APT2024

The 9th Asian Particle Technology Symposium

Engineering a Sustainable Future

Sydney, 1 – 4 December 2024

Amora Hotel Jamison Sydney

APT2024

Jointly organised by

Australasian Particle Technology Society

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Welcome Messages

Professor Yansong Shen

Symposium Chair

Professor Alex Yip

Symposium Chair

Dear Colleagues,

It is a great honour and privilege to welcome you to the APT2024.

This year's theme, "Engineering a Sustainable Future," reflects our collective commitment to advancing technologies that promote environmental stewardship and sustainable development.

As we gather here as an international particle technology community, we have a unique opportunity to share our knowledge, exchange innovative ideas, and collaborate on solutions that address some of the most pressing challenges of our time. Your participation and contributions are invaluable to the success of this symposium and to the broader goal of creating a sustainable future for all.

I look forward to the insightful discussions, groundbreaking research presentations, and forging new partnerships that will emerge from this event. Together, we can significantly impact the world through our dedication to particle technology and sustainable engineering.

We sincerely thank all our sponsors for their generous support and, of course, all delegates for participating in the APT2024.

Sydney is an attractive world-class city where a vibrant lifestyle meets the natural environment. I trust that you will enjoy your time here with us.

Let us inspire and be inspired!

Yansong Shen

Professor Yansong Shen

Chair of the APT2024

President of Australasian Particle Technology Society

University of New South Wales, Australia

Ngā mihi,

Professor Alex Yip

Chair of the APT2024

Vice President of Australasian Particle Technology Society

University of Canterbury, New Zealand

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Alex Yip	University of Canterbury, New Zealand

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Symposium Information

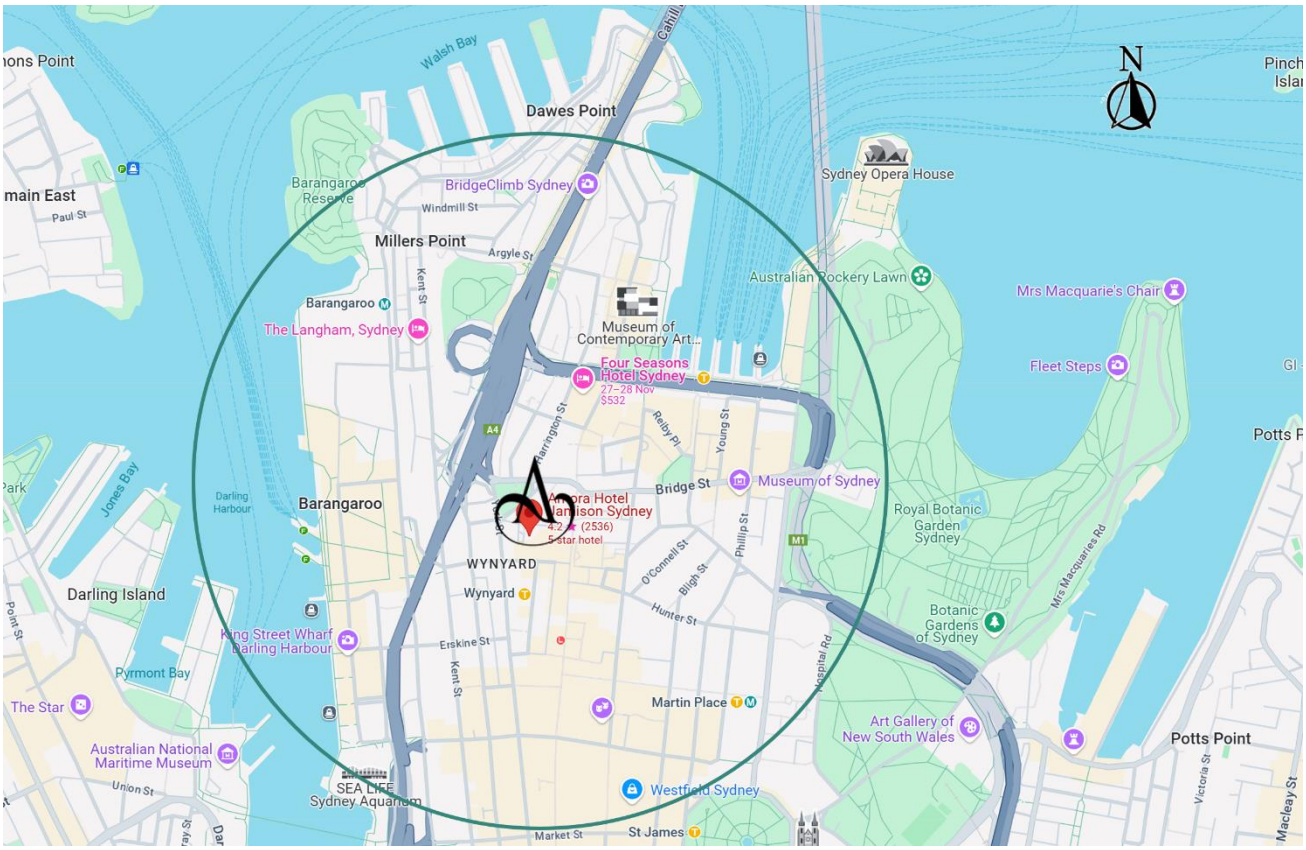
DATE

1-4 December, 2024

VENUE

Amora Hotel Jamison Sydney

11 Jamison Street, Sydney, NSW 2000



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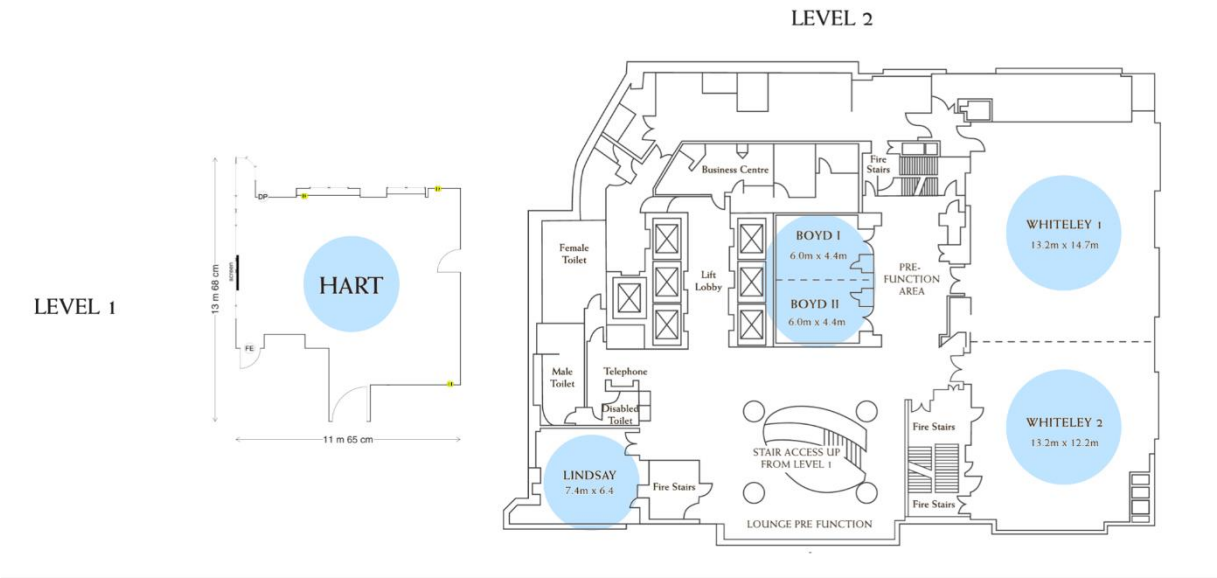

WIFI ACCESS

Wifi Details:

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Password: Conference

TRANSPORT INFO

Amora Hotel is a 4-minute walk from Wynyard Station (York Street Exit)

Amora Hotel is a 2-minute walk from Bridge Street Light Rail station (L2 or L3)

Transport to Amora from the Airport

From Sydney International and Domestic Airport (approx. 14km from the hotel) there are a few commute options available:

Train:

It will take approximately 25 minutes to arrive at Wynyard Station which is right next to the hotel. Take the York Street exit and turn right, you are now heading north. Cross over on Margaret Street and continue to the next street which is Jamison Street. Turn right onto Jamison Street and about 250 metres down on the right hand side is the hotel – 11 Jamison Street. A regular one-way train trip from Sydney airport to the city centre costs approx. AU$18.00 per person.

Shuttle Bus:

The hotel does not operate a shuttle service to and from the airport. Should you require a shuttle bus service from the hotel to the airport, we recommend you book directly with www.redy2go.com.au.
Cost approx. AU$16.00 per person, one way.

Taxi:
It can take around 35 to 45 minutes from the airport to the hotel, and can cost anywhere from AU$50.00 to AU$60.00 (depending on traffic) for up to 2 people with 1 suitcase each way. A Maxi Taxi is recommended for 4 to 5 people (extra charges apply). Taxi ranks are located in front of all airport terminals.

CAR PARKING INFO

Amora Hotel Jamison Sydney has 80 car spaces, located directly underneath the hotel and operated by Care Parking. Guests can enter this carpark by turning left from George Street on to Jamison street (second secure parking entrance towards end of street).

Self-Parking Parking for conference attendees is at AU$67.00 per car per 24 hours.
To receive this rate, please make sure the parking ticket is validated at the reception before leaving.
For attendees that are staying in the hotel, and require multiple entry, please validate the ticket during the check in process.

Valet Parking is offered at AU$85.00 per car per 24 hours.
Vehicles with wheel size of 22 inches and above will be unable to Valet Park.

Access is from the car park under Amora Hotel and there is more info on this link:
https://www.carepark.com.au/find-a-care-park/amora-hotel-jamison-sydney/
which you can also access via the QR code below:

Both options allow for multiple entries and exits. Furthermore, the car park features a height clearance of 2 meters.

Plenary Speakers

(Alphabetical order)

Prof. Rose Amal

The University of New South Wales, Australia

Engineering Nanoparticles for Harvesting Solar Energy for Chemical and Fuel

ABSTRACT

The push for sustainable energy solutions has led to significant progress in particle technology as Particle technology plays a vital role across several industries essential for decarbonisation, from the mining and processing of essential minerals like lithium and cobalt to the purification of these materials for use in advanced applications. These steps involve complex techniques like flotation and magnetic separation, and precise particle size management, which are crucial for enhancing efficiency and environmental sustainability.

Furthermore, the field of catalysis has greatly benefited from nanoparticles, especially in designing nanoparticles to better capture and convert solar energy into valuable chemicals and fuels through solar-driven chemical reactions. The unique properties of nanoparticles, such as their large surface area and tunable surface and electronic properties, boost catalytic performance and selectivity, making the conversion of solar energy more effective. Our research spans the entire solar spectrum, employing UV and visible light for photocatalytic reactions and infrared radiation for thermal catalysis. These processes are essential for driving reactions such as water splitting to produce hydrogen, CO_2 reduction to generate methanol, and the nitrogen fixation needed for ammonia production. Each of these chemicals plays a critical role in the energy sector: hydrogen as a clean fuel, ammonia as a vital component in agriculture and energy storage, and methanol as a versatile fuel and industrial feedstock.

In our research group, nanoparticles are synthesised using various methods, each imparting distinct characteristics to the catalysts. Techniques such as flame synthesis, hydrothermal precipitation, and electrodeposition are employed, each providing unique control over the catalysts' properties. Flame synthesis, characterised by high temperatures and brief residence times, typically yields catalysts with more defects and smaller particle sizes. These properties are conducive to certain photo-electro-chemical applications where high reactivity and large surface areas are beneficial. In contrast, hydrothermal precipitation, involving longer durations under pressure, produces more crystalline structures, enhancing the stability and conductivity of the catalysts for sustained energy conversion processes.

This presentation will explore how engineering nanoparticles and atomic clusters has revolutionised solar energy conversion. This includes discussing the integration of solar-thermal reactors with PV-electrolysers and presenting real-world examples that demonstrate the scalability of these technologies for global energy solutions.

BIOGRAPHY

Professor Rose Amal is a Scientia Professor in the School of Chemical Engineering, UNSW, Sydney. She is Co-Director of ARC Training Centre for the Global Hydrogen Economy and Lead of NSW Powerfuel including H_2 Network. She is Co-Editor in Chief of Applied Catalysis B: Environment and Energy. Her research focuses on designing innovative catalysts to harness solar energy via photocatalysis, electrocatalysis, and thermal catalysis, converting water, air, or waste into valuable chemicals and fuels such as hydrogen, ammonia, and methanol.

Professor Rose Amal has received numerous prestigious awards including CHEMECA medalilst (2021) and named as 2019 NSW Scientist of the Year. She is a Fellow of Australian Academy of Technology and Engineering (FTSE), a Fellow of Australian Academy of Science (FAA), Fellow of Royal Society NSW (FRSN), and Honorary Fellow of Engineers Australia. She has received the nation's top civilian honour – the Companion of the Order of Australia - for her service to chemical engineering, particularly in the field of particle technology, through seminal contributions to photocatalysis, to education as a researcher and academic, and to women in science as a role model and mentor.

Prof. Debra Bernhardt

The University of Queensland, Australia

Heat Transport across Interfaces: Challenges and Insight from Simulation

ABSTRACT

Heat transport in particulate systems is of often critical to the functioning of the system. When particles are immersed in a fluid, there are various processes that are relevant including particle-particle heat transfer, the thermal conductivity of the particles and fluid, coupling of heat transport to flow, and thermal transport at interfaces. One process of particular interest is thermal transport from heated nanoparticles in a fluid.

Molecular simulations provide a useful approach to analyse such systems since they allow them to be probed without disturbing the system. This is particularly relevant when temperature profiles or heat fluxes in nanopores are being probed, as the system is easily disturbed during the experimental measurement of these properties. We will present results of molecular dynamics simulations that we have carried out with fluids in nanopores where we are interested in determining the temperature profile, interfacial thermal resistance and heat flux. Results for simple slit nanopores and also pores with more complex wall structures will be discussed. The challenges that needed to be overcome to calculate the temperature profile when the molecules have geometric constraints will be discussed, and the new approach we have developed will be outlined. Our results also show how the thermal properties vary with the composition of the fluid. The results have wide-ranging applications in nanotechnology and biological systems.

BIOGRAPHY

Professor Debra Bernhardt is internationally recognised for her contributions to the development of nonequilibrium statistical mechanics and thermodynamics including far-from-equilibrium fluids and confined fluids. She is a Fellow of Australian Academy of Science and the Royal Australian Chemical Institute and an ARC Australian Laureate Fellow. Professor Bernhardt's 30 years of research experience includes appointments at the University of Basel, Switzerland; the Australian National University; and Griffith University, where she was founding director of the Queensland Micro- and Nanotechnology Centre. Professor Bernhardt's research interests focus on the use of a range of theoretical and computational approaches to develop a fundamental understanding of the behaviour of matter, and application of these approaches to a wide range of problems including transport in nanopores, fluctuation phenomena, design of materials, gas separation, energy storage and conversion.

Prof. Rajesh Davé

New Jersey Institute of Technology, USA

Enhanced Properties of Powders and Blends through Particle Engineering

ABSTRACT

Our research focuses on developing fundamental understanding of particle properties and their interactions at the nano and micro scales, along with translating that knowhow to innovate powder based solid form products. Recent work has specifically targeted pharmaceutical industry with a hope to satisfy unmet industry and patient needs. Unique contributions that will be discussed in this presentation include predictive property enhancements for fine powders, their blends, and compressed tablets through particle engineering, potentially enabling digital product design and manufacturing of high-quality, low-cost, smaller tablet products, as well as process understanding via multi-scale modeling. We have leveraged these recent fundamental advances to develop innovative processes and products spanning important areas such as; overcoming the difficulties in processing pharmaceutical powders due to their high cohesion via solventless mechanical coating of nanoparticles on their surfaces; use of modeling tools for enhanced process and product understanding; and improved bioavailability of poorly water-soluble drugs. Highlights of some of these topics will be presented including recent advances uncovering the role of fine particle agglomeration on powder behavior and power-law relationship between agglomeration, flowability, and packing where the granular Bond number could be used as a dimensionless scaling parameter. The synergistic enhancements in the blend or formulation properties will be highlighted including blend uniformity, flowability, compaction properties, and enhanced capability for direct blend direct compaction (DB-DC) tableting at either high or very low drug loadings.

BIOGRAPHY

Prof. Rajesh Davé Fellow of the American Institute of Chemical Engineers (AIChE), American Association of Pharmaceutical Scientists (AAPS), and National Academy of Inventors (NAI) is a Distinguished Professor of Chemical and Materials Engineering at New Jersey Institute of Technology (NJIT). He has granted 38 PhDs to his students, seven of those have been placed in US academia. His research contributions include 200+ journal papers (16,200+ Google citations, H-Index 68), and 23 issued patents. He has received numerous awards, including 2022 American Institute of Chemical Engineering (AIChE) PD2M Award for Outstanding Contribution to QbD for Drug Product, 2016 Thomas Alva Edison Patent Award, and 2015 AIChE Particle Technology Forum Fluidization Lectureship. He is currently the U.S. Executive Editor of *Advanced Powder Technology*, and the Past Chair of the AAPS *Manufacturing Science and Engineering Community* (MSE).

Prof. Kevin Galvin

University of Newcastle, Australia

How to Build a Particle Separator

ABSTRACT

This presentation addresses one of the simplest but most significant separations in the minerals industry, the separation of particles based on density. Invariably, the value of the mineral correlates with the metal content, and hence the density of the particles. We must first understand the nature of the challenge. The limits of separation are governed by the inevitable balance between particle segregation and dispersion within the fluid. Differential settling is the primary source of segregation, governed by the interplay between the fluid hydrodynamic forces that act on the particle, and the body force arising from gravity and buoyancy, referred to here as the net weight force of the particle in the fluid.

This lecture introduces the basic geometry of the Reflux Classifier, a system of parallel inclined channels above a conventional, vertical, fluidized bed. This system was motivated by the remarkable benefits of inclined settling, the so-called Boycott Effect, combined with a conventional fluidized bed. There was a light bulb moment in the act of the original invention that such a system carried many desirable features. However, there was no knowledge concerning the physical dimensions needed to achieve separations in minerals processing. The first full-scale Reflux Classifier had an inclined channel spacing of z=60 mm, and was even tested using a spacing of z=120 mm. The channel spacing became the primary focus of the technology in the early years. There was the natural resistance to considering a relatively small channel spacing of less than z=10 mm given the perception of the unforgiving nature of the minerals industry.

“How to build a particle separator”, is a question that has plagued me for more than twenty years. The separator receives a mixture of particles that must be untangled into two streams. Significant knowledge on this novel system was assembled through numerous PhD studies, but there has also been a series of step changes that have led to new trajectories for further advancement. Fundamentally, a high-performance separator must function like an algorithm in computational fluid dynamics. The entire solution rests on the provision of robust boundary conditions!

BIOGRAPHY

Kevin Galvin is the inventor of the Reflux Classifier used in gravity separation of fine mineral particles. With over 240 installations around the world, the technology has been used to beneficiate iron ore, mineral sands, metallurgical coal, potash, chromite, lithium, and other base metal oxides. New innovative systems are emerging including the Reflux Flotation Cell, Graviton, and a novel agglomeration technology. Kevin Galvin is a Laureate Professor at the University of Newcastle, Australia. He is a Fellow of the Australian Academy of Science and Australian Academy of Technology and Engineering and previous recipient of numerous awards including the Ian Wark Medal, ATSE Clunies Ross Award, and Antoine Gaudin Award in mineral processing. He is Director of the ARC Centre of Excellence for Enabling Eco-Efficient Beneficiation of Minerals.

Prof. Liejin Guo

Xi'an Jiaotong University, China

Intensification of Supercritical Water-Particle Reacting Flow

ABSTRACT

Supercritical water-coal multiphase reacting flow can achieve multigoals of clean, low-carbon, and efficient for hydrogen production and power generation. Strengthening the hydrogen production from the supercritical water gasification of coal can further increase conversion efficiency. However, this process involves strongly coupled physical and chemical processes across multiple scales, making it difficult to control by adjusting a single set of parameters. Supercritical water gasification process intensification of coal from multiple scales is investigated. This work reveals the flow pattern distribution and evolution of the transcritical jet, and proposes that the environmental turbulence can promote the shapeless plume, achieving rapid heating of coal particles and side reactions suppression. A trans-scale kinetic model of coal particles is established. The rate-limiting step is found and relative enhancement methods is revealed. The invention of the swirl distributor with cone-shaped structure in the dense phase region has maintained the appropriate reaction temperature in the reaction zone. This work indicates that heat and mass transfer resistance can be reduced by organizing flow fields to decrease the irreversibility of the process. The above design idea is used for designing a demonstration system, and reduces the complete gasification temperature to be below 670°C. It paves the way for cheap material selection and low cost hydrogen production and power generation.

BIOGRAPHY

Prof. Liejin Guo is an Academician of the Chinese Academy of Sciences (CAS),Academician of the World Academy of Sciences for the advancement of science in developing countries(TWAS), Professor of Xi'an Jiaotong University, an prestigious expert in engineering thermophysics and energy utilization, one of the principle investigators on multiphase flow in power engineering and hydrogen energy discipline in China, the first batch of distinguished professors of Yangtze River scholars of the Ministry of Education of China in the field of thermal energy engineering, the pioneer and founder of China's first discipline and specialty of New Energy Science and Engineering, the Chief scientist of the Major State Basic Research Development Program of China (973 Program), the Principal Scientist of Oversea Expertise Introduction Center for Discipline Innovation ("111 plan") of the State Administration of Foreign Experts Affairs, the Principal Scientist of the key R & D plan of the Ministry of science and technology, the Principal Scientist of the Basic Science Center Program for Order-ised Energy Conversion of the National Natural Science Foundation of China, and the director of State Key Laboratory of Multiphase Flow in Power Engineering.

Professor Guo has conducted extensive research in multiphase flow and heat & mass transfer in energy power systems, multiphase flow in petroleum engineering, theoretical and technological research on high-efficiency renewable development and utilization of new energy, as well as hydrogen science and technology. As the first awardee, he has been won the second prize of National Natural Science Award twice, the second prize of the National Natural Science Invention Award once, and the first prize from provinces or Chinese ministries seven times. He also received the inaugural National Award for Excellence in Innovation. His invention, the poly-generation technology of the Coal Supercritical Water Gasification for Hydrogen Production and Power Generation was granted as one of the 'The Ten Major Science and Technology Advances of China's Colleges and Universities'. He was honored with two Special Prize of Teaching Achievements in Shaanxi Province in 2019 and 2023, and the First Prize of National Teaching Achievements (Undergraduate) in 2022. Additionally, he has been recognized as a Highly Cited Researchers, World's Top 2% Scientists, Highly Cited Chinese Researchers and Best Scientists Ranking etc.

Prof. Hidehiro Kamiya

Tokyo University of Agriculture and Technology, Japan

Nano and Fine Particles Dispersion Behavior Control Based on Interface Structure Design, and its Application for Circular Economy

ABSTRACT

Aggregation and dispersion behavior control of nano and fine particles is one of the most important science and technology in the field of functional materials processing, such as fine ceramics, polymer composites and Li ion battery electrodes. Molecular and nanometer scaled interface structure control by using various surface modification methods, such as organic ligands and polymer dispersant on particles are developing to control above behavior in liquids.

Firstly, we will introduce some investigation about design and synthesis of novel amphiphilic organic ligands with various molecular structure and discovered the optimum structure to disperse nanoparticles into various polar and nonpolar organic solvents. Since the optimum organic structure of ligand for dispersion depend on the kind of organic solvent and matrix materials, ligand exchange process is generally applied. For this process, new characterization methods of adsorbed "strength" between the surface on nanoparticles with different materials and ligand adsorption group were developed by using simple method and NMR.

Based on these above approaches included ligand structure design for different nanoparticles dispersion behavior control in different solvent and solid matrix, we focus on the application for circular economy systems, recently. By the well dispersion of conductive nanoparticles into strong adhesive raw organic molecules for automobiles and other large equipment, we achieved easy decomposition of adhesive by high voltage electric pulse and separated different materials. I will introduce the outline of this new project.

In the case of fine particles, which size are larger than 100 nm in diameter, various kinds of polymer dispersant have been applied to control dense suspension behavior in ceramic processing and Li-ion battery. Colloid probe AFM method has been applied to discuss the action mechanism of polymer dispersant by using original probe preparation method.

Furthermore, fine ash particles adhesion and ash layer growth phenomena hindered stable operation of various energy systems using biomass and waste for sustainable energy systems. Original characterization systems of ash adhesion phenomena at high temperature conditions and analyzing methods have been developed. Based on the fundamental characterization method, the adhesion behavior control by using nanometer scale structure design between fine ash particles have been investigated.

BIOGRAPHY

Dr. Hidehiro Kamiya was Vice president, Trustee, Tokyo University of Agriculture and Technology, Japan from April 2020 to March 2024. He was Dean of Graduate school of Bio-Applications and Systems Engineering, 2013-2019, and Dean of Global Innovation Research Institute, 2017-2020. He is editorial board member of "Powder Technology" from 2002. He received B.C. degree (1981) and PhD (1986) in Department of Chemical Engineering at Nagoya University, Japan. He currently works as a professor at Waseda university from April 2024. He has published over 260 papers (211 WoS papers) about fine and nano-particles aggregation and adhesion behavior characterization and control. His fine particle science and technology has also been applied in various fields, for examples, ceramics, materials, energy and environmental, DDS, cosmetics, pigment, toner and produced many collaboration with industries. Professor Kamiya has received various award included the SCEJ Award for Outstanding Research (2007), Technology (2016) Achievement, and Society of Chemical Engineers, SCEJ Award (2022), Japan, and KONA award (2023)

Prof. Jinghai Li

Institute of Process Engineering, Chinese Academy of Sciences, China

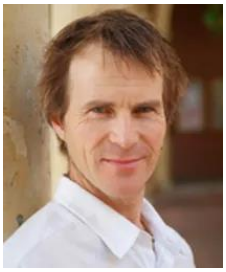
How Science Can Better Support Tackling Global Challenges

ABSTRACT

This talk will first discuss the interplay between global challenges and knowledge gaps, believing that tackling global challenges is now hindered seriously by the missing links of knowledge at the mesoscale of different levels and that filling knowledge gaps needs the driving forces from tackling global challenges. Then, three common features for all challenges will be discussed respectively by taking examples of SDGs, carbon neutrality and human health et al. the first common feature is that these challenges are all in compliance with the principle of compromise in competition and multi-objective optimization. The second is the multilevel mesoscale characteristics of complexity. The third is the dependence of global behaviors on all involved levels of systems. The presentation will be concluded with prospective on advancing the mesoscale complexity at different levels.

BIOGRAPHY

LI Jinghai, chemical engineer, was elected Member of the Chinese Academy of Sciences in 1999. He is a Member of The World Academy of Sciences as well as a Foreign Fellows of the Swiss Academy of Engineering Sciences, the Royal Academy of Engineering (UK), and the Australian Academy of Technology and Engineering, and the Royal Society (UK). He mainly works on the quantified design and amplification of particle-fluid two-phase reaction systems. He established the energy-minimization multi-scale (EMMS) method, which has been successfully applied in complex system simulation and industrial process simulation. In addition, he developed the multi-scale computing model and proposed the concept of mesoscience.



Prof. Gus Nathan

The University of Adelaide, Australia

Emerging High Temperature Particle Reactor Technology for the Net-Zero Industrial Transition

ABSTRACT

The transition to net-zero-emission operation for processes such as iron, alumina, cement and lime will lead to substantial change in both the design the operation of the high temperature reactors used to undertake processes such as iron ore reduction and alumina calcination. New types of flash and fluidised bed reactors are emerging because of their greater potential to accommodate electrification, hydrogen and/or direct capture of CO_2, together with the opportunity to reduce costs through increased efficiency, shorter residence time and increased circularity. However, substantial changes to process operation will be needed to accommodate these new pathways, which include additional pre-processing of the ores, such as through new beneficiation technologies, together with changes to reactor gaseous atmospheres and operating temperatures. New particle reactors are also expected to play a role in other emerging technologies for processes such as direct air capture. This transition of particle reactor technology will be summarised.

To achieve the scale of this transformation in these processes by 2050 will also require a step-change in the predictive capability of the numerical engineering models employed in the development, upscaling and design of these reactors. This is because current engineering models employ many simplifying assumptions owing to the complexity of the multi-phase fluid-dynamical transport and reaction phenomena within them, which are coupled, non-linear and multi-scale. Furthermore, the complex and unique properties of each ore means that each process is bespoke and must be purpose-designed for each plant. Whilst the current engineering models that have been progressively refined over the years are reasonable for current operation, their reliability in the new environments of future reactors is much lower. Furthermore, these new mode of operation for these technologies is largely unproven at commercial scale so that a high degree of confidence is needed to avoid costly operational challenges that could potentially occur from undesired phenomena such as blockages and reduced production from particle stickiness. New understanding is therefore needed for each of the underlying transport and reaction processes in these new operating regimes, together with new data for model development and validation. It is vital to avoid such challenges, which would otherwise slow down the roll out of these technologies through the sector. The presentation will therefore also address recent progress in the development of both the understanding and of the numerical modelling tools that will be needed for the low-carbon transition. These advances are occurring both in the optical diagnostic techniques used to provide insights and quantitative data sets, and in the emergence of physics-informed deep learning methods.

BIOGRAPHY

Gus Nathan is the founding Director of The University of Adelaide's Centre for Energy Technology. He has led the centre in developing its vision, identifying priorities and devising and implementing a strategic plan. Under his leadership the Centre has identified novel approaches with strong potential to make a breakthrough in the delivery of low-cost, clean energy technologies and has engaged with partners spanning industry, international research institutions and government agencies.

Professor Nathan is an ARC Discovery Outstanding Researcher who specialises in thermal energy engineering in systems supplied by solar, geothermal and the combustion of fossil and bio-fuels, but also works with hydrogen, wind and wave power. His recent work has focussed on novel approaches to integrate and optimise these different energy sources. He has played a leading role in the development of six patented technologies. He was principal leader of the Chief Design Team for the award winning fuel and combustion system for the Sydney Olympic Relay Torch and was co-inventor of the patented combustor that was subsequently also used in the torch and Stadium flame for the Athens Games. He has also jointly led the development of low NOx "Gyrotherm" burner being commercialised by partner FCT Combustion in rotary cement kilns and in the development of a technology to enhance the capture of ultra-fine particles and mercury in partnership with Indigo Technologies. A current focus is the development of novel hybrid power systems that combine solar energy with combustion or gasification, with one patent pending in this field.

Prof. Raffaella Ocone

Heriot-Watt University, UK

The Dynamic Behaviour of Wet Fluidization

ABSTRACT

A wide range of industrial processes concerns with processing and handling wet particles. For example, in power generation, oil/tar is formed in low-temperature regions of biomass thermal conversion reactors. In some circumstances, small amounts of liquid are added into processes involving particles, such fluidized bed. In physical processing, liquid is commonly sprayed into mixers or fluidized beds for particle coating and granulation. Catalyst particles can be adequately wetted to improve the performance of trickled-bed reactors; in fluidized catalytic cracking reactors, the sprayed droplets introduced through atomisers may spread on the surface of hot catalyst particles and vaporize to enhance the cracking efficiency. To produce high-performance polyethylene, multiple zones of different temperature are obtained by injecting condensated liquid into the fluidized bed.

Even small amounts of liquid can give rise to strong cohesion for granular materials, imposing a marked impact on fluidization and mixing in fluidized reactors. The liquid presence in solid processing systems results in changing the inter-particle forces and energy dissipation at collisional contacts.

The paper gives an account of wet fluidisation, starting from the observed behaviour then describing it by modelling the dynamics of the liquid bridges that create between particles. A detailed account of the formation and rupture of liquid bridges is provided through the introduction of a new liquid bridge evolution model to take into account the effects of particle relative velocity on the lifecycle of the liquid bridge. The new model introduces a critical parameter, namely the normal relative velocity between particles, v_{nc}, to control the liquid bridge force between particles, resulting in a monotonous increase of the liquid bridge force when v_{nc} changes from 0 to ∞ m/s. A measurement of one single bubble injected into a lab-scale incipiently fluidized bed from the literature is used for model validation.

The CFD-DEM simulations show the ability of the proposed model to provide a good estimation of the bed behaviour for various liquid loading and liquid viscosities. The hydrodynamic changes due to introduction of the liquid are correctly predicted. Extensions of the model are presented and the results from the simulations are compared with experiments. A simple analytical model to estimate the optimal range of v_{nc} is presented providing a complete methodology to study wet systems of particles.

BIOGRAPHY

Raffaella Ocone OBE, FREng, FRSE holds degrees from the Università di Napoli, Italy, and Princeton University, USA. She is the Chair of Chemical Engineering at Heriot-Watt University, UK, and Guest Professor at Ruhr University Bochum, Germany. Currently, she serves as the Deputy President of the Institution of Chemical Engineers (IChemE) and will become the 84th President in 2025.

In 2007, Raffaella was honoured with the title of Cavaliere by the President of the Italian Republic. In 2019, she was recognised as one of the top 100 Most Influential Women in the Engineering Sector by Inclusive Boards, in partnership with the Financial Times. In 2017, she became the inaugural "Caroline Herschel Visiting Professor" in Engineering at Ruhr University Bochum, Germany, in recognition of her contributions to engineering ethics.

Raffaella's research primarily focuses on modelling multiphase reactive systems, with a particular emphasis on developing responsible technologies in the energy sector. Her current work centres on advancing low-carbon hydrogen production.

Prof. Aibing Yu

Monash University, Australia

Simulation and Modelling of Particulate Systems

ABSTRACT

Particle science and technology is a rapidly developing interdisciplinary research area with its core being the understanding of the relationships between micro- and macro-scopic properties of particulate/granular matter – a state of matter that is widely encountered but poorly understood. The macroscopic behaviour of particulate matter is controlled by the interactions between individual particles as well as interactions with surrounding gas or liquid and wall. Understanding the microscopic mechanisms in terms of these interaction forces is therefore key to leading to truly interdisciplinary research into particulate matter and producing results that can be generally used. This aim can be effectively achieved via particle scale research based on detailed microdynamic information such as the forces acting on and trajectories of individual particles in a considered system. In the past two decades or so, such research has been rapidly developed worldwide, mainly as a result of the rapid development of discrete particle simulation technique and computer technology. This talk presents an overview of such developments, focusing on those in our laboratory "SIMPAS". It is demonstrated through examples that the study of small particles is well linked to many challenging problems in big science and particle scale approach has gradually emerged to be a powerful tool not only for fundamental research but also for engineering application. Needs for future development are also discussed.

BIOGRAPHY

Professor Aibing Yu specialized in process metallurgy, obtaining BEng in 1982 and MEng in 1985 from Northeastern University, PhD in 1990 from University of Wollongong, and DSc in 2007 from the University of New South Wales (UNSW). He is currently Sir John Monash Distinguished Professor, Pro Vice-Chancellor (China Strategy) and Foundation President (Suzhou), Monash University. He is also ARC Research Hub for Computational Particle Technology (continued as ARC Research Hub for Smart Process Design and Control).

He is a world-leading scientist in particle/powder technology and process engineering. He has made many significant contributions and is recognised as an authority in particle packing and flow, particulate and multiphase processing, and simulation and modelling. He has authored/co-authored >1,300 publications (including >900 collected in the Web of Science), delivered many invited plenary/keynote presentations at various international conferences, and graduated >50 postdoc fellows and >150 PhD students. He is Executive Editor of Powder Technology, Regional Editor of Granular Matter, and on the editorial board of ~20 learned journals.

He is a recipient of numerous prestigious awards/fellowships including ARC Australian Professorial and Federation Fellowships, Josef Kapitan Award from Iron and Steel Society, Ian Wark Medal from Australian Academy of Science, Exxon Mobile Award from Australian and New Zealand Federation of Chemical Engineers, Shell Thomas Baron Award from American Institute of Chemical Engineers, and the Top 100 Most Influential Engineers in Australia. He was elected to Fellow of the Australian Academy of Technological Sciences and Engineering in 2004, and Australian Academy of Science in 2011, and Foreign Member of Chinese Academy of Engineering in 2017.

Keynote Speakers

(Alphabetical order)

Prof. Wei Ge

Institute of Process Engineering, Chinese Academy of Sciences

Prof. Daniel Holland

University of Canterbury

Prof. Shu-san Hsiau

National Central University

Prof. Shunying Ji

Dalian University of Technology

Prof. Hsiu-Po Kuo

National Taiwan University

Prof. Kun Luo

Zhejiang University

Prof. Hiroshi Nogami

Tohoku University

Prof. Mikio Sakai

The University of Tokyo

Prof. Yanbai Shen

Northeastern University

Prof. Arash Tahmasebi

University of Newcastle

Prof. Yuanqiang Tan

Huaqiao University

Prof. Junichi Tatami

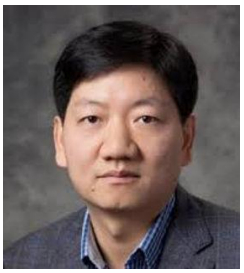
Tokyo Institute of Technology

Prof. Chiharu Tokoro

Waseda University

Prof. Haigang Wang

Institute of Engineering Thermophysics, Chinese Academy of Sciences



Prof. Junwu Wang

China University of Petroleum-Beijing

A/Prof. Meng Wai Woo

University of Auckland

Prof. Hongwei Wu

Curtin University

Program at a Glance

Technical session	T1. Modelling and simulation
	T2. Modelling and simulation of multiphase flow
	T3. Gas-solid flow: microscopic to macroscopic
	T4. Characterization & evaluation and control of particle dispersions
	T5. Powder handling: flow, mixing, and compaction
	T6. Particle synthesis and functionalization
	T7. Particle technology in low carbon metallurgy & recycling industries
	T8. Aerosol & interfacial science of particle
	T9. Particle technology for medical and pharma
	T10. Particle technology for energy and power sources
	T11. Recycling and waste management
	T12. Frontiers in powder technology
	T13. Special session for ARC hub for SPDC
Panel discussion	P1. Female in powder technology panel discussion
	P2. Grant writing panel discussion
	P3. ECR in powder technology panel discussion
Poster session	PS1 - PS11

Program at a Glance

Date	Slot	Technical session													Panel discussion		
		T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13	P1	P2	P3
1 Dec. (Sun)	15:00-18:00	Pre-registration and welcome reception (17:00)															
2 Dec. (Mon)	8:10-8:20	Acknowledgement of Country															
	8:20-8:50	Opening Speaker: Prof. Robin Batterham															
	8:50-9:00	Conference Photo															
	9:00-9:35	Plenary Lecture 1															
	9:35-10:10	Plenary Lecture 2															
	10:10-10:30	Coffee Break															
	10:30-12:10	Whiteley 2	Whiteley 1				Lindsay					Boyd	Hart				
	12:10-13:15	Lunch															
	13:15-13:50	Plenary Lecture 3															
	13:50-14:25	Plenary Lecture 4															
	14:25-14:50	Coffee Break															
	14:50-15:50	Whiteley 2	Whiteley 1				Lindsay						Hart		Boyd		
	15:50-18:00													Boyd			

Program at a Glance

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<tr><th>T1</th><th>T2</th><th>T3</th><th>T4</th><th>T5</th><th>T6</th><th>T7</th><th>T8</th><th>T9</th><th>T10</th><th>T11</th><th>T12</th><th>T13</th><th>P1</th><th>P2</th><th>P3</th></tr>
<tr><td rowspan="12">3 Dec. (Tue)</td><td>8:45-9:20</td><td colspan="16">Plenary Lecture 5</td></tr>
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<tr><td>16:30-18:00</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>Lindsay</td><td></td></tr>
<tr><td>18:45-21:30</td><td colspan="16">Pre-drink and Gala Dinner
Speakers: Prof. Julien Epps, Prof. Cordelia Selomulya, Prof. Satoru Watano</td></tr>
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Program at a Glance

Date	Slot	Technical session													Panel discussion		
		T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13	P1	P2	P3
4 Dec. (Wed)	8:45-9:20	Plenary Lecture 9															
	9:20-9:55	Plenary Lecture 10															
	9:55-10:55	Coffee Break + Poster Session															
	10:55-12:40			Boyd					Whiteley 2	Whiteley 1	Lindsay						Hart
	12:40-13:00	Closing Ceremony															
	13:00-14:00	Lunch															

Plenary Lecture

(Venue: Whiteley)

- **2nd December, Monday**
  - **Morning plenary session (Chair: Prof. Yansong Shen & Prof. Debra Bernhardt)**
    - **Plenary Lecture 1 (Prof. Jinghai Li)**

      Time: 9:00-9:35
    - **Plenary Lecture 2 (Prof. Rose Amal)**

      Time: 9:35-10:10
  - **Afternoon plenary session (Chair: Prof. Alex Yip & Prof. Rose Amal)**
    - **Plenary Lecture 3 (Prof. Hidehiro Kamiya)**

      Time: 13:15-13:50
    - **Plenary Lecture 4 (Prof. Raffaella Ocone)**

      Time: 13:50-14:25
- **3rd December, Tuesday**
  - **Morning plenary session (Chair: Prof. Hidehiro Kamiya & Prof. Rajesh Dave)**
    - **Plenary Lecture 5 (Prof. Aibing Yu)**

      Time: 8:45-9:20
    - **Plenary Lecture 6 (Prof. Liejin Guo)**

      Time: 9:20-9:55
  - **Afternoon plenary session (Chair: Prof. Aibing Yu & Prof. Gus Nathan)**
    - **Plenary Lecture 7 (Prof. Kevin Galvin)**

      Time: 13:15-13:50
    - **Plenary Lecture 8 (Prof. Rajesh Dave)**

      Time: 13:50-14:25
- **4th December, Wednesday**
  - **Morning plenary session (Chair: Prof. Kevin Galvin & Prof. Raffaella Ocone)**
    - **Plenary Lecture 9 (Prof. Debra Bernhardt)**

      Time: 8:45-9:20
    - **Plenary Lecture 10 (Prof. Gus Nathan)**

      Time: 9:20-9:55

Technical Session

T1. Modelling and simulation

Chairs: Satoru Watano, Daniel Holland, Hao Zhang, Kuang C. Lin, Shuai Wang, Yiran Liu

Date	Session Chair	Slot	Venue: Whiteley 2
2 Dec. (Mon)	Kuang C. Lin, Yiran Liu	10:30-10:50	**Keynote:** Cutting-edge discrete element methodologies for digital twin integration (**Mikio Sakai***)
		10:50-11:10	**Invited:** Numerical prediction on frictional characteristics of binary mixtures consisting of flexible cylindrical particles and rigid spheres (Yanping Zhu, Xiwen Mu, Pengyue Guo, **Hao Zhang***)
		11:10-11:30	**Invited**: A study on the dynamics of steel frames with damping particles (**Yun-Chi Chung***, Chun-Cheng Yang)
		11:30-11:50	Coarse grained DEM with rolling resistance and particle size distributions (**Kimiaki Washino***, Yuze Hu, Ei L. Chan, Jun-ichi Watanabe, Masahiro Takezawa, Takuya Tsuji, Toshitsugu Tanaka)
		11:50-12:10	CPFD prediction of coal-ammonia co-firing in a 550 MWe USC boiler for carbon-free power generation (**Joonwoo Kweon**, Byoung-Hwa Lee, Chung-Hwan Jeon*)
		12:10-13:15	**Lunch**
		13:15-13:50	**Plenary 3**
		13:50-14:25	**Plenary 4**
		14:25-14:50	**Coffee break**
	Satoru Watano, Hao Zhang	14:50-15:10	**Keynote:** Characterisation of granular flows using MRI (Maral Mehdizad, Daniel Clarke, Petrik Galvosas, **Daniel Holland***)
		15:10-15:30	**Invited**: CFD-DEM model development and applications in polydisperse solid-fluid systems (**Zhouzun Xie**, Yansong Shen*)
		15:30-15:50	**Invited**: 2-D simulations of fibrous particle penetration through mesh screens: a hybrid lattice-Boltzmann Lagrangian method (Thanh-Phat Duong, Yen-Hsi Li, Sheng-Yao Chou, Hairong Tao, **Kuang C. Lin***)
		15:50-16:10	Super-quadric CFD-DEM-VOF modelling of gas-solid-liquid systems (**Xinxin Tang**, Yansong Shen*)
		16:10-16:30	Simulation analysis of particle behavior during wet ball milling (**Kizuku Kushimoto***, Junya Kano)

		16:30-16:50	The efficient calibration and industrial application of discrete element method (**Ben Jenkins***, A.L. Nicuşan, A. Neveu, G. Lumay, F. Francqui, J.P.K. Seville, C.R.K. Windows-Yule)
		16:50-17:10	Evaluation and correction of systematic errors in unsteady cavitation flow visualization experiments (**Longhao Xiang**, Songying Chen*)
		17:10-17:30	Accurate and efficient realization of stress jump condition in the IB-LBM modelling of flow around and through porous bodies (**Xiaowen Liu***, Qingang Xiong)
		17:30-17:50	A SPH-DEM-FEM coupled model for non-regular particle-fluid-structure interactions based on geometric solid-liquid boundary condition (**Jie Wu**, Lu Liu, Shunying Ji*)
3 Dec. (Tue)	Daniel Holland, Shuai Wang	10:15-10:35	**Keynote:** Discrete element methods for largely deformed granular materials with arbitrary morphologies (**Shunying Ji**)
		10:35-10:55	**Invited**: GPU-accelerated CFD-DEM modeling of gas-solid reacting flow with complex geometry (**Dazhao Gou**, Yansong Shen*)
		10:55-11:15	Influence of the calculation method of liquid bridge force model on DEM simulation of wet powder behavior (**Tomotaka Otsu**, Hideya Nakamura*, Shuji Ohsaki, Satoru Watano)
		11:15-11:35	Measurement on the plane strain deformation of sand based on digital image correlation technology and its DEM numerical simulation (**Xiaoxia Guo***, Pengpeng Wang)
		11:35-11:55	Numerical simulation of the evolution of the funicular liquid bridge in a three-particle system (Fengjie Yao, Yinyi Xue, Di Wu, Liu Liu, Ping Zhou, **Dongling Wu***)

T2. Modelling and simulation of multiphase flow

Chairs: Junwu Wang, Junichi Tatami, Wei Ge, Arash Tahmasebi, Haigang Wang, De-Hao Tsai, Hiroshi Nogami, Xiaobing Yu

Date	Session Chair	Slot	Venue: Whiteley 1
2 Dec. (Mon)	Junwu Wang, Junichi Tatami	10:30-10:50	**Keynote:** Two-phase flow analysis on particle motion in blast furnace raceway (**Hiroshi Nogami***, Ryusei Matsuda, Shungo Natsui)
		10:50-11:10	**Invited:** POD-based reduced-order model for dense particulate flow (**Shuai Wang***, Kun Luo, Jianren Fan)
		11:10-11:30	**Invited:** Pyrolysis behavior of thermally thick biomass particles: A modelling study (**Xiaoke Ku***, Jin Wang)
		11:30-11:50	Impact of flow on the distribution of particle agglomerate impurities and the development of an associated model (**Yiting Xiao**, Zhengbin Pan, Bo Kong*)
		11:50-12:10	CFD analysis of raceway dynamics and emission control with COG and RCOG injection in an ironmaking blast furnace (**Ehsan Farajzadehdevin**, Yuting Zhuo, Yansong Shen*)
		12:10-13:15	**Lunch**
		13:15-13:50	**Plenary 3**
		13:50-14:25	**Plenary 4**
		14:25-14:50	**Coffee break**
	Hiroshi Nogami, Arash Tahmasebi	14:50-15:10	**Keynote:** Physics-informed dynamic mode decomposition for short-term and long-term prediction of gas-solid flows (Dandan Li, Bidan Zhao, Shuai Lu, **Junwu Wang***)
		15:10-15:30	**Invited:** Lattice Boltzmann method for modeling gas-solid fluidization (**Limin Wang***, Wei Ge)
		15:30-15:50	**Invited:** The fluctuating characteristics of particle flow during silo discharge (**Xiaoxing Liu***, Dancheng Zhang, Xiaodong Yang, Hui Guo)
		15:50-16:10	Collaborative modelling of gas-solid reacting flow in a fuel reactor equipped with process controllers in chemical looping combustion (**Guoyin Yu**, Yuting Zhuo, Shuyue Li, Yansong Shen*)
		16:10-16:30	Application study on a coarse-grained DEM-CFD to a wet bead mill simulation (**Yuki Tsunazawa***, Mikio Sakai)

		16:30-16:50	VOF-DEM investigation of the wet grinding process in a SAG mill (**Qixuan Zhu**, Yuqing Feng*, Peter Witt, Warren Bruckard, Runyu Yang)
		16:50-17:10	Prediction of flow through packed beds using machine learning (Sagar G. Nayak, Hariprasad Kodamana, **Prapanch Nair***)
		17:10-17:30	Research on drag force of bubble swarms based on direct numerical simulation (**Zhendong Li**, Fan Duan, Xiao Chen, Qiang Zhou*)
		17:30-17:50	Diffusion and dissolution of oil droplet in supercritical water (**Qiuyang Zhao**, Lichen Zheng, Xuetao Wang, Yu Dong, Liejin Guo*)
3 Dec. (Tue)	Haigang Wang, De-Hao Tsai	10:15-10:35	**Keynote:** Intelligent virtual process engineering: modelling, computing and analysing (Haolei Zhang, Aiqi Zhu, Ji Xu, **Wei Ge***)
		10:35-10:55	**Invited:** Development of advanced models for blast furnace ironmaking: analysis of operational dynamics and process optimization (**Xiaobing Yu**, Yansong Shen*)
		10:55-11:15	Towards pore-scale simulation of multiphase flows in porous media (**Zhisong Ou***, Qiang Xue)
		11:15-11:35	A corrected solid stress closure considering the effect of the wall boundary in gas-particle fluidized bed (**Shouzheng Yuan**, Qiang Zhou*)
		11:35-11:55	Analysis of simulated metal powder distribution in new design DED nozzle out flow field (**Bing-zhi Wang**, Li-Tsung Sheng, Shu-San Hsiau*)
		12:00-13:15	**Lunch**
		13:15-13:50	**Plenary 7**
		13:50-14:25	**Plenary 8**
		14:25-14:50	**Coffee break**
		14:50-15:10	**Keynote:** Investigation the gas-solids two-phase flows in fluidised bed with different scale based on MP-PIC approach (**Haigang Wang**)
		15:10-15:30	**Invited:** Numerical simulation of the decarboxylation process of powdered $CaCO_3$ in the pilot jet flame (Susumu Tsuchiya, **Masaya Muto***, Yuta Umeno, Takayuki Nishiie, Noriaki Nakatsuka, Fumiteru Akamatsu, Ryoichi Kurose)
		15:30-15:50	**Invited:** A numerical simulation study of particle flow and reaction flow in H_2 shaft furnace (**Zhengjian Liu***, Shaofeng Lu, Yaozu Wang, Jianliang Zhang)

	Wei Ge, Xiaobing Yu	15:50-16:10	CFD-DEM study of the effect of lump ore on in-furnace phenomena in an ironmaking blast furnace (**Peng Zhou**, Shibo Kuang*, Dianyu E, Ruiping Zou, Wenqi Zhong, Aibing Yu*)
		16:10-16:30	Numerical investigation of motion of a pellet-shaped particle placed in uniform flow (**Kenji Tanno***, Toshiaki Fukada)
		16:30-16:50	Validation study on the coarse graining DEM-CFD simulation for large-scale industrial liquid–solid flow systems (**Nobutaka Kitsunai**, Mikio Sakai)
		16:50-17:10	Numerical study on the dynamic behaviors of shear-thinning droplets impacting on a hydrophobic spherical surface (**Jialiang Cai**, Jiliang Ma*, Xiaoping Chen, Cai Liang)
		17:10-17:20	A mPOD-based reduced-order modelling approach for fast gas-solid flow simulations (**Huiting Chen**, Wangyan Li, Jie Bao, Yansong Shen*)
		17:20-17:30	Super-quadric CFD-DEM study of spout deflection behaviour of non-spherical particles in a spout fluidized bed (**Zhan Luo**, Shuai Wang, Yansong Shen*)

T3. Gas-solid flow: microscopic to macroscopic

Chairs: Tawatchai Charinpanitkul, Dazhao Gou

Date	Session Chair	Slot	Venue: Boyd
4 Dec. (Wed)	Tawatchai Charinpanitkul, Dazhao Gou	10:55-11:15	**Invited:** Simulations of ethylene oxychlorination in a catalyst pellet packed reactor of dual space resolutions (Cheng-En Li, An-Ni Huang, Wan-Yi Hsu, Tsuo-Feng Wang, **Hsiu-Po Kuo**[*])
		11:15-11:35	**Invited:** Development of a filtered reaction rate model for a non-equimolar reaction (Lingxue Wang, Zheqing Huang, **Qiang Zhou**[*])
		11:35-11:55	Enhanced powder properties of nano/micro particles enabled by atomic and molecular scale coatings (**Fuweng Zhang**[*])
		11:55-12:15	Mixing/segregation behaviours for density difference binary particle bed in a vibrating fluidized bed (**Yoshihide Mawatari**[*], Naoki Iwamura, Yuki Ishiyama)
		12:15-12:25	Insights into the gas-solid hydrodynamics and thermochemical mechanisms in calcium-looping energy storage using CFD-DEM (**Hongchuan Jiang**, Cai Liang[*])
		12:25-12:35	Numerical simulation on the fluidization-atomic layer deposition of the nanoparticle agglomerates under the scale of agglomerate and fluidized bed (**Zuyang Zhang**, Daoyin Liu[*])

T4. Characterization & evaluation and control of particle dispersions

Chairs: Shu-San Hsiau, Tatsushi Matsuyama

Date	Session Chair	Slot	Venue: Boyd
3 Dec. (Tue)	Shu-San Hsiau, Tatsushi Matsuyama	14:50-15:10	**Keynote:** Dispersion and flocculation transition of alumina slurries as temperature changes evaluated by a combined OCT and rheometer system (**Junichi Tatami***, Miyu Nakamura, Motoyuki Iijima, Takuma Takahashi)
		15:10-15:30	**Invited:** The study of particle size and morphology changes of metal powders on the same shear energy and impaction with DEM simulation (**Heekyu Choi***, Khulan Uranchimeg, Amgalan Bor, Kyung Sung Kim)
		15:30-15:50	**Invited:** Non-parametric evaluation for particle size distribution analysis (**Tatsushi Matsuyama**)
		15:50-16:10	Photocurable aqueous suspension design for greener additive manufacturing process of alumina ceramics (**Motoyuki Iijima***, Bohua Ma, Junichi Tatami)
		16:10-16:30	Elucidation of influence of saponification degree of added PVA on internal structural changes during drying of SiO_2 slurry by operando OCT observation (**Hiromasa Kuroda**, Junichi Tatami*, Motoyuki Iijima, Takuma Takahashi)
		16:30-16:50	Investigation of micronization of TSLP single-domain antibody for pulmonary drug delivery (**Jingyu Shi**, Hao Miao, Zhenbo Tong*)
		16:50-17:10	Effective prevention of palladium metal particles sintering by histidine stabilization on silica catalyst support (**Harry Cahyanto**, Xuanming Chen, Frank L. Y. Lam, Ploychanok Iadrat, Chularat Wattanakit, Pinit Kidkhunthod, Varinder Singh, Sally Brooker, Shusheng Pang, Jungkyu Choi*, Alex C. K. Yip*)
		17:10-17:30	Automated synthesis of Al-doped ZnO nanoparticles: an online UV-Vis spectroscopy approach (**Guohui Yang***, Marcel Kévin Jiokeng Dongmo, Thomas Meurer, Hermann Nirschl)
		17:30-17:50	An approach to automated process optimization in mixing using adaptive and dynamic mixing modes (**Benedikt Schwarz***, Johannes Lindner)

T5. Powder handling: flow, mixing, and compaction

Chairs: Hsiu-Po Kuo, Shunying Ji, Chun-Chung Liao, Zhouzun Xie

Date	Session Chair	Slot	Venue: Lindsay
3 Dec. (Tue)	Chun-Chung Liao, Zhouzun Xie	10:15-10:35	**Keynote:** The influence of intruder geometry on the segregation phenomenon in a vibrated particle bed (**Shu-San Hsiau***, Li-Tsung Sheng, Jia-Jung Wu)
		10:35-10:55	**Invited:** Experimental study the combine the effects of density and shape on the dynamic properties and segregation mechanisms of granular material in a rotating drum (**Chun-Chung Liao***, Zhe-Hao Zhang)
		10:55-11:15	Prediction and optimization of particulate processes using physics augmented machine learning approach (Chengbo Liu, Tingting Liu, Kun Hong, **Xizhong Chen***)
		11:15-11:35	PTFE fibrillation by dry powder mixing and its application to electrode fabrication for all-solid-state battery (**Hideya Nakamura***, Shota Miyake, Motoshi Iwao, Shuji Ohsaki, Satoru Watano)
		11:35-11:45	The rapid prediction of pulverized coal MILD combustion field: CFD + ensemble learning (**Hang Shu**, Wenqi Zhong*, Xuejiao Liua, Xi Chen)
		11:45-11:55	Towards the influence of fluid convection on filtered drag in fluidized gas-particle flows (**Ju Jiang**, Xiao Chen, Qiang Zhou*)
		12:00-13:15	**Lunch**
		13:15-13:50	**Plenary 7**
		13:50-14:25	**Plenary 8**
		14:25-14:50	**Coffee break**
	Shunying Ji Hsiu-Po Kuo	14:50-15:10	**Keynote:** On the cemented carbide powder forming process based on the discrete element simulation (**Yuanqiang Tan***, Chao Liu, Jie Li, Wenqing Zheng)
		15:10-15:30	**Invited:** On the electrostatics of granules and granular flows (**Yanlin Zhao**, Jun Yao*)
		15:30-15:50	Granular mixing and segregation: continuum modelling and processes optimization (**Liuyimei Yang***, Xinyu Liu, Qijun Zheng, Aibing Yu)
		15:50-16:10	Inorganic-organic hybrid porous ceramics using non-firing solidification and functionalizing starch (**Kento Ishii**, Tetsuo Uchikoshi, Masayoshi Fuji*)
		16:10-16:30	Effects of dispersants and floc formation on yielding phenomena for concentrated silica slurry (**Tomonori Fukasawa***, Tatsuhiko Murakami, Mayuna Oka, Yuki Nishimura, Toru Ishigami, Kunihiro Fukui)

T6. Particle synthesis and functionalization

Chairs: Cordelia Selomulya, Ziguang Zhao, Yanbai Shen, Masaya Muto

Date	Session Chair	Slot	Venue: Lindsay
2 Dec. (Mon)	Cordelia Selomulya, Ziguang Zhao	10:30-10:50	**Keynote:** High sensitive and selective H_2 sensors based on sandwich-structured M_xSn_y-rGO-SnO_2 composites (**Yanbai Shen***, Guodong Li, Sikai Zhao, Cong Han)
		10:50-11:10	**Invited:** Microfluidic-aerosol hyphenated synthesis of metal-organic framework-derived hybrid catalysts for CO_2 utilization (Yi-Hsuan Sung, **De-Hao Tsai***)
		11:10-11:30	Functionalization of BTX-derived MWNCTs as a fluorescence sensor hybridized with coumarin for use in metal ion detection (**Weerawut Chaiwat***, Thanchanok Vettavong, Pimonpan Inthapat, Phitchawalai Ninthachan, Chawalkul Chotmunkhongsin, Sirilak Wangngae, Sutthira Sutthasupa*)
		11:30-11:50	Synthesis and functionalization of carbon black-silica hetero-aggregates (**Simon Buchheiser***, Hermann Nirschl, Frank Rhein)
		11:50-12:10	Synthesis and gas sensing properties of semiconducting metal oxide nanostructures (**Sikai Zhao***, Yanbai Shen, Wenbao Liu)
		12:10-13:15	**Lunch**
		13:15-13:50	**Plenary 3**
		13:50-14.25	**Plenary 4**
		14:25-14:50	**Coffee break**
	Yanbai Shen, Masaya Muto	14:50-15:10	**Invited:** The role of coating homogeneity for enhanced performance in lithium-ion battery cathodes (**Tomoya Ohno***, Jeevan Kumar Padarti, Shigeto Hirai, Takeshi Matsuda)
		15:10-15:30	Biosynthesis of zinc oxide nanoparticle using clove extract for antimicrobial applications (**Tjokorde Walmiki Samadhi***, Vita Wonoputri, Claritta Sukmalovelina, Intan Subadri)
		15:30-15:50	Enhancing the scalability of metal-organic frameworks with copper-crosslinked carboxymethyl cellulose hydrogel support (**Paul Kinyanjui Kimani***, Chika Takai-Yamashita, Edwin Madivoli)
		15:50-16:10	Enhanced CO_2 hydrogenation performance of modified commercial high entropy alloys (Chunjing Su, **Jiaquan Li***, Jun Huang*)

		16:10-16:30	Electrostatic particle assembly technique for formation of structurally controlled composite granules (**Wai Kian Tan***, Koki Iwata, Keita Tsuzuki, Go Kawamura, Atsunori Matsuda, Hiroyuki Muto)
		16:30-16:50	Spray drying synthesis of alginate particles for enzyme encapsulation (**Yilun Weng**)
		16:50-17:10	Novel metal-organic frameworks (MOFs) series: UC-MUFs (**Soongseok Yoon**, Agung Bagus Pambudi, Daisong Chen, Jin Shang, Shane G. Telfer, Ben Hang Yin, Jungkyu Choi, Alex C. K. Yip*)
		17:10-17:30	0D-2D heterostructures of SnO_2 QDs-metallic sulphide nanomaterials for room-temperature NH_3 sensing (**Jinzhou Bai**, Yanbai Shen*, Sikai Zhao, Cong Han)
		17:30-17:50	Synthesis of SW/MWCNTs from flare gas: a comparative study on catalyst preparation methods and process optimization (**Chawalkul Chotmunkhongsin**, Paeka Klaitong, Sunisa Watcharasing, Tawatchai Charinpanitkul, Sakhon Ratchahat, Weerawut Chaiwat*)

T7. Particle technology in low carbon metallurgy & recycling industries

Chairs: Mikio Sakai, Limin Wang

Date	Session Chair	Slot	Venue: Whiteley 2
3 Dec. (Tue)	Mikio Sakai, Limin Wang	14:50-15:10	**Keynote:** Reactivity and degradation mechanism of metallurgical coke during reaction with H_2O and CO_2 using kinetics modelling and micro-CT analyses (**Arash Tahmasebi***, Ai Wang, Behnaz Rahmatmand, Salman Khoshk Rish, David Jenkins)
		15:10-15:30	**Keynote:** Coproducing biochar pellets and green chemicals from pyrolysis of mallee biomass in Western Australia: a techno-economic analysis (Xiangpeng Gao, **Hongwei Wu***)
		15:30-15:50	**Invited:** Driving the transformation to hydrogen ironmaking: an experimental vertical shaft H_2-DRI reactor facility (**Ben Hang Yin***, Shaira Mendoza, Chris W. Bumby)
		15:50-16:10	**Invited:** CFD study of hydrogen injection in blast furnaces: tuyere co-injection of hydrogen and coal (**Yiran Liu***)
		16:10-16:30	The reduction kinetic of lump ore by hydrogen (**Shuoyang Liu**, Helen Tang, Tom Rufford, Geoff Wang, Tim Evans, Xiaodong Ma*)
		16:30-16:50	Recovery of citric acid-soluble potassium components from biomass combustion bottom ash using both grinding and classification (**Fandi Angga Prasetya**, Sawa Ishizuka, Tomonori Fukasawa, Toru Ishigami, Kunihiro Fukui*)
		16:50-17:10	New frontiers for electrostatic separation (**Peter M. Ireland***)
		17:10-17:20	How blast rate variation affects dynamic in-furnace behaviours and energy consumption of an industrial-scale blast furnace: a transient-state CFD study (**Jin Xie**, Xiaobing Yu, Yansong Shen*)
		17:20-17:30	A novel technology of co-injecting hydrogen and biomass in blast furnaces for a sustainable carbon-neutral ironmaking (**Ming Jiang Gan**, Yiran Liu, Yansong Shen*)

T8. Aerosol & interfacial science of particle

Chairs: Wenjing Sun, Shuang Song

Date	Session Chair	Slot	Venue: Whiteley 2
4 Dec. (Wed)	Wenjing Sun, Shuang Song	10:55-11:15	Amino acid-derived polynorbornene: investigating the shift from synthetic polymers to polymer interfaces and interface bridging with multi-wall carbon nanotubes (**Sutthira Sutthasupa***, Sirilak Wangnage, Sukanya Thisan, Sarawut Kamphune, Apiwat Pankaew, Weerawut Chaiwat)
		11:15-11:35	AI-based model prediction of respiratory deposition distribution of dry powder inhalation formulations (**Lixing Zhang**, Zhenbo Tong*, Aibing Yu)
		11:35-11:55	Agglomerate aerosols by ultrasound: its impact on air filter pressure drop (**Pengzhan Liu***, Xin Zhang, Guicai Liu, Shi Hao Lim, Man Pun Wan, Grzegorz Lisak, Bing Feng Ng)
		11:55-12:15	Seasonal characteristic variations of $PM_{2.5}$ chemical components and implications for cloud condensation nuclei activation properties (**Yongwei Lu**, Yunkun Chen, Xin Wang*, Bo Ren, Biao Li, Eric Lichtfouse, Yueshe Wang*)

T9. Particle technology for medical and pharma

Chair: Meng Wai Woo, Yuting Zhuo

Date	Session Chair	Slot	Venue: Whiteley 1
4 Dec. (Wed)	Meng Wai Woo, Yuting Zhuo	10:55-11:15	**Keynote:** Advances in spray drying powders (**Meng Wai Woo***)
		11:15-11:35	**Invited:** Assembly of hybrid nanoparticles via metal coordination for disease Treatment (**Zi Sophia Gu***)
		11:35-11:55	Nasal delivery of encapsulated recombinant ACE2 as a prophylactic drug for SARS-CoV-2 (**Alberto Baldelli**, Hale Oguzlu, Hui Xin Ong, Daniela Traini)
		11:55-12:15	Inhalable high-loading cannabidiol powders (**Waiting Tai**, Grace Tsz Yan Yau, Jonathon Carl Arnold, Hak-Kim Chan, Philip Chi Lip Kwok*)

T10. Particle technology for energy and power sources

Chairs: Xiaoke Ku, Heekyu Choi

Date	Session Chair	Slot	Venue: Lindsay
4 Dec. (Wed)	Xiaoke Ku, Heekyu Choi	10:55-11:15	Highly stable and pH-universal catalysts for hydrogen evolution reactions (**Zhaojun Han**[*])
		11:15-11:35	Numerical study on the carbonation reaction of CaO with supercritical CO_2 in a fluidized bed reactor for CSP application (**Nan Zheng**, Shaoxin Chen, Hanqing Liu, Jinjia Wei[*])
		11:35-11:55	Nickel ferrite nanoparticles synthesized by the electrochemical method for energy storage applications (**Heru Setyawan**[*], Widiyastuti Widiyastuti, Suci Madhania)
		11:55-12:15	Integration of calcium looping with methane Bi-reforming via the Ni-Pd interface: a combined experimental and DFT study (**Zhi Xuan Law**, Kun-Han Lin, De-Hao Tsai[*])
		12:15-12:25	Ignition characteristic of coal particle under high pressure (**Dongdong Fang**, Yuanqiang Duan[*], Lunbo Duan[*])
		12:25-12:35	Gas penetration and powder compression of powder bed in lock-hopper silo under high pressure dynamic load (**Minghao You**, Xin Wang, Liang Cai[*])

T11. Recycling and waste management

Chairs: Ben Hang Yin, Xiaoxing Liu, Junichi Ida

Date	Session Chair	Slot	Venue: Boyd
2 Dec. (Mon)	Ben Hang Yin, Xiaoxing Liu	10:30-10:50	**Keynote:** Efficient separation technology of spent photovoltaic panels for the circular economy (**Chiharu Tokoro***)
		10:50-11:10	**Invited:** Application of particle technology and materials science to biological wastewater treatment (**Junichi Ida***, Stella Chan, Kento Nishi, Kiriko Aramoto, Beatriz Durán, Shinichi Akizuki, Pabel Cervantes Avilés, German, Tatsushi Matsuyama)
		11:10-11:30	**Invited**: Multi-scale modelling and simulation of particulate multiphase flow applied in mineral processing (**Yuqing Feng***, Peter Witt, Phil Schwarz)
		11:30-11:50	Gasification of solid wastes for high-purity hydrogen and syngas production with CO_2 capture (**Xiuping Liao**, Soo Jean Park, Yijiao Jiang*)
		11:50-12:00	Synergistic effect of heavy metals stabilization during the co-processing of contaminated soil in cement kiln (**Ming Gao**, Lin Li, Xue Liu, Zhipan Ma, Guang Sun, Zhihao Zhou, Bing Li, Lunbo Duan*)
		12:00-12:10	Design and optimization of oxy-combustion CFB power plant with energy storage system based on particle flow, heat transfer (**Xuchen Fu**, Yuanqiang Duan, Lunbo Duan*)
3 Dec. (Tue)	Ben Hang Yin, Junichi Ida	10:15-10:35	**Keynote:** A CFD-DEM approach to continuous VOC adsorption in a countercurrent fluidized bed (Wei-Han Jen, Wan-Yi Hsu, Tsuo-Feng Wang, An-Ni Huang*, **Hsiu-Po Kuo***)
		10:35-10:55	**Invited:** Silver recovery from crystalline silicon photovoltaic solar cells using continuous stirred-tank reactors (**Shuang Song**, Yansong Shen*)
		10:55-11:15	Investigation on the behavior and mechanism of low-grade magnesite separation enhanced by polycarboxylic acid grinding aid (**Wenbao Liu***, Yanbai Shen, Wengang Liu, Sikai Zhao, Qiang Zhao)
		11:15-11:35	Magnetic cleaning of particulate materials on solar panels (**Masato Adachi***, Ryo Goda)
		11:35-11:55	Novel insights into the microscale modelling of bubble-particle collision efficiency in flotation process (**Min Sun**, Yuqing Feng*, Peter Witt, Phil Schwarz, Baoyu Cui, Junwu Zhou)

T12. Frontiers in powder technology

Chairs: Qiang Zhou, Tomoya Ohno, Kun Luo, Yun-Chi Chung

Date	Session Chair	Slot	Venue: Hart
2 Dec. (Mon)	Qiang Zhou, Tomoya Ohno	10:30-10:50	**Keynote:** Acceleration Algorithms for Modeling Dense Gas-Solid Reactive Flows (**Kun Luo***)
		10:50-11:10	**Invited:** Numerical Study of hydrogen storage design and optimisation (**Yuting Zhuo**, Yansong Shen*)
		11:10-11:30	**Invited:** Comparative analysis of Particle density effects on fluidization in gas-solid fluidized beds (**Shuyue Li***, Yongmin Zhang, Wenjie Wang, Huan Wang)
		11:30-11:50	DEM study on ellipsoidal particle mixing in an industrial mixer (**Shintaro Kajiwara***, Mikio Sakai)
		11:50-12:10	DEM-FEM coupling simulation for improved deformation prediction in a hot isostatic pressed part (**Wenqing Tian***, Runyu Yang, Cao Cai)
		12:10-13:15	**Lunch**
		13:15-13:50	**Plenary Lecture 3**
		13:50-14:25	**Plenary Lecture 4**
		14:25-14:50	**Coffee break**
	Kun Luo, Yun-Chi Chung	14:50-15:10	**Invited:** Scaled-up spout fluidized beds for heat release process of thermochemical particles in solar thermal power generation (**Yuanhe Yue**, Weiwei Zhao, Chenzhen Liu, Zhonghao Rao*)
		15:10-15:30	**Invited:** Application of ironmaking blast furnace transient numerical model to study innovative operations for decarbonisation (**Ziguang Zhao**, Yansong Shen*)
		15:30-15:50	**Invited:** Low temperature CO_2 methanation using Ni-Al-Ce-La layer double hydroxide catalyst (Haftu Gebretsadik Gebreegziabher, Noriaki Sano, Sakhon Ratchahat, **Tawatchai Charinpanitkul**)
		15:50-16:10	**Invited:** Numerical study on particle motion and deposition characteristics inside the film cooling holes of turbine blade (**Wenjing Sun***, Jianghan Yu, Yuqiu Zheng, Jingzhou Zhang)
		16:10-16:30	Multiscale kinetic theory for heterogeneous granular and gas-solid flows (**Bidan Zhao**, Junwu Wang*)

		16:30-16:50	Simulation of the biomass gasification process of cubic particles in a fluidized bed using the superquadric method (**Jun Xie***, Hao Xu, Xinhe Shen)
		16:50-17:10	An environmentally friendly depressant in the selective flotation of magnesite and calcite: selective inhibition and adsorption mechanism (**Yong Mao**, Wengang Liu*, Yanbai Shen, Wenbao Liu)
		17:10-17:30	Numerical study on the influence of cell size and turbulence on the behavior of slurry particles inside a three dimensional rotating drum (**Ikki Adji Dharma***, Yun-Chi Chung, Li-Shin Lu, Shu-San Hsiau)
		17:30-17:40	Numerical study and parameters investigation of aerosol droplets in aerosol jet printing process (**Xiaojing Bai**, Minshu Zhan, Qijun Zheng*, Aibing Yu*)
		17:40-17:50	Coupling computational fluid dynamics and finite element method (CFD-FEM) for modelling dense particle-fluid flows (**Yinghui Wu**, Qijun Zheng*, Liuyimei Yang, Aibing Yu)

T13. Special session of ARC hub for SPDC

Chairs: Shibo Kuang, Kejun Dong

Date	Session Chair	Slot	Venue: Boyd
2 Dec. (Mon)	Kejun Dong, Shibo Kuang	15:50-16:00	**Director Welcome** **Prof. Aibing Yu**
		16:00-16:15	**Invited:** Predicting railway in-train forces from ATO measurements - a data-driven approach (Sheng Zhang, Pu Huang, **Wenyi Yan***)
		16:15-16:30	**Invited:** Structure characterisation of active particles and comparison with granular particles (**Kejun Dong***, Ruizhi Jin, Jigar Modi)
		16:30-16:45	**Invited:** Interaction forces of patchy gold nanoparticles derived from molecular dynamics simulation (Pan Yang, **Qinghua Zeng***, Kejun Dong, Haiping Zhu)
		16:45-17:00	**Invited**: Development of low-carbon ironmaking technologies (**Shibo Kuang**, Aibing Yu)
		17:00-17:10	Fully-resolved simulation of newtonian and non-newtonian particle flows (**Mohammad Fazli***, Shibo Kuang, Murray Rudman, Aibing Yu)
		17:10-17:20	Effect of particle shape on tribocharging in horizontal pneumatic transport (**Fayuan Huang**, Shibo Kuang*, Ruiping Zou, Aibing Yu)
		17:20-17:30	Numerical simulation study of sludge drying process based on CFD-DEM (**Gong Li**, Hao Zhang*, Aibing Yu, Zongyan Zhou)
		17:30-18:00	*For SPDC Hub members only* **Hub Annual Meeting Discussions** **Hub Director Conclusions**

Panel Discussion

P1. Female in Particle Technology

Time: 14:50-15:50 (2 December, Monday)

Venue: Boyd

Chair: Meng Wai Woo

Panel members: Prof. Debra Bernhardt, A/Prof. Zi Sophia Gu, Dr. Yiran Liu, Prof. Raffaella Ocone, Prof. Cordelia Selomulya, Prof. Chiharu Tokoro

P2. Grant Writing

Time: 16:30-17:50 (3 December, Tuesday)

Venue: Lindsay

Chair: Daniel Holland

Panel members: Prof. Hidehiro Kamiya, Prof. Jinghai Li, Prof. Aibing Yu

P3. Early Career Researcher in Particle Technology

Time: 10:55-12:15 (4 December, Wednesday)

Venue: Hart

Chair: Prof. Hongwei Wu

Panel members: Prof. Rajesh Dave, Prof. Kevin Galvin, Prof. Wei Ge, Prof. Shunying Ji, Prof. Gus Nathan

Poster Session

9:55-10:55 4 December, Wednesday

Code	Authors	Title
PS1-001	**Ting Qiao**, Shunying Ji*	3D cell-split failure model in polyhedron DEM for modeling breakable granular materials
PS1-002	**Kazunori Kadota***, Yuhei Tsugawa, Mikio Yoshida, Yoshiyuki Shirakawa	Predicting liquid-liquid phase separation in small-molecule crystallization using phase-field simulations
PS1-003	**Naoki Kishida**, Hideya Nakamura*, Ohsaki Shuji, Satoru Watano	High speed simulation of powder mixing in bi-disperse particle systems
PS1-004	**Zhen Tan***, Zhonghua Yu	Valuations of charging efficiency and critical gap under contact electrification model
PS1-005	**Haruki Mochizuki***, Kizuku Kushimoto, Junya Kano	ADEM simulation validation for the construction of grinding theory
PS1-006	**Kyota Mitsunashi**, Shota Yokokawa, Hideya Nakamura*, Naoki Kishida	Granular shear flow criteria for accuracy of coarse-grained DEM
PS1-007	**Ryo Miyazawa**, Yutaro Takaya, Susumu Gunji, Kenichi Momota, Satoshi Shiina, Kyoko Okuyama, Hidehiro Kamiya, Chiharu Tokoro*	Optimization of media size combination and agitator geometry for high grinding efficiency agitated media mill by DEM
PS1-008	**Atsushi Omori**, Shuji Ohsaki, Hideya Nakamura, Satoru Watano	Numerical analysis on dominant factors affecting flow ability of composite particles
PS1-009	**Kinuko Hayashi**, Hideya Nakamura*, Shuji Ohsaki, Satoru Watano*	Sensitivity analysis of DEM parameters on bulk powder properties
PS1-010	**Hyung-Tae Kim**, Ji-Hwan Lee, Hyeong-Bin Moon, Jin-Wook Lee, Byoung-Hwa Lee, Chung-Hwan Jeon*	Simulation research of the impact of pressure on the gasification performance of Pet-Coke slurry in an entrained-flow gasifier
PS1-011	**Rezwana Rahman**, Haiping Zhu*, Yang Xiang, Aibing Yu	A macro-dynamic analysis of the density induced segregation in a rotating drum based on CFD simulation
PS1-012	**Kailai Chen**, Shibo Kuang*, Lulu Jiao, Aibing Yu	Numerical modelling of raw material effects in ironmaking blast furnaces
PS1-013	**Yudong Zou***, Yaoyu Li, Jie Bao, Runyu Yang	Combined DEM-LSTM-CNN modelling to predict mill load and particle size in ball mills
PS1-014	**Sagar G. Nayak***, Prapanch Nair, Zhenjiang You, Geoff Wang	Numerical modelling of particle transport and retention in porous media
PS2-001	**Xiaodie Guo**, Wenjing Zhou*, Jinjia Wei	Numerical simulation of immersed tube bubbling fluidized bed in calcium-based thermochemical energy storage system: influence of key parameters

PS2-002	**Hainuo Wang**, Yumeng Zhang*, Shijun Yan, Wenhao Ding, Pengfei Lv, Bo Wang*	Promotion of particle agglomeration by different vortex generator angles based on PIV-PDPA experiment
PS2-003	**Guanlong Ren**, Qingang Xiong*, Fangjun Chen	CFD investigation of the structural effects of internal gas intake on powder conveying performance in fuel supply systems for aerospace engines
PS2-004	**Haoyi Zhang**, Lu Liu, Shunying Ji*	Mechanical behavior analysis of vertical ocean structures based on DEM-FEM-SPH coupling method
PS2-005	**Shuaiqi Zhao**, Han Huang, Rui Zhang, Kunpeng Zhao, Bofeng Bai*	Chemical evolution of reactive particle aggregates in fluids
PS2-006	**Yuan Xi***, Wanyi Xu	CFD study on reducing microfiltration membrane fouling with hemispherical promoter
PS2-007	**Ami Takahashi**, Shuji Ohsaki, Hideya Nakamura, Satoru Watano*	Numerical simulation of upper airway in sleep apnea
PS2-008	**Momoko Sugimoto**, Shuji Ohsaki, Hideya Nakamura, Satoru Watano*, Keisuke Terada, Kazuhiro Nishimi, Shuji Hasegawa	Simulation of slurry filling in cosmetics manufacturing
PS2-009	**Tomoyuki Hirota**, Shuji Ohsaki*, Hideya Nakamura, Satoru Watano	Elucidation of granulation mechanism of pressure swing granulation: a combined experimental and simulation study
PS2-010	**Qing Ye**, Shibo Kuang*, Peibo Duan, Ruiping Zou, Aibing Yu	A surrogate prediction model for air core prediction of hydrocyclones to stabilize operation
PS2-011	**Arata Hashimoto**, Mikio Sakai	Numerical simulation on powder die-filling in a rotary tablet press
PS2-012	**Chao Chang**, Qijun Zheng, Yong Wang*, Shibo Kuang*	Mass transfer enhancement in liquid-liquid extraction with discrete liquid film flow
PS2-013	**Qiang Zheng***, Yujie Tian*, Wei Wang, Qijun Zheng, Shibo Kuang	An intraparticle model for simulation of biomass conversion: the effect of temperature inhomogeneity on heat capacity, heat transfer, drying and pyrolysis
PS2-014	**Dan Xu,** Yansong Shen*	CFD-DEM-DPM modelling of fluid-particles-fines reacting flows in blast furnace
PS3-001	**Chung-Min Wang**, An-Ni Huang, Ruey-Chi Hsu, Tsuo-Feng Wang, Hsiu-Po Kuo*	The influences of the inlet and outlet designs on the performances of a cyclone separator
PS3-002	**Ju Jiang**, Xiao Chen, Qiang Zhou*	Towards the influence of fluid convection on filtered drag in fluidized gas-particle flows
PS3-003	**Zhang Leilei**, Chen Yanxin, Zhao Bo	Numerical simulation study on multi-component gas sulphur reduction of phosphogypsum
PS3-004	**Jingyi Chen**, Yanxin Chen*, Leilei Zhang	Numerical simulation of a secondary separation cyclone separator
PS3-005	**Jun Xie***, Hao Xu, Xinhe Shen	Simulation of the biomass gasification process of cubic particles in a fluidized bed using the superquadric method
PS3-006	**Yu Tian**, Lin Jiang, Rongzheng Liu, Youlin Shao, Xu Yang, Bing Liu, Malin Liu*	Interaction force analysis in the binary nuclear fuel particle co-fluidization simulations in spouted bed using CFD-DEM method

PS4-001	**Harry Cahyanto**, Xuanming Chen, Frank L. Y. Lam, Ploychanok Iadrat, Chularat Wattanakit, Pinit Kidkhunthod, Varinder Singh, Sally Brooker, Shusheng Pang, Jungkyu Choi*, Alex C. K. Yip*	Effective prevention of palladium metal particles sintering by histidine stabilization on silica catalyst support
PS4-002	**Kosuke Nakai***, Masato Adachi	Effects of a dispersing liquid's property on an electrically induced fluid flow and particle traps in a self-healing wire system
PS4-003	**Kenta Kitaumra***, Takamasa Mori	Study of particles dispersion change over time for aqueous ceramics slurries
PS4-004	**Taeko Semba***, Kazuyoshi Yamada, Toshiki Matsuoka, Tsutomu Takahashi	Surface treatments with linear alkyl silane coupling agents and their effect on rheological properties
PS4-005	**Shogo Tsutaki**, Yoshihiko Yamanoi, Junichi Tatami, Motoyuki Iijima*	Design of interparticle photo-cross-linkable pickering emulsions for DLP printing of porous silica components
PS4-006	**Yuki Imai**, Junichi Tatami, Motoyuki Iijima*	Evaluation of particle concentration dependent stability of silica slurries by 1H pulsed NMR
PS4-007	**Sayaka Yamada**, Junichi Tatami, Motoyuki Iijima*	Design of interparticle photo-cross-linkable slurries treated with silane alkoxides for DLP-3D printing of transparent silica components
PS4-008	**Noriko Kanai**, Scott A. Willis, Abhishek Gupta, Izuru Kawamura*, William S. Price*	MRI and NMR evaluations of pickering emulsions stabilized by cellulose nanofibers
PS5-001	**Shunsuke Mitsunaga***, Masato Adachi	Effects of particle charge variation on the cleaning performance of an electrodynamic dust shield under ion irradiation
PS5-002	**Natsuki Miura**, Yusuke Imayoshi, Shuji Ohsaki*, Hideya Nakamura, Satoru Watano	Internal structure evaluation during tablet compaction using multiparticle finite element method
PS5-003	**Kensuke Kumeda**, Hideya Nakamura*, Shuji Ohsaki, Satoru Watano, Shohei Fujiwara, Yuji Iwami, Akinori Murao	Relationship between powder rheology of wet iron ore powder and its granule strength
PS5-004	**Yurui Wang***, Yudong Zou, Runyu Yang	DEM modelling of the effect of triboelectric charging on the mixing of fine powder
PS5-005	**Riko Yamazaki**, Junichi Tatami*, Motoyuki Iijima, Shinya Kawaguchi, Naoki Kondo	Spray freeze granulation drying of non-aqueous Si_3N_4 slurry effect of the amount of OA in added PEI-OA complex
PS5-006	Nagatomo Mononobe, **Hiroaki Minamisawa***, Sakiyori Mononobe, Taizou Uchimura, Masakazu Matsumoto, Shinnosuke Kamei, Hiromichi Asamoto, Keisuke Suzuki, Susumu Takahashi	Preparation of arsenic, boron and radioactive cesium adsorbent powder

PS5-007	**Qiuhua Miao**, Peng Huang*, Runyu Yang, Aibing Yu, Shibo Kuang	Macroscopic mixing and segregation behavior of polydisperse spherocylindrical particle mixtures in rotary drums
PS5-008	**Wai Kian Tan***, Koki Iwata, Keita Tsuzuki, Go Kawamura, Atsunori Matsuda, Hiroyuki Muto	Graded porous Al_2O_3 fabrication using electrostatic integrated polymethyl methacrylate (PMMA)-Al_2O_3 composite granules
PS5-009	**Yun-Chien Lin**, An-Ni Huang, Wan-Yi Hsu, Tsuo-Feng Wang, Hsiu-Po Kuo*	Preparation of three-dimensional flowability diagrams for powder beds with different caking behaviours
PS6-001	**Shumpei Yonetsu**, Shota Kitai, Yuto Higuchi, Shunsuke Tanaka*, Saki Moriya, Miki Sugita, Takahiko Takewaki	Synthesis of metal-organic framework CALF-20 via mechanochemical route
PS6-002	**Yuto Higuchi***, Shunsuke Tanaka*	Synthesis of gmelinite zeolite particles toward selective CO_2 recovery
PS6-003	**Yan Dai***, Yaping Ding, Huahao Wang	Synergistic improvement in gas separation performance of MMMs by orogenic action and strong molecular forces of nano particle
PS6-004	**Takahiro Onizuka**, Tomohiro Iwasaki*	Mechanochemically assisted synthesis of magnetite nanoparticles for the catalytic removal of methylene blue
PS6-005	Chawalkul Chotmunkhongsin, **Paeka Klaitong**, Sunisa Watcharasing, Tawatchai Charinpanitkul, Sakhon Ratchahat, Weerawut Chaiwat*	Conversion of flare gas to SWCNTs: a preliminary study on bimetallic catalyst formulas and synthesis condition
PS6-006	**Pimonpan Inthapat**, Phitchawalai Ninthachan, Thanchanok Vettavong, Warodom Thepmongkorn, Chawalkul Chotmunkhongsin, Maturada Assawagetmanee, Tawatchai Charinpanitkul, Sakhon Ratchahat, Weerawut Chaiwat*	Synergistic effect of heating rates during plastic pyrolysis and Fe-based catalyst supports on synthesis of MWCNTs from HDPE wastes
PS6-007	**Naoki Toyama***, Eisaku Kimura, Shinosuke Kamei, Masakazu Matsumoto, Shigeki Furukawa	Synthesis of nickel supported on mesoporous silica hollow spheres catalysts and their activity for reduction of p-nitrophenol
PS6-008	**Shinnosuke Kamei***, Takuya Hasegawa, Shu Yin, Naoki Toyama, Takeshi Takemura, Sigeki Furukawa, Koji Masaoka, Masakazu Matsumoto	Synthesis of calcium carbonate using hard clam (mercenaria mercenaria) shells for a source of calcium-based materials
PS6-009	**Masakazu Matsumoto***, Shinnosuke Kamei, Naoki Toyama, Yuzuha Matsuda, Takayoshi Fujii, Yasushi Noda, Koji Masaoka	Synthesis of carbonates by reactive crystallization between Ca·Mg in industrial wastes and CO_2 - Controlling the crystal qualities with bubble diameter and $[Mg^{2+}]/[Ca^{2+}]$ ratio in bulk solution

PS6-010	**Ryo Murayama**, Stella Chan On San, Kento Nishi, Tatsushi Matsuyama, Junichi Ida*	Enhancing methane production performance by addition of magnetite nano particle doped powdered activated carbon
PS6-011	**Bingke Qin**, Yizhu Lei	Thermoelectric properties of $CoSb_3$ prepared by solid-state reaction
PS6-012	**Zhaopeng Liu***, Yizhu Lei*, Youming Ni, Wenliang Zhu, Zhongmin Liu	Achieving high syngas/CO_2 conversion into C_2+hydrocarbon species over metal oxide nanoparticles as dual-bed catalyst in tandem
PS7-001	**Yuki Hiroshige**, Junichi Tatami, Motoyuki Iijima*	Disassembling silica green bodies photocured from interparticle photo-cross-linkable suspension
PS7-002	**Zhou Kun**, Mauricio Córdova-Udaeta, Keishi Oyama, Hidehiro Kamiya, Chiharu Tokoro*, Masahiro Ito, Kazuhiro, Fujimori, Yoshihiro Iwai, Eisuke Tamura	Reduction of heavy metal content from sewage sludge ash using a Coanda effect-based air classification
PS7-003	**Jayden D'Agostin**, Junxian Liu, Yanyan Zhao, Yuqing Feng*	A CFD study of gas solid flow in a gas cyclone separator for recycling of waste lithium-ion batteries
PS7-004	**B. Maisuria***, C.Bumby,D. Del Puerto. M.Watson, R. Longbottom, B. Monaghan	Hydrogen reduction of New Zealand titanomagnetite ironsand in a fluidised bed reactor for direct reduced iron production
PS7-005	**Yancong Liu***, Shibo Kuang, Lulu Jiao, Aibing Yu	Numerical simulation of vanadium titanium magnetite (VTM) BF ironmaking process
PS7-006	**Jiayi Wang**, Shibo Kuang*, Ning Yang*, Aibing Yu	Modeling and analysis of the hydrogen reduction in the flash ironmaking process
PS7-007	**Yang Fei***, Shibo Kuang, Xiaoping Guan, Aibing Yu, Ning Yang	Numerical study on hydrogen-intensive industrial shaft furnaces
PS7-008	**Naghmeh Abavi Torghabeh** *, Peter M. Ireland, Grant B. Webber	A novel hybrid free-fall electrostatic separator
PS7-009	**Wenchao Zhang**, Heng Zhou*, Yifan Hu,Yapu Xing	Numerical simulation of the influence of injection structure on pulverized coal gasification in the dome zone of COREX melter gasifier
PS7-010	Shangming Wang, Yunan Chen, **Bin Chen***	Polymer characterization and pyrolysis mechanism of end-of-life photovoltaic modules
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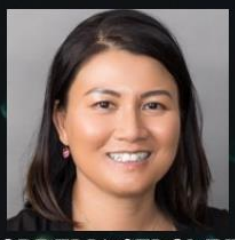

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- Dynamics and phenomena of powder
- Powder and particle characterization
- Production of powder and particulate materials in gases and liquids (nanoparticles, fine ceramics, pharmaceuticals, particle modification, novel functional materials, etc.)
- Powder handling and operations (comminution, storage, transport, granulation, separation, fluidization, etc.)
- Aerosol and colloidal processing
- Measurement and control of powder processes
- Numerical simulation method (CFD, DEM, Monte Carlo method, population balance, etc.)

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