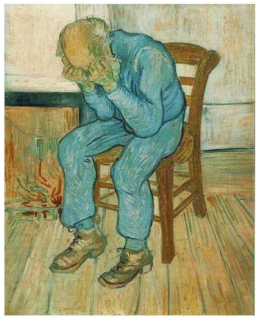
The PTF Newsletter

Letter from the "Chair"



I hope that you are all set for the AIChE annual meeting in Minneapolis, MN, coming up later this month. If you have not done already, please purchase your PTF dinner tickets as soon as possible, since the event has been sold out last two years. As you may know, Bruce Hook has planned an exciting PTF Dinner along with tours of particle technology companies. This dinner is at dinner at the notorious Wabasha Street Caves, and will require going by bus. We have obtained generous support from Computational Particle Fluid Dynamics (CPFD) to make the bus ride available for dinner as well as optional industry tours to AVEKA and Bepex. You can find more details in a separate article by Bruce. Please join us for the dinner and give a round of applause to our winners of awards ranging from PTF Lifetime Achievement to Best Ph.D. You can find these details in this issue including the names and bios of the award winners. During the dinner, we will also honor the poster award winners. Dinner and reception are supported in part by generous support from our longtime supporter, Jenike & Johanson, and a new sponsor, Freeman Technology, UK. We are very pleased to have them providing the much needed support.

As was mentioned in the previous Newsletter, you are all invited to the PTF general business meeting on held Monday, October 30, 2017, 6:00 PM-7:00 PM. In addition, all past PTF chairs and PTF EC members are also invited to attend the PTF Executive Committee (EC) meeting, Sunday, October 29, 2017, 6:00 PM-7:30 PM. Please let me know if you plan to attend the EC meeting or if you have questions. Please also attend the PTF programming meetings for groups A through E. This time, we are trying a revised format so there will be two joint sessions. Joint Areas 3A, 3D, and 3E Meeting will be Tuesday, 10:30 am – 11:50 am in 200H and Joint Areas 3B and 3C Meeting in 200I, both in Minneapolis Convention Center. Please reach out to area chairs and co-chairs ahead of time if you want to volunteer for 2018, and also attend these meetings.

Lastly, please join us for the PTF Awards session that will include three major award lectures. It is scheduled 03:15 PM - 05:15 PM, Wednesday, November 01, 2017, Minneapolis Convention Center - 200H. You can learn from outstanding people in our field, and congratulate these winners.

Please have safe travels and I am looking forward to seeing you in Minneapolis.

Rajesh N. Dave, NJIT

Chair, Particle Technology Forum

The hard work of all the volunteers in the AIChE and the PTF organizations has resulted in an exciting technical program at the Annual Meeting. Once again, we meet to share knowledge and felicitate our colleagues for their outstanding achievements. AIChE is a voluntary organization, and its efficacy is dictated by the engagement of its members in various activities. Similarly, for PTF, I urge our members to step-up, participate and volunteer in various organizational tasks. The PTF newsletter and the website are two tangible deliverables for the PTF. If you are interested in contributing to the content, please contact me or Pat Spicer. Safe travels to Minneapolis!

Shrikant Dhodapkar, Dow Chemical

Editor, PTF Newsletter

Highlights of this issue ...

2017 Particle Technology Forum Awards

PTF Lifetime Achievement Award

Prof. Alan Weimer
University of Colorado

Alan has had distinguished career in developing novel technologies using particle technology. Starting with a PhD in fluidized beds, he continued at Dow Chemical working fluid-particle process development, becoming a key inventor of Dow's carbothermal-reduction technologies for making high value ceramics.

Desiring a greater freedom to explore process development and new product opportunities, Al became a professor at U. Colorado Boulder and has explored the boundaries of fine particle, high temperature and vapor deposition processes ever since. His novel work on solar processes and solar energy led to the founding of an energy research institute (C2B2) and two technology companies.

Al bases his work on fundamental chemical engineering, and an excellent teacher and mentor to many students, especially his own. He has been awarded several faculty teaching and advising awards reflecting his dedication to his students. He has received several awards for his technology development: e.g. Dow's Excellence in Science and Inventor of Year awards, PTF Baron Award, & Process Research Award.

Al has over 185 peer-reviewed, 32 issued US patents, 8 pending He has Long service to the PTF, serving as Session, Area, and PTF chair, as well as chair of other areas such as materials Engineering and Ceramics.

PSRI Lectureship in Fluidization Award

Marc-Olivier Coppens,
University College London

Marc-Olivier Coppens introduced the concepts of "Nature-Inspired Engineering" to the field of fluid-particle systems that has had a tremendous impact about how fluid-beds, catalyst supports, and many other transport-based, process systems are organized and designed.

Marc-Olivier's nature inspiration culminated in his idea for a fractal structure that could be applied as the injector of a fluidized bed. He refined the idea into a method for injecting secondary air into fluidized beds that tremendously improved the overall mixing and stability of the bed. Due to the fractal design, the system was easily scaled, improving our ability to design and build fluidized bed systems. Marc-Olivier discovered that pulsing the gas flow into a fluidized bed allowed him to control the nature of the bubbling and transform a chaotic bubbly flow into a series of well-defined bubble trains.

Marc-Olivier's work has brought him much recognition. His list of awards is quite long. Marc-Olivier is an AIChE Fellow & IChemE Fellow. He has been very active in AIChE, serving on the International Committee, Particle Technology Forum and the Catalysis and Reaction Engineering Division. He is the Editor-in-Chief of Chemical & Engineering Processing: Process Intensification and serves on the editorial board of Powder Technology.

2017 Particle Technology Forum Awards

Shell Thomas Baron Award in Fluid-Particle Systems

Jeffrey F Morris
City College NY

Jeff is internationally known and respected in suspension mechanics and has a broad and deep understanding of the mechanics of fluid-particle systems. His explanations include experimental and theoretical insights. He has published widely and participated in major leadership roles in the field, including programs in fluid mechanics for the AIChE and chairing the Bingham Award Committee for Society of Rheology. Jeff is an acknowledged leader worldwide on fluid-particle systems, widely recognized for his theoretical contributions as well as using numerical simulations to address challenging problems in suspension mechanics. In his own group and collaboration, Jeff has produced results on phenomena in suspension flows and new experimental approaches for these problems.

Jeff's major contributions to the rheology of suspensions include theory-simulations based on single-particle insights as well as modeling with effective medium approaches. He studies the rheology of Brownian and non-Brownian suspensions and studied unusual fluid-particle systems such as interfaces, commonly used for the stabilization of multiphase materials. Jeff's new ideas, including accounting for finite volume fractions and inertial effects, have been tested using numerical simulations and experiments. He reviews the progress in the field and applies the results to more practical situations: suspension flow in thin films and suspension jet flow.

Dow Particle Processing Award

Timothy Healy
Exxon Mobil Corp.

Upon completing his PhD, Timothy M. Healy joined ExxonMobil Research and Engineering as part of the Chemical Engineering Technology section as a specialist in single- and multiphase fluid dynamics and computational fluid dynamics (CFD). In his career to date, Timothy has developed fast, efficient, and accurate computational models for various types of fluidized bed reactors including fluid catalytic cracking risers and regenerators and fluidized bed cokers. These models have been applied and extended successfully to improve existing process performance and aid in the development of novel fluidized bed processes for refining and chemicals applications. In his current role as Fluid Dynamics and CFD Group Head, Timothy serves as the company's subject-matter expert in the areas of fluid dynamics and CFD. He directs all fluid dynamics consulting work done by the group as well as mentoring engineers in fluid dynamics analysis and industrial practice. Timothy has been with ExxonMobil for 16 years. In this time, he's won numerous awards highlighted by two consecutive Innovator of the Year Awards given by the Process Technology Department. Timothy has 4 patents, another pending, 16 external publications and numerous internal reports. Timothy holds a BS in Chemical Engineering from the University of Minnesota and a PhD from The Georgia Institute of Technology.

2017 Particle Technology Forum Awards

SABIC Young Professional Award

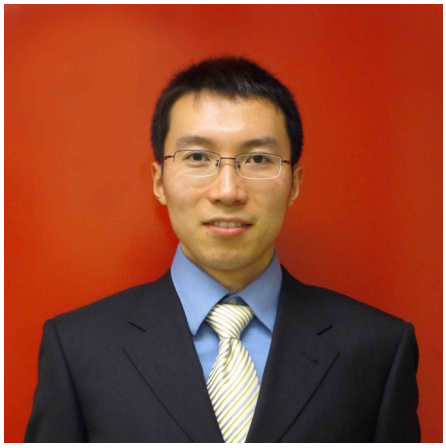
Jia Wei Chew
Nanyang Technological University
Singapore

Jia started working in fluidization as she worked at PSRI as part of her dissertation at University of Colorado (Boulder) with Prof. Christine Hrenya. Her research findings and insights have challenged some "well-established" methods. She published twelve peer-reviewed papers based on her work at PSRI. Her research efforts discerned particle segregation, cluster formation and stability in riser hydrodynamics, providing the most complete data for a large circulating fluidized bed. All providing much needed data and subsequent analysis for the model development and advancement of computational fluid dynamic (CFD) modeling of granular-fluid systems.

Dr. Jia Wei Chei is an Assistant Professor at the School of Chemical and Biomedical Engineering, at the Nanyang Technological University, in Singapore. At the University, she uses her experience towards membrane-based filtration processes and thin film hydrodynamics. She has published over 60 papers. She received the Singapore Youth Award, that is given in recognition of the individual with a 'can-do' attitude towards challenges, and the passion to 'serve by doing' to make a better world for all. Jia dedicates free time to her local community: helping train ex-convicts making furniture and under-privileged mothers to make soap for Singapore hotels.

As a person, Jia is generous, caring, motivated, intelligent and professional. Its a combination of skills that have made her truly noticeable at such a young age.

George Klinzing Best PhD Award



Mo Jiang
MIT

Dr. Jiang has demonstrated great enthusiasm and strong motivation for his PhD work. His PhD work combined fluid dynamics, particle engineering, crystallization dynamics and computation/theory, making it a very strong and comprehensive dissertation. In particular, his idea using dual-impinging jets to decouple nucleation and growth in his micro-crystallizers is highly novel and interesting, leading to some good potential applications in the field of pharmaceutical crystallization where control of crystal size/shape is always problematic. This type of idea can be easily transferred to other particle-engineering areas where production of particles/crystals of uniform size and shape is highly desirable.

Dr. Jiang's PhD should be considered to be outstanding, as his work has resulted in publication of several papers in some prestigious journals, including Mo et al, Crystal Growth & Design, 2014 (2), 851-860; Mo et al., Chemical Engineering and Processing: Process Intensification, 2015, 187-194; Mo et al., Crystal Growth & Design, 2015, 15(5), 2486-2492; Mo et al., Chemical Engineering Science, 2012, 77, 2-9; Mo et al., Industrial & Engineering Chemistry Research, 2014, 14(2), 5325-2336, some of which have attracted >20 citations.

PTF Service Award

Prof. L-S. Fan
Ohio State University

PTF Committee & Programming Meetings At AIChE Annual Meeting—Minneapolis

Meeting	Date/Time	Location
Executive Committee Meeting	Sunday, October 29, 2017 6:00 PM-7:30 PM	Symphony I (Hilton Minneapolis)
General Business Meeting	Monday, October 30, 2017 6:00 PM-7:00 PM	200H (Minneapolis Convention Center)
Joint Areas 3A, 3D, and 3E Meeting	Tuesday, October 31, 2017 10:30 AM-11:50 AM	200H (Minneapolis Convention Center)
Joint Areas 3B and 3C Meeting	Tuesday, October 31, 2017 10:30 AM-11:50 AM	200I (Minneapolis Convention Center)

Nominations are sought for Programming Group co-chairs. Please send your nominations to the respective Group chairs (see page 32). The elections will be held during the programming meetings on Tuesday, Oct 31st.

The Dow Chemical Co.
Sponsor of the
Particle Processing Award

Sponsor of the
Young Professional Award

University of Pittsburgh Alumni
Sponsor of the
George Klinzing Best PhD Award

PTF Membership

To continue receiving the PTF newsletters (3 issues per year) and stay current with particle technology events and news, please make sure to renew/start your membership by either:

- Checking Particle Technology Forum when renewing your AIChE membership annually.
- Become a PTF lifetime member so that you don't have to renew membership every year.

Become a PTF only member

(annual $15, lifetime $150)

If you don't see the PTF membership in your renewal screen, you can choose "Update Membership Options" and add PTF to your order.

You can also contact AIChE customer service at 800-242-4363 (US); +203-702-7660 (Outside the US); or email customerservice@aiche.org for membership questions and help.

PTF Membership Committee

AIChE Annual Meeting - Minneapolis

The World of Particle Technology Shared with Future Engineers and Scientists— AIChE Particle Technology Forum Student Workshop

Presenters

Mayank Kashyap (SABIC), S.B. Reddy Karri (PSRI), Ben Freireich (PSRI)

As part of the mission of AIChE PTF, we have been proudly serving the particle technology community by introducing the field to students, young engineers and scientists, and raising awareness about its importance and relevance to the modern Chemical Process Industry. Continuing the tradition of organizing workshops for students at the *AIChE Annual Student Conferences* over the years, PTF will be bringing the world of particle technology into the lives of future engineers and scientists once again this year in Minneapolis, MN.

The hugely successful workshops provided by PTF in the past few years had witnessed over 500 students and professors in attendance on each occasion. We expect to raise the bar even higher this year with a greater response from participants. We encourage undergraduate and graduate students to participate in the following fun-filled and educational session that will include exciting presentations and live demonstrations from some of the well-renowned researchers in the field of particle technology:

World of Particle Technology

2017 AIChE Annual Student Conference

Saturday, October 28, 2017: 11:45 AM – 12:30 PM

Minneapolis Convention Center, 101 F/G/H

2016 AIChE PTF Student Workshop

Part I: More than 80% of your gasoline, 70% of your polyolefins and a plethora of other products are made using fluidized bed technology. From gasification to drying, fluidized beds and circulating fluidized beds provide the distinct advantage of high heat transfer and solids mobility. These features have resulted in several breakthrough technologies with better temperature control and the ability to move solids from a reduction to an oxidation environment. This workshop will focus on some of these breakthrough technologies.

Part II: Billions of pounds of bulk solids are processed and handled every year by the US process industries, yet most chemical engineers are ill-equipped to deal with the complexities of the engineering science of solids processing/ particle technology. Hence, plants and products suffer with lost production, inability to achieve design production rates, off grade or off specification products, etc. During this session, we will take a look at the fun and exciting (and often counterintuitive!) world of solids processing. Specifically, we will look at some of the more common particle-based technologies examining both the important role they play in society today along with the associated technical challenges.

Demonstration of Particle Technology in Action: If a picture is worth a thousand words, then a video is worth a thousand pictures and a live demonstration is worth a thousand videos. This session will also illustrate some of the awe-

inspiring and unique features in the field of particle technology through hands-on demonstrations on fluidization, hopper design, segregation, etc.

The featured demonstration unit this year will include a mini-circulating fluidized bed (CFB) prototype comprising a riser, standpipe, and cyclone. The cold-flow mini-CFB is capable of fluidizing particles classified as Geldart groups A, B, C and D in various fluidization regimes, such as core-annular, bubbling, turbulent, transport regimes, etc.

Students are invited to stay through the lunch break for additional demonstrations.

Details on the workshop can be found here.

Please email Mayank Kashyap (mkashyap@sabic.com) if you have any questions.

Mayank Kashyap, SABIC

PTF Special Sessions: AIChE Annual Meeting 2017

Session 43 **Solids Handling and Processing in the Chemical Industry: What They Don't Teach You at School**, Sunday, October 29, 2017, 03:30 PM - 06:00 PM

Session 285 **Fluid-Particle Flow and Reaction Systems I - In Honor of Professor L.S. Fan**, Minneapolis Convention Center - 200I, Tuesday, October 31, 2017, 08:00 AM - 10:30 AM

Session 356 **Fluid-Particle Flow and Reaction Systems II - In Honor of Professor L.S. Fan**, Minneapolis Convention Center - 200I, Tuesday, October 31, 2017 12:30 PM – 3:00 PM

Session 486 **Honoring the Lifelong Achievements of Dr. Jerry Johanson**, Minneapolis Convention Center - 200J, Wednesday, November 1st, 2017 08:00 AM-10:30 AM

Session 573 **Special Session: Celebrating Prof. Mori's Career Long Accomplishments**, Minneapolis Convention Center - 200I, Wednesday, November 1st, 2017 12:30 PM – 3:00 PM

Session 620 **PTF Award Lectures:** November 01, 2017, 03:15 PM - 05:45 PM , Minneapolis Convention Center - 200 H

Session 400 **Poster Session:** October 31, 2017, 03:15 PM - 04:45 PM, *Minneapolis Convention Center, - Exhibit Hall B*

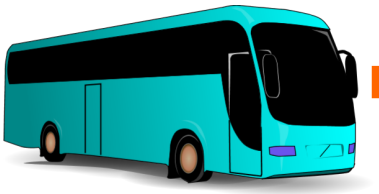
Technical Program For Particle Technology Forum

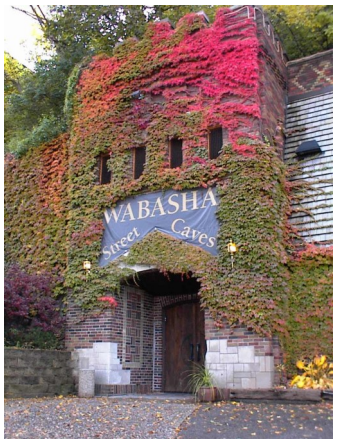
PTF Dinner - Bus Schedule

Date: November 1, 2017 (Wednesday)

Time: 7:20 pm — 10:00 pm

Location: Wabasha Street Caves, 215 Wabasha St S , Saint Paul, MN 55107-1805





The Awards Session talks should end at 5:15 pm. This allows 15 minutes for folks to get to the bus loading area (TBD) and load onto the various buses. Target time for the buses to depart the Minneapolis Convention Center is 5:30 pm. If you choose not to take one of the provided buses, cabs are available at your expense from the MCC or hotels to the Wabasha Street Caves (215 Wabasha St. South, St. Paul, MN)

There will be three buses leaving the convention center that eventually end up at the dinner venue. Each bus holds 50 people. The first two will take participants on tours of either Bepex or AVEKA and the last one will go directly to the Wabasha Street Caves for dinner. Unfortunately, tours of both companies were not possible within the time available. There is room for 50 people on each bus.

Bus 1 (Bepex only): Start loading at 5:15 pm, **Depart 5:30 pm**; Allow 15 min to get to Bepex. Arrive at 5:45 (play safety video on the way)

65 min to de-bus, and take tour. Getting back on bus at 6:50 pm.
5 min to load bus, 20 min to Wabasha Street Caves for dinner, arrive by 7:30 pm.

Bus 2 (AVEKA Only): Start loading at 5:15 pm, **Depart 5:30 pm**, Allow 30 min to get to AVEKA. Arrive at 6:00 (play safety video on the way)

65 min to de-bus, and take tour. Getting back on bus at 7:05 pm.
5 min to load bus, 15 min to Wabasha Street Caves for dinner, arrive by 7:25 pm.

Bus 3 (No tour-straight to dinner): Load at 6:30 pm, **Depart 6:45 pm**. Allow 30 min to get to Wabasha Street Caves for dinner, arrive by 7:20 pm.

Bus ride is provided courtesy of our dinner sponsor—CPFD.

Drinks and hors d'ouvres will be served 7:20-7:55 pm. **Seating will be at 7:55 pm**. Dinner will start at 8 pm with salad service. There will be steak and fish served, with a vegetarian option available. Award presentations between the main course and dessert.

All three buses will be available for taking attendees back to the Minneapolis Convention Center after the dinner is over. They will depart ~10 pm and arrive at MCC ~10:30.

If you have questions, contact Bruce Hook (979-235-0554 cell) or Ben Freireich (847-471-5254 cell)

Particle Technology Forum Dinner

Wabasha Street Caves

The Wabasha Street Caves is the most unique facility for private events in the Twin Cities. Located along the Mississippi River in downtown St. Paul, The Wabasha Street Caves offers a fascinating and mysterious setting for your next gathering event. The Caves 12,000 square feet of space is tastefully finished with brick walls, stucco ceilings, carpeted dining space and beautiful tile floors in the cocktail area. There is a theatrical stage, large hardwood dance floor, plenty of dining and meeting space, and a handsome 60 foot bar. Since the Caves are underground, geothermal energy is used to help limit the fuel needed for heating and we can conserve energy without the use of air conditioning.

Location: 215 Wabasha St S , Saint Paul, MN 55107-1805

Sponsors of the PTF Dinner & Buses

JENIKE & JOHANSON
Bulk Solids: Science/Engineering/Design

cfd COMPUTATIONAL PARTICLE FLUID DYNAMICS

freemantechnology

TOUR INFORMATION

1 NOVEMBER 2017 – 5:00 PM
BEPEX & AVEKA

5:00 PM — BOARD BUS AT AICHE TO TOUR BEPEX & AVEKA

7:30 PM — ARRIVE AT WABASHA STREET CAVES FOR BANQUET

10:00 PM — BOARD BUS FOR RIDE BACK TO AICHE

AVEKA TOUR HIGHLIGHTS

- SPECIALTY GRINDING
- MAIC (MAGNETICALLY ASSISTED IMPACT COATING)
- PRILLING
- SPRAY DRYING

BEPEX TOUR HIGHLIGHTS

- AGGLOMERATION & COMPACTING
- THERMAL PROCESSING
- MIXING
- SIZE REDUCTION

AVEKA
Contract Manufacturing & Custom Research

AVEKA is a contract manufacturing and research & development company that focuses on particle technology. From lab-scale samples to full scale production, AVEKA has a platform to make your engineered particles. Servicing most industries from industrial materials to food and nutraceuticals.

AVEKA Incorporated
2045 Wooddale Drive
Woodbury, MN 55125
651-730-1729
www.aveka.com

Bepex

Bepex is recognized worldwide as an industry-leading process equipment manufacturer. Our team of process engineers and field technicians has helped customers realize their potential for decades. Integrity, innovation and commitment are at the forefront of our approach to supply custom process systems.

Bepex International LLC
333 Taft St NE
Minneapolis, MN 55413
612-360-2797
www.bepex.com

PARTICLE TECHNOLOGY FORUM

ANNUAL BANQUET

To attend, you must register for the 2017 AIChE Conference and select the PTF Banquet

If you have any questions, please email Bruce at bdhook@dow.com

Bepex International LLC
Solid Process Design

Our fully-equipped Process Development Center (PDC) in Minneapolis, MN, is designed for introductory bench-scale tests through pilot testing for full-scale commercial design. Our purpose-built technology includes:

- Thermal processes including reacting, drying, heating, cooling, and crystallization
- Pressure agglomeration methods such as roll compaction and briquetting
- Wet agglomeration techniques such as low-pressure extrusion and mixing
- Size reduction such as chopping, crushing, pulverizing, and micronizing

A tour of the Bepex PDC will provide participants with an overview of our diverse range of equipment for each of the unit operations listed above. During a brief presentation, the advantages and limitations of each process will be addressed to demonstrate how science is applied to problem solving. Examples of unique applications that stretch the capabilities of each system will be discussed during the tour. Please call Bepex at 612-360-2797 for additional information.

AVEKA Incorporated
Specialists in Particle Technology

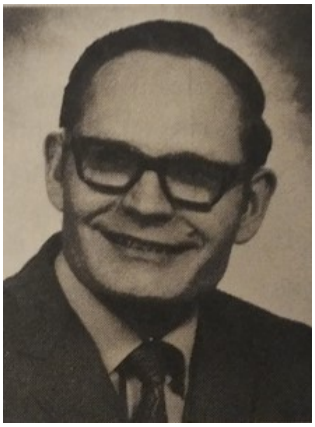
AVEKA is a full-service toll processing and research & development company that focuses on particle technology. From lab-scale to production and over 30 unit operations, we can handle your one-step or multi-step manufacturing needs. Our five manufacturing facilities specialize in:

- Drying such as spray Drying, fluid bed drying, tray drying, and roll drying
- Size Reduction and Classification such as hammer milling, jet milling, ball milling, air classification and screening
- Particle Coating and Surface Modification such as fluid bed coating, tablet coating, Magnetically Assisted Impact Coating (MAIC), and spheroidization
- Specialty Services such as repackaging, prilling or spray congealing, microencapsulation, alginate beads, separation and filtration, dispersion processing and characterization

On a tour of AVEKA, you will walk through an active industrial processing facility where there will be demonstration stations to provide you with real-world examples of how AVEKA's processing techniques can apply to your current projects. Your tour guide is happy to answer your questions along the way, so don't forget to bring your closed toe shoes so you can enjoy the tour. Please call AVEKA 651-730-1729 for additional information.

History Of Particle Technology

Dr. Jerry Johanson's Contributions to Bulk Solids Handling



As the University of Utah started its 1957 fall quarter, Jerry Johanson began a path that would ultimately lead two researchers to introduce the world to the concept of solids flow. Soon after Jerry married, he started looking for sufficient part-time employment so that both he and his new wife could continue attending school. Art Nettleship, a professor at the University, rode the bus daily with Jerry and, feeling a protective kinship, hired him as his lab assistant for the first two class quarters. In the spring of 1958, he introduced Jerry to Dr. Andrew W. Jenike who was looking for a student assistant.

After the interview Jerry rushed home to inform his new bride that he was going to the graduate school and with that the road to development of a new theory describing bulk solids flow began. Dr. Jenike's goal had begun four years earlier at the American Smelting and Refining Engineering Department where he designed an ore bin. Through this experience, Jenike realized that there was a significant void in current understanding of reliable bin design. He quit his job and started the long and innovative task of mathematically defining bulk solids flow. Part of that endeavor was to develop the first bulk solids flow lab which was housed in the University of Utah's Fuel Technology Building. This is where Jerry Johanson met Jenike. The lab was equipped with a belt feeder, shear tester (which Jenike had just built) and a small office containing a drafting board and desk. Jerry's first assignment was to modify the shear test procedure to produce consistent results.

Jenike Shear Tester

The trick to getting consistent data was to implement a series of pre-consolidation twisting steps while simultaneously applying the shear stress to the top cover and the shear cell ring. During that period Profs. Jenike and Shield were developing the concept of the effective yield locus. There were no texts outlining solid flow theory, and the University was not equipped to teach applied mechanics, so Jenike, Shield and Johanson painstakingly went through Pragger's *The Theory of Plasticity* and a similar publication by Hill. However, the most important theoretical reference came from Sokolovskii's *Statics of Soil Media*, which was not yet published in English. Jenike obtained a Polish translation of the original Russian text and translated it into English. Then Jenike and Johanson studied the text together. Anyone reading that text knows that a common phrase of Sokolovskii's was "it follows that…" What the author implied was that after 10 pages of detailed derivation the astute reader could eventually discover the link between consecutive equations in Sokolovskii's text. In Sokolovskii's last chapter (Equilibrium of Wedges) he considered a mathematical

phenomenon where soil stress varied in proportion to the distance from a fixed point. Upon reading this, Jenike proclaimed, "**We've found the answer**!" Jenike recognized that his earlier pressure measurements fit Sokolovskii's mathematical curiosity (radial stress) perfectly. With this radial stress assumption, the partial differential equations describing bulk solids flow reduced to total differential equations making them readily solvable.

That spring, Jenike visited his native Poland leaving his student Jerry Johanson behind to calculate the radial stress field. Upon his return from Poland, Jerry excitedly told him that "we can now calculate critical arching dimensions by incorporating the shear test data, the radial stress calculation, and the arch stress formula" which Jenike had developed previously. This was the final link to develop the **flow-no-flow criteria** governing the flow of cohesive solids in bin and hoppers. **The breakthrough led to the concept of flow factor and allowed calculation of arching from first principles without the need for empirical correlations.** However, the concept of radial stress theory also led to another curious behavior. Calculations of variously shaped conical hoppers showed some conditions where radial stress conditions could not exist because of the hopper geometry. This behavior was the focus of Jerry Johanson's PhD thesis. It eventually led to the conclusion that in situations where radial stress can exist, the entire mass in the hopper is active in flowing. This was the birth of the **mass flow – funnel flow concept** that identified and predicted flow behavior in bins and hoppers.

In 1962, Jerry Johanson graduated from the University of Utah and went to work at US Steel. Henk Colijn was the R&D leader of the material handling research section at US Steel and had been watching the development of the solids flow theory at the University of Utah very closely. Henk knew that the very conservative company US Steel needed to be sold on the concept of this new theory and gave Jerry his first assignment to develop a seminar to simplify and teach these new concepts to the steel industry. Jerry developed the seminar and created "The Million Dollar Rat Hole" movie. He condensed the new theory into an easily understood paper with a step-by-step bin design procedure.

In 1964, Jerry extended the arching theory developed by Jenike to include dynamic arches and used the theory to predict the flow rate of cohesive materials in bins and hoppers at US Steel. He was able to predict flow rates to within a few percent. While at US Steel, Jerry used the new theory to successfully predict stresses required to create briquettes in a briquette press, thereby extending the solids flow theory to geometries other than just bins and hoppers. Also while at US Steel, Jerry Johanson applied the solid flow principles to explain how inserts placed in a hopper could be used to solve flow issues.

By 1966, Jenike had completed his work at the University of Utah and started a consulting company near Boston. Jenike convinced Jerry to come to work for him. In August they formed **Jenike & Johanson, Inc.** located in the basement of Jenike's Winchester, Massachusetts home. Until then, they had taught that successful bin design required only three things: walls steep and smooth enough to induce mass flow along them, outlets large-enough to prevent solids from bridging as determined by the flow-no-flow criteria, and a feeder that insures uniform draw across the entire outlet area. Then they discovered fine dry powders.

Appling the new theory to fine powders proved challenging. ELKM in Norway was the first application of the new theory to fine powders. They were experiencing flooding and flushing problems caused by rathole collapse. Application of the basic solid flow theory suggested that the existing conical bin should be replaced by a chisel shaped, mass flow bin with a belt feeder. The modified system cured the flushing problems. However, increasing the material flow rate through the bin beyond half the required rate was impossible. Jenike and Johanson postulated that the stress levels in the bin were squeezing gas out of the material and that, when this de-aerated material approached the outlet and attempted to expand, a limiting flow rate resulted due to permeability and compressibility effects. The solution was a well placed and controlled air injection system to replace the gas that was squeezed out of the bulk material during flow. This was the first time gas injection was used to correct flow rate issues in bins and hoppers. Jenike and Johanson spent the next 10 years incorporating gas effects into the bulk solids flow theory.

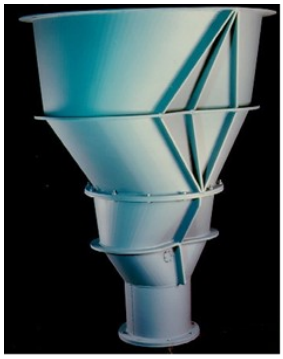
In 1969, Jenike and Johanson applied the new theory to compute bin loads in mass flow hoppers and extended the work of Janssen to include flow in converging geometries. The big surprise was the very large peak stress values occurring at the transition between the cylinder and the cone. This led, in some cases, to wall loads that were 10 times the loads predicted by Janssen. During the 1970's Johanson developed a concept of using an inverted conical insert to modify the velocity profiles in bins and formed the basic concepts behind blending in bins and hoppers. However, the inverted cone concept had significant limitations in its ability to create good blending in bins and hoppers.

In 1979, Jerry spent a sleepless night and, in the morning, postulated the use an internal cone within an existing geometry to promote mass flow in flat geometries and create blending profiles in bins. This became known as the cone-in-cone concept and was used to convert funnel flow bins to mass flow bins. It was further incorporated as an inline blending bin to smooth out concentration fluctuations.

Also, in the 1970s the bulk solids flow theory was extended to viscous materials such as tar sands. Jerry Johanson developed methods to measure the strain rate dependent strength and then, using that information, advanced methods to compute arching and flow rates in bins subjected to these viscous materials. During this time the bulk solids flow theory was further extended to include proper design of screw feeders, belt feeders, and vibrator pan feeders. Late in 1979, he drafted the basis of a theory introducing gas pressure effects to the flow of bulk solids and extended the flow theory to process vessels with liquid and gas streams.

In the 1980's, Jerry Johanson developed the concept of the Diamondback® hopper. One limitation of plane flow bin designs was the need to use an expensive feeder to interface with the slot outlet created in typical plane flow bin designs. He circumvented that limitation using a converging plane flow hopper to take a circular outlet to an oval outlet, followed by a plane flow oval to round outlet to converge the oval outlet to circular. The result was a plane flow hopper that could interface to circular feeders such as rotary valves while still maintaining the increased arch breaking capability of a plane flow outlet.

Cone-in-cone Concept



Diamondback® Hopper

The usefulness of any theory is longevity as well as breadth of application. Since its formulation in a small office at the University of Utah, the solids flow theory has withstood the test of time. It has been the backbone of equipment design for 50 plus years. But, it has also found application in many more areas such as roll presses, feeder design, pulping vessels, ion exchange resin systems, direct reduction of iron ore, die filling, tablet presses, product design, and of course many silo and bin designs handling solids of all descriptions.

Please join us this year at **Session 486** **Honoring the Lifelong Achievements of Dr. Jerry Johanson**, Minneapolis Convention Center - 200J, Wednesday, November 1st, 2017, 08:00 AM-10:30 AM

- Dr. Kerry Johanson, Material Flow Solutions, Inc.

Notable Publications of Dr. Johanson

1. Johanson, J.R., Stress and Velocity Fields in the Gravity Flow and Bulk Solids, Bulletin No. 116 and PhD thesis, University of Utah, Utah Engineering Experiment Station, (1962).
2. Johanson, J.R., Stress and Velocity Fields in the Gravity Flow of Bulk Solids, Journal of Applied Mechanics, Series E, 86 (September, 1964);499-506.
3. Johanson, J.R. and H. Colijn, New Design Criteria for Hoppers and Bins,Iron & Steel Engineering, (October, 1964 ;85-105.
4. Johanson, J.R., Method of Calculating Rate of Discharge from Hoppers and Bins, Transactions of Society of Mining Engineers,232 (1965); 69-80
5. Johanson, J.R., A Rolling Theory for Granular Solids, Journal of Applied Mechanics, Series E, 1965, 32;842-848.
6. Johanson, J.R., The Use of Flow Corrective Inserts in Bins, Journal of Engineering Industry, Series B, 88 (1966);24-230.
7. Johanson, J.R., and A.W Jenike, Settlement of Powders in Vertical Channels Caused by Gas Escape, Journal of Applied Mechanics, (December 1972); 863-868.
8. Jenike, A.W., J.R. Johanson, and J.W Carson, Bin Loads, Part 2: Concepts, Journal of Engineering for Industry, 99 (1973); l-5. Part 3: Mass Flow Bins, Journal of Engineering for Industry, 99 (1973); 6-12. Part 4: Funnel Flow Bins, Journal of Engineering for Industry. 9913-16.
9. Johanson, J.R., Particle Segregation and What to do About it, Chemical Engineering, (May 1978); 183-188.
10. Johanson, J.R., Two-Phase Flow Effects in Solids Processing and Handling, Chemical Engineering, (January 1,1979);77-86.
11. Improving Solids Flow in Bins and Hoppers Using the Diamondback Hopper . Joe Ririe and Jerry R. Johanson, Ph.D. Association of Operative Millers Bulletin, September 1996.
12. Limiting flow rates from hoppers. Jerry R. Johanson, Ph.D. Chemical processing 1997 Powder & Solids Annual.
13. Making Solids Flow in Hoppers Using Passive Activation. Jerry R. Johanson, Ph.D. bulk solids handling, January 2000.

Key Patents By Dr. Johanson

1. US Patent 6494612, Racetrack-shaped dynamic gravity flow blender, Dec 2002
2. US Patent 6336573, Hopper, or bin, screw feeder construction controlling discharge velocity profile, Jan 2002
3. US Patent 6086307, Hoppers with directionally applied relative motion to promote solids flow, July 2000
4. US Patent 6055781, Archbreaking hopper for bulk solids, May 2000
5. US Patent 5289728, Flow-no-flow Tester, March 1994
6. US Patent 4986456, Flow rate controller and feeder, Jan 1991
7. US Patent 4958741, Modular Mass-Flow Bin, Sept 1990
8. US Patent 4795266, Solids blender with cylindrical inserts, Jan 1989
9. US Patent 4646910, Generalized high speed belt to belt transfer chute, March 1987
10. US Patent 4446717, Abrasive wear tester, May 1984
11. US Patent 4286883, Blending apparatus for bulk solids, September 1981

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Session 43: Solids Handling and Processing in the Chemical Industry - "What They Don't Teach You at School"

Sunday, October 29, 2017, 03:30 PM - 06:00 PM, Minneapolis Convention Center - 200J

Presenters:
George Klinzing, Ray Cocco, Pat Spicer, Manuk Colakyan, Shrikant Dhodapkar

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Congratulations Joe !!!

Recognizing his impact on undergraduate engineering at the University of Pittsburgh, **Prof. Joseph McCarthy** this summer was appointed **Vice Provost for Undergraduate Studies** effective August 1, 2017. Dr. McCarthy, the William Kepler Whiteford Professor of Chemical and Petroleum Engineering in Pitt's Swanson School of Engineering, succeeds Juan Manfredi, who served as Vice Provost for seven years.

Since joining the faculty as an assistant professor in 1998 and promoted to professor in 2010, Dr. McCarthy has been recognized for his contributions to teaching, curriculum development, and his leadership of undergraduate research programs. In 2008, he received the Carnegie Science University Educator Award for developing and implementing the Innovative "Pillars" curriculum that reshaped undergraduate education in chemical engineering. In 2012, the Swanson School recognized his contributions with its Outstanding Educator Award, and in 2015, he received the Chancellor's Distinguished Teaching Award.

In addition to his scholarly and instructional activities, Dr. McCarthy's record of administrative experience in the chemical engineering department dates back to 2005 and includes serving as Undergraduate Coordinator, and then as Vice Chair for Education. In these roles, he has focused on leading department-wide educational initiatives for undergraduate and graduate programs during a time when undergraduate enrollment within the department has more than tripled.

In announcing this new appointment, Pitt Provost Patricia S. Beeson noted, "Dr. McCarthy has focused on leading department-wide educational initiatives for undergraduate and graduate programs during a time when undergraduate enrollment within the department has more than tripled. I have great confidence in Dr. McCarthy's academic and organizational leadership. He shares my strong commitment to student achievement and has the energy and experience to help us continue to build on the University's existing strengths and priorities in undergraduate education."

This spring, thanks to Dr. McCarthy, the NSF awarded a Research Experience for Undergraduates (REU) grant to provide undergraduate students with research opportunities in the Swanson School's Department of Chemical and Petroleum Engineering. The three-year, $425,000 grant will fund a 10-week summer research program for students and provide them with a stipend and financial assistance for food, housing, and travel. Dr. McCarthy co-authored the grant proposal "REU Site: Enhancing Knowledge Integration Through Undergraduate Research – Particle-based Functional Materials for Energy, Sustainability, and Biomedicine." Co-Principal Investigator Taryn M. Bayles, also a professor in the Department of Chemical and Petroleum Engineering, will assist with the REU program.

As a Particle-based Functional Materials (PFM) REU grant, the student research will comprise computational and experimental studies of materials that fulfill a specific function either because of their particulate nature or the influence of particles on structure. The program will admit 12 students each year beginning in 2017 and take place between May and August.

The PFM REU program is in its third round of funding and is the second funded grant for the Department of Chemical and Petroleum Engineering to help provide research opportunities for undergraduate and graduate students focused on this topic. For more than a decade, this REU program combined with a similar program called the PFM Graduate Assistance in Areas of National Need (GAANN) fellowships have provided both undergraduate and graduate students with research opportunities at Pitt. By the end of this funding cycle, these combined programs will have sponsored over 100 students to pursue their research goals.

Dr. McCarthy earned his PhD in chemical engineering from Northwestern University, and BS in chemical engineering from Notre Dame.

Academic Perspective: Prof. Patrick Spicer's Research Group

Professor Patrick Spicer

The University of New South Wales

Sydney, Australia

Email: p.spicer@unsw.edu.au

Patrick Spicer is an Associate Professor in UNSW's School of Chemical Engineering. He is leader of the Complex Fluids group, a team that works with industry and academic partners to design smart fluids with unique response and flow behaviour linked directly to product and material performance. His lab at UNSW combines broad microscopy, microfluidic, and rheology capability that can be used to understand the behaviour of fluid coatings, films, and other complex products. Before UNSW, Pat ran a central engineering research section for the Procter & Gamble Company in the US for 15 years. His group developed new product and process technology there for all of P&G's billion-dollar brands. He is co-inventor of P&G's $30 million cubosome patent portfolio that Children's Hospital Cincinnati used to develop the first skin treatment to prevent life-threatening infections in premature infants. He is also an inventor of P&G's recently-patented responsive droplet technology.

An overview of the group's publications, projects, and other information can be found at their web site:

http://softmatterhacker.com/

Because much of our work is highly visible, we regularly upload interesting images and movies of microscale particulate phenomena on Instagram:

https://www.instagram.com/softmatterhacker/

And we tweet news, updates, and comments on our Twitter account:

http://twitter.com/SoftMatterHackr

Research Interests at UNSW

Design and development of microstructured fluid materials by understanding their kinetic behavior. Most of our work deals with complex fluids, fluids containing small amounts of colloids, polymers, and surfactants that exhibit highly non-ideal behaviour with fascinating dynamics. Complex fluids are a key part of most major products and manufacturing processes. Our group uses advanced imaging and rheology techniques to understand fundamental complex fluid properties, specifically:

Shape - Particle shape affects advanced material strength, reactivity, and biological uptake.

Structure - Self-assembly creates soft structures with biological, chemical, and physical applications.

Flow - Microstructured fluids are a part of most commercial products, and processes, and their flow affects stability.

Current Areas

Shape-Changing Droplets: We study flow of anisotropic colloids like rods and fibers in fluids but are also exploiting the shaped droplets we developed to understand stability of emulsions in complex flows and the new types of structures that can now be formed from droplets rather than solid particles. A particular area of interest is the types of shapes, and shape-change mechanisms, that we can develop using these unique droplet building blocks.

Self-Assembly: We also have a long history of working with surfactant self-assembly and have developed new ways of

making soft colloidal polyhedra with complex shapes that we are templating via polymerization and gelation. We'd also like to explore applications for such regular, but soft, shapes.

Microrheology: We have a new active technique we've developed that allows detection of very low yield stresses in biological fluids but also allows in situ determination of the properties of complex foods like doughs and batters as their development of gas cells during preparation and cooking is not well understood. We also perform passive microrheology of biofilms and other biological fluids as they are degraded by enzymes and antibiotics.

Bubble dynamics: Deceptively simple, bubbles can drive complex fluid flows in unique ways and can be a reservoir for enormous energy. We have open projects to study a model soft matrix containing highly pressurized micro bubbles to simulate and visualize explosions. We are also studying the ability of fluid rheology to interfere with bubble expansion and shrinkage in complex fluids.

Food and consumer product microstructure: We have mapped the formation of complex structures in foods, and other formulated materials based on emulsions, and developed physical models of their stability, rheology, and performance. Our open projects in this area are aimed at designing more sophisticated functions and performance for formulated materials, enabling new forms that increase accessibility to safe products in remote regions. We also would like to develop a new structural description of thixotropy in structured fluids: when a fluid behaves differently depending on whether it flows from low to high or high to low shear rates.

New Areas

Advanced Microfluidics: Many of our microscale projects need "scaling up" to produce larger volumes of particles or droplets. Examples include new projects on the charging behavior of flow electrodes that contain nanostructured carbon particles with non-spherical shapes, allowing the exploitation of phenomena like segregation to improve charging performance. New chips are also planned to attack biofilms with rapid gradient manipulation, model complex biofluid transport through cartilage and tissue, test deposition of shaped particles onto biological surfaces, and assemble multiple shaped droplets into hierarchical structures.

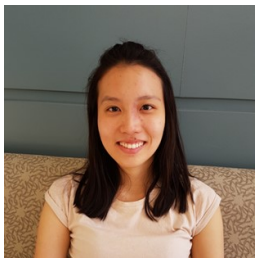
Complex Surface Coatings: We have found new ways to coat tissue and skin using very weakly-structured fluids, improving efficiency by a factor of six or more over conventional delivery techniques, but need to map the mechanism of performance improvement as it is still not well understood. We are also interested in the phenomenon of detergency when it is comparable in magnitude to the rheology of the fluid being removed. The development of increasingly complex surface treatments and morphologies means a need to better understand how such surfaces can be cleaned.

Biofluids: Joint projects with Medicine and Biomedical Engineering will look at mapping the rheology and flow of biological complex fluids like synovial fluid, mucus, and blood to fingerprint their key mechanical properties, develop mimics, and understand their interactions with artificial joints and bone implants. Molding flow channels and surfaces to real biological surfaces with small-scale features will enable us to test the structural adjustments that drive extremely complex flow interactions in the mouth, blood vessels, cartilage, and on other body tissues like skin.

Jie Song

Jie Song studies the microstructure and rheology of cellulose microfibers produced by bacterial fermentation. The fibers are unique in that they are microns in length but only nanometers thin, meaning they provide a novel means of changing the rheology of a fluid or product with very small amounts of additive. Jie developed a new microrheometer, based on a microbubble, which can detect pre-yielding and yielding events in dispersions of these fibers at very low solids loadings. She is investigating the application of these materials as enhanced coatings, for nasal sprays, as innovative rheology modifiers, for formulated suspension products, and has developed a new method of producing microcapsules of these materials that provide benefits for controlled release.

Goldina Kwandou



Goldina Kwandou is studying the microstructural heterogeneity and microrheology of biological fluids and biofilms. She has examined the effects of novel cold plasma treatments on the physical and chemical disruption of the biofilms and has discovered unique physical and biological mechanisms of resistance by bacteria. Goldina has also begun studying the effects of fluid rheology on biofilm growth and development as a way of harnessing certain biofilms to produce useful particulate products.

Zhiwei Li

Zhiwei Li studies biological tissue adhesion and its complex deformation during treatments like orthoscopic surgery. He has developed novel microfluidic methods to mimic and study the flow of complex fluids between adhering biological tissue as a way of overcoming tissue adhesion that can cause trauma during surgery. He is also designing methods that will allow modeling of surgical robotic performance and enable development of algorithms to make robotic surgery more responsive to realistic tissue environments.

Wenjia Tang

Wenjia Tang is studying the coating performance of dispersions of microfibrous cellulose. She studies the fluid behavior at the droplet-scale, the spray-scale, and the film-scale to understand how short-time changes in fluid structure and rheology affect coating, spreading, and retention on surfaces. She uses high-speed video to understand very short time dynamics and relate flow to structure as it interacts with complex surfaces on biological tissues. Her work will be used to develop more effective approaches to deliver active materials to human tissue and plant surfaces.

Chen Hao

Chen Hao examines the production of viscoelastic droplets with non-spherical shapes using a unique microstructured fluid that maintains liquid-like behavior while still providing the benefits of unusual shape. Using microfluidics, he makes monodisperse droplets with controlled shape, like ellipsoids with varying aspect ratio and rheology. The droplets enhance delivery to surfaces by exposing more surface area than a spherical droplet, but also by more complex tumbling and shape-change dynamics than possible for spheres. He is studying now how to model the behavior of such droplets in aggregated networks as their liquid interface drives surprising restructuring and densification behavior. They also exhibit useful movements similar to elliptical gears that allow microscale functions to be performed using chemical triggers.

Haiqiao Wang

Haiqiao Wang produces novel liquid crystalline particles with controlled polyhedral shapes using a simple emulsion process. Shape allows control over surface, frictional, and biological functions of the particles and the combination of a soft particle matrix with a sharp, faceted shape could be a unique tool for enhanced delivery and treatment. They also have unique acoustic and biological properties that will provide a platform for material development and applications. Haiqiao also uses the particles as templates for the production of controlled size and shape polymeric particles.

Haoda Zhao

Haoda Zhao investigates shaped and stimulus-responsive droplets for drug delivery. Droplet shape is thought to be a strong determinant of the efficacy of particulate drug delivery, and many biological surfaces have characteristic length scales and shapes that can be selectively targeted for improved delivery performance. He is using a generic liquid matrix as a basis to create drops with controlled shapes and will carry out microfluidic screening of different shapes predicted to deposit onto complex, biologically-specific surfaces. Applications include cosmetic, medical and food products.

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WORLD CONGRESS ON PARTICLE TECHNOLOGY
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A BRIEF HISTORY OF THE WCPT8

Held every 4 years since its inception in 1990, the World Congress on Particle Technology rotates between North America, Europe and Asia. In 2018, it returns to Orlando, Florida, USA where it will be hosted by the AIChE. Held April 22—26, 2018, the WCPT8 will be co-located with the 2018 AIChE Spring Meeting and 14th Global Congress on Process Safety. We invite you to participate, learn, teach and collaborate at this prestigious event.

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- → Stimulate discussions on the forefront of research in particle science & technology.
- → Address both the fundamental and applied aspects of particle technology.
- → Allow for interaction with leading researchers from around the world.
- → Share ideas and gaps that span beyond individual research areas in particle technology.
- → Provide an opportunity to network and collaborate with engineers involved in topics beyond particle technology:
  - 2018 AIChE Spring Meeting
  - 14th Global Congress on Process Safety
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	George Klinzing, University of Pittsburgh	klinzing@pitt.edu
Combustible Dust Safety	Manjunath Konanur, The Dow Chemical Company	kmanjunath@dow.com

Learn more at wcpt8.org

Computational Fluid Dynamics (CFD) Workshop on Particle Technology

Sunday, April 22, 2018
9 AM to 5 PM

The application of computational fluid dynamics (CFD) in multiphase flow systems, especially multiphase fluidized bed reactors, has gained popularity over the years. CFD is now often used in a wide range of industries, such as oil and gas, energy, pharmaceutical, chemical, food processing, automotive, metallurgy, etc., due to its potential to successfully help the companies to make engineering decisions pertaining to the designing, troubleshooting, debottlenecking, retrofitting, and scale-up aspects of commercial-scale systems. Key examples of the use of commercial as well as open source CFD codes include fluid catalytic cracking (FCC) reactors in the oil industry, gas-phase polyolefin reactors, fluidized bed reactors for polysilicon production, coal and biomass gasification reactors, and many more.

Many CFD codes are available in the market today, and they all require good understanding of the basic principles of multiphase flow and numerical methods. One of the objectives of this workshop is to review basic multiphase flow conservative laws, and to show the participants how to use CFD codes to obtain meaningful information. The workshop will also provide users with the information on several modeling approaches involving physics relevant to certain applications. During this hands-on workshop, attendees will also have a chance to run a sample multiphase model on their laptops (to be brought in by the attendees) using the Illinois Institute of Technology (IIT) multiphase code and evaluate the results.

This workshop is for undergraduate and graduate students, engineers and scientists who want to learn how to use modern computational tools to improve the performance and design of multiphase fluidized bed reactors. The audience is encouraged to participate in this fun-filled and educational workshop that promises to provide a unique platform and opportunity to interact with six multiphase flow CFD practitioners and experts from academia, industry and national laboratory, with a combined experience of over 100 years in this field. The instructors have delivered several successful workshops on multiphase flow CFD in various fora, and the bar is expected to rise even higher at the 8th World Congress on Particle Technology.

In addition to learning key features about CFD codes, such as Barracuda®, ANSYS® Fluent, IIT multiphase code, MFiX, and STAR-CCM+, the workshop will also include a live demonstration of a mini-circulating fluidized bed (CFB) prototype comprising a riser, standpipe, and cyclone, and its comparison with Barracuda®. The cold-flow mini-CFB is capable of fluidizing particles classified as Geldart groups A, B, C and D in various fluidization regimes, such as bubbling, turbulent, transport regimes, etc.

Please select **CFD Workshop on Particle Technology** as an **add-on** at www.wcpt8.org once the registration is open. Lunch and snacks will be provided during the day of the workshop.

For any questions regarding the workshop, please contact Mayank Kashyap (mkashyap@sabic.com) or Reza Mostofi (reza.mostofi@honeywell.com).

Presenters	Topics
 **Mayank Kashyap**, Ph.D., Lead Scientist – Process Technology, SABIC E: mkashyap@sabic.com	Introduction to fluidization; Plexiglas mini-circulating fluidized bed demonstration unit comprising a riser, standpipe and cyclone that has the ability to fluidize particles in the core-annular and other flow regimes; Introduction to Barracuda®
 **Dimitri Gidaspow**, Distinguished Professor, Emeritus, Illinois Institute of Technology, Chicago E: gidaspow@iit.edu	Conservation laws and constitutive equations (D. Gidaspow. "Multiphase Flow and Fluidization". *Academic Press*, 1994); Formation and elimination of bubbles using IIT multiphase CFD code with input viscosities for the Westinghouse 3 meter fluidized bed (D. Gidaspow & V. Jiradilok. "Computational Techniques". *Nova Science Publishers*, 2010)
 **Reza Mostofi**, Ph.D., Lead Engineer, Honeywell E: reza.mostofi@honeywell.com	Overcoming challenges in a gas-solids CFD model; Simulations using ANSYS Fluent
 **Madhava Syamlal**, Ph.D., Senior Fellow – Computational Engineering, National Energy Technology Laboratory (NETL), U.S. Department of Energy (DOE) E: madhava.syamlal@netl.doe.gov	Multiphase flow science at NETL
 **Oleh Baran**, Ph.D., Product Manager - STAR-CCM+ Lagrangian Multiphase and DEM, Siemens PLM E: oleh.baran@cd-adapco.com	Coupling DEM and CFD to optimize particulate flows
 **Huilin Lu**, Professor, Harbin Institute of Technology, China E: huilin@hit.edu.cn	Modified MFiX code to simulate hydrodynamics of gas-solids circulating fluidized beds

Treasurer's Report (2016-2017)

NY ACCOUNT	Starting	Income	Expenses	Balance
monthly fee (08/31/2016)			$18.00	$4,631.16
monthly fee (09/30/2016)			$18.00	$4,613.16
monthly fee (10/31/2016)			$18.00	$4,595.16
monthly fee (11/30/2016)			$18.00	$4,577.16
monthly fee (12/30/2016)			$18.00	$4,559.16
monthly fee (1/31/2017)			$18.00	$4,541.16
check from NJ account to avoid monthly fees (2/17/2017)		$4,000.00		$8,541.16
monthly fee (2/28/2017)			$18.00	$8,523.16
Totals as of 9/2017	$4,649.16	$4,000.00	$126.00	**$8,523.16**

NJ ACCOUNT	Starting	Income	Expenses	Balance
Sponsor check from ANSYS for award (11/04/2016)		$1,240.00		$7,740.00
Sponsor check from PSRI for award (11/04/2016)		$1,240.00		$8,980.00
Sponsor check from Jenike for dinner (11/04/2016)		$2,000.00		$10,980.00
Sponsor check from CPFD for dinner (11/04/2016)		$2,000.00		$12,980.00
Payment to Picture-it Awards Inc. (check # 0991), cashed			$518.85	$12,461.15
Sponsor check from U Pittsburgh for award (12/05/2016)		$740.00		$13,201.15
Check to Reza Mostofi for awards (chech # 0992), cashed			$28.79	$13,172.36
Sponsor electronic payment from Elsevier for award (12/16/2016)		$1,325.00		$14,497.36
Check to Allisa Park to avoid NYC account monthly fee (chech # 0993), cashed on 2/17/2017			$4,000.00	$10,497.36
Coperion K-Tron check (deposited on 2/2/2017)		$250.00		$10,747.36
Totals as of 9/2017	$6,500.00	$8,795.00	$4,547.64	**$10,747.36**

Funds obtained through advertisements in the PTF Newsletter:

Organization	Description	Income
Coperion K-Tron	A half page advertisement in Summer 2015 Edition Check received in NY account on 11/17/2015	$250.00
Kansas State University	A half page advertisement in Summer 2015 Edition Check received in NY account on 11/17/2015	$250.00
Coperion K-Tron	A half page advertisement in Fall 2015 Edition Check received in NY account on 2/17/2016	$250.00
University of Delaware	A full page advertisement in Fall 2015 Edition Check received in NY account on 4/7/2016	$500.00
Coperion K-Tron	A half page advertisement in Fall 2016 Edition Check received in NJ account on 2/2/2017	$250.00
		Total: $1500.00

Treasurer's Report (2016-2017)

AIChE ACCOUNT	Starting	Income	Expenses	Balance
Dues Income - Divisions (08/2016)		$ 510.00		$ 15,171.31
Registration Income - Special Events (08/2016)		$ 1,190.00		$ 16,361.31
Promotion-email (08/2016)			$ 25.76	$ 16,335.55
Dues Income - Divisions (09/2016)		$ 615.00		$ 16,950.55
Registration Income - Special Events (09/2016)		$ 3,400.00		$ 20,350.55
Promotion-email (09/2016)			$ 26.99	$ 20,323.56
Dues Income - Divisions (10/2016)		$ 735.00		$ 21,058.56
Registration Income - Special Events (10/2016)		$ 3,485.00		$ 24,543.56
Site Costs - Special Events (Annual Dinner) (10/2016)			$ 4,265.00	$ 20,278.56
Monetary Awards (Thomas Baron, George Klinzing Best PhD) (10/2016)			$ 1,500.00	$ 18,778.56
Dues Income - Divisions (11/2016)		$ 675.00		$ 19,453.56
Registration Income - Special Events (11/2016)		$ 2,635.00		$ 22,088.56
Corp Sponsorship Inc - Dow (11/2016)		$ 660.00		$ 22,748.56
Promotion-email (11/2016)			$ (175.59)	$ 22,924.15
Dues Income - Divisions (12/2016)		$ 570.00		$ 23,494.15
Registration Income - Special Events (12/2016)		(85.00)		$ 23,409.15
Corp Sponsorship Inc - Merck (12/2016)		$ 1,500.00		$ 24,909.15
Promotion-email (12/2016)			$ (24.82)	$ 24,933.97
Site Costs - Special Events (Annual Dinner reimbursement) (12/2016)			$ 7,288.69	$ 17,645.28
Monetary Awards (Service, Lifetime, Lectureship, SABIC Young, Poster x3) (12/2016)			$ 5,500.00	$ 12,145.28
Invest Inc - Interest (12/2016)		$ 924.79		$ 13,070.07
Promotion-email (12/2016)			$ 24.82	$ 13,045.25
Dues Income - Divisions (1/2017)		$ 375.00		$ 13,420.25
Corp Sponsorship Inc - Shell (1/2017)		$ 1,240.00		$ 14,660.25
Dues Income - Divisions (2/2017)		$ 285.00		$ 14,945.25
Dues Income - Divisions (3/2017)		$ 300.00		$ 15,245.25
Dues Income - Divisions (4/2017)		$ 225.00		$ 15,470.25
Dues Income - Divisions (5/2017)		$ 30.00		$ 15,500.25
Corp Sponsorship Inc - SABIC (1/2017)		$ 1,240.00		$ 16,740.25
Dues Income - Divisions (6/2017)		$ 30.00		$ 16,770.25
Site Costs - Special Events (Annual Meeting) (6/2017)			$ 800.00	$ 15,970.25
Dues Income - Divisions (7/2017)		$ 300.00		$ 16,270.25
Registration Income - Special Events (7/2017)		$ 255.00		$ 16,525.25
Delivery Service (7/2017)			$ 30.71	$ 16,494.54
Totals as of 9/2017	$ 14,661.31	$ 21,094.79	$ 19,261.56	**$ 16,494.54**

Job Posting

PURDUE
UNIVERSITY

College of Engineering
Faculty Position in Designer Particulate Products

The College of Engineering at Purdue University has set a strategic priority to build a world leading pre-eminent team in Designer Particulate Products including foods and feed, consumer goods, specialty chemicals, agricultural chemicals, pharmaceuticals, and energetic materials. The team will focus on model-based process design to produce engineered particles and structured particulate products, developing the understanding of process-structure-function relationships for these products, and building capacity through a highly qualified workforce in particulate science and engineering. The College invites applications for any rank (Assistant, Associate, or Full Professor). Purdue University seeks to attract exceptional candidates with interests and expertise in:

1. On- line sensing and chemometrics applied to the manufacture of particulate products;
2. Particle and granule engineering with a focus on product design and performance.

Outstanding candidates in other areas of particle technology related to the manufacture of particulate products will also be considered.

Successful candidates must hold a Ph.D. degree in some field of Engineering or a related discipline and demonstrate excellent potential to build an independent research program at the forefront of their field, work well in a larger interdisciplinary team, and educate and mentor students. Successful candidates will conduct original research, will advise graduate students, will teach undergraduate and graduate level courses, and will perform service both at the School and University levels. Candidates with experience working with diverse groups of students, faculty, and staff and the ability to contribute to an inclusive climate are particularly encouraged to apply.

The College of Engineering at Purdue University has a strong core of faculty engaged in particulate products research as well as significant interdisciplinary efforts across campus, with other academic institutions, and industry partners. For a detailed description of research activities see https://engineering.purdue.edu/CP3

Purdue University's College of Engineering is committed to advancing diversity in all areas of faculty effort, including scholarship, instruction, and engagement. Candidates should address at least one of these areas in their cover letter and indicate their past experiences, current interests or activities, and/or future goals to promote a climate that values diversity and inclusion.

Submit applications online at https://engineering.purdue.edu/Engr/AboutUS/Employment/Applications, including curriculum vitae, teaching and research plans, and the names of three references. For information/questions regarding applications, contact the Office of Academic Affairs, College of Engineering, at coeacademicaffairs@purdue.edu. Review of applications will begin on December 1, 2017 and will continue until the position is filled. A background check will be required for employment in this position.

Purdue's main campus is located in West Lafayette Indiana, a welcoming and diverse community with a wide variety of cultural activities, events, and industries. Purdue and the College of Engineering have a Concierge Program to assist new faculty facilitate their relocation.

Purdue University is an EOE/AA employer. All individuals, including minorities, women, individuals with disabilities, and veterans are encouraged to apply.

Particle Technology Forum Organization

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PROGRAMMING LEADERSHIP

GROUP 3A: PARTICLE PRODUCTION AND CHARACTERIZATION

Chair: Dr. Stephen Conway
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Vice Chair: Dr. Rohit Ramachandran
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GROUP 3B: FLUIDIZATION & FLUID-PARTICLE SYSTEMS

Chair: Dr. Marc-Olivier Coppens
(m.coppens@ucl.ac.uk)

Vice Chair: Dr. Tim Healy
(timothy.m.healy@exxonmobil.com)

GROUP 3C: SOLIDS FLOW, HANDLING AND PROCESSING

Chair: Dr. Clive Davies
(C.Davies@massey.ac.nz)

Vice Chair: Dr. Madhusudhan Kodam
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GROUP 3D: NANOPARTICLES

Chair: Dr. Steven Saunders
(steven.r.saunders@wsu.edu)

Vice Chair: Dr. Satish Nune
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GROUP 3E: ENERGETICS

Chair: Dr. Lori Groven
(Lori.Groven@sdsmt.edu)

Vice Chair: Dr. Travis Sippel
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