

*Program*

# Fluidization XV

May 22-27, 2016

Fairmont Le Chateau Montebello  
Quebec, Canada

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Polytechnique de Montréal, Canada

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# **Fluidization Conference History**

## ***An ECI Conference Series***

Fluidization I (1975)

D. L. Keairns  
Asheville, North Carolina

Fluidization II (1978)

J. L. Davidson and D. L. Keairns  
Cambridge, England

Fluidization III (1980)

J. M. Matsen and J. R. Grace  
Henniker, New Hampshire

Fluidization IV (1983)

Daizo Kunii and R. Toei  
Kashikojima, Japan

Fluidization V (1986)

Knud Ostergaard and A. Sorensen  
Helsingor, Denmark

Fluidization VI (1989)

John R. Grace and Maurice A. Bergounou  
Banff, Alberta, Canada

Fluidization VII (1992)

O.E Potter and D.J. Nicklin  
Brisbane, Australia

Fluidization VIII (1995)

C. Laguerie and J.F. Large  
Tours, France

Fluidization IX (1998)

T. Knowlton and L.S. Fan  
Tamarron, Colorado

Fluidization X (2001)

Moonson Kwauk, Jinghai Li, and Wen-Ching Yang  
Beijing, China

Fluidization XI (2004)

Umberto Arena, Michele Miccio, Riccardo Chirone, and Piero Salatino  
Ischia, Italy

Fluidization XII (2007)

Franco Berruti, Xiaotao Bi, and Todd Pugsley  
British Columbia, Canada

# **Fluidization Conference History**

## ***An ECI Conference Series***

(continued)

Fluidization XIII (2010)

Sang Done Kim, Yong Kang, Jea Keun Lee, and Yong Chil Seo  
Gyeong-ju, Korea

Fluidization XIV (2013)

J.A.M. Kuipers, N.G. Denn, R.F. Mudde and J.R. van Ommen  
Noordwijkerhout, The Netherlands

## A TRIBUTE TO PROFESSOR MAURICE A. BERGOUGNOU



It was with great sadness that we learned of the death of Professor Maurice A. Bergougnou, Emeritus Professor of Chemical Engineering at the University of Western Ontario in Canada, on 30 November 2015 in his 88th year. Maurice will be most fondly remembered by everyone as a loving husband, father and grandfather, and as a caring mentor and welcoming friend.

Maurice was one of the founders of the fluidization community: he was very much involved over the last fifty years in the meetings and conferences of this community. In the early days, he was very much involved in the American Institute of Chemical Engineers (AIChE) Fluidization Group which was small at the time. He devoted a significant amount of his time in making sure that the sessions sponsored by this group were of the highest quality, and delivered important information to the community.

Maurice was born a poor farm boy in the south-west of France. In his youth, he was selected by the Jesuits to study at the Lycée Saint-Joseph de Tivoli in Bordeaux in occupied France during World War II. After the war, he graduated in 1953 from the French chemical engineering “school” ENSIC in Nancy. He then received a prestigious Fulbright Scholarship to study chemical engineering at the University of Minnesota under supervision of Professor E. L. Piret. Upon receiving his Ph.D. in 1958, Maurice joined Exxon in New Jersey and was instrumental in the development of fluidized beds and the catalytic cracking process in petroleum refining. In 1967, he accepted a professorship at the University of Western Ontario in London, Ontario, and moved to Canada. At Western, he was a pioneer in biofuel technology. In the late 1970's, he developed ultrapyrolysis, an innovative process which combines a jet impact mixer with a downflow reactor to convert organic materials into biofuels. Professor Bergougnou pioneered a very practical capstone design course which for many years set the standard in Canadian Engineering schools. Professor Bergougnou is fondly remembered by generations of engineering students for his inspirational teaching and the care and concern which he showed them. The excellence of his teaching and research was recognized by many awards throughout his career. In 1994, he became a Chevalier dans L'Ordre des Palmes Académiques in France and, in 1999, he was awarded the Killam Prize for Engineering for his "exceptional achievements in engineering research and world class contributions to the advancement of knowledge". In 2004, the “Maurice Bergougnou Lab” at Western was inaugurated to honor his huge contribution to the Faculty of Engineering with support from former students and industrial partners.

We do not know exactly the size of Maurice’s circle of friends. It is very large, composed of former students, colleagues at Western, engineers in industry and academics. To all those lucky and privileged enough to work with him, he passed on, in addition to his knowledge of fluidization, his own particular research style, based on constant questioning and curiosity, reflection and in-depth study, as well as a desire to be creative and see things through to completion.

Maurice’s research was world class. His work was of a very high quality and generally focused toward solving or understanding industrial problems. As a result, he saw many of his research and ideas adopted by industry.

As a French citizen, Maurice was very anxious to give back to France by using his considerable experience to educate and train French students and collaborate with French companies. During his French tours, he was regularly involved in the CPIC industrial training sessions in Nancy and at the IFP School (ENSPM). Collaborating with several French companies, he welcomed numerable French graduate students at Western.

Maurice Bergougnou had a very modest, kind, approachable character, with immense human qualities. He was motivated by the love of research and inspired by strong moral principles. Many visitors to London will forever remember his warm hospitality, often involving invitations to his house for a home-cooked meal and intense discussions, usually about politics or religion. The evenings were very collegial and enjoyable, punctuated with some very funny stories told by Maurice, who would laugh heartily at his own jokes.

The Fluidization XV community, therefore, wants to honor Professor Bergougnou's memory. We shall remember him as a great man, with immense charisma and deep humanity. He will be thoroughly missed.

Thierry Gauthier, Rob Ham, Ted Knowlton, Cedric Briens and Franco Berruti

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**Sunday, May 22, 2016**

- |               |   |
|---------------|---|
| 16:00 - 18:00 | Conference Check-in                       |
| 18:00 - 20:00 | Dinner followed by Reception at the river |

***NOTES***

- Locations of sessions and meals will be announced on site.
- 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.
- Please write your name in the front of this booklet in case it is misplaced.
- Be sure to check the participant list in this booklet to confirm that your listing is correct. If there are changes or updates, please login to the ECI website and update your listing so that the list that ECI will send to all participants after the conference will be correct.

**Monday, May 23, 2016**

06:30 - 08:00 Breakfast

08:00 - 08:15 Opening Remarks – Conference Chairs and ECI Liaison  
Tribute to **Maurice Bergougnou (Franco Berruti)**

**Plenary 1** (Introduction by Jamal Chaouki)

08:15 - 08:45 **A few recent developments in fluidized bed technology applications for fuel conversion**  
Guangwen Xu, Institute of Process Engineering, China

**Fluidization of Irregular Shape Particles** (Session Chair: Tony Bi)

09:00 - 09:15 **Attrition rate of iron ore in the gas-solid fluidized beds with the wide size distribution**  
Dong-Hyun Kang, Sungkyunkwan University, Korea

09:15 - 09:30 **Spouting behavior of binary mixtures of spherical and cylindrical particles**  
Douglas W. Marshall, Battelle Energy Alliance, LLC/Idaho National Laboratory, USA

09:30 - 09:45 **Analyzing the fluidization of a mixture of gas-sand-biomass using CFD techniques**  
Ricardo de Andrade Medronho, Universidade Federal do Rio de Janeiro, Brazil

09:45 - 10:00 **Novel method to measure fine particle circulation rates in draft tube conical spouted beds**  
Mikel Tellabide, University of the Basque Country, Spain

10:00 - 10:15 **Flow regime identification in fluidized beds by analyzing pressure fluctuations signal based on Kolomogorov entropy approach**  
Vineet Alexander, Missouri University of Science & Technology, USA

**Micro-Fluidized Bed Reactors** (Session Chair: Franco Berruti)

09:00 - 09:15 **Identification of discharge regimes of cyclone dipleg-trickle valve system based on pressure fluctuation profiles**  
Yaodong Wei, China University of Petroleum, China

09:15 - 09:30 **Numerical and experimental study of particle deposition in a tangential inlet cyclone separator**  
Yaodong Wei, China University of Petroleum, China

09:30 - 09:45 **Jiggle bed reactor for testing catalytic activity of olivine in bio-oil gasification**  
Mohammad Latifi, Ecole Polytechnique de Montreal, Canada

09:45 - 10:00 **Characteristics of gas back-mixing in micro fluidized bed**  
Sulong Geng, Chinese Academy of Sciences, China

**Monday, May 23, 2016 (continued)**

10:00 - 10:15      **Computational fluid dynamics study of CREC riser simulator: Mixing patterns**  
Hugo De Lasa, University of Western Ontario, Canada

**Clean Energy Processes** (Session Chair: Ray Cocco)

09:00 - 09:15      **Effect of bed particle size on heat transfer between fluidized bed of group B particles and vertical rifled tubes**  
Artur Blaszczyk, Czestochowa University of Technology, Poland

09:15 - 09:30      **Analysis of fluctuations in velocities, voidage and gas concentration in CFB conditions**  
Timo Niemi, VTT Technical Research Centre of Finland, Finland

09:30 - 09:45      **Validation of the oxygen buffering ability of bed materials used for OCAC in a large scale CFB boiler**  
Angelica Corcoran, Chalmers University of Technology, Sweden

09:45 - 10:00      **Predicting gas-flow distribution in pilot-scale fluidized beds using CFD simulations**  
Akhilesh Bakshi, Massachusetts Institute of Technology, USA

10:00 - 10:15      **Experimental investigation with digital particle image velocimetry for turbulent flow of slender particles in a stirred tank**  
Long Fan, Memorial University of Newfoundland, Canada

10:15 - 10:45      Coffee Break

**Fundamentals** (Session Chair: Tony Bi)

10:45 - 11:00      **Hydrodynamics and heat transfer of suspended surface in a supercritical CFB furnace**  
Linjie Xu, Zhejiang University, China

11:00 - 11:15      **The relationship between fluidized bed electrostatics and entrainment**  
John R. Grace, University of British Columbia, Canada

11:15 - 11:30      **Solid flux in travelling fluidized bed operating in square-nosed slugging regime**  
John R. Grace, University of British Columbia, Canada

11:30 - 11:45      **Pattern formation in fluidized and vibrated beds: Experimental and computational insights**  
Lilian de Martín, University College London, United Kingdom

11:45 - 12:00      **Three-dimensional CFD simulation of the regeneration of MgO-based sorbent in a carbon capture process**  
Hamid Arastoopour, Illinois Institute of Technology, USA

**Monday, May 23, 2016 (continued)**

**Coating Technologies and Fluidized Nanoparticles** (Session Chair: Franco Berruti)

- 10:45 - 11:00 **Pickup velocity of nanoparticles**  
J. Ruud van Ommen, Delft University of Technology, The Netherlands
- 11:00 - 11:15 **Size distribution prediction of nanoparticle agglomerates in a fluidized bed**  
Andrea Fabre, Technical University of Delft, The Netherlands
- 11:15 - 11:30 **Effect of design and operating variables on spout diameter in spouted beds using factorial design of experiments approach with the aid of new optical fiber probe**  
Vineet Alexander, Missouri University of Science & Technology, USA
- 11:30 - 11:45 **Fluidization of cohesive nanoparticles with a new pulsation technique**  
Mohammad Latifi, Ecole Polytechnique de Montreal, Canada
- 11:45 - 12:00 **Treatment of polymer powders by combining an atmospheric plasma jet and a fluidized bed reactor**  
Marius Sachs, Friedrich-Alexander-University of Erlangen-Nuremberg, Germany

**Chemical Looping Combustion (CLC)** (Session Chair: Ray Cocco)

- 10:45 - 11:00 **Carbon dioxide recovery by means of TSA in a sound assisted fluidized bed of fine activated carbon**  
Federica Raganati, Istituto di Ricerche sulla Combustione – CNR, Italy
- 11:00 - 11:15 **First experience in operation of cold model of FB-CLC-SF (fluidized-bed chemical-looping-combustion solid-fuels) facility**  
Tomasz Czakiert, Czestochowa University of Technology, Poland
- 11:15 - 11:30 **A 1.5 model of a complex geometry laboratory scale fluidized bed CLC equipment**  
Jaroslaw Krzywanski, Jan Dlugosz University in Czestochowa, Poland
- 11:30 - 11:45 **Reaction characteristics of waste coffee grounds chemical-looping gasification**  
Qing Jie Guo, Qingdao University of Science & Technology, China
- 11:45 - 12:00 **Effect of steam on the performance of Ca-based sorbents in calcium looping processes**  
Fabio Montagnaro, University of Naples 'Federico II', Italy
- 12:00 - 12:15 **Modelling study of two chemical looping reforming reactor configurations: Looping vs. switching**  
Joana F. Morgado, University of Coimbra/Norwegian University of Science and Technology, Norway
- 12:00 - 13:30 Lunch

**Monday, May 23, 2016 (continued)**

13:30 - 16:30      Networking

**Plenary 2 (Introduction by Jamal Chaouki)**

16:30 - 17:00      **CFD in fluidized beds: The state of the art**  
Olivier Simonin, Institut de Mecanique des Fluides de Toulouse CNRS/INPT/UPS,  
France

**Fundamentals (Session Chair: Tony Bi)**

17:15 - 17:30      **Horizontal secondary gas injection in fluidized beds: Solids concentration and velocity in multiphase jets**  
Benedikt Königer, Friedrich-Alexander-University of Erlangen-Nuremberg,  
Germany

17:30 - 17:45      **Prediction of the radial solids concentration distribution in circulating fluidized bed risers**  
Timo Hensler, Friedrich-Alexander-University of Erlangen-Nuremberg, Germany

17:45 - 18:00      **Sub-grid drag model for immersed vertical cylinders in fluidized beds**  
Tingwen Li, National Energy Technology Laboratory, USA

18:00 - 18:15      **Force on a single slat during the start-up process of a fluidized bed**  
Duiping Liu, China University of Petroleum, China

18:15 - 18:30      **The effect of riser end geometry on gas-solid hydrodynamics in a CFB riser operating above fast fluidization regimes**  
Larry Shadle, National Energy Technology Laboratory, USA

18:30 - 18:45      **Multiscale modeling of pattern formation in pulsed fluidized beds: Continuum and discrete approaches**  
Kaiqiao Wu, University College London, United Kingdom

18:45 - 19:00      **Measurement of dynamic forces in fluidized bed systems**  
Shyam Sundaram, Particulate Solid Research, Inc., USA

**Clean Energy Processes (Session Chair: Franco Berruti)**

17:15 - 17:30      **Study on single and multi-phase laminar flow containing spherical or slender particles in a stirred tank using DPIV**  
Long Fan, Memorial University of Newfoundland, Canada

17:30 - 17:45      **Heat transfer challenge and design evaluation for a multi-stage temperature swing adsorption (TSA) process**  
Gerhard Hofer, University of Natural Resources and Life Sciences, Austria

**Monday, May 23, 2016 (continued)**

- 17:45 - 18:00      **Hydrodynamics of compartmented fluidized beds for concentrated solar power applications**  
Roberto Solimene, Consiglio Nazionale delle Ricerche/Istituto di Ricerche sulla Combustione, Italy
- 18:00 - 18:15      **Mass transfer in fluidized bed reactors using a novel non-invasive, whole field and high temporal resolution infra-red technique**  
Jose A. Medrano, Eindhoven University of Technology, The Netherlands
- 18:15 - 18:30      **Investigating the performance of different fluidized bed membrane reactor geometries**  
Ramon Voncken, Eindhoven University of Technology, The Netherlands
- 18:30 - 18:45      **Characterization of fuel segregation in a fluidized bed by magnetic particle tracking**  
Anna Köhler, Chalmers University of Technology, Sweden
- 18:45 - 19:00      **Experimental characterization of operational regimes in low aspect-ratio CFB risers**  
David Pallarès, Chalmers University of Technology, Sweden
- Thermal and Catalytic Cracking** (Session Chair: Ray Cocco)
- 17:15 - 17:30      **Effect of interactions between spray jets on liquid distribution in a fluidized bed**  
Franco Berruti, ICFAR, Canada
- 17:30 - 17:45      **Impact of local fluidized bed hydrodynamics on interactions between particles and gas-liquid sprays**  
Cedric Briens, ICFAR, Canada
- 17:45 - 18:00      **CFD simulation of hydrodynamic characteristics in a modified internally circulating fluidized bed mixer**  
Zhenliang Meng, China University of Petroleum (Beijing), China
- 18:00 - 18:15      **Hydrodynamics of high velocity circulating fluidized bed risers**  
Allan S. Issangya, Particulate Solid Research, Inc., USA
- 18:15 - 18:30      **Analysis of particle trajectories in a quick-contact cyclone reactor using discrete phase model (DPM)**  
Liyun Zhu, China University of Petroleum, China
- 18:30 - 18:45      **Pyrolysis characteristics of fat from *Nannochloropsis sp.* and its effect on pyrolysis of all components**  
Qing Jie Guo, Qingdao University of Science and Technology, China
- 18:45 - 19:00      **Influence of catalyst conditioning on products in a continuously operated FCC pilot plant**  
Matthias Swoboda, Vienna University of Technology, Austria

**Monday, May 23, 2016 (continued)**

19:00 - 20:30      Dinner

20:30 - 22:30      Poster Session and Social Hour



**Tuesday, May 24, 2016**

06:30 - 08:00 Breakfast

08:00 - 08:15 Remarks

**Plenary 3** (Introduction by Ted Knowlton)

08:15 - 08:45 **Mixing and segregation in fluidized bed thermochemical conversion of biomass**

Piero Salatino, Universita Degli Studi Di Napoli Federico II, Italy

**Fluidization of Irregular Shape Particles** (Session Chair: Raman Sharma)

09:00 - 09:15 **Pulsation-assisted fluidized bed for the fluidization of high moisture and irregular particles and its application for brown coal fluidization**

Yuping Liu, IHI Corporation, Japan

09:15 - 09:30 **The effects of virtual mass force and particle aspect ratio on orientation of slender particles in a stirred tank**

Long Fan, Memorial University of Newfoundland, Canada

09:30 - 09:45 **Heat transfer study in corrugated wall bubbling fluidized bed reactor: Experiments and CFD simulations**

Alam Nawaz Khan Wardag, Pakistan Institute of Engineering and Applied Sciences (PIEAS), Pakistan

09:45 - 10:00 **DEM simulation of wood pellets dynamics in a mechanically fluidized reactor**

Stefan Heinrich, Hamburg University of Technology, Germany

10:00 - 10:15 **Fundamentals of rotating fluidized beds and application to particle separation**

Larry Shadle, National Energy Technology Laboratory, USA

**Micro-Fluidized Bed Reactors + Thermal and Catalytic Cracking** (Session Chair: Ray Cocco)

09:00 - 09:15 **Flow regime map of a liquid-solid micro-circulating fluidized bed**

Vladimir Zivkovic, Newcastle University, United Kingdom

09:15 - 09:30 **Catalytic ash free coal gasification in a fluidized bed thermogravimetric analyzer**

Said Samih, Ecole Polytechnique Montreal, Canada

09:30 - 09:45 **Partial slip boundary conditions for collisional granular flows at flat frictional walls**

Lei Yang, Eindhoven University of Technology, The Netherlands

**Tuesday, May 24, 2016 (continued)**

**Polymerization Processes** (Session Chair: Daria Boffito)

- 09:00 - 09:15     **The influence of particle surface friction on the behavior of gas-fluidized beds: Development of a two fluid model**  
Lei Yang, Eindhoven University of Technology, The Netherlands
- 09:15 - 09:30     **Application of multiphase flow CFD in the gas phase polymerization process**  
Mayank Kashyap, Saudi Basic Industries Corporation (SABIC), USA
- 09:30 - 09:45     **CFD-DEM modeling of fluidized beds with heat production: Influence of the particle size distribution and heat source**  
Zizi Li, Eindhoven University of Technology, The Netherlands
- 09:45 - 10:00     **Reactive hybrid Eulerian/Lagrangian Two Fluid Model (TFM) simulation of industrial scale olefin polymerization fluidized bed reactors**  
Pablo Aguayo, Borealis Innovation Process Technology, Austria
- 10:00 - 10:15     **Dynamic behavior of fluidized bed reactors for gas phase LLDPE polymerization**  
Mpho Setlhaku, SABIC T&I, The Netherlands
- 10:15 - 10:45     Coffee Break

**Fundamentals** (Session Chair: Wei Ge)

- 10:45 - 11:00     **Modeling the gas-solid flow in diameter-changing fluidized beds**  
Xinhua Liu, Chinese Academy of Sciences, China
- 11:00 - 11:15     **Experimental and simulation study on heat transfer in fluidized beds with heat production: An integrated DIA/PIV/IR technique and CFD-DEM**  
Zizi Li, Eindhoven University of Technology, The Netherlands
- 11:15 - 11:30     **Performance evaluation of different approaches for early detection of defluidization**  
Jaber Shabani, Polytechnique Montreal, Canada
- 11:30 - 11:45     **Characterization of wake properties in freely bubbling fluidized beds using Particle Image Velocimetry**  
Jose A. Medrano, Eindhoven University of Technology, The Netherlands
- 11:45 - 12:00     **Collision dynamics of colliding wet solids: Rebound and rotation analysis**  
Britta Crüger, Hamburg University of Technology, Germany
- 12:00 - 12:15     **Discrete element method simulations of Geldart Group a particles in a micro fluidized**  
Tingwen Li, National Energy Technology Laboratory, USA

**Tuesday, May 24, 2016 (continued)**

12:15 - 12:30      **Multi-scale simulation of gas solid fluidization based on EMMS-DPM**  
Wei Ge, IPE, Chinese Academy of Science, China

**Thermal and Catalytic Cracking** (Session Chair: Raffaella Ocone)

10:45 - 11:00      **Thermal cracking of canola oil in a continuously operating pilot plant**  
Josef Fimberger, Vienna University of Technology, Austria

11:00 - 11:15      **Measurement of penetration and cycle time of jets from an industrial fluid coking spray nozzle**  
Francisco J. Sanchez Careaga, ICFAR, Canada

11:15 - 11:30      **Effect of local hydrodynamics on the distribution of liquid sprayed into a Fluidized Bed**  
Ben Li, ICFAR, Canada

11:30 - 11:45      **Development and study of measurement methods for bogging in a fluidized bed**  
Cedric Briens, ICFAR, Canada

11:45 - 12:00      **Coproduction of liquids and syngas via residue oil cracking-coke gasification (RCCG) process**  
Yuming Zhang, China University of Petroleum, China

12:00 - 12:15      **Modeling FCC spent catalyst regeneration with computational fluid dynamics**  
Raj Singh, Technip Stone & Webster Process Technology, USA

12:15 - 12:30      **Riser hydrodynamics and cluster characterization by Particle Image Velocimetry (PIV) and Digital Image Analysis (DIA) coupling**  
Alvaro Carlos Varas, Eindhoven University of Technology, The Netherlands

**Clean Energy Processes** (Session Chair: Hamid Arastoopour)

10:45 - 11:00      **A multi-stage fluidized bed system for Continuous CO<sub>2</sub> capture by means of temperature swing adsorption – First results from bench scale experiments**  
Florian Dietrich, Vienna University of Technology, Austria

11:00 - 11:15      **Modeling of ash deposition on the wall of a high temperature thermal reformer**  
Tommaso Melchiori, University of Sherbrooke, Canada

11:15 - 11:30      **An experimental study on heat transfer in liquid-solid packed fluidization**  
Debapriya Mandal, Bhabha Atomic Research Centre, India

11:30 - 11:45      **Research and simulation of fast, strong exothermic reaction in gas-solid fluidized bed about temperature distribution and hot spot problem**  
Zhao Jia, Tsinghua University, China

**Tuesday, May 24, 2016 (continued)**

- 11:45 - 12:00      **Dense gas-particle suspension upward flow used as heat transfer fluid in solar receiver: PEPT experiments and 3D numerical simulations**  
Renaud Ansart, LGC-INPT, France
- 12:00 - 12:15      **Influence of bubble bursting on heat transfer phenomena in directly irradiated fluidized beds**  
Roberto Solimene, IRC-CNR, Italy
- 12:15 - 12:30      **Monitoring of the hydrodynamic instabilities in conical spouted beds by recurrence plot analysis of pressure fluctuations and acoustic emission signals**  
Navid Mostoufi, University of Tehran, Iran
- 12:30 - 14:00      Lunch
- 14:00 - 17:00      Networking
- Plenary 4 (Introduction by Joachim Werther)**
- 17:00 - 17:30      **Fluidized bed chemical reactors – Old and new applications**  
Leslaw Mleczko, Bayer Technology Services GmbH, Germany
- Fundamentals (Session Chair: Navid Mostoufi)**
- 17:45 - 18:00      **Fluid-dynamic study on a multi-stage fluidized bed column for continuous CO<sub>2</sub> capture via temperature swing adsorption**  
Egon Zehetner, Vienna University of Technology, Austria
- 18:00 - 18:15      **Direct numerical simulations of collision dynamics of wet particles**  
Yali Tang, Eindhoven University of Technology, The Netherlands
- 18:15 - 18:30      **Characterization of loop seal in a complex circulating fluidized bed system**  
Dawei Wang, The Ohio State University, USA
- 18:30 - 18:45      **CFD simulation of the influence of suspension section on the hydrodynamics of CFB riser**  
Wei Wang, Chinese Academy of Sciences, China
- 18:45 - 19:00      **New hybrid CPU-GPU solver for CFD-DEM simulation of fluidized bed**  
Reza Zarghami, University of Tehran, Iran
- Chemical Looping Combustion (CLC) (Session Chair: Thierry Gauthier)**
- 17:45 - 18:00      **Dynamic flowsheet simulation of gas and solids flows in a system of coupled fluidized bed reactors for chemical looping combustion**  
Johannes Haus, Hamburg University of Technology, Germany

**Tuesday, May 24, 2016 (continued)**

- 18:00 - 18:15      **Numerical simulation of hydrogen production by chemical looping reforming in a dual interconnected fluidized bed reactor**  
Giuseppe Diglio, Università degli Studi del Sannio, Italy
- 18:15 - 18:30      **Measurement of solids circulation rates with optical techniques in circulating beds and comparison to pressure drop methods**  
Jose A. Medrano, Eindhoven University of Technology, The Netherlands
- 18:30 - 18:45      **A twin-bed test reactor for characterization of calcium looping sorbents**  
Antonio Coppola, Istituto di Ricerche sulla Combustione – CNR, Italy
- 18:45 - 19:00      **Feasibility of fluidized bed reactor systems for pressurized chemical looping combustion of natural gas**  
Florian Zerobin, University of Natural Resources and Life Sciences, Austria
- 19:00 - 19:15      **Hydrodynamics of chemical looping combustion systems: Effects of reactor design parameters**  
Dawei Wang, The Ohio State University, USA

**Encapsulation + Composites** (Session Chair: Ruud Van Ommen)

- 17:45 - 18:00      **Spouted bed design considerations for coated nuclear fuel particles**  
Douglas W. Marshall, Battelle Energy Alliance, LLC/Idaho National Laboratory, USA
- 18:00 - 18:15      **Conformal multilayer coatings on fine silica microspheres by atmospheric pressure fluidized bed chemical vapor deposition**  
Jamal Chaouki, Polytechnique Montreal, Canada
- 18:15 - 18:30      **Investigations on tribocharging behavior of pharmaceutical powders in a fluidized bed dryer**  
Lifeng Zhang, University of Saskatchewan, Canada
- 18:30 - 18:45      **Catalyst preparation for fluidized bed reactors by spray drying**  
Marco Giulio Rigamonti, École Polytechnique de Montréal, Canada
- 18:45 - 19:00      **High-efficiency mixing of fine powders via sound assisted fluidized bed for metal foam production by an innovative cold gas dynamic spray deposition method**  
Federica Raganati, Istituto Di Ricerche Sulla Combustione - CNR, Italy
- 19:00 - 19:15      **Using of spouted bed spray granulation process for fabricating of metal/ceramic-polymer composites**  
Eduard Eichner, Hamburg University of Technology, Germany
- 19:15 - 20:45      Dinner
- 20:45 - 22:30      Poster Session and Social Hour

**Wednesday, May 25, 2016**

06:30 - 08:00 Breakfast

**Plenary 5 (Introduction by Shaffiq Jaffer)**

08:00 - 08:30 **CLC, a promising concept with challenging development issues**  
Thierry Gauthier, IFPEN, France

**Plenary 6 (Introduction by Shaffiq Jaffer)**

08:30 - 09:00 **Chemical looping gasification and reforming – A perspective and prospects of novel circulating fluidized bed systems**  
Liang-Shih Fan, The Ohio State University, USA

**Chemical Looping Combustion (CLC) (Session Chair: L.S. Fan)**

09:15 - 09:30 **The effect of gas extraction through vertical membranes on the bubble hydrodynamics in a fluidized bed reactor**  
Solomon Assefa Wassie, Norwegian University of Science And Technology, Norway

09:30 - 09:45 **Metal oxides in fluidized bed conversion systems**  
Tobias Mattisson, Chalmers University of Technology, Sweden

09:45 - 10:00 **Modelling of a chemical looping combustion system equipped with a two-stage fuel reactor**  
Antonio Coppola, Istituto di Ricerche sulla Combustione – CNR, Italy

10:00 - 10:15 **Scale-up of CLC oxygen carriers for gaseous fuels**  
Arturo Cabello, Instituto de Carboquímica (ICB-CSIC), Spain

10:15 - 10:30 **Determination of solids circulation rate through magnetic tracer tests**  
Diana Carolina Guío Pérez, National University of Colombia, Colombia

**Coating Technologies and Fluidized Nanoparticles (Session Chair: Guangwen Xu)**

09:15 - 09:30 **CFDEM® modelling of particle coating in a three-dimensional prismatic spouted bed**  
Swantje Pietsch, Hamburg University of Technology, Germany

09:30 - 09:45 **De-agglomeration of nanoparticles in an impactor-assisted fluidized bed**  
Hamed Nasri Lari, Ecole Polytechnique of Montreal, Canada

09:45 - 10:00 **Pressure and X-ray tomography characterization of the fluidization behavior of TiO<sub>2</sub> nanoparticles**  
Jesus Gomez-Hernandez, Carlos III University of Madrid, Spain

**Wednesday, May 25, 2016 (continued)**

- 10:00 - 10:15      **Mixing and separation of liquid-liquid two-phase in a novel cyclone reactor of isobutane alkylation catalyzed by ionic liquid**  
Mingyang Zhang, China University of Petroleum, China
- 10:15 - 10:30      **Multi-scale characteristics of vibration acceleration signals in vapor-liquid-solid fluidized bed evaporator**  
Xiaoping Xu, Tianjin University, China
- 10:30 - 10:45      **Reduction of hematite (Fe<sub>2</sub>O<sub>3</sub>) to metallic iron (Fe) by CO in a micro fluidized bed reaction analyzer: A multistep kinetics study**  
Hongsheng Chen, Chongqing University, China

**Biomass to Chemicals** (Session Chair: Cedric Briens)

- 09:15 - 09:30      **Modeling and process features of plug flow reactor with internal recirculation for biomass pyrolysis**  
Chris Harris, Hatch Ltd, Canada
- 09:30 - 09:45      **Technology development for the production of hydrocarbons from fast pyrolysis of kraft black liquor**  
Xuantian Li, NORAM Engineering and Constructors Ltd., Canada
- 09:45 - 10:00      **Cold flow modelling of char concentration in the recirculated bed material stream of a dual fluidized bed steam gasification system**  
Stephan Kraft, Bioenergy2020+ GmbH, Austria
- 10:00 - 10:15      **Measurement of solids circulation rate in a high temperature dual fluidized bed pilot plant**  
M. Hafizur Rahman, The University of British Columbia, Canada
- 10:15 - 10:30      **Assessment of new scale-up methodology of hydrodynamics similarity in gas-solid fluidized beds using advanced non-invasive measurement techniques (CT and RPT)**  
Vineet Alexander, Missouri University of Science and Technology, USA
- 10:30 - 10:45      **The role of fuel mixing on char conversion in a dual fluidized bed gasifier**  
Louise Lundberg, Chalmers University of Technology, Sweden
- 10:45 - 11:15      Coffee Break

**Chemical Looping Combustion (CLC)** (Session Chair: Stefan Heinrich)

- 11:15 - 11:30      **On the novel Chemical Switching Reforming (CSR) reactor for hydrogen production with integrated CO<sub>2</sub> capture**  
Solomon Assefa Wassie, Eindhoven University of Technology, The Netherlands

**Wednesday, May 25, 2016 (continued)**

11:30 - 11:45      **Hydrodynamic behavior of coal and bottom ash mixtures in a fluidized bed gasifier**

Shantanu Roy, Indian Institute of Technology – Delhi, India

11:45 - 12:00      **Operating experience of a 50kWth methane chemical looping reactor**

Samuel C. Bayham, ORISE/NETL/DOE, USA

12:00 - 12:15      **The performance of air and fuel reactors in a chemical looping combustion plant**

Raffaella Ocone, Heriot-Watt University, United Kingdom

12:15 – 12:30      **Fluid dynamics study on a dual fluidized bed pyrolysis process in an automated cold-flow model**

Chrisoph Pfeifer, University of Natural Resources and Life Sciences, Austria

**Biomass to Chemicals** (Session Chair: Kamal Adham)

11:15 - 11:30      **Comparison of multi-component kinetic relations on bubbling fluidized-bed woody biomass fast pyrolysis reactor model performance**

Johnny Matta, University of Ottawa, Canada

11:30 - 11:45      **Evaluating the impact of feed location on the bubbling fluidized bed gasification of biomass**

Benjamin Bronson, NRCan/CanmetENERGY, Canada

11:45 - 12:00      **Hydrodynamic study of a circulating fluidized bed used for biomass gasification between 20°C and 900°C**

Sébastien Pécate, CNRS LGC Toulouse, France

12:00 - 12:15      **High solar flux heating of upflow bubbling fluidized bed circulating in opaque vertical tube - 3D numerical simulation**

Renaud Ansart, LGC-INPT, France

12:15 - 13:45      Lunch

13:45 - 17:00      Networking

17:00 - 19:00      Poster Session and Social Hour

19:30 - 21:30      Conference Banquet



**Thursday, May 26, 2016**

06:30 - 08:00 Breakfast

**Plenary 7** (Introduction by John Grace)

08:00 - 08:30 **Surface engineering and vapor phase technologies for coating and functionalizing complex objects and small particles**  
Ludvik Martinu, Polytechnique Montreal, Canada

**Plenary 8** (Introduction by John Grace)

08:30 - 09:00 **CFB reactor to CFB combustor - The R&D of CFB combustion in China**  
Guangxi Yue, Tsinghua University, China

**Fundamentals** (Session Chair: Renaud Ansart)

09:15 - 09:30 **DEM-CFD simulation for mixing process of binary particles with large size difference in a bubbling fluidized bed**  
Kyohei Higashida, Osaka University, Japan

09:30 - 09:45 **Evaluation of the minimum fluidization velocity at elevated temperature and pressure through experiments and modelling**  
Jan Hendrik Cloete, Norwegian University of Science and Technology, Norway

09:45 - 10:00 **The sensitivity of filtered two fluid models to the underlying resolved simulation setup**  
Jan Hendrik Cloete, Norwegian University of Science and Technology, Norway

10:00 - 10:15 **X-Ray imaging for design of gas nozzles in large scale fluidized bed reactors**  
Massimiliano Materazzi, University College London, United Kingdom

10:15 - 10:30 **CFD-DEM simulation of nanoparticle agglomerates fluidization with a micro-jet**  
J. Ruud van Ommen, Delft University of Technology, The Netherlands

**Coating Technologies and Fluidized Nanoparticles** (Session Chair: Wolfgang Peukert)

09:15 - 09:30 **Heat transfer characteristics of the vapor-liquid-solid boiling flow in a fluidized bed evaporator**  
Min An, Tianjin University, China

09:30 - 09:45 **Long-term transients in fluidization of oxide nanoparticle agglomerates**  
Samir Salameh, Delft University of Technology, The Netherlands

09:45 - 10:00 **Gas-phase carbon coating of LiFePO<sub>4</sub> for rechargeable batteries**  
Mohammad Latifi, Ecole Polytechnique de Montreal, Canada

**Thursday, May 26, 2016 (continued)**

10:00 - 10:15      **Effect of sieving and isopropanol on the fluidization behavior of TiO<sub>2</sub> nanoparticles**

Jesus Gomez-Hernandez, Carlos III University of Madrid, Spain

10:15 - 10:30      **Fluidized bed rheometry – Science, practice and industrial applications**

Denis Schütz, Anton Paar GmbH, Austria

**Lignin and Wood Products + Biomaterials and Fibers** (Session Chair: Gregory Patience)

09:15 - 09:30      **Comparison of optical probes and X-ray tomography for bubble characterization in fluidized bed methanation reactors**

Frank Schillinger, Paul Scherrer Institut, Switzerland

09:30 - 09:45      **Gas-solid conversion of lignin to carboxylic acids**

Daria Camilla Boffito, Ecole Polytechnique de Montreal, Canada

09:45 - 10:00      **Combustion of lignin-rich residues with coal in a pilot-scale bubbling fluidized bed reactor**

Roberto Solimene, Consiglio Nazionale delle Ricerche/Istituto di Ricerche sulla Combustione, Italy

10:00 - 10:15      **Expansion properties of Alginate beads as cell carrier in the fluidized bed bioartificial liver**

Seyed Danial Naghib, Universita della Calabria, Italy

10:15 - 10:30      **Experimental validation of CFD hydrodynamic models for catalytic fast pyrolysis (CFP)**

Bruce Adkins, KIOR, USA

10:30 - 11:00      Coffee Break

**Fundamentals** (Session Chair: Guangxi Yue)

11:00 - 11:15      **An improved contact detection algorithm for DEM modeling of polydisperse systems: Application to coal-ash mixture fluidization**

Shantanu Roy, Indian Institute of Technology – Delhi, India

11:15 - 11:30      **Applications of tribology and fracture mechanics to determine wear and impact attrition of particulate solids in CFB systems**

Samuel C. Bayham, ORISE/NETL/DOE, USA

11:30 - 11:45      **Experimental study of solid mixing mechanism in a 2D fluidized bed**

Fernando Hernández Jiménez, Universidad Carlos III de Madrid, Spain

11:45 - 12:00      **Microscopic modelling of capillary liquid bridge force and volume repartition for DEM simulations of polydisperse systems**

Alberto Di Renzo, University of Calabria, Italy

**Thursday, May 26, 2016 (continued)**

12:00 - 12:15      **Reversal of gulf stream circulation in a vertically vibrated triangular fluidized bed**  
Eduardo Cano-Pleite, Universidad Carlos III de Madrid, Spain

**Fluidization of Irregular Shape Particles** (Session Chair: Reza Zarghami)

11:00 - 11:15      **Characteristics of a semi-industrial downer reactor for the rounding of irregular polymer particles**  
Marius Sachs, Friedrich-Alexander-University of Erlangen-Nuremberg, Germany

11:15 - 11:30      **Simulation of segregation in a fluidized bed by CFD-DEM by using similarities**  
Zhihong Liu, IHI Corporation, Japan

11:30 - 11:45      **The relevance of surface impurities on the effect of temperature on powder flow behavior**  
Roberto Chirone, University College London, United Kingdom

11:45 - 12:00      **Analysis of industrial reactive powders flow properties at high temperature**  
Domenico Macri, University College London, United Kingdom

12:00 - 12:15      **Recirculating fluidized bed reactor for chemical-looping**  
Raman Sharma, Birla Institute of Technology and Science Pilani, Rajasthan, India

12:15 – 14:00      Lunch

14:00 - 17:00      Networking

**Fundamentals** (Session Chair: Robin Hughes)

17:00 - 17:15      **Mechanism of particle build-up on gas-solid fluidization column wall due to electrostatic charge generation**  
Di Song, University of Ottawa, Canada

17:15 - 17:30      **Force on a large sphere immersed in an expanded water-fluidized bed over a wide range of voidage values**  
Alberto Di Renzo, University of Calabria, Italy

17:30 - 17:45      **Investigation of agglomerates growth mechanism for thermal seawater desalination**  
Atsushi Tsutsumi, The University of Tokyo, Japan

17:45 - 18:00      **Transitions in beds of aerated powders**  
Clive E. Davies, Massey University, New Zealand

18:00 - 18:15      **Control of particle circulation rate in circulating fluidized bed by a pulsed gas flow**  
Masanori Ishizuka, The University of Tokyo, Japan

**Thursday, May 26, 2016 (continued)**

- 18:15 - 18:30      **Similarities between gas-solid fluidization in the presence of interparticle forces at high temperature and induced by a polymer coating approach**  
Jaber Shabani, Polytechnique Montreal, Canada
- 18:30 - 18:45      **Solids maldistribution in parallel cyclones**  
Ted M. Knowlton, Particulate Solid Research, Inc., USA
- 18:45 - 19:00      **Hydrodynamic study of heat transfer in a fluidized bed by discrete particle simulations**  
Lijing Mu, Eindhoven University of Technology, The Netherlands

**Thermal and Catalytic Cracking** (Session Chair: Karl-Ernst Wirth)

- 17:00 - 17:15      **Particle cluster sizing in downer units: An applicable across downer scale methodology**  
Angel Lanza, University of Western Ontario, Canada
- 17:15 - 17:30      **Micro/Meso simulations of a fluidized bed with heat transfer**  
Florian Euzenat, IFP Energies Nouvelles, France
- 17:30 - 17:45      **Stability analysis of gas solids separation in scaling-up fluidized bed reactors**  
Chenxi Zhang, Tsinghua University, China
- 17:45 - 18:00      **Numerical investigation of an industrial scale circulating fluidized bed furnace: Effects of position of coal feeders and coal feeding rates**  
In Sik Hwang, Yonsei University, South Korea
- 18:00 - 18:15      **Hydrocracking of a plastic mixture over various micro-mesoporous composite zeolites**  
Dureem Munir, University of the Punjab Lahore, Pakistan
- 18:15 - 18:30      **Performance prediction of riser termination devices using barracuda**  
Madhusudhan Kodam, The Dow Chemical Company, USA
- 18:30 - 18:45      **Induction heating fluidized bed reactor for coal-based cofiring tests**  
Mohammad Latifi, Ecole Polytechnique de Montreal, Canada
- 18:45 - 19:00      **Complex reactions in an FCC riser reactor**  
Raffaella Ocone, Heriot-Watt University, United Kingdom

**Fluidization of Irregular Shape Particles** (Session Chair: Leslaw Mleczko)

- 17:00 - 17:15      **Attrition of methanol to olefins catalyst in a jet cup**  
Mao Ye, Chinese Academy of Sciences, China

**Thursday, May 26, 2016 (continued)**

- 17:15 - 17:30      **Improved gas-solid mixing and mass transfer in a pulsed fluidized bed of biomass with tapered bottom**  
Dening Jia, University of British Columbia, Canada
- 17:30 - 17:45      **Fluidization of graphene nanoplatelets for atomic layer deposition**  
Samir Salameh, Delft University of Technology, The Netherlands
- 17:45 - 18:00      **Fluidization of irregular particles - Part I: A discrete element method to model collisions between non-convex particles**  
Andriarimina Daniel Rakotonirina, IFP Energies Nouvelles, France
- 18:00 - 18:15      **Simulation of fuel particles motion in a 2D fluidized bed using a hybrid-model considering wall friction**  
Fernando Hernández Jiménez, University Carlos III of Madrid, Spain
- 18:15 - 18:30      **Fluidization of irregular particles - Part II: A particle-resolved simulation method to model hydrodynamic interactions**  
Andriarimina Daniel Rakotonirina, IFP Energies Nouvelles, France
- 18:30 - 18:45      **Segregation of equal-sized particles of different densities in a vertically vibrated fluidized bed**  
Eduardo Cano-Pleite, Universidad Carlos III de Madrid, Spain
- 18:45 - 19:00      **Cold flow modelling of dual fluidised bed pyrolysi**  
Christoph Pfeifer, University of Natural Resources and Life Sciences, Austria
- 19:00 - 20:30      Dinner
- 20:30 - 22:30      Poster Session and Social Hour

**Friday, May 27, 2016**

06:30 - 08:00      Breakfast and Departure

## **Poster Presentations**

1. **Experimental study on a new FCC spent catalyst distributor**  
Yongmin Zhang, China University of Petroleum, Beijing, China
2. **A neural-based modelling approach to estimate residence time and solids flow rate in a conical spouted bed with and without draft tubes**  
Mikel Tellabide, University of Basque Country, Spain
3. **CFD modelling of electrostatic charge generation in gas-solid Fluidized Bed-A preliminary work**  
Fahad Chowdhury, University of Ottawa, Canada
4. **HPC large scale simulation of an industrial fluidized bed and applications to chemical engineering processes with NEPTUNE\_CFD**  
Herve Neau, Université de Toulouse; INPT, UPS; IMFT; CNRS, France
5. **The effect of bubble size on the performance of ebullated bed hydroprocessors**  
Connor G. Farrell, University of Ottawa, Canada
6. **Numerical and experimental study of a multiphase cold bubbling bed reactor**  
Leonardo Tricomi, University of Sherbrooke, Canada
7. **The understanding of silicon sequential elutriation behaviour**  
Nicolas Estime, Bluestar Silicones, France
8. **The three-dimensional simulation of vortex on the bottom of a particle in gas-liquid two-phase flow**  
Guangxiang He, Beijing Institute of Petrochemical Technology, China
9. **Preparation of supported skeletal Ni catalyst and its catalytic hydrogenation performance of C9 fraction from coking process**  
Xin Xu, Beijing Institute of Petrochemical Technology, China
10. **Effect of pressure and gas velocity on residence time of particles susceptible to entrainment in gas-solid fluidized beds**  
Marc-Andre Seguin, University of Ottawa, Canada