IN A MICRO TUBE

P. Ua-arayaporn*, K. Fukagata*, N. Kasagi* and T. Himeno**

**Department of Mechanical Engineering, **Department of Aeronautics and Astronautics, The University of Tokyo, Japan*

CFD SIMULATIONS OF THE EFFECT OF INLET CONDITIONS ON TAYLOR FLOW FORMATION

N. Shao, W. Salman, A. Gavriilidis and P. Angeli

Department of Chemical Engineering, University College London, UK

10:35 - 11:00 Coffee Break

11:00 - 13:00 **Session: FLOW BOILING 2 – FB2**

Session chair: L. Tadrist

INVESTIGATION OF CRITICAL HEAT FLUX IN SINGLE, UNIFORMLY HEATED MICROCHANNELS

L. Wojtam, R. Revellin and J.R. Thome

Heat and Mass Transfer Laboratory (LTCM), Ecole Polytechnique Fédérale de Lausanne (EPFL), Lausanne, Switzerland

FLOW BOILING VISUALIZATION IN A VERTICAL CIRCULAR MICROCHANNEL AT HIGH QUALITY

W. Owhaib, C. Martin-Callizo and B. Palm

Royal Institute of Technology (KTH), Department of Energy Technology, Stockholm, Sweden

AN EXPERIMENTAL INVESTIGATION OF FLOW BOILING IN AN ASYMMETRICALLY HEATED RECTANGULAR MICROCHANNEL

C. Huh and M.H. Kim

Department of Mechanical Engineering, POSTECH, Korea

WEDNESDAY, SEPTEMBER 28, 2005 (continued)

COMPARISON OF AN EXTENDED DATABASE OF FLOW BOILING HEAT TRANSFER COEFFICIENTS IN MULTI-MICROCHANNEL ELEMENTS WITH THE THREE-ZONE MODEL

B. Agostini and J.R. Thome

Heat and Mass Transfer Laboratory (LTCM), Ecole Polytechnique Fédérale de Lausanne (EPFL), Lausanne, Switzerland

EQUALIZING CALCULUS IN MINICHANNEL FLOW BOILING HEAT TRANSFER CALCULATION

S. Hozejowska, M. Piasecka and M.E. Poniewski

Kielce University of Technology, Poland

EXPERIMENTAL STUDY OF VAPORIZATION IN A PARTIALLY HEATED SQUARE CROSS SECTION MINI CHANNEL: CAPILLARY DRIVEN AND FORCED CONVECTION FLOW CASES

V. Serin, P. Soler, P. Lavieille and M. Miscevic

Laboratoire d'Energétique, Université Paul Sabatier, Toulouse, France

13:00 – 14:00

Lunch

13:00 – 18:00

Optional Excursion to Lucca (Box lunches for those on optional excursion)

14:00 - 20:30

Free time/ad hoc discussions

20:30

Banquet

THURSDAY, SEPTEMBER 29, 2005

07:30 – 08:30

Breakfast

08:30 - 09:15

Keynote lecture: LOCALLY HEATED ANNULAR LIQUID FILMS IN MICROCHANNELS AND MINICHANNELS

O. Kabov, Yu.V. Lyulin, I.V. Marchuk and D.V. Zaitsev

Heat Transfer International Research Institute of Universite Libre de Bruxelles and Institute of Thermophysics of Russian Academy of Sciences, Brussels, Belgium

Session chair: J.R. Thome

09:15 - 10:35

Session: FLUID FLOW 3 – FF3

Session chair: A. Jacobi

PASSIVE MOVEMENT AND MANIPULATION OF MICROFLUIDS USING BUOYANCY

E.J. Walsh, C.R. King, R.H. Grimes, M.R. Davies and T.M. Dalton

Stokes Research Institute, Department of Mechanical and Aeronautical Engineering, University of Limerick, Ireland

COMPRESSIBILITY EFFECTS OF GAS FLOWS IN MICROTUBES

G.L. Morini, M. Lorenzini and S. Salvigni

DIENCA-Università di Bologna, Italy

THERMALLY DEVELOPING LAMINAR FLOW IN MICROCHANNELS WITH TEMPERATURE DEPENDENT VISCOSITY AND VISCOUS DISSIPATION

S. Del Giudice, C. Nonino and S. Savino

Dipartimento di Energetica e Macchine, Università degli Studi di Udine, Italy

EFFECTS OF VISCOUS DISSIPATION AND TEMPERATURE DEPENDENT VISCOSITY IN SIMULTANEOUSLY DEVELOPING LAMINAR FLOW IN MICROCHANNELS

C. Nonino, S. Del Giudice and S. Savino

Dipartimento di Energetica e Macchine, Università degli Studi di Udine, Italy

10:35 - 11:00

Coffee

11:00 - 12:20

Session: SINGLE-PHASE HEAT TRANSFER – SPHT

Session chair: X.G. Liang

JET IMPINGEMENT COOLING IN MICROSCALE

C. Glynn and D.B. Murray

CTVR (Centre for Telecommunications Value-Chain-Driven Research), Department of Mechanical and Manufacturing Engineering, Trinity College, Dublin, Ireland

THREE-DIMENSIONAL ROUGHNESS EFFECT ON MICROCHANNEL HEAT TRANSFER AND PRESSURE DROP

G. Croce, P. D'Agaro, C. Nonino and F. Zani

Dipartimento di Energetica e Macchine, Università degli Studi di Udine, Italy

OPTIMIZATION OF SINGLE PHASE MICROSCALE FRACTAL-LIKE BRANCHING FLOW HEAT SINKS

K.E. Enfield, D.V. Pence and V. Narayanan

Oregon State University, Mechanical Engineering Department, Corvallis, USA

THURSDAY, SEPTEMBER 29, 2005 (continued)

MICROTUBE HEAT TRANSFER SCALING EFFECTS – AN EXPERIMENTAL VALIDATION

G.P. Celata*, M. Cumo**, V. Marconi*, S.J. McPhail* and G. Zummo*
**ENEA, Institute of Thermal Fluid Dynamics, Rome, Italy, **DINCE, University of Rome 'La Sapienza', Italy*

12:30 - 14:30

Lunch

14:30 - 16:30

Session: **MEMS SYSTEMS AND MICROFLUIDIC DEVICES 1 – MSMD1**

Session chair: D. Pence

DYNAMIC AND THERMAL MICRO-BOILING CHARACTERIZATION

S. Escobar-Vargas*, D. Fabris*, J.E. Gonzalez*, R. Sharma**, C. Bash**, L. Ortiz*** and J. Cartagena***
Santa Clara University, Department of Mechanical Engineering, CA, USA, **Hewlett Packard Laboratories, Palo Alto, CA, USA, *Hewlett Packard of Puerto Rico, Agüadilla, PR*

FEASIBILITY OF MICRO HEATING IN THE FOOD INDUSTRY

M. Verschueren, P. de Jong and J.J. van Haren
Department of Processing, NIZO food research, Ede, The Netherlands

EXPLOSIVE VAPORIZATION IN MICROENCLOSURES

G. Romera-Guereca*, J. Lichtenberg**, A. Hierlemann** and D. Poulikakos*
**Laboratory of Thermodynamics in Emerging Technologies, **Physical Electronics Laboratory, Swiss Federal Institute of Technology Zurich, Switzerland*

INTEGRATED MICRO-THERMOELECTRIC COOLER FOR MICROFLUIDIC CHANNELS

G. Rosengarten, S. Mutzenich and K. Kalantar-zadeh
School of Electrical and Computer Engineering, RMIT University, VIC, Australia

CHANNEL NETWORKS FOR OPTIMAL HEAT TRANSFER AND HIGH THROUGHPUT MIXERS

N. Kockmann, T. Kiefer, M. Engler and P. Woias
Laboratory for Design of Microsystems, Institute of Microsystem Technology, IMTEK, Albert-Ludwig University of Freiburg, Germany

SPECTRAL APPROACH TO CHAOTIC MIXING IN MICROFLOW DEVICES

S. Cerbelli*, F. Creta**, A. Adrover*, M. Valorani** and M. Giona*
**Dip. Ingegneria Chimica, **Dip. Meccanica ed Aeronautica, Università di Roma 'La Sapienza', Italy*

16:30 - 17:00

Coffee

THURSDAY, SEPTEMBER 29, 2005 (continued)

17:00 - 18:00

Session: MICROFLUIDIC SYSTEMS 2 – MFS2

Session chair: J. Brandner

A FULLY CONTROLLED NATURAL CONVECTION POLYMERASE CHAIN REACTION DEVICE

J. Daly, M. Davies and T. Dalton

Stokes Research Institute, Department of Mechanical and Aeronautical Engineering, University of Limerick, Ireland

MICRO-SCALE DROPLET CONTROL AND COALESCENCE ON HETEROGENEOUS SUBSTRATES

H.M. Thompson, N. Kapur, Y-C Lee, N. Teo and P.H. Gaskell

Engineering Fluid Mechanics Research Group, School of Mechanical Engineering, University of Leeds, UK

A NUMERICAL STUDY ON THE FREEZE DRYING OF SPRAYED PARTICLE PACKING

C.S. Song* and J.H. Nam**

**Korea Institute of Machinery and Materials, Daejeon, Korea, **Ilshin Lab Co., Gyeonggi-do, Korea*

18:00 - 19:00

Session: CONDENSATION – CON

Session chair: O. Kabov

FORCED CONVECTION CONDENSATION INSIDE MINICHANNELS: GUIDELINES FOR A NEW PREDICTIVE PROCEDURE

A. Cavallini, D. Del Col, L. Doretto, M. Matkovic, L. Rossetto and. C. Zilio

Dipartimento di Fisica Tecnica, Università di Padova, Italy

HEAT TRANSFER ANALYSIS ACCORDING TO CONDENSATION FLOW STRUCTURE IN A MINICHANNEL

B. Médéric, L. Pascal and M. Miscevic

Laboratoire d'Energetique, Université Paul Sabatier, Toulouse, France

MOLECULAR GAS DYNAMICS APPROACHES TO INTERFACIAL PHENOMENA ACCOMPANIED WITH CONDENSATION

S. Mikami, T. Ota, K. Kobayashi, S. Fujikawa, T. Yano and M. Ichijo

Division of Mechanical and Space Engineering, Graduate School of Engineering, Hokkaido University, Sapporo, Japan

20:00

Dinner followed by Social Hour

FRIDAY, September 30, 2005

07:30 – 08:30 Breakfast

08:30 - 09:15 Keynote lecture: **SINGLE-PHASE PRESSURE DROP IN MICROCHANNELS**
P.S. Hrnjak* and X. Tu**
**Department of Mechanical and Industrial Engineering, University of Illinois at Urbana-Champaign, USA, Microsoft Corp., USA*
Keynote chair: G. Zummo

09:15 - 10:35 Session: **FLUID FLOW 4 – FF4**
Session chair: G. Zummo

SLIP EFFECT IN MICROCHANNEL FLOW

A. Yamamoto*, S. Mori**, K. Katori*, D. Tsuboi** and M. Suzuki**
**Tokyo Institute of Technology Intensive Center, The Research Association of Micro Chemical Process Technology, Department of Chemical Engineering, Tokyo Institute of Technology, **Department of Chemical Engineering, Tokyo Institute of Technology, Japan*

FLOW PATTERNS IN EVAPORATING MINI-LAYERS WITH AN INERT GAS FLOW

C.S. Iorio*, O. Kabov*** and P. Colinet*
**Universite Libre de Bruxelles, Microgravity Research Center, Brussels, Belgium, **Heat Transfer International Research Institute of Universite Libre de Bruxelles and Institute of Thermophysics of Russian Academy of Sciences, Brussels, Belgium*

STUDIES ON MICRO NOZZLE FLOWS FOR MICRO SPACECRAFT PROPULSION

V.R. Sanal Kumar*, H.D. Kim*, B.N. Raghunandan**, T. Setoguchi** and S. Raghunathan****
Andong National University, Korea, **IISc, India, *Saga University, Japan, ****Queen's University Belfast, UK*

ENERGY AND MOMENTUM TRANSFER IN AN ULTRA-THIN LIQUID WATER FILM SHEARED BETWEEN SOLID SURFACES

D. Torii and T. Ohara
Graduate School of Engineering, Tohoku University, Japan

10:35 - 11:00 Coffee

11:00 - 12:20 Session: **MEMS SYSTEMS AND MICROFLUIDIC DEVICES 2 – MSMD2**
Session chair: J.A. Liburdy

NUMERICAL INVESTIGATION ON CARRIER-PHONON INTERACTIONS IN GAAS THIN FILM STRUCTURES IRRADIATED BY PICOSECOND LASER PULSES

J.H. Lee and S.H. Lee
School of Mechanical Engineering, Chung-Ang University, Seoul, Korea

THERMAL CHARACTERISTICS OF THE HIGH HEAT FLUX MICRO EVAPORATOR

T. Tsukamoto and R. Imai
Ishikawajima-Harima Heavy Industries Co., Ltd., Yokohama, Japan

FRIDAY, SEPTEMBER 30, 2005 (continued)

MICRO HEAT SPREADERS FOR CONCENTRATED POWER FLUXES ON SPACECRAFTS: FIRST ASSESSMENT

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PATH FLOW MINIATURIZATION AND IRREVERSIBILITY

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12:20 - 12:45	Summary and future plans
12:45 – 14:00	Lunch
14:00	Bus departs to Pisa train station and airport