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

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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 Khalilii, 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 Engn. & Particle Technology), Germany  
Chair: Shuji Matsusaka, Kyoto University
**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, 1 Laval University, Canada. 2 Aluminerie 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 1 Imperial College London, UK. 2 University of California Santa Barbara, USA

12:15 – 12:35  ONLINE SHAPE ANALYSIS OF PARTICLES USING AN IN-SITU VISION SYSTEM
Jan Willems 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 Wood1,2
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 Gncchi1, 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-LING 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
   ¹ Institute of Chemical and Engineering Sciences, Singapore ² Tianjin University, China
   (presented by Yu Zaiqun)

6. PARTICLE COATINGS: INFLUENCE OF POLYMER MECHANICAL PROPERTIES ON PARTICLE COATINGS
   Giacomo Perfetti¹, Bas van Laarhoven¹, Simone Wiers¹, Gabrie Meesters²
   ¹ Delft University of Technology, The Netherlands
   ² DSM Food Specialties, Research Department, The Netherlands