

Final Program

Control of Particulate Processes VII

*Intelligent Sensing and Control –
the Path to Manufacturing Excellence*

October 29 – November 2, 2006
Harrison Hot Springs, BC, Canada

Conference chair

Prof. **Xue Z Wang**,
The University of Leeds, UK

Co-chairs

Prof. Dr.-Ing. **Michael Bottlinger**, Trier University for Applied Sciences, Germany
Prof. **Panagiotis D. Christofides**, University of California, Los Angeles, USA
Prof. **Furong Gao**, , Hong Kong University of Science and Technology, Hong
Kong
Dr. **Richard Tweedie**, Malvern Instruments Ltd, UK

ECI

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Sunday, October 29, 2006

17:00 – 19:00 Check in

17:00 – 18:00 Meeting of Organizing Committee

18:30 – 19:30 Welcome Reception

19:30 – 21:00 Opening Dinner

21:00 – 22:00 Social Hour

NOTES

- **Please observe “No Smoking” at ECI technical sessions, meals and social hours.**
- **Speakers should allow time at the end of their presentation for questions and discussion.**
- **Please silence your cell phone during technical sessions.**

Monday, October 30, 2006

07:30 – 08:30 Breakfast

08:30 – 09:00 Opening remarks:
Conference Co-Chairs
ECI Liaison: Richard Williams, ECI Director Barbara K. Hickernell

09:00 – 09:45 **Plenary 1: CONTROL OF THE PRODUCT QUALITY IN BATCH CRYSTALLIZATION OF PHARMACEUTICALS AND FINE CHEMICALS**
Keynote Speaker: Professor Sohrab Rohani, The University of Western Ontario, Canada
Chair: Michael T. Bottlinger, Umwelt-Campus Birkenfeld Campusallee

Technical Session 1 - CRYSTALLIZATION

Chair: Charles D. Immanuel, Imperial College London

09:45 – 10:05 **CONCENTRATION-CONTROL OF ANTI-SOLVENT CRYSTALLIZATION USING ATR-FTIR**
Reginald B.H. Tan¹, Zai Qun Yu¹, Pui Shan Chow², ¹National University of Singapore, Singapore. ²Institute of Chemical and Engineering Sciences Ltd., Singapore

10:05 – 10:25 **MONITORING CRYSTALLISATION OF ORGANIC CHEMICALS USING ULTRASOUND SPECTROSCOPY**
Radoslav Y Penchev, Richard Tweedie, Xue Z Wang, Kevin J Roberts, University of Leeds, UK

10:25 – 11:05 Tea / coffee break

11:05 – 11:25 **OPTIMAL OPERATION OF ENANTIOSEPARATION BY BATCH-WISE PREFERENTIAL CRYSTALLIZATION**
Ivan Angelov Angelov¹ Jörg Raisch¹ Martin-Peter Elsner² Andreas Seidel-Morgenstern²
¹ Max-Planck for Dynamics of Complex Technical Systems, TU-Berlin, Germany
² Max-Planck for Dynamics of Complex Technical Systems, Otto-von-Guericke University, Germany

11:25 – 11:45 **MULTI-DIMENSIONAL POPULATION BALANCE MODELLING INCORPORATING REAL-TIME CRYSTAL SHAPE MEASUREMENT VIA IN-PROCESS IMAGING**
C Y Ma, X Z Wang, J Calderon De Anda, K J Roberts
University of Leeds, UK

11:45 – 12:05 **ADAPTIVE HIGH RESOLUTION SCHEMES FOR MULTIDIMENSIONAL POPULATION BALANCES IN CRYSTALLIZATION PROCESSES**
Shamsul Qamar, Azhar ashfaq, Gerald Warnecke
Otto-von-Guericke University, Germany

12:25 – 13:45 Lunch

13:45 – 16:00 Free time (*while it is light outside*)

Monday, October 30, 2006 (continued)

16:00: 16:45 **Plenary 2: IMPORTANCE OF REFERENCE PARTICLES FOR SIZE MEASUREMENT BY LASER DIFFRACTION METHOD**
Keynote speaker: Professor Yasushige Mori, Doshisha University, Japan
Chair: Richard Williams, University of Leeds

Technical Session 2 – CHARACTERISATION

Chair: Rachel Brody, Pfizer Global R&D, Sandwich

- 16:45 – 17:05 **ATTRITION AND ABRASION TESTING OF COATED GRANULES**
Bas van Laarhoven¹, Simone Wiers¹, Stefan Schaafsma², Gabrie Meesters³,
¹NSM/DCT, Delft University of Technology, The Netherlands
²ACES, DSM research, The Netherlands
³DSM food specialties, The Netherlands
- 17:05 – 17:25 **PARTICULATE PHASE CHROMATOGRAPHY FOR CLASSIFICATION AND CHARACTERISATION OF DRY MICRON PARTICLES**
Yulong Ding, Wei Yang, Yurong He, University of Leeds, UK
- 17:25 – 17:45 **DEACTIVATION OF CATALYST PARTICLES IN HYDROPROCESSING REACTORS**
Ezra Kam, Mahmoud Al-Shamali, Mohammad Juraidan, Kuwait Institute for Scientific Research, Kuwait
- 17:45 – 18:15 Tea/coffee break
- 18:15 – 18:35 **OCCUPATION EXPOSURE TO PM2.5 IN COMMERCIAL TRUCK CABINS**
Zhongchao Tan, University of Calgary, Canada
- 18:35 – 18:55 **THE USE OF NANOSCALE IRON PARTICLES FOR GROUNDWATER REMEDIATION**
Heike B. Bradl, University of Applied Sciences Trier, Umwelt-Campus Birkenfeld, Germany
- 18:55– 19:15 **ANALYSIS OF HIV INFECTION RESPONSE TO TREATMENT STRATEGIES**
Antonis Armaou, Samira Khalili, The Pennsylvania State University, USA
- 20:00 Dinner
- 21:30 Social Hour

Tuesday, October 31, 2006

07:30 – 08:30 Breakfast

08:30 – 09:15 **Plenary 3: MODEL-BASED CONTROL OF PARTICULATE PROCESSES**
Keynote speaker: Professor Panagiotis D. Christofides, University of California at Los Angeles, USA
Chair: Furong Gao, Hong Kong University of Science and Engineering

Technical Session 3 – MODEL BASED PARTICULATE PROCESS CONTROL

Chair: Sohrab Rohani, The University of Western Ontario

09:15 – 09:35 **OPTIMAL CONTROL OF PARTICLE SIZE DISTRIBUTION IN SEMI-BATCH EMULSION POLYMERISATION**
Charles D. Immanuel, Imperial College London, UK

09:35 – 09:55 **MODEL-BASED FAULT DIAGNOSIS AND FAULT-TOLERANT CONTROL OF PARTICULATE PROCESSES**
Nael H. El-Farra, Arthi Giridhar, University of California, Davis, USA

09:55 – 10:15 **MODEL-BASED CONTROL OF SURFACE ROUGHNESS DURING THIN-FILM DEPOSITION**
Antonios Armaou, Amit Varshney, Pennsylvania State University, USA

10:15 – 10:35 **CONTROL OF THE FLUIDISED BED FOR PELLET SOFTENING**
Kim van Schagen¹, Luuk Rietveld¹, Robert Babuška¹, Eric Baars²
¹Delft University of Technology, ²Waternet, The Netherlands

10:35 – 11:35 Tea / Coffee Break and Poster Viewing

11:35 – 11:55 **MODEL-BASED NONLINEAR CONTROL OF BATCH FLUIDIZED BED DRYERS**
Mingzhong Li, University of Oxford, UK

11:55 – 12:15 **PREDICTIVE CONTROL OF PARTICULATE PROCESSES WITH ACTUATOR/SENSOR FAULTS**
Panagiotis D. Christofides, University of California at Los Angeles, USA

12:15 – 12:35 **MODEL IDENTIFICATION OF WET GRANULATION FOR MOMENT-BASED CONTROL OF PARTICLE SIZE**
Constantijn F.W. Sanders, Francis J. Doyle III, University of California Santa Barbara, USA

12:40 – 13:45 Lunch

13:45 – 16:00 Free time (*while it is light outside*)

16:00 - 16:45 **Plenary 4: DESIGN PRODUCTS, STRUCTURED PARTICLES**
Keynote speaker: Prof. Dr.-Ing. Ulrich Bröckel, IMiP (Inst. f. Micro Process Engr. & Particle Technology), Germany
Chair: Shuji Matsusaka, Kyoto University

Tuesday, October 31, 2006 (continued)

Technical Session 4 – DESIGN AND MODELLING

Chair: Wim Oostra, NV Organon

- 16:45 – 17:05 **DESIGN AND PERFORMANCE EVALUATION OF A NOVEL UNIFLOW CYCLONE**
Laleh Golshahi, Z.C.Tan, J.Abedi, University of Calgary, Canada
- 17:05 – 17:25 **HIGH RESOLUTION FINITE VOLUME SCHEMES FOR SOLVING MULTIDIMENSIONAL POPULATION BALANCE EQUATIONS**
Shamsul Qamar, University of Magdeburg, Germany
- 17:25 – 17:45 **AN EFFICIENT TECHNIQUE FOR MODELLING BREAKAGE PHENOMENA IN MULTI-DIMENSIONAL POPULATION BALANCES**
Charles D. Immanuel¹, Francis J. Doyle III²
¹Imperial College London, UK, ²University of California Santa Barbara, USA
- 17:45 – 18:15 Tea/coffee break
- 18:15 – 18:35 **MODELING AND CONTROL OF PARTICLE SIZE DISTRIBUTION: APPLICATION TO A SEMIBATCH EMULSION COPOLYMERIZATION SYSTEM**
Mustafa T. Dokucu, Myung-June Park, Francis J. Doyle III,
University of California Santa Barbara, USA
- 18:35– 18:55 **A POPULATION BALANCE MODEL OF EMULSION POLYMERISATION FOR COMBINED PARTICLE SIZE DISTRIBUTION AND MOLECULAR WEIGHT DISTRIBUTION**
Charles D. Immanuel¹, S. J. Sweetman¹, T. Malik², S. Emmett², Neal Williams²,
¹Imperial College London, UK, ²ICI Paints, UK
- 20:00 Dinner
- 21:30 Social Hour

Wednesday, November 1, 2006

07:30 – 08:30 Breakfast

08:30 – 09:15 **Plenary 5: INTELLIGENT WIRELESS PARTICLES AND SENSORS**

Keynote speaker: Richard A Williams, The University of Leeds, UK

Chair: Richard J Tweedie, Malvern Instruments Ltd

Technical Session 5 – IMAGING

Chair: Mingzhong Li, University of Oxford

09:15 – 09:35 **THREE-DIMENSIONAL MEASUREMENT OF PARTICLE SHAPES AND SIMULATION OF BULK SOLID PROPERTIES**

Michael Bottlinger, Beate Bujak, Martin Bruecher,
Umwelt-Campus Birkenfeld, Germany

09:35 – 09:55 **SHAPE - THE FINAL FRONTIER**

Xue Z Wang, The University of Leeds, UK

09:55 – 10:15 **GRANULATION OF MULTICOMPONENT POWDERS: DISTRIBUTION OF COMPONENTS**

Themis Matsoukas¹, Kangtaek Lee², Taehoon Kim²,
¹Penn State, USA, ²Yonsei University, Korea

10:15 – 10:35 **THE EFFECT OF ILLUMINATION WAVELENGTH WHEN MEASURING THE SIZE OF VERY SMALL PARTICLES USING A NOVEL IMAGING BASED SYSTEM**

Dr Robert M. Carter, Yong Yan, University of Kent, UK

10:35 – 11:35 Tea / Coffee Break and Poster Viewing

11:35 – 11:55 **ESTIMATION OF ALUMINA CONTENT OF ANODE COVER MATERIAL USING MULTIVARIATE IMAGE ANALYSIS TECHNIQUES**

Jayson Tessier¹, Claude Gauthier², ¹Laval University, Canada. ²Aluminerie Deschambault, Canada

11:55 – 12:15 **A MECHANISTIC DESCRIPTION OF THE AGGREGATION PHENOMENON IN POPULATION BALANCE MODELS OF GRANULATION**

Charles D. Immanuel¹, Rohit Ramachandran¹, Jonathan Poon¹, Francis J. Doyle III², Frantisek Stepanek¹ ¹Imperial College London, UK. ²University of California Santa Barbara, USA

12:15 – 12:35 **ONLINE SHAPE ANALYSIS OF PARTICLES USING AN IN-SITU VISION SYSTEM**

Jan Willem Gerristen¹, Ruifa Li², Radoslav Penchev², Xue Zhong Wang², Kevin Roberts², Richard Tweedie³ ¹Perdix Analytical Systems B.V., Netherlands. ²University of Leeds, UK. ³Malvern Instruments Ltd, UK.

12:40 – 13:45 Lunch

13:45 – 16:00 Free time (*while it is light outside*)

16:00: 16:45 **Plenary 6: DATA MINING AND KNOWLEDGE DISCOVERY FOR INDUSTRIAL PARTICLE AND POWDER PROCESSING**

Keynote speaker: Akeel Attar, XpertRule - KPS Group, UK

Chair: Yasushige Mori, Doshisha University

Wednesday, November 1, 2006 (continued)

Technical Session 6 – QUALITY CONTROL, DESIGN AND OPERATIONAL SPACE

Chair: Themis Matsoukas, Pennsylvania State University

- 16:45 – 17:05 **BATCH-TO-BATCH OPTIMAL CONTROL OF A BATCH POLYMERISATION PROCESS BASED ON STACKED NEURAL NETWORK MODELS**
Jie Zhang, University of Newcastle, UK
- 17:05 – 17:25 **DEFINING THE DESIGN SPACE FOR DRY GRANULATION USING OFF- AND ON-LINE PARTICLE CHARACTERISATION**
Rachel Brody¹, Andrew Lake¹, Alex Pysik¹, Elanor Wood^{1&2}
¹Pfizer Global R&D, Kent, UK. ²University of Edinburgh
- 17:25 – 17:45 **INDUSTRIAL APPLICATIONS OF THE MEASUREMENT OF PARTICULATES IN MIXING, FLOW AND SEPARATION USING TOMOGRAPHIC SYSTEMS**
Gary Bolton, Industrial Tomography Systems, UK
- 17:45 – 18:15 Tea/coffee break
- 18:15 – 18:35 **WAVELENGTHS SELECTION AND CALIBRATION MODEL DEVELOPMENT USING GENETIC ALGORITHM AND PLS IN APPLYING NIR TO MONITORING MULTIPLE PROPERTIES OF CRYSTALLISATION**
Rui F. Li, Xue Z. Wang, Solomon B. Abebe, Xiaojun Lai, University of Leeds, UK
- 18:35 – 18:55 **ON LINE ANALYSIS OF STRUCTURE DISPERSIONS IN AN OSCILLATORY BAFFLED REACTOR (OBR) USING ELECTRICAL IMPEDANCE TOMOGRAPHY (EIT)**
Gregorio Vilar Uso¹, Richard A. Williams¹, Mi Wang¹, Richard J. Tweedie²
¹University of Leeds, UK. ²Malvern Instruments Ltd, UK
- 18:55– 19:15 **CONTROL OF A PILOT SCALE SOLID/LIQUID SEPARATION PLANT USING EIT MEASUREMENTS**
Jose Antonio Gutierrez Gnechi¹, Julio Cesar Herrera Garcia²
¹Enrique Reyes.Archundia, Mexico. ²Instituto Tecnologico De Morelia, Mexico
- 20:00 Conference Dinner

Thursday, November 2, 2006

07:30 – 08:30 Breakfast

08:30 – 09:15 **Plenary 7: USING ON-LINE PARTICLE SIZING FOR PROCESS**
Keynote speaker: Dr Richard Tweedie, Malvern Instruments Ltd, UK
Chair: Panagiotis D. Christofides, University of California, Los Angeles

Technical Session 7 - ON-LINE SENSING

Chair: Jie Zhang, University of Newcastle upon Tyne

09:15 – 09:35 **A SIMPLE INSTRUMENT FOR Q/D/M MEASUREMENTS ON POWDERS**
Maciej A. Noras, Trek, Inc, USA

09:35 – 09:55 **ANALYSIS OF ELECTRIC SIGNALS GENERATED FROM METAL PIPES IN PNEUMATIC CONVEYING SYSTEM**
Shuji Matsusaka¹, Hiroshi Fukuda¹, Mojtaba Ghadiri² ¹Kyoto University, Japan.
²The University of Leeds, UK

09:55 – 10:15 **DEVELOPMENT OF A CAPACITIVE SENSOR FOR INJECTION MOLDING**
Furong Gao¹, Ho Yin Wong¹, Ka Tsai Fung¹, Xi Chen²
¹Hong Kong University of Science and Technology, Hong Kong, China
²Zhejiang University, Zhejiang, China

10:15 – 10:35 **DETERMINING KINETICS OF CALCIUM CARBONATE PRECIPITATION BY INLINE TECHNIQUE**
Amjad Shaikh, W.N. Al Nasser, C. Morriss, M.J. Hounslow, A.D. Salman,
University of Sheffield, UK

10:35 – 11:35 Tea / Coffee break

11:55 – 12:15 Wrap-up / Final remarks

12:45 – 13:45 Lunch and departure

POSTER SESSION

- 1. THE USE OF NANOSCALE IRON PARTICLES FOR GROUNDWATER REMEDIATION**
Heike B. Bradl, University of Applied Sciences Trier, Umwelt-Campus Birkenfeld, Germany
- 2. INLINE INSITU MONITORING OF CALCIUM CARBONATE SCALING BEHAVIOUR**
Waleed AL-Nasser, C. Morriss, A. Shaikh, M.J. Hounslow, The University of Sheffield, UK
- 3. GRANULAR FILTRATION FOR CONTAMINATED GAS AND SUBMICRON PARTICULATE MATTERS**
Laleh Golshahi, Z.C.Tan, J. Abedi, R. J. Hugo, University of Calgary, Canada
- 4. COMPARISON OF MOISTURE ISOTHERMS OF SEVERAL PHARMACEUTICAL POWDERS**
Erica Emery, Todd Pugsley, University of Saskatchewan, Canada
- 5. STUDY OF STABILIZED ANTI-SOLVENT CRYSTALLIZATION USING IN-SITU MONITORING TECHNIQUES**
Shuyi Xie¹, Reginald B. H. Tan¹, Xing Yi Woo¹, Hongyuan Wei²,
¹Institute of Chemical and Engineering Sciences, Singapore ²Tianjin University, China
(presented by Yu Zaiqun)
- 6. PARTICLE COATINGS: INFLUENCE OF POLYMER MECHANICAL PROPERTIES ON PARTICLE COATINGS**
Giacomo Perfetti¹, Bas van Laarhoven¹, Simone Wiers¹, Gabriele Meesters²
¹Delft University of Technology, The Netherlands
²DSM Food Specialties, Research Department, The Netherlands