

Program

Fluidization XIV From Fundamentals to Products

May 26-31, 2013

*NH Conference Center Leeuwenhorst
Noordwijkerhout, The Netherlands*

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PREFACE

Fluidization is an important field of both fundamental research and broad industrial applications. Current understanding of the complex fluid-particle multiphase flow patterns, coupled with heat and mass transfer and chemical reactions, is still incomplete. Reliable design and scale up of commercial fluidized bed reactors remains a challenging task. The past thirteen ECI Fluidization Conferences, from 1975 to 2011, have put the emphasis on fundamental research to stimulate exchange of ideas from researchers all over the world in order to develop generic tools and theories for applications.

The Fluidization XVI conference continues the tradition of this conference series, with the particular aim to bridge fundamental research on fluidization and emerging applications of fluidization and novel fluidization technologies.

Organizing the conference has been a pleasure for us and we keep good memories of the correspondence with the conference participants. We would like to thank the members of the local organizing committee for their help in preparing the conference: this is very much appreciated. We are also grateful to all referees who evaluated the papers. Their role was invaluable in the selection of the material and they contributed to the high quality of the papers accepted for presentation and publication in this volume. We would like to thank ECI for the practical organization of the conference and the assistance in editing the proceedings.

Finally, and last but not least, we wish to acknowledge our sponsors for their generous support.

Hans Kuipers
Robert Mudde
Ruud van Ommen
Niels Deen

Eindhoven, April 2013

A TRIBUTE TO PROFESSOR DEREK GELDART



Like most ideas in science, the simplest often turn out to be the best. Professor Geldart's contribution to fluidisation is of fundamental importance, extremely useful and beautiful in its simplicity: Derek will not be remembered for complicated equations or sophisticated theories but for fundamental practical results which everyone working in fluidisation can use. Derek revealed, through immediate and carefully undertaken experiments, the essential classes of behaviour observed in fluidised beds. His name remains associated to his famous diagram classifying the way particles behave when fluidised in air. Many of us who learned the Geldart diagram have thought – "I could have done that!"; well, we didn't, but Derek did!

Derek Geldart was born in Stockton Upon Tees, England, on 4 September 1931 and attended Oxbridge Lane Boys School, Holy Trinity Higher Grade School and Stockton Grammar School. After graduating from the University of Newcastle upon Tyne in Mechanical Engineering, he studied for a further two years for a Masters degree in Chemical Engineering. He then worked as a Chemical Engineer for six years in Research and Development for the United Kingdom Atomic Energy Authority and he was in charge of the experimental beryllium plant for two years, from 1956 to 1958. From 1958 till 1960 Derek dealt mainly with the design of beryllium plant and gas cleaning.

In 1960, Derek joined the University of Bradford as a Lecturer. He was promoted to Senior Lecturer in 1968, Reader in 1979 and in 1988 he was appointed to a personal chair as Professor of Powder Technology. Derek became Emeritus Professor of Powder Technology at the University of Bradford in 1996 and Visiting Professor in the School of Process, Environment and Material Engineering at the University of Leeds; Honorary Professor of Chemical Engineering at Heriot-Watt University; and Honorary Professor of Powder Technology at the University of Birmingham. He was also Director of Powder Research Ltd., a company dedicated to providing training and consultancy services in powder technology.

A Fellow of the Institution of Chemical Engineers (IChemE), Derek acted as a consultant for many companies in the UK, Europe, and the USA. He was a member of the Editorial Board of the journal *Powder Technology*, and of the *International Journal on the Science and Technology of Wet and Dry Particulate Systems*. At the 8th International Engineering Foundation Conference on Fluidization in 1995, he was awarded a medal in recognition of his outstanding

contribution to the field over the past 25 years. He was presented with an award by the AIChE Particle Technology Forum for his contributions to fluidisation research and education. In 2005, he received an award from the IChemE Particle Technology Special Interest Group to celebrate his long standing achievements in Particle Technology.

Derek started his research into fluidisation in 1967 and was awarded a Ph.D in 1971 for a dissertation that included a diagram for characterising powders according to their fluidisation and aerated flow behaviour. That diagram is now used worldwide and is known as the “Geldart Fluidisation Diagram”. The classification is nowadays so embedded in the field that researchers often refer to particles by identifying them with the Geldart’s group to which they belong (A, B, C or D). The paper appeared in *Powder Technology* and remains undoubtedly one of the most cited works in the area. It is widely used in undergraduate education, in research and in industry demonstrating its core role in the field. It is difficult to think of another concept or finding that enjoys the same impact in the study and practice of fluidisation.

The “Diagram”, however, did not have an easy birth due to sceptical reviewers. It is only due to Derek’s perseverance and the trust of the then editor of *Powder Technology* that we have the good fortune to know and use this powerful tool. Surely the paper must have been cited more than any other paper published in *Powder Technology* and, if not, it can only be due to the fact that the work is so entrenched that we refer to the “Geldart Classification” without citing the original paper. Derek would sometimes recount his struggle to other scientists to show the value of persevering against opposition when you trust your own work. But we do not need to convince readers of the importance of Derek’s scientific contribution. The “Diagram” was not the only research contribution of Derek: he contributed more than 200 publications in books, academic journals, and conference proceedings. Indeed, the evening before he died he was writing a paper on research undertaken by a young Erasmus student in Compiègne that Derek supervised for six months. Derek had a rare attitude towards research and interaction with colleagues and students and it is this aspect that we would like to concentrate on: we all know the scientist, but only few had the fortune to interact directly with him and then know the man.

We both had the great fortune to meet Derek and to interact with him professionally and personally. Derek was a very kind, straightforward and modest person (with little to be modest about!). He was friendly and open, always happy to share his knowledge, generous with his help. Derek was a true gentleman. One of us (RO) met him as a colleague, the other (PL) as a student. However, by comparing notes, we can definitely assert that Derek was a man of culture, a man of science, who loved exchanging ideas and debating findings, no matter

whether one was a student, a young colleague or a well-established academic. Derek treated all equally with the same attention, curiosity and respect.

When RO started to study particle technology, one of the first notions to be learnt was the famous "Geldart diagram". At the time, as a young student the name was not really associated to an actual person. Only after eight years, in 1995, following her move to the UK, RO had the good fortune to meet Derek in person, following the suggestion of her head of department, who knew of her scientific interests. RO contacted Derek with some considerable reluctance given his great stature in the subject. (This hesitation arose from years of acquaintance with Academia in Italy, where a professor is an almost God-like entity and therefore unapproachable - certainly by a young researcher). Derek, to her huge surprise, was open, friendly and suggested meeting to discuss ideas in fluidisation. This was the beginning of a long friendship and of a scientific and human exchange. Derek had the rare quality of immediately making one feel at ease. He used to say: "poor preparation precedes poor presentation": one clear memory of many, concerns the preparation of a co-authored presentation at the Fluidization X conference which was held in China in 2001; RO was supposed to give the paper but then, following her trip cancellation, Derek had to give it instead. (The paper appeared in the Proceedings edited, among others, by Professor Mooson Kwauk who we also remember on this occasion). It was astonishing that Derek's preparation for the talk was so meticulous given his huge knowledge of the subject. Derek loved culture in all its expression; after his death, RO found two books that he gave her - both novels about Italy, a country that he loved. As with every good engineer, he wanted to test theory with experiments so they would discuss whether the Italy depicted in novels was a fair representation of Italy as seen by an Italian.

PL met Derek during her PhD studies in fluidisation, the very first meeting happened in a similar setting to the one we are in. It was the Fluidization conference held in Durango, USA, in 1998. The conference was her first opportunity to present her research in front of a distinguished audience of eminent academics and practitioners in the field, such as Derek, an experience that as a student one may perceive as being thrilling as much as intimidating, and yet the meeting with Derek was extremely reassuring as well as inspiring. Derek became her PhD examiner one year later and the passionate discussion on the relative importance between the inter-particle and hydro-dynamic forces on fluidisation is still vivid in her memory. Since then the professional relationship grew into a lasting friendship. Derek was very generous in sharing his technical and scientific knowledge in particle technology and fluidisation; he was a natural teacher and a caring mentor. His passion for the discipline was contagious and his enthusiasm and dedication to enhance the students' awareness of the beauty and challenges of the field remain his legacy with the IChemE Particle Technology Subject Interest Group. Over the years, Derek's interest also in the

diversity of cultures and his great sense of humour became apparent as a distinctive facet of his vitality; the regular exchange of emails and jokes with him always brought colour, a smile and a laugh, and it will be greatly missed.

The conclusion from our joint experience of Derek is a clear picture of the scientist, the engineer and, above all, the teacher. Over the years, we both continued to meet Derek attending the IChemE Particle Technology Interest Group: Derek always contributed actively to the group, but what he enjoyed best was the interaction with the young researchers. He was a dedicated teacher who knew all the tricks to instil the love for the field in a young mind. One of his last contributions to teaching was "*A day in the life of a young, single, professional working in industry*" or "*How every aspect of his/her life is affected by or involved with powders*". The article started with waking up, throwing back *nylon* sheets, getting out of bed, drawing back *nylon* curtains, opening double-glazed *uPVC* window starting sneezing as *pollen particles* are breathed in.... and finishes with... switching on the laptop computer - pay some urgent bills on-line putting sheets in the washer, with *powder* detergent.... Particle technology affecting every hour of every day.

Derek's approach to science is wonderfully captured by his son, Andrew, who quoted part of the following poem from Rudyard Kipling for his Dad:

*"My Father kept six serving men
(Who taught him all he knew)
Their names were What? And Why? And When?
And Where? And How? And Who?"*

A pioneer in fluidisation, Derek's impact in the field will last forever. Whether academic or industrially applied, fluidisation research will carry Derek's influence.

Derek died on 4 December 2012 aged 81 leaving Margaret, his wife of 56 years, and two sons Jonathan and Andrew as well as three grandchildren.

*Raffaella Ocone
Heriot-Watt University, Edinburgh*

*Paola Lettieri
University College London*

A TRIBUTE TO PROFESSOR MOOSON KWAIK



Prof. Mooson Kwauk, our dear friend and colleague, passed away due to illness on November 20, 2012 in Beijing at the age of 92. His image remains indelibly impressed upon our memory and we often feel he were still busy working at home as usual. As Mooson's friends for several decades, we witnessed his unwaveringly high standards of excellence and his great passion for research. We consider him a fearless climber who would never stop the endless journey to the summit of Mount Science. We all feel a strong sense of loss of his passing away and a deep grief as thousands of words well up in our hearts.

We can hardly begin to delineate his lifelong achievements, contributions and influence to society as a great scientist and educator. His cutting-edge research insight, endless pursuit of knowledge, persistent upkeep with the latest intellectual trends and, most impressively, his forever friendly disposition established a distinguished model for youth to follow.

Mooson was born in Hanyang, Hubei Province, China, on June 24, 1920, and grew up in Shanghai. He graduated from the University of Shanghai with a degree in chemistry in 1943 and studied for his Master's degree at Princeton University from 1945 to 1946 under the late Prof. Richard H. Wilhelm. At Princeton, Mooson showed exemplary research capability, authoring the classical paper, "Fluidization of Solids Particles" (Chem. Eng. Prog., vol. 44, 1948, p.201.), in which aggregative fluidization and particulate fluidization were distinguished for the first time. After leaving Princeton, he joined Hydrocarbon Research in New York to work on process development for coal gasification, air separation, gas purification and gaseous reduction of iron ores. During a 4-year interlude of the employment by the Coca-Cola Export Corp., he built the first bottling plant in India, received the Chesterman Award in 1950 and led the Export Corp. Lab in New York City. Mooson later continued his career at Hydrocarbon Research and returned to China with his family in 1956.

Upon his return to China, Mooson helped to found the Institute of Chemical Metallurgy (ICM) (later renamed the Institute of Process Engineering in 2001 on the basis of his concept of "process engineering") in the Chinese Academy of Sciences (CAS), where he remained until his retirement. He set up China's first fluidization research laboratory in ICM and pioneered his

country's fluidization research. In his early career, Mooson endeavored to unify all types of gas-solid operations and established the theory of Generalized Fluidization. Mooson also cooperated with industry in scaling up fluidized sulfate roasting of cupriferous iron ores, two-phase fluidized roasting of laterite, and other processes, which stimulated the application of fluidization in China. For these activities, the government awarded him the title Excellent Scientific Researcher, a high honor

In 1966 Mooson's research was interrupted due to the onset of the Cultural Revolution from which he and his family suffered greatly. Yet in spite of losing the right to conduct laboratory studies during this chaotic period, he continued to analyze experimental data, write notes and plan for future research from home, developing the concept of bubbleless gas–solid contacting and various other ideas. When research at ICM was partially restored in 1972, Mooson began testing his bubbleless contacting concept by studying heat transfer in dilute phase, multi-stages shallow fluidized beds and fast fluidization. At this pivotal time, Mooson was appointed as the director of ICM with a mission to reestablish and reinvigorate research within the Institute. He was later elected a Member of the Chinese Academy of Sciences.

Under Mooson's leadership, ICM began a new era focusing on fundamental and innovative research and development in response to the needs of industry. New research areas were initiated, including biochemical engineering, particle technology, metallurgical physical chemistry, and multi-phase reaction engineering. Such changes won the support of the United Nations Development Program in 1984, leading to the establishment of the Multi-Phase Reaction (MPR) Lab in 1986, which was upgraded to the State Key Lab of Multi-Phase Complex Systems in 2006. Mooson guided the Lab through research of meso-scale problems like particle clustering in gas-solid flow and engineering problems like coal topping. Even after retirement as the Institute Director in 1986, Mooson never ceased his leadership and guidance to the Lab. He continued as the Emeritus Director of both ICM and the MPR Lab and made great efforts to promote scientific exchanges and to spearhead new disciplines. Beyond organizing many national and international conferences, he founded the Chinese Society of Particuology and served in leadership roles for the Chemical Industry and Engineering Society of China (CIESC). Mooson's lifetime of scientific achievements are recognized by many honors, such as the International Fluidization Award of Achievement at FLUIDIZATION VI, Banff in 1989; three National Natural Science Awards; he was honored as one of the fifty eminent chemical engineers of the "Foundation Age" by the American Institute of Chemical Engineering in 2008, and elected as foreign member of the Swiss Academy of Engineering Science. His contributions to the field are described in books like FLUIDIZATION: Idealized and

Bubbleless (Science Press, Beijing; Ellis Horwood, U.K.), Particle-Fluid Two-Phase Flow-Energy-Minimization Multi-Scale Method (Metallurgical Industry Press, Beijing, 1994), From Multiscale modeling to Mesoscience (Springer, 2013), and four other books in Chinese. His research approaches are remembered as the guidance of R&D that he laid down for the MPR laboratory: “emphasizing accumulation (of knowledge), seeking excellence, exploring frontiers, and targeting needs.” Mooson’s achievements were largely due to his being open-minded, great enthusiasm, and consistent support of new ideas.

Perhaps the most long-lasting of Mooson’s academic legacy is his impact on future generations of scholars to whom he dedicated long hours—as he always wanted—developing their writing skills. One is filled with great admiration upon browsing the articles that Mooson revised. His graduate students sent him poorly organized papers, and received after his careful and repeated revisions a well-thought out edited version with logic clearly supported by figures and tables. When he thought there were too many revisions for students to recognize, he would type and print the revised article for them; his high expectations towards his students can be felt between the lines. In addition to supporting young scholars by initiating the Young Scientist Award in Particuology with his own savings, he designed a science writing course in English to help graduate students write their papers using good English. His teachings in this course have been edited and published in the book *How to Write Science Papers in English* (Science Press, 2009).

Mooson’s commitment to the exploration of new ideas and to the advancement of his discipline is evident by his diligence as the Editor (Beijing) of *Chemical Engineering Science* (Pergamon) and Editor-in-Chief of *Particuology*, a journal he launched in 2003 at the age of 83, each for more than a decade. He put forth tremendous effort preparing worthy papers for his readers. As a rule, he always pre-edited manuscripts several times in consultation with the authors before sending them out for review, some of which were revised more than 10 times! He guided his colleagues in the Editorial Office of *Particuology* to check every equation and citation for accuracy and accessibility on Internet. In an interview in 2011, he said, “In all my life I never presented second-class products. The journal I run would never present inferior papers to my readers.” Through his tremendous efforts, *Particuology* has become a well-known international journal with high scientific quality.

There are many stories of his everyday life, which have a quiet but very powerful way to move and influence those around him. He also had an endearing habit of entering a room shaking hands and having small chats with everyone. He had the gift to make everyone feel that he

regarded them important. Mooson always remembered what was said in the small chats even many years later. He never ceased learning something new and always maintained his curiosity in learning new things from his friends. Apart from writing skills, a most important lesson Mooson's students and colleagues learned from him was his meticulous attention to details and his matter-of-fact attitude as a scientist. Colleagues who attended scientific activities with him witnessed this in his note-making., He would clearly and carefully record and archive the key points made by a speaker and summarize the content without exception. This kind of diligence is rarely seen! When we lost certain materials, we would invariably find an original copy at Mooson's place.

Many of us in the chemical engineering community learned the true meaning of being a scientist from Mooson, whether inspired by his adept ability to draw complicated diagrams with computers in the 1980s—when computers had not yet become a familiar everyday research tool in China—or by his logical way of doing everything, including his hobbies. Mooson's mind never slowed down from meaningful research and outreach activities that made science available to the public. For instance, his bilingual book, *Geometric Mobiles* (Science Press, 2008), promotes public understanding of the connection between artistic inspiration and scientific analysis. And even a few hours before he passed away, he was engaged in the work of promoting public understanding of science. Mooson's commitment to science will be esteemed by the younger generations. His image will never fade from our memories and we will miss him forever!

We would like also to pay tribute to Huichun Gui, Mooson's beloved wife, now 93. Huichun contributed significantly to Mooson's accomplishments, in particular, always encouraging him to carry out world-class research under very difficult conditions and circumstances. Together, Mooson and Huichun were a model couple, supporting each other in a colorful and interesting life, contributing to society jointly and winning the respect of everyone who came to know them.

The world has lost a great man of science. We have lost a revered friend and mentor. Mooson's family has lost a devoted father and loving husband. Mooson is survived by Huichun, three children, and six grandchildren. Our hearts go out to them. We send them our best wishes.

Jinghai Li, James Wei, Norman Li and Liang-Shih Fan

Sunday, May 26, 2013

16:00 – 18:00	Conference Registration (Gaudi Lounge)
16:30 – 17:30	Organizing Committee Meeting
18:00 – 19:00	Welcome Reception (Gaudi Lounge)
19:00 – 20:30	Opening Remarks & Dinner
20:30 – 21:30	Chairperson Meeting

NOTES

- Audiotaping, videotaping and photography of presentations are strictly prohibited.
- Please do not smoke at any conference functions.
- Turn your cellular telephones to vibrate or off during technical sessions.
- Plenary sessions will be in Sorbonne 2.
- Parallel sessions will be on Sorbonne 2 and Sorbonne 4.
- Poster sessions and coffee breaks will be in the Asamblea.
- Breakfasts, lunches and dinners will be in the Dali or Gaudi restaurants. The banquet dinner on Thursday will be in the Rotonde.
- Be sure to check your contact information on the Participant List in this program and make any corrections to your name/contact information online. A corrected copy will be sent to all participants after the conference.
- Speakers – Please leave at least 5 minutes for questions and discussion. Be available for discussion during meals and social periods

Monday, May 27, 2013

07:00 – 08:30	Breakfast	
	PLENARY SESSION 1 Chair: Hamid Arastoopour, Illinois Institute of Technology	
08:15 – 08:30	Opening announcements Hans Kuipers, Eindhoven University of Technology	
08:30 – 09:30	P-1: Coarse-grained models for momentum, energy and species transport in gas-particle flows Sankaran Sundaresan, Princeton University	
09:30 – 10:00	COFFEE BREAK	
	SESSION 1: Mixing and Segregation	SESSION 2: Chemical Looping
	Chair: Ted Knowlton, PSRI	Chair: Yi Cheng, Tsinghua University
10:00 – 10:30	K-1 Key Note: Solids back-mixing in CFB-furnaces Filip Johnsson, Chalmers University of Technology	K-2 Key Note: Operation of a coupled fluidized bed system for chemical looping combustion of solid fuels with a synthetic cu-based oxygen carrier Ernst-Ulrich Hartge, Hamburg University of Technology
10:30 – 10:45	1-1: Three dimensional computational modeling of particulate solids segregation and elutriation in a commercial scale fluidized bed classifier Kamal Adham, Hatch Ltd.	2-1: CO₂ capture by CaO in a sound assisted fluidized bed at Ca-looping conditions Jose Manuel Valverde, University of Seville
10:45 – 11:00	1-2: CFD simulation of binary fluidized mixtures: Effects of restitution coefficient and spatial discretization methods Carla Tagliaferri, University College London	2-2: Hydrogen generation from coal using novel chemical looping process with CuO and CaO as solid carrier Qingjie Guo, Qingdao University of Science and Technology

11:00 – 11:15	<p>1-3: Hydrodynamic characterization of "gulf stream" circulation in a pilot scale fluidized bed combustor Roberto Solimene, Consiglio Nazionale delle Ricerche/Istituto di Ricerche sulla Combustione</p>	<p>2-3: Simulating chemical looping combustion of solid fuels with a synthetic Cu-based oxygen carrier Joachim Werther, Hamburg University of Technology</p>
11:15 – 11:30	<p>1-4: Theoretical and numerical issues concerning DQMOM when simulating polydisperse fluidized powders Luca Mazzei, University College London</p>	<p>2-4: A novel reactor concept for hydrogen production with CO₂ capture: Membrane assisted chemical looping reforming José Antonio Medrano Jimenez, Eindhoven University of Technology</p>
11:30 – 11:45	<p>1-5: Estimation of the circulation time in a large-scale fluidized bed using DBM simulation data Javier Sánchez-Prieto, Universidad Carlos III de Madrid</p>	<p>2-5: Bed Sherwood Number and Chemical Kinetic Coefficient in a Fuel Reactor of Chemical Looping Combustion by Eulerian CFD Modeling Srujal Shah, Lappeenranta University of Technology</p>
11:45 – 12:00	<p>1-6: Segregation patterns in gas-fluidized beds Mark Gilbertson, University of Bristol</p>	<p>2-6: Fluidized bed calcium looping cycles for CO₂ capture: A comparison between dolomite and limestone Fabrizio Scala, Istituto di Ricerche sulla Combustione - CNR</p>
12:00 – 12:15	<p>1-7: Particle mixing and segregation in gas-solid fluidized beds containing polydisperse mixtures Olasaju Olaofe, Eindhoven University of Technology</p>	<p>2-7: Reactivating the CO₂ capture capacity of exhausted Ca-based sorbent particles for fluidized bed calcium looping application (double looping) Fabio Montagnaro, University of Naples</p>
12:15 – 12:30	<p>1-8: Experimental verification of the particle segregation model predictions for fluidized biomass/inert mixtures Alberto Di Renzo, University of Calabria</p>	

12:30 – 14:00	LUNCH & FREE TIME	
	SESSION 3: Micro-Scale Modeling	SESSION 4: Liquid Injection
	<u>Chair:</u> Raffaella Ocone, Heriot-Watt University	<u>Chairs</u> Abdelghafour Zaabout, SINTEF
14:00 – 14:30	K3 Keynote: Clustering instabilities in gas-solid systems: Role of dissipative collisions vs. viscous losses Peter Mitrano, Colorado School of Mines	K4 Keynote: Liquid injection into fluidized beds Ray A. Cocco, Particulate Solid Research, Inc.
14:30 – 14:45	3-1: Drag force model for DEM-CFD simulation of binary or polydisperse bubbling fluidized beds Alberto Di Renzo, University of Calabria	4-1: The effects of liquid properties and bed hydrodynamics on the distribution of liquid on solid fluidized particles in a cold-model fluidized bed Maryam Mohagheghi, ICFAR/Western University
14:45 – 15:00	3-2: Coupled LBM-DEM simulations of gas fluidized beds Christoph Müller, ETH Zürich	4-2: Bogging detection in the fluidized bed using planar capacitance sensors Majid Hamidi, ICFAR/Western University
15:00 – 15:15	3-3: DNS of the convective heat transfer in a fluidized bed with non-spherical particle Elias A.J.F.Peters, Eindhoven University of Technology	4-3: Agglomerate behavior in a recirculating fluidized bed with sheds: Effect of agglomerate properties Francisco Sanchez, ICFAR/Western University
15:15 – 15:30	3-4: Study on relationship between powder flow characteristics and lateral force acting on two contacting particles Azri Alias, Okayama University of Science	4-4: Evaluation of agglomerate stability in an industrial scale fluidized bed using conductivity method Nicholas Prociw, ICFAR/Western University
15:30 – 15:45	3-5: Effect of electrostatic forces on the axial and radial diffusivity of solid particles Reza Zarghami, University of Tehran	4-5: Review of methods to measure the contact between injection liquids and fluidized solids Francisco Sanchez, ICFAR/Western University
15:45 – 16:00	3-6: Use of computational modeling for FCC reactor cyclone erosion reduction at the Marathon Petroleum Catlettsburg Refinery Scott Thibault, CPF D Software LLC	4-6: Development of an experimental cold model for the fluid coking process Carolina Morales, ICFAR/Western University

16:00 – 16:15	3-7: Verification of sub-grid drag modifications for dense gas-particle flows in bubbling fluidized beds Simon Schneiderbauer, Johannes Kepler University	4-7: Simultaneous particle agglomeration and attrition in a fluidized bed reactor Tarek Jamaledine, ICFAR/Western University
16:15 – 16:45	COFFEE BREAK	
16:45 – 19:00	INDIVIDUAL MEETING & DISCUSSION	
19:00 – 21:00	DINNER	
21:00 – 23:00	POSTER SESSION 1 & SOCIAL HOUR (ORAL SESSION 1, 2, 3 & 4 PAPERS)	
PM 1	Solids back-mixing in CFB-furnaces Filip Johnsson, Chalmers University of Technology	
PM 3	Three dimensional computational modelling of particulate solids segregation and elutriation in a commercial scale fluidized bed classifier Kamal Adham, Hatch Ltd	
PM 5	CFD simulation of binary fluidized mixtures: Effects of restitution coefficient and spatial discretization methods Carla Tagliaferri, University College London	
PM 7	Hydrodynamic characterization of "gulf stream" circulation in a pilot scale fluidized bed combustor Roberto Solimene, Consiglio Nazionale delle Ricerche/Istituto di Ricerche sulla Combustione	
PM 9	Theoretical and numerical issues concerning DQMOM when simulating polydisperse fluidized powders Luca Mazzei, University College London	
PM 11	Estimation of the circulation time in a large-scale fluidized bed using DBM simulation data Javier Sánchez-Prieto, Universidad Carlos III de Madrid	
PM 13	Segregation patterns in gas-fluidised beds Mark Gilbertson, University of Bristol	
PM 15	Particle mixing and segregation in gas-solid fluidized beds containing polydisperse mixtures Olasaju Olaofe, Eindhoven University of Technology	
PM 17	Experimental verification of the particle segregation model predictions for fluidized biomass/inert mixtures Alberto Di Renzo, University of Calabria	
PM 19 (poster only)	A novel technology to segregate binary mixtures of different density in a conical spouted bed Maria J. San Jose, University of the Basque Country	
PM 21 (poster only)	Modelling the transition to the fluidized state of two-solid beds: Mixtures of particles of irregular shape Brunello Formisani, Università della Calabria	

PM 23 (poster only)	Takeover velocity in a gas-solid fluidized bed with binary solids Dong Hyun Lee, Sungkyunkwan University
PM 25 (poster only)	A new approach to analyse the influence of biomass devolatilisation on the segregation in a bubbling fluidised bed for gasification Benjamin Cluet, LEMTA
PM 27	Operation of a coupled fluidized bed system for chemical looping combustion of solid fuels with a synthetic Cu-based oxygen carrier Joachim Werther, Hamburg University of Technology
PM 29	CO₂ capture by CaO in a sound assisted fluidized bed at Ca-looping conditions Jose Manuel Valverde, University of Seville
PM 31	Hydrogen generation from coal using novel chemical looping process with CuO and CaO as solid carrier Qingjie Guo, Qingdao University of science and technology
PM 33	Bed Sherwood Number and Chemical Kinetic Coefficient in a Fuel Reactor of Chemical Looping Combustion by Eulerian CFD Modeling Srujal Shah, Lappeenranta University of Technology
PM 35	Fluidized bed calcium looping cycles for CO₂ capture: A comparison between dolomite and limestone Fabrizio Scala, Istituto di Ricerche sulla Combustione - CNR
PM 37	Reactivating the CO₂ capture capacity of exhausted Ca-based sorbent particles for fluidized bed calcium looping application (double looping) Fabio Montagnaro, University of Naples
PM 39	Simulating chemical looping combustion of solid fuels with a synthetic Cu-based oxygen carrier Ernst-Ulrich Hartge, Hamburg University of Technology
PM 41 (poster only)	A novel configuration of the fuel reactor for chemical-looping combustion with oxygen uncoupling (CLOU) of solid fuels Antonio Coppola, Università degli Studi di Napoli Federico II
PM 43	Clustering instabilities in gas-solid systems: Role of dissipative collisions vs. viscous losses Peter Mitrano, Colorado School of Mines
PM 45	Coupled LBM-DEM simulations of gas fluidised beds Christoph Müller, ETH Zürich
PM 47	DNS of the convective heat transfer in a fluidized bed with non-spherical particle Elias A.J.F.Peters, Eindhoven University of Technology
PM 49	Effect of electrostatic forces on the axial and radial diffusivity of solid particles Reza Zarghami, University of Tehran
PM 51	Drag force model for DEM-CFD simulation of binary or polydisperse bubbling fluidized beds Alberto Di Renzo, University of Calabria
PM 53	Study on relationship between powder flow characteristics and lateral force acting on two contacting particles Azri Alias, Okayama University of Science
PM 55	Use of computational modeling for FCC reactor cyclone erosion reduction at the marathon petroleum catlettsburg refinery Scott Thibault, CPF Software LLC

PM 57 (poster only)	Lagrangian simulation of bubbling dynamics in a lab-scale 2D fluidized bed Antonio Busciglio, Università degli Studi di Palermo
PM 59 (poster only)	Lattice boltzmann simulation of gas-solid fluidized bed containing non-spherical particles Christoph Müller, ETH Zürich
PM 61	Liquid injection into fluidized beds Ray A. Cocco, Particulate Solid Research, Inc.
PM 63	The effects of liquid properties and bed hydrodynamics on the distribution of liquid on solid fluidized particles in a cold-model fluidized bed Maryam Mohagheghi, ICFAR/Western University
PM 65	Bogging detection in the fluidized bed using planar capacitance sensors Majid Hamidi, ICFAR/Western University
PM 67	Agglomerate behavior in a recirculating fluidized bed with sheds: Effect of agglomerate properties Francisco Sanchez, ICFAR/Western University
PM 69	Evaluation of agglomerate stability in an industrial scale fluidized bed using conductivity method Nicholas Prociw, ICFAR/Western University
PM 71	Review of methods to measure the contact between injection liquids and fluidized solids Francisco Sanchez, ICFAR/Western University
PM 73	Development of an experimental cold model for the fluid coking process Carolina Morales, ICFAR/Western University
PM 75	Simultaneous particle agglomeration and attrition in a fluidized bed reactor Tarek Jamaledine, ICFAR/Western University
PM 77	Verification of sub-grid drag modifications for dense gas-particle flows in bubbling fluidized beds Simon Schneiderbauer, Johannes Kepler University

Tuesday, May 28, 2013

07:00 – 08:30	Breakfast	
	PLENARY SESSION 2 Chair: Joachim Werther, Hamburg University of Technology	
08:30 – 09:30	P-2: Fluidization of amorphous granules - Practical challenges, product structures and progress in modeling Prof. Heinrich (TU Hamburg) and Prof. Palzer	
09:30 – 10:00	COFFEE BREAK	
	SESSION 5: Discrete Element Modeling	SESSION 6: Novel Fluidized-Bed Reactors
	Chair: Sankaran Sundaresan, Princeton University	Chair: Mike Wormsbecker, Syncrude
10:00 – 10:30	K5 Keynote: A DEM study of the reduction of volumetric flow in bubbling fluidized bed methanation reactors Mao Ye, Dalian Institute of Chemical Physics	K6A Keynote: Two-zone fluidized bed reactor (TZFBR) as a potential tool for process intensification in catalytic reactions Miguel Menendez, University of Zaragoza
10:30 – 10:45	5-1: Hydrodynamic study of spout fluidized bed with draft plates by experimental and numerical investigations Vinayak Sutkar, Eindhoven University of Technology	6-1: Behavior of magnetofluidized beds as affected by particle size and field orientation Jose Manuel Valverde, University of Seville
10:45 – 11:00	5-2: The Formation and Interaction of Jets: A Magnetic Resonance Imaging Study Christoph Müller, ETH Zürich	6-2: Design of a statistical strategy to the control of a fluidized bed equipped with a rotating distributor Jesús Gómez-Hernández, Carlos III University of Madrid
11:00 – 11:15	5-3: The similarity for CFD-DEM simulation of fluidized bed and its numerical and experimental validation Zhihong Liu, IHI Corporation	6-3: Design criteria for a packed-fluidized bed: Homogeneous fluidization of Geldart's class B solids Vincenzino Vivacqua, University of Calabria
11:15 – 11:30	5-4: Coarse-grid simulations using parcels: an advanced drag model based on filtered CFD-DEM data Stefan Radl, Graz University of Technology	6-4: Effects of diameter, baffles and operating conditions on pressure fluctuations in fluidized beds Allan Issangya, PSRI

11:30 – 11:45	5-5: Euler-Euler and Euler-Lagrangian evaluation of a pseudo-2D gas fluidized bed: An estimation of the wall boundary condition from DEM Fernando Hernández-Jiménez, Carlos III University of Madrid	K6B Keynote: Development of a novel concept of solar receiver/thermal energy storage system based on compartmented dense gas fluidized beds Piero Salatino, Università di Napoli Federico II
1:45 – 12:00	5-6: Space-time distribution analysis of biomass in a gasification dense fluidized bed reactor. Claudia Cadile, IUSTI	
12:00 – 12:15	5-7: Integration of high level CFD process simulation for development of fluidized bed biomass gasification Martin Weng, aixprocess GmbH	6-5: Development and application of an innovative dry bed ash extraction system for fluidized bed combustion boilers Lorenzo Lepore, Magaldi
12:15 – 12:30	5-8: Influence of viscous forces on the particle dynamics and agglomeration in fluidized beds Sergiy Antonyuk, Hamburg University of Technology	6-6: Packed fluidization and nuclear fusion technology D. Mandal, Bhabha Atomic Research Centre
12:30 – 12:45	5-9: Discrete particle modeling of a novel prismatic spouted bed reactor Sergiy Antonyuk, Hamburg University of Technology	
12:45 – 19:00	Lunch & Excursion / Workshop	
19:00 – 19:15	Group photo	
19:15 – 21:00	BANQUET	
21:00 – 23:00	POSTER SESSION 2 & SOCIAL HOUR (ORAL SESSION 5 & 6 PAPERS and FREE POSTER FORUM)	
PM 2	A DEM study of the reduction of volumetric flow in bubbling fluidized bed methanation reactors Yuli Zhang, Southeast University	
PM 4	The similarity for CFD-DEM simulation of fluidized bed and its numerical and experimental validation Zhihong Liu, IHI Corporation	

PM 6	Hydrodynamic study of spout fluidized bed with draft plates by experimental and numerical investigations Vinayak Sutkar, Eindhoven University of Technology
PM 8	Coarse-grid simulations using parcels: An advanced drag model based on filtered CFD-DEM data Stefan Radl, Graz University of Technology
PM 10	Euler-Euler and Euler-Lagrangian evaluation of a pseudo-2D gas fluidized bed: An estimation of the wall boundary condition from DEM Fernando Hernández-Jiménez, Carlos III University of Madrid
PM 12	Space-time distribution analysis of biomass in a gasification dense fluidized bed reactor Claudia Cadile, IUSTI
PM 14	Integration of high level CFD process simulation for development of fluidized bed biomass gasification Martin Weng, aixprocess GmbH
PM 16	Discrete particle modeling of a novel prismatic spouted bed reactor Sergiy Antonyuk, Hamburg University of Technology
PM 18 (poster only)	Numerical studies of the dynamics of gas-fluidized beds comprised of non-spherical particles using the DEM-CFD Christoph Müller, ETH Zürich
PM 20	Influence of viscous forces on the particle dynamics and agglomeration in fluidized beds Sergiy Antonyuk, Hamburg University of Technology
PM 22	The formation and interaction of jets: A magnetic resonance imaging study Christoph Müller, ETH Zürich
PM 24	Development of a novel concept of solar receiver/thermal energy storage system based on compartmented dense gas fluidized beds Piero Salatino, Università di Napoli Federico II
PM 26	Two-zone fluidized bed reactor (TZFBR) as a potential tool for process intensification in catalytic reactions Miguel Menendez, University of Zaragoza
PM 28	Behavior of magnetofluidized beds as affected by particle size and field orientation Jose Manuel Valverde, University of Seville
PM 30	Design of a statistical strategy to the control of a fluidized bed equipped with a rotating distributor Jesús Gómez-Hernández, Carlos III University of Madrid
PM 32	Design criteria for a packed-fluidized bed: Homogeneous fluidization of Geldart's Class B solids Vincenzino Vivacqua, University of Calabria
PM 34	Effects of diameter, baffles and operating conditions on pressure fluctuations in fluidized beds Allan Issangya, PSRI
PM 36	Development and application of an innovative dry bed ash extraction system for fluidized bed combustion boilers Lorenzo Lepore, Magaldi Power S.p.A.

PM 38 (poster only)	Development of a new concept of fluidized bed solar receiver: Experimental and 3D numerical study Benjamin Boissière, UMR 5503, Laboratoire de Génie Chimique
PM 40 (poster only)	Dual fluidized bed steam gasification of coal and pyrolyzed coal Stefan Kern, Vienna University of Technology

Wednesday, May 29, 2013

07:00 – 08:30	Breakfast	
	PLENARY SESSION 3 Chair: TBA	
08:30 – 09:30	P-3: Integrating Plasma Physics & Chemistry with Multiphase Flows in Fluidization Engineering Prof. Yi Cheng, Tsinghua University	
09:30 – 10:00	COFFEE BREAK	
	SESSION 7: Large-Scale Simulation and Modeling 1	SESSION 8: Measurement and Instrumentation 1
	Chair: Hamid Arastoopour, IIT	Chair: Daniel Lepek, The Cooper Union
10:00 – 10:30	K7 Keynote: Simulation of a high-density circulating fluidized bed riser with EMMS-based two-fluid model Junwu Wang, Chinese Academy of Sciences	K8 Keynote: Pressure signals in a gas-solid fluidized bed with thermally induced interparticle forces Jamal Chaouki, Ecole Polytechnique de Montreal
10:30 – 10:45	7-1: Characterization of the bubble behavior in vibrated fluidized beds by means of two-fluid CFD simulations coupled with accelerometry data Eduardo Cano-Pleite, Carlos III University of Madrid	8-1: Object motion in the freeboard of a bubbling fluidized bed Luis Miguel Garcia-Gutierrez, Carlos III University of Madrid
10:45 – 11:00	7-2: Theoretical investigation of the behavior of cohesive homogeneous gas-fluidized beds Oyebanjo Oke, University College London	8-2: Recurrence quantification analysis: A simple method to characterization of various structures in gas-solid fluidized beds Reza Zarghami, University of Tehran
11:00 – 11:15	7-3: Simulation of gas-solid turbulent fluidized bed hydrodynamic Salma Benzarti, National Engineering School of Monastir	8-3: Forces on horizontal tubes of non-circular cross-section in fluidized beds Yusumi Nagahashi, Kochi National College of Technology
11:15 – 11:30	7-4: Numerical study of gas-solid fluidized beds: Analysis of pressure fluctuations for detection of disturbed fluidization Philipp Wiedemann, Brandenburg University of Technology Cottbus	8-4: Attractor comparison of vibration signal to characterize of hydrodynamics of fluidized beds Reza Zarghami, University of Tehran

11:30 – 11:45	7-5: A structure-dependent multi-fluid model for heterogeneous gas-solid flows Wei Wang, Chinese Academy of Sciences	8-5: Linking of the pressure oscillation in a pseudo two-dimensional bed with the spatiotemporal distribution of particles Fernando Hernández-Jiménez, Carlos III University of Madrid
11:45 – 12:00	7-6: An assessment of the ability of the TFM approach to predict gas mixing in a pseudo-2D bubbling fluidized bed Abdelghafour Zaabout, Sintef Materials and Chemistry / TUE Eindhoven	8-6: Numerical analysis of the dynamics in gas-solid fluidized beds and experimental validation using X-ray tomography Vikrant Vikrant, Eindhoven University of Technology
12:00 – 12:15	7-7: Numerical and experimental study of the agglomeration in a lab scale fluidized bed Manuel Heine, Hamburg University of Technology	8-7: Investigating flow structures of the bubbling-, turbulent- and fast-fluidization regime using fast X-ray tomography Jean Saayman, University of Pretoria
12:15 – 12:30		8-8: Development of a fluidized bed TGA Jamal Chaouki, Polytechnique Montreal

12:30 – 14:00	LUNCH & FREE TIME	
	SESSION 9: Large-Scale Simulation and Modeling 2	SESSION 10: Measurement and Instrumentation 2 - Honouring John Yates
	Chair: Martin van Sint Annaland, Eindhoven University of Technology	Chairs: Ray Cocco, PSRI & Paola Lettieri, UCL
14:00 – 14:30	K9 Keynote: 3D numerical simulation of circulating fluidized bed: Comparison between theoretical results and experimental measurements of hydrodynamic Renaud Ansart, LGC-INPT	K10 Keynote: Non-intrusive online detection of ferromagnetic particles for measurement of bed density and residence time distribution in circulating fluidized bed systems Diana Carolina Guío Pérez, Vienna University of Technology
14:30 – 14:45	9-1: Scale-up of bubbling fluidized beds using CFD simulations Hamid Arastoopour, IIT	10-1: Magnetic resonance studies of deadzones in gas-solid fluidized beds Daniel Holland, University of Cambridge
14:45 – 15:00	9-2: Time-averaged simulation of the furnace of a commercial CFB boiler Juho Peltola, VTT Technical Research Centre of Finland	10-2: Development of a high temperature endoscopic-laser PIV/DIA technique for the study of the hydrodynamics of gas-solid fluidized beds Ildfonso Campos Velarde, Eindhoven University of Technology
15:00 – 15:15	9-3: Detailed macroscopic flowsheet simulation of fluidized bed granulation process based on microscale models Sergiy Antonyuk, Hamburg University of Technology	10-3: Characterizing electrostatic charges in high-pressure gas-solid fluidized beds: Experimental design and preliminary results Fawzi Salama, University of Ottawa
15:15 – 15:30	9-4: Development of a modeling tool representing biomass gasification in a dual fluidised bed unit Halima Noubli, CEA	10-4: Scale-up of fluidized bed reactors with vertical internals: a new approach accounting for chemistry and hydrodynamics Simon Maurer, Paul Scherrer Institut
15:30 – 15:45	9-5: An analysis method for fluidized bed flow behavior using electric circuit analogy Masanori Ishizuka, The University of Tokyo	10-5: Micro fluidized bed reaction analysis and its applications Xi Zeng, Chinese Academy of Sciences
16:00 – 19:30	INDIVIDUAL MEETING & DISCUSSION	

19:30 – 21:00	DINNER
21:00 – 23:00	POSTER SESSION 2 & SOCIAL HOUR (ORAL SESSION 7, 8, 9 & 10 PAPERS)
PM 79 (poster only)	An EMMS-based two-fluid model for heterogeneous gas-solid riser flows: Type-A EMMS model vs Type-B EMMS model Junwu Wang, Chinese Academy of Sciences
PM 81	Characterization of the bubble behavior in vibrated fluidized beds by means of two-fluid CFD simulations coupled with accelerometry data Eduardo Cano-Pleite, Carlos III University of Madrid
PM 83	Theoretical investigation of the behavior of cohesive homogeneous gas-fluidized beds Oyebanjo Oke, University College London
PM 85	Simulation of gas-solid turbulent fluidized bed hydrodynamic Salma Benzarti, National Engineering School of Monastir
PM 87	Numerical study of gas-solid fluidized beds: Analysis of pressure fluctuations for detection of disturbed fluidization Philipp Wiedemann, Brandenburg University of Technology Cottbus
PM 89	A structure-dependent multi-fluid model for heterogeneous gas-solid flows Wei Wang, Chinese Academy of Sciences
PM 91	An assessment of the ability of the TFM approach to predict gas mixing in a pseudo-2D bubbling fluidized bed Abdelghafour Zaabout, Sintef Materials and Chemistry / TUE Eindhoven
PM 93	Numerical and experimental study of the agglomeration in a lab scale fluidized bed Manuel Heine, Hamburg University of Technology
PM 95 (poster only)	Study of flow behavior in bubbling fluidized bed biomass gasification reactor with CFD simulation Rajan Kumar Thapa, Telemark University College
PM 97 (poster only)	Two-fluid (Euler-Euler) numerical simulation of wall-to-bed heat transfer coefficients in a vertically vibrated gas-fluidized bed Antonio Acosta-Iborra, Carlos III University of Madrid
PM 99 (poster only)	Numerical investigation of the hydrodynamics of cylindrical fluidized bed Aditya Karnik, CD-adapco
PM 101 (poster only)	Time-averaged modeling of BFBS: Analysis of the terms in the momentum equations Sirpa Kallio, VTT Technical Research Centre of Finland
PM 103 (poster only)	Numerical modeling of gas-solids flow in large scale circulating fluidized bed using subgrid-scale model Srujal Shah, Lappeenranta University of Technology
PM 105 (poster only)	High performance computing (HPC) with neptune_CFD for the fluidization of particle-laden reactive flows Hervé Neau, Université de Toulouse / CNRS

PM 107	Pressure signals in a gas-solid fluidized bed with thermally induced interparticle forces Jaber Shabani, Ecole Polytechnique de Montreal
PM 109	Object motion in the freeboard of a bubbling fluidized bed Luis Miguel Garcia-Gutierrez, Carlos III University of Madrid
PM 111	Recurrence quantification analysis: A simple method to characterization of various structures in gas-solid fluidized beds Reza Zarghami, University of Tehran
PM 113	Forces on horizontal tubes of non-circular cross-section in fluidized beds Yusumi Nagahashi, Kochi National College of Technology
PM 115	Attractor comparison of vibration signal to characterize of hydrodynamics of fluidized beds Reza Zarghami, University of Tehran
PM 117	Numerical analysis of the dynamics in gas-solid fluidized beds and experimental validation using X-ray tomography Vikrant Verma, Eindhoven University of Technology
PM 119	Investigating flow structures of the bubbling-, turbulent- and fast fluidization regime using fast X-ray tomography Jean Saayman, University of Pretoria
PM 121	Linking of the pressure oscillation in a pseudo two-dimensional bed with the spatiotemporal distribution of particles Fernando Hernández-Jiménez, Carlos III University of Madrid
PM 123	Development of a fluidized bed TGA Jamal Chaouki, Polytechnique Montreal
PM 125 (poster only)	New generation X-ray imaging for multiphase systems Paola Lettieri, University College London
PM 127 (poster only)	Mechanical impact power erosion evaluation of fluidized bed reactor: Oil shale particle case Bouhafid Abdelmounaim, Université Cadi Ayyad
PM 129 (poster only)	Comparison of four different methods for measuring the solids circulation rate in circulating fluidized beds Florian Dietrich, Vienna University of Technology
PM 131 (poster only)	Analysis of the particle movement in dense granular flow Stefan Heinrich, Hamburg University of Technology
PM 133 (poster only)	Pressure drop correlation for the design of open-sided draft tube conical spouted beds Gartzen Lopez, University of the Basque Country
PM 135 (poster only)	Effect of irregular particles immersed in a bed of sand on the fluidization characteristics of the bed inventory Jamal Chaouki, Ecole Polytechnique de Montreal
PM 137 (poster only)	Identification of bed zones and flow regimes in single and multiple spout-operated beds by digital image processing and pressure probes Simon Schneiderbauer, Johannes Kepler University
PM 139	3D numerical simulation of circulating fluidized bed: Comparison between theoretical results and experimental measurements of hydrodynamic Renaud Ansart, LGC-INPT

PM 141 (poster only)	Scale-up of the bubbling fluidized beds using CFD simulations Hamid Arastoopour, IIT
PM 143	Time-averaged simulation of the furnace of a commercial CFB boiler Juho Peltola, VTT Technical Research Centre of Finland
PM 145	Detailed macroscopic flowsheet simulation of fluidized bed granulation process based on microscale models Sergiy Antonyuk, Hamburg University of Technology
PM 147	Development of a modeling tool representing biomass gasification in a dual fluidised bed unit Halima Noubli, CEA
PM 149	An analysis method for fluidized bed flow behavior using electric circuit analogy Masanori Ishizuka, The University of Tokyo
PM 151	Non-intrusive online detection of ferromagnetic particles for measurement of bed density and residence time distribution in circulating fluidized bed systems Diana Carolina Guío Pérez, Vienna University of Technology
PM 153	Magnetic resonance studies of deadzones in gas-solid fluidised beds Daniel Holland, University of Cambridge
PM 155	Development of a high temperature endoscopic-laser PIV/DIA technique for the study of the hydrodynamics of gas-solid fluidized beds Ildefonso Campos Velarde, Eindhoven University of Technology
PM 157	Scale-up of fluidized bed reactors with vertical internals: A new approach accounting for chemistry and hydrodynamics Simon Maurer, Paul Scherrer Institut
PM 159	Characterizing electrostatic charges in high-pressure gas-solid fluidized beds: Experimental design and preliminary results Fawzi Salama, University of Ottawa-Chemical & Biological Engineering Department
PM 161	Micro fluidized bed reaction analysis and its applications Xi Zeng, Chinese Academy of Sciences

Thursday, May 30, 2013

07:00 – 08:30	Breakfast	
	PLENARY SESSION 4 Chair: John Grace, University of British Columbia	
08:30 – 09:30	P-4: Fluidization of fine powders: Cohesive versus dynamic aggregation Jose Manuel Valverde (Universidad de Sevilla)	
09:30 – 10:00	COFFEE BREAK	
	SESSION 11: Nano and Fine Particles	SESSION 12: Circulating Beds and Fast Fluidization
	Chair: Jamal Chaouki, Ecole Polytechnique De Montreal	Chair: Ernst-Ulrich Hartge, Hamburg University of Technology
10:00 – 10:30	K11 Keynote: Estimating the size of polar and apolar nanoparticle agglomerates in a fluidized bed Lilian de Martín, Delft University of Technology	K12 Keynote: Non-Hg catalyst and fluidized-bed process: from lab-scale to industrial pilot trial for Chinese green PVC industry Guohua Luo, Tsinghua University
10:30 – 10:45	11-1: Fluidization assistance of nanopowders by an alternating nonuniform electric field Jose Manuel Valverde, University of Seville	12-1: A new method to intensify heat transfer capacity of an FCC catalyst cooler: Experimental validation Yongmin Zhang, China University of Petroleum
10:45 – 11:00	11-2: Fluidization of nanoparticles: The effect of surface characteristics J. Ruud van Ommen, Delft University of Technology	12-2: Particle clusters properties in Gas-Solid Downer Units Angel Lanza, University of Western Ontario
11:00 – 11:15	11-3: Microscopic characterization of mechanically assisted fluidized beds David Valdesueiro, Delft University of Technology	12-3: The impact of a flue gas recirculation on temperature distribution and solids concentration inside a large-scale supercritical CFB boiler Artur Blaszcuk, Czestochowa University of Technology
11:15 – 11:30	11-4: Experimental measurements and links between gas-fluidization and flow properties of fine lactose powders Clive Davies, Massey University	12-4: Comparison of the gas and solids phase RTDS in a CFB downer reactor Martin R.J. Huard, ICFAR, Western University

11:30 – 11:45	11-5: Agitated fluidization of nanopowders using mechanical stirring Daniel Lepek, The Cooper Union	12-5: Flow development in the inlet section of a riser Maria N. Pantzali, Ghent University
11:45 – 12:00	11-6: Fluidization and mixing of nanoparticle agglomerates assisted via magnetic impaction James Scicolone Rutgers University	12-6: Analysis of length scales of solids volume fraction variations in a circulating fluidized bed of Geldart group B particles Debanga Mondal, Åbo Akademi University

12:30 – 14:30	LUNCH & FREE TIME	
	SESSION 13: Heat and Mass Transfer	SESSION 14: Reactor Performance
	Chair: Lilian de Martin, Delft University of Technology	Chair: Poupak Mehrani, University of Ottawa
14:30 – 15:00	K13 Keynote: Experimental studies of phase change materials in a bubbling fluidized bed Maria Izquierdo, Carlos III University of Madrid	K14 Keynote: Gas bypass and solids circulation rate of an i-CFB reactor with coarse particles Xiaotao Tony Bi, University of British Columbia
15:00 – 15:15	13-1: Analysis of lateral fuel mixing in a fluid dynamically down-scaled bubbling fluidized bed Erik Sette, Chalmers University of Technology	14-1: Carbonization characteristics of biomass/coal blend for bio-coke Myung Won Seo, Korea Institute of Energy Research
15:15 – 15:30	13-2: CO₂ capture on fine activated carbon under sound assisted fluidization conditions Federica Raganati, P.le V. Tecchio 80	14-2: The gas flow in the loop seals of a dual circulating fluidized bed: Splitting of the fluidizing agent and gas leakage through the loop seals Karl Mayer, Vienna University of Technology
15:30 – 15:45	13-3: Simulation of fuel mixing in fluidized beds using a combined tracking technique David Pallarès, Chalmers University of Technology	14-3: A kinetic study of methanol to OLEFINS (MTO) process in fluidized bed reactor Lei Ying, Zhejiang University

15:45 – 16:00	13-4: Development of a novel non-invasive IR technique for concentration measurements in gas-solid fluidized beds: Application to bubble-to-emulsion phase mass transfer measurements Nhi Dang, Eindhoven University of Technology	14-4: Comparison of impact and torque forces on erosion of oil shale particle processed in fluidized bed reactor Bouhafid Abdelmounaim, Semlalia Université Cadi Ayyad Marrakech Morocco
16:00 – 16:15	3-5: Multi-scale modeling of dense particle-laden flow including heat transfer Amit Patil, TU Eindhoven	14-5: Exploring the interplay between attrition and separation Ben Freireich, The Dow Chemical Company
16:30 – 17:00	ORGANIZING COMMITTEE & ECI MEETING	
17:00 – 19:00	POSTER SESSION 4 & SOCIAL HOUR (Oral Session 11, 12, 13 & 14 Papers)	
PM 42	Estimating the size of polar and apolar nanoparticle agglomerates in a fluidized bed Lilian de Martín, Delft University of Technology	
PM 44	Fluidization assistance of nanopowders by an alternating nonuniform electric field Jose Manuel Valverde, University of Seville	
PM 46	Fluidization of nanoparticles: The effect of surface characteristics J. Ruud van Ommen, Delft University of Technology	
PM 48	Microscopic characterization of mechanically assisted fluidized beds David Valdesueiro, Delft University of Technology	
PM 50	Experimental measurements and links between gas-fluidization and flow properties of fine lactose powders Clive Davies, Massey University	
PM 52	Agitated fluidization of nanopowders using mechanical stirring Daniel Lepek, The Cooper Union	
PM 54 (poster only)	Nanostructured materials for CO₂ capturing: A comparison of two approaches Jose Manuel Valverde, University of Seville	
PM 56 (poster only)	Transition of fluidization mode for fine cohesive powders under mechanical vibrating conditions Yoshihide Mawatari, Kyushu Institute of Technology	
PM 58	Non-Hg catalyst and fluidized-bed process: from lab-scale to industrial pilot trial for Chinese green PVC industry Guohua Luo, Tsinghua University	
PM 60	A new method to intensify heat transfer capacity of an FCC catalyst cooler: Experimental validation Yongmin Zhang, China University of Petroleum	

PM 62	The impact of a flue gas recirculation on temperature distribution and solids concentration inside a large-scale supercritical CFB boiler Artur Blaszczyk, Czestochowa University of Technology
PM 64	Flow development in the inlet section of a riser Maria N. Pantzali, Ghent University
PM 66	Analysis of length scales of solids volume fraction variations in a circulating fluidized bed of Geldart B particles Debanga Mondal, Åbo Akademi University
PM 68	Comparison of the gas and solids phase RTDS in a CFB downer reactor Martin R.J. Huard, ICFAR/Western University
PM 70	Particle clusters properties in gas–solid downer units Angel Lanza, University of Western Ontario
PM 72 (poster only)	The equalization function of a standpipe Ted M. Knowlton, PSRI
PM 74 (poster only)	Vertical solids distribution under air/carbon dioxide fluidization conditions in a circulating fluidized bed Wojciech Nowak, Czestochowa University of Technology
PM 76 (poster only)	CO - fluidization of fine particles and straw pellets at room and elevated temperatures Dmitry Viryasov, Tambov State Technical University
PM 78 (poster only)	Two-phase flow structure in a cold model gas-solid airlift loop reactor Mengxi Liu, China University of Petroleum
PM 80	Analysis of lateral fuel mixing in a fluid dynamically down-scaled bubbling fluidized bed Erik Sette, Chalmers University of Technology
PM 82	CO₂ capture on fine activated carbon under sound assisted fluidization conditions Federica Raganati, P.le V. Tecchio 80
PM 84	Simulation of fuel mixing in fluidized beds using a combined tracking technique David Pallarès, Chalmers University of Technology
PM 86	Experimental studies of phase change materials in a bubbling fluidized bed María A. Izquierdo-Barrientos, Carlos III University of Madrid
PM 88	Development of a novel non-invasive IR technique for concentration measurements in gas-solid fluidized beds: Application to bubble-to-emulsion phase mass transfer measurements Nhi Dang, Eindhoven University of Technology
PM 90	Multi-scale modeling of dense particle-laden flow including heat transfer Amit Patil, TU Eindhoven
PM 92 (poster only)	Convective heat transfer coefficient in a bubbling fluidized bed with PCM María A. Izquierdo-Barrientos, Carlos III University of Madrid

PM 94 (poster only)	Effects of temperature and sorption on the hydrodynamics of gas-phase polymerization reactors Mariët Slagter, Eindhoven University of Technology
PM 96 (poster only)	The jiggled bed reactor, a new fluidized bed reactor for catalyst testing Franco Berruti, ICFAR/Western University
PM 98	Gas bypass and solids circulation rate of an I-CFB reactor with coarse particles Xiaotao Tony Bi, University of British Columbia
PM 100	Carbonization characteristics of biomass/coal blend for bio-coke Myung Won Seo, Korea Institute of Energy Research
PM 102	The gas flow in the loop seals of a dual circulating fluidized bed: Splitting of the fluidizing agent and gas leakage through the loop seals Karl Mayer, Vienna University of Technology
PM 104	A kinetic study of methanol to OLEFINS (MTO) process in fluidized bed reactor Lei Ying, Zhejiang University
PM 106	Comparison of impact and torque forces on erosion of oil shale particle processed in fluidized bed reactor Bouhafid Abdelmounaim, Semlalia Université Cadi Ayyad Marrakech Morocco
PM 108	Exploring the interplay between attrition and separation Ben Freireich, The Dow Chemical Company
PM 110 (poster only)	Steam gasification of waste plastics in a conical spouted bed reactor Gartzen Lopez, University of the Basque Country
PM 112 (poster only)	Effects of particle properties, temperature and relative humidity on electrostatics in gas-solid fluidized beds Xiaotao Bi, University of British Columbia
PM 114	Technical aspects and thermodynamic evaluation of a two stage fluid bed-plasma process for solid waste gasification Massimiliano Materazzi, University College of London
PM 116 (poster only)	Effect of vortex stabilizer and solids loading on erosion in 2nd stage cyclones S. B. Reddy Karri, PSRI
PM 118 (poster only)	Performance analysis of semifluidized bed biofilm reactors with liquid phase oxygen(LPO) utilisation C.M. Narayanan, National Institute of Technology
PM 120 (poster only)	Optimization of a pilot scale fluidized bed reactor through application of a novel internal Suren Sookai, Sasol Technology
PM 122 (poster only)	Control of the reaction zone in bubbling fluidized beds by means of secondary gas injection Timo Hensler, University of Erlangen-Nuremberg
PM 124 (poster only)	Development and large-scale optimization of fluidized-bed steam drying of lignite Joachim Werther, Hamburg University of Technology
PM 126 (poster only)	Technical superiority of fluidized bed over fixed bed for syngas methanation Xi Zeng, Chinese Academy of Sciences

PM 128	Fluidization and mixing of nanoparticle agglomerates assisted via magnetic impaction James Scicolone Rutgers University
19:00 – 19:15	POSTER PRIZE CEREMONY
19:15 – 21:00	FAREWELL PARTY

Friday, May 31, 2013

07:00 – 08:30	Breakfast
10:30 – 13:00	LOCAL ORGANIZING COMMITTEE MEETING & LUNCH

Free Poster Forum

No	Authors	Title
1	Rosario Porrazzo, Graeme White, Raffaella Ocone	Chemical Looping Simulations using Aspen Plus
2	Patrice Perreault, François-Xavier Chiron and Gregory Patience	The "perfect contactor": Micro-fluidized beds as an ideal reactor
3	C.M. Boyce, D.J. Holland, S.A. Scott, J.S. Dennis	Experimental and numerical investigation of a 3D cylindrical fluidized bed using MRI and DEM-CFD
4	X. Lu, D.J. Holland	Analysis of drag in two-fluid simulations of Group A particles in a bubbling fluidized bed
5	Maitraye Sen, Dana Barrasso, Anwasha Chaudhury Rohit Ramachandran	Formulation of a Multi-dimensional hybrid PBM-DEM description of a fluidized bed wet granulation process
6	Meenal Pore, Ong Gim Hoe, Thusara Chandrasekera, Daniel J Holland and John S Dennis, Paola Lettieri and Massimiliano Materazzi	Characterisation of Jets in a 3D Fluidized Bed using Magnetic Resonance Imaging, and X-ray Radiography and Electrical Capacitance Tomography
7	David Valdesueiro, J. Ruud van Ommen, Gabrie M.H. Meesters, and Lilia Ahrné	PowTech: Integrating research training in particle & powder technology to deliver efficient products with high functionality
8	Aristeidis Goulas and J. Ruud van Ommen	Atomic layer deposition of platinum clusters on fluidized titania nanoparticles at atmospheric pressure
9	A. Busciglio, G. Vella, G. Micale	Mixing dynamics of powders mixtures in 2D fluidized beds
10	C.Cadile, F.Topin, L.Tadrst	Euler-Lagrange/DEM simulation of shallow dense fluidised bed dynamics for wood gasification