

Particle Technology Forum

Held at the 2024 AIChE Annual Meeting

San Diego, California, USA
27-31 October 2024

ISBN: 979-8-3313-1675-4

Printed from e-media with permission by:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571



Some format issues inherent in the e-media version may also appear in this print version.

Copyright© (2024) by AIChE
All rights reserved.

Printed with permission by Curran Associates, Inc. (2025)

For permission requests, please contact AIChE
at the address below.

AIChE
120 Wall Street, FL 23
New York, NY 10005-4020

Phone: (800) 242-4363
Fax: (203) 775-5177

www.aiche.org

Additional copies of this publication are available from:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571 USA
Phone: 845-758-0400
Fax: 845-758-2633
Email: curran@proceedings.com
Web: www.proceedings.com

TABLE OF CONTENTS

FLUIDIZATION: EXPERIMENTAL INVESTIGATION AND MODELING OF FLUIDIZATION PROCESSES

| | |
|---|---|
| 147a A Review of Spent Catalyst Feeders in FCC Regenerators | 1 |
| <i>Allan Issangya, Surya Karri, Francisco S. Careaga</i> | |
| 147b A Coarse-Grain CFD-DEM Approach Based on Particle Filtering for Simulating Fluidized Polydisperse Particles..... | 2 |
| <i>Sathvik Bhat, Yuan Yao, Pedram Pakseresht, Yi Fan, Jorg Theuerkauf, Jesse Capecelatro</i> | |
| 147d Investigation of Heat Transfer in Fluidized Bed Heat Exchangers..... | 3 |
| <i>Krutika Appaswamy, Aaron Morris, Zhiwen Ma</i> | |
| 147e Study on Process Intensification of Granular Flow of Using Pulsed Load..... | 4 |
| <i>Haifeng Lu, Liang Zhang, Xiaolei Guo, Haifeng Liu</i> | |
| 147f Study on Evolution of Wet Agglomerates and Dispersion of Wet Particles in Gas-Solid Fluidized Bed | 5 |
| <i>Congjing Ren, Jingyuan Sun, Jianan Cheng, Jingdai Wang</i> | |
| 147g Flow Transitions and Effective Properties in Multiphase Taylor–Couette Flow | 6 |
| <i>Abhishek Shetty, Melany Hunt, Arthur Young</i> | |
| 147h A Monte Carlo Approach to Modeling Fluidized Systems | 7 |
| <i>Matthew Black, Aaron Morris</i> | |

FLUIDIZATION: FUNDAMENTALS

| | |
|--|----|
| 85a Analysis of Solids Volume Fraction and Dimensionless Regime Mapping in a Circulating Fluidized Bed Riser | 8 |
| <i>Steven Rowan, Ronald Breault, Justin Weber</i> | |
| 85b Effect of Viscosity on a Slip Velocity in a Liquid-Solid Circulating Fluidized Bed..... | 9 |
| <i>Nirmala Gnana Sundaram, Muruganandham Loganathan, Kumar Perumal, Chitra Devarajulu</i> | |
| 85c The Advanced Scale up Reactor Experiment (ASURE) Facility: A Testbed for Demonstration of Advances in Biomass and Waste Co-Gasification Systems..... | 10 |
| <i>Steven Rowan, Ronald Breault</i> | |
| 85d Descent of Intruders in Vibrated Gas Fluidized Beds..... | 11 |
| <i>Oscar Punch, Qiang Guo, Maty Gueye, Javad Omidi, Christopher Boyce</i> | |
| 85e Faraday Wave Patterns in Fluidized Granular Materials: Effects of Combined Vertical and Horizontal Vibration..... | 12 |
| <i>Javad Omidi, Oscar Punch, Qiang Guo, Christopher Boyce</i> | |
| 85f Magnetic Resonance Velocimetry of Particle Hydrodynamics in a Three-Dimensional Draft Tube Spout-Fluid Bed | 13 |
| <i>Jens P. Metzger, Boyuan Chen, Alexander Penn, Christian Guenthner, Klaas P. Pruessmann, Christoph R. Müller</i> | |

MODELING FLUIDIZATION: APPROACHES, APPLICATIONS, AND FUNDAMENTAL INSIGHTS

| | |
|---|----|
| 215a Oscillated Gas-Injection in Granular Matter: Exploring Structured Bubbling Flow | 15 |
| <i>Javad Omidi, Christopher Boyce</i> | |
| 215b A CFD-DEM Study to Quantify the Influence of Particle Clustering on Catalytic Reactions..... | 16 |
| <i>Balivada K. Kumar, Himanshu Goyal</i> | |
| 215c Elucidating Chromium Contaminates Distribution in a Circulating Fluidized Bed for Light Alkane Dehydrogenation..... | 17 |
| <i>Yupeng Du, Yuchao Zhao</i> | |
| 215d Novel Techniques for Surrogate Based Global Sensitivity Analysis on Low Pressure Fluidized Bed Encapsulation..... | 18 |
| <i>Anurag Guha, Aydin Sunol</i> | |
| 215e Analysis of Dry Reforming of Methane Underdifferent Fluidization Regimes Using a Multiphaseparticle-in-Cell Approach | 19 |
| <i>Fahad Al Otaibi, Abdallah S. Berrouk</i> | |

NANOCOMPOSITES, COATINGS, AND HYBRID MULTISCALE SYSTEMS

| | |
|---|----|
| 36b Spray-Dried Powder Hand Sanitiser with a Long-Lasting Effect..... | 20 |
| <i>Viola Tokarova, Lucie Vecerkova, Lucie Maskova, Ondrej Kaspar</i> | |
| 651b The Roles of Surface Chemistry and Particle Morphology in the Formation and Properties of Silica-Polyelectrolyte Microcapsules | 21 |
| <i>Matthew Lertola, Sapir Lifshiz-Simon, Yeshayahu Talmon, Romain Bordes, Michael Persson, Krister Holmberg, Matthew Helgeson, Bradley F. Chmelka</i> | |
| 651c Tunable Light-Matter Interactions in Complex Perovskite-Coated Particles with Multiscale Chirality..... | 22 |
| <i>Michael Veksler, Jeffery Raymond, Tao Ma, Nicholas A. Kotov</i> | |
| 651d Atomic Layer Etching of Ni-Based Materials by Nitridation..... | 23 |
| <i>Taylor G. Smith, Ali M. Ali, Jean-François De Marneffe, Jane Chang</i> | |
| 651e Autonomous Nanomanufacturing of CsPbBr ₃ Nanoplatelets..... | 24 |
| <i>Nikolai Mukhin, Arup Ghorai, Pragyan Jha, Milad Abolhasani</i> | |
| 651f Data-Driven Synthesis Space Mapping of Colloidal Semiconductor Nanocrystals with a Multi-Robotic Platform | 25 |
| <i>Jinge Xu, Fazel Bateni, Chrisropher H. J. Moran, Koray Latif, Andrew Cahn, Milad Abolhasani</i> | |
| 651g Photo-Induced Bandgap Engineering of Metal Halide Perovskite Quantum Dots in Flow..... | 26 |
| <i>Pragyan Jha, Nikolai Mukhin, Hamed Morshedian, Arup Ghorai, Fernando D. Licona, Milad Abolhasani</i> | |

NANOSTRUCTURED MATERIALS FOR BIOIMAGING AND THERANOSTICS

| | |
|---|----|
| 489a Flame-Made Fractal-Like Nanoparticles as Drug Carriers | 27 |
| <i>Georgios A. Sotiriou</i> | |

| | |
|--|----|
| 489b Flame Aerosol Synthesis of Doped Iron Oxide Nanoparticles as Tracers with High Resolution for Magnetic Particle Imaging | 28 |
| <i>Shaquib R. Ansari, Andrii Melnyk, Yael D. C. S. López, Carlos Rinaldi-Ramos, Alexandra Teleki</i> | |
| 489c Material-Intrinsic NIR-Fluorescence Enables Image-Guided Surgery for Ceramic Fracture Removal | 29 |
| <i>Robert Nijßler, Elena Totter, Sebastian Walter, Justus Metternich, Oscar Cipolato, Dimitri Nowack, Alexander Gogos, Inge Herrmann</i> | |
| 489d A Computational Approach to Predicting the Self-Assembly of Particle-Based Steroid Therapeutics | 30 |
| <i>Oluwaseun Akanbi, Thi Vo, Omolola Eniola-Adefeso</i> | |
| 489e Formulation, Efficacy, and Delivery of Organic Nanocarriers Encapsulating Streptomycin for Treating Trees Infected with Citrus Greening Disease | 31 |
| <i>Luiza Oliveira, Kenedy Sanchez, Riley Jones, Hagai Kohay, Philippe Rolshausen, Arnold Schumann, Gregory V. Lowry, Kurt Ristroph</i> | |
| 489f Flame-Made Fluorescent Nanothermometers Enable Superior Control in Laser Tissue Soldering | 33 |
| <i>Oscar Cipolato, Inge Herrmann</i> | |
| 489g Programmable Cargo Release from Jet-Printed Microgel Particles Via an in Situ Ionic Exchange Method..... | 34 |
| <i>Rong Ma, Sungwan Park, Albert Liu</i> | |

NANOSTRUCTURED MATERIALS FOR CATALYSIS AND ENERGY APPLICATIONS

| | |
|--|----|
| 86a Materials across Scales for the Energy Transition | 35 |
| <i>Dionisios Vlachos</i> | |
| 180n Extended Pt Alloy Ultrathin Surface as ORR Electrocatalysts..... | 36 |
| <i>Mingze Sun, Zhiqiang Niu</i> | |
| 86c Morphology Controlled Synthesis of Catalytic Metal Nanocrystals within 2D Material Nanoconfinements..... | 37 |
| <i>Joshua Little, Amy Chen, Ali Kamali, Tanmay Akash, Chan-Soo Park, Dongxia Liu, Siddhartha Das, Taylor J. Woehl, Po-Yen Chen</i> | |
| 86d Rational Design of Nanoscale Stabilized Oxide Catalysts for the Oxygen Evolution Reaction with OC22 | 38 |
| <i>Richard Tran, Liqiang Huang, Yuan Zi, Shengguang Wang, Benjamin M. Comer, Xuqing Wu, Stefaan Raaijman, Nishant Sinha, Sajanikumari Sadasivan, Shabin Thundiyil, Kuldeep B. Mamtani, Ganesh Iyer, Lars Grabow, Ligang Lu, Jiefu Chen</i> | |
| 86e CO ₂ Hydrogenation to Methanol Using Hybrid Flame-Made CuO/ZrO ₂ – Polymer Membrane Reactors..... | 39 |
| <i>Quang H. Pham, Eirini Goudeli, Colin Scholes</i> | |
| 86f Tuning Metal Nanoparticle Surface Site Accessibility, Electronic State, and Reaction Microenvironment Using Bound Organic Ligands..... | 41 |
| <i>Sayed A. Sufyan, Michael Nigra</i> | |

| | |
|---|----|
| 86g Understanding the Reaction Mechanism of One-Dimensional Silver and Palladium Nanostructure Synthesis in a Millifluidic Reactor: A Kinetic Study Using UV-Vis Spectroscopy | 42 |
| <i>Shohreh Hemmati, Sina Kaabipour, Chamath V. B. Pussepitiyalage, Destiny Williams</i> | |

NANO- AND MICROPARTICLES FOR PHARMACEUTICAL, BIOMEDICAL AND FOOD APPLICATIONS

| | |
|---|----|
| 651a Flame-Made Nanoparticles for Molecular Sensing | 43 |
| <i>Andreas Guentner</i> | |
| 36c Design of Modular 3D-Printed Milli-Fluidic Mixers to Enable Sequential Nanoprecipitation (SNaP) for the Tunable Synthesis of Nano- and Micro- Particles | 44 |
| <i>Nouha El Amri, Thomas Belinky, Parker Lewis, Rachel Pollard, Allie Karakosta, Nathalie M. Pinkerton</i> | |
| 36d Investigating the Inflammatory Response to Exposure of Ultrafine TiO ₂ Particulate Matter to Huvecs | 46 |
| <i>Laura A. E. Brunmaier, Travis W. Walker</i> | |
| 36e Sequential Nanoprecipitation (SNaP) Allows Uniform Co-Encapsulation of Small Molecules and Colloidal Nanocrystals within Polymeric Nanospheres..... | 47 |
| <i>Rachel Pollard, Nouha El Amri, Parker Lewis, Ashley Han, Thomas Belinky, Jacques Z. T. Ponce, Nathalie M. Pinkerton</i> | |
| 36f Selectivity of Bacterial Capture by Polydopamine-Coated Magnetic Nanoclusters..... | 48 |
| <i>William Pitt, Bowen J. Houser, Alyson N. Camacho, Camille A. Bryner, Masa Ziegler, Tochukwu P. Okonkwo, Roger G. Harrison, Karine Chesnel</i> | |
| 36g Study of Molecular Interaction and Texture Characteristics of Hydrocolloid-Mixed Alginate Microspheres: As a Shell to Encapsulate Multiphase Oil Cores..... | 49 |
| <i>Yuting Wu, Boya Lv, Shiteng Wang, Zhe Liu, Xiao D. Chen, Yi Cheng</i> | |
| 36h Albumin Nanovectors with Tunable Size and Hydrophilicity as a Precursor to Bifunctional Colloids | 50 |
| <i>Blake Bartlett, Sepideh Razavi, John Klier</i> | |

PARTICLE BREAKAGE AND COMMINUTION PROCESSES: IN MEMORY OF THE LATE PROFESSOR LEONARD G. AUSTIN

| | |
|--|----|
| 216a Some Fundamental Insights from Late Professor Leonard Austin's Research on the PBM of Milling Processes | 51 |
| <i>Ecevit Bilgili</i> | |
| 216b A Detailed Study of the Energy Utilisation in a Drop-Weight Tester | 54 |
| <i>Ngonidzashe Chimwani, Mulenga Bwalya</i> | |
| 216c Scale-Up Studies of the Spiral Air Jet Mill..... | 55 |
| <i>Kunal Sharma, Devang Khakhar</i> | |
| 216d Effect of Fines and Process Conditions on Particle Abrasion..... | 57 |
| <i>Alejandro G. Tovar, Lauren Endress, Wyatt C. La Marche, S. B. Reddy Karri, Jennifer Curtis</i> | |
| 216e Breakage of Structured Particles through Crack Propagation Phase-Field Model (PFM) Prediction Coupled with Population Balance Modeling..... | 58 |
| <i>Kerry Johanson</i> | |

| | |
|---|----|
| 216g Microhydrodynamic Scaling Analysis of a Vertical Wet Stirred Media Mill: Justifying PBM Parameters on Physical Grounds | 60 |
| <i>Ecevit Bilgili, Alper Toprak, Deniz Altun, Okay Altun</i> | |

PARTICLE CHARACTERIZATION

| | |
|---|----|
| 148a Characterisation of Eco-Friendly Calcium Carbonate-Polydopamine Microcapsules with Superior Mechanical, Barrier, and Adhesive Properties | 64 |
| <i>Daniele Baiocco, Benjamin Lobel, Mohammed Al-Sharabi, Alexander Routh, Olivier J. Cayre, Zhibing Zhang</i> | |
| 148b Comprehensive Powder Flow Characterization with Reduced Testing | 66 |
| <i>Catarina Chendo, João F. Pinto, Maria Paisana</i> | |
| 148c Multidimensional Nanoparticle Characterization | 67 |
| <i>Wolfgang Peukert, Johannes Walter</i> | |
| 148d Scalable Manufacturing of X-Ray Compatible Microfluidics for High-Throughput Structure Determination and Integrated Liquid Handling Strategies | 69 |
| <i>Sarthak Saha, Yaozu Chen, Sarah Perry</i> | |
| 148e A Novel Technique to Characterize the Phenomena of Crystallization and Aggregation in a Suspension Settling in a Vertical Tube | 70 |
| <i>Rutuja Amrale, Jyoti Seth, Vinay Juvekar</i> | |
| 148f Role of <i>Staphylococcus Aureu</i> 's Buoyant Density in the Development of Biofilm Associated Antibiotic Susceptibility | 71 |
| <i>Sarah Kispert, Madison Liguori, Cody Velikaneye, Chong Qiu, Shue Wang, Nan Zhang, Huan Gu</i> | |

PARTICLE FORMATION PROCESSES

| | |
|---|----|
| 37a A Novel Hypergravity Platform to Tune the Particle Size Distribution of Small Molecules with Increasing g-Levels | 72 |
| <i>Adrian Radocea</i> | |
| 37b Insights into Particle-Droplet Collisions | 73 |
| <i>Andrew Bayly, Tushae Srivastava</i> | |
| 37c Impacts of Surface Composition on Dissolution Performance of Amorphous Solid Dispersions | 74 |
| <i>Yingzhen Ma, Pavithra Sundararajan, Luke Schenck, Ashish Punia, Jasmine Rowe, Daniel Smith</i> | |
| 37d Environmentally and User-Friendly Composite Microcapsules with Superior Mechanical Properties for Potential Applications in Fast-Moving Consumer Goods..... | 75 |
| <i>Daniele Baiocco, Mohammed Al-Sharabi, Benjamin Lobel, Alexander Routh, Olivier J. Cayre, Zhibing Zhang</i> | |
| 37e Aggregation and Breakage Dynamics of Alumina Particles Under Laminar Shear By CFD-DEM Simulations | 77 |
| <i>Lequan Zeng, George Franks, Eirini Goudeli</i> | |
| 37f Impact of Silica Nanoparticles on Microstructure and Rheology of Wax Network Suspensions..... | 79 |
| <i>Pooja Saxena, Jyoti Seth, Vinay Juvekar</i> | |

PARTICLE TECHNOLOGY FORUM AWARD PRESENTATIONS

| | |
|---|----|
| 548a Shell Thomas Baron Award in Fluid-Particle Systems: Magnetic Nanoparticle Suspensions in Time Varying Magnetic Fields – Colloidal Hydrodynamics to Biomedical Applications | 80 |
| <i>Carlos Rinaldi-Ramos</i> | |
| 548b PSRI Fluidization and Fluid-Particle Systems Award: Dynamics of Fluid-Particle Systems of Magnetically Responsive Janus Particles | 81 |
| <i>James Gilchrist</i> | |
| 548c Elsevier PTF Lifetime Achievement Award | 82 |
| <i>Hamid Arastoopour</i> | |

PARTICLE TECHNOLOGY IN PRODUCT DESIGN AND MANUFACTURING

| | |
|---|----|
| 217b Effect of Processing on Physicochemical Properties and Powder Flow Performance of Zeolites | 83 |
| <i>Angeliki Chalasti, Canan Güçlüyener, Jerry Heng</i> | |
| 217c Food Phantom Packaging: Prolonging Product Shelf Life Via Microstructure Engineering of Particulate Consumer Foods | 86 |
| <i>Luc Dewulf, Michael K. Hausmann, Annabel Bozon, Gerhard Niederreiter, Agba D. Salman</i> | |
| 217d The Effect of Moisture Content on Mechanical Properties of Alumina Catalysts Tablets..... | 88 |
| <i>Mingzhi Zhao, Sai Yellapragada, Christine Hrenya, Benjamin Glasser, Alberto Cuitino</i> | |
| 217e Atomic Layer Deposition of Sintering Aids to Accelerate Tungsten Powder Metallurgy..... | 89 |
| <i>Davis R. Conklin, Hailey Loehde-Woolard, Arne Croell, Jhonathan Rosales, Alan W. Weimer</i> | |
| 217f Processing and Design Challenges of Highly Filled Composites | 90 |
| <i>Hulusi Turgut, Kelly Krzysik, Bryan Kenyon</i> | |

PARTICULATE MIXING AND SEGREGATION

| | |
|--|----|
| 341a Mixed Soft-Rigid Granular Flows: Role of Soft Particles in Inducing Metastable Arches | 91 |
| <i>Saeed Alborzi, Sara Hashmi</i> | |
| 341b Segregation of Fine and Cohesive Particles | 92 |
| <i>Richard Lueptow, Qiong Zhang, Dhairyा R. Vyas, Paul Umbanhauer, Julio M. Ottino</i> | |
| 341c Scaling Continuous Powder Blenders: The Length-Scale Problem..... | 93 |
| <i>Ivan Bogaerts, James Holman, Anthony Tantuccio, Sarang Oka</i> | |
| 341d Investigation of Mixing Behavior in Shape-Dependent Polydisperse Mixtures and Critical Length Scale of Percolation in a Vibrating Bed System Using DEM..... | 94 |
| <i>Praveen Dubey, Anshu Anand</i> | |
| 341e Exploration of the Effect of Micro Dimpling on Wall Materials to Improve Flow of Cohesive and Non-Cohesive Powders in Bins and Hoppers | 95 |
| <i>Kevin Kellogg, Justin Phillips, Matthew Dubay, Joerg Heinrich, Jorg Theuerkauf</i> | |
| 234b Are Blenders Needed in Continuous Direct Compaction? | 96 |
| <i>Yi Tao, Carlos Ortega-Zuniga, James Scicolone, Fernando Muzzio</i> | |

PARTICULATE PROCESS MODELING AND PRODUCT DESIGN SESSION 1

| | |
|---|-----|
| 342a Adaptive PBM-DEM Framework for Wet Granulation: A Mechanistic, Multi-Component, and Bi-Directional Approach | 97 |
| <i>Ashok Das, Tarun De, Ashley Dan, Rohit Ramachandran</i> | |
| 342b Extraction of Aggregation Kernel from DEM Simulations Using Sustained Contact: A New Kernel Extraction Methodology for Drum Granulators..... | 98 |
| <i>Archita Karar, Jayanta Chakraborty, Jitendra Kumar, Anurag Tripathi</i> | |
| 342c Combining Artificial Intelligence and Discrete Element Method Simulations for Oral Solid Dose Manufacturing Process Optimization - a Case Study on Bin Blending..... | 100 |
| <i>Stefan Pantaleev</i> | |
| 342d A Model for Reliable Prediction of Tabletingability of Mixtures from Those of Individual Components..... | 101 |
| <i>Changquan Sun</i> | |
| 342e A Reduced-Order Mechanistic Tablet Coating Model to Capture Downstream Drug-Release Variability | 102 |
| <i>Abhishek Paul, Indu Muthancheri, Mario Roussel, Yasser Jangjou</i> | |
| 342f Decoupling Calibration and Coarse-Graining for DEM Simulation of Fine Particles | 103 |
| <i>Lokeshwar Mahto, Jayanta Chakraborty, Jitendra Kumar, Anurag Tripathi, Maitraye Sen, William Ketterhagen</i> | |
| 342g A Coupled Modeling Framework as a Soft Sensor for Monitoring the Drying of Active Pharmaceutical Ingredient Powders in Drug Substance Manufacturing Process Trains | 104 |
| <i>Shashank V. Muddu, Ajinkya Pandit, Yi Wei, Yihui Yang, Wenlong Tang, Neda Nazemifard, Charles D. Papageorgiou, Richard Braatz, George Barbastathis, Allan Myerson</i> | |
| 342h Using Discrete Element Model Technique to Design a Densification Process for a Lyophilized Pharmaceutical Powder Formulation..... | 105 |
| <i>Maitraye Sen, Callum Bruce</i> | |

PARTICULATE SYSTEMS: DYNAMICS AND MODELING: APPLICATIONS

| | |
|--|-----|
| 149a Improving the Flowability of Lignocellulosic Biomass in Wedge-Shaped Hoppers Via External Vibrational Forcing: A DEM Study..... | 106 |
| <i>Nicholas Deak, Yimin Lu, Hari Sitaraman, Jordan Klinger, Yidong Xia</i> | |
| 149c Drag Model Implementation for CFD-DEM Modeling of Dense Flow with Non-Spherical Particles in Ansys Rocky | 107 |
| <i>Lucas B. Baggio, Lucilla C. De Almeida, Joao A. A. Oliveira, Emilio E. Paladino</i> | |
| 149d Population Balance Model and Deep-Learning Model for Predicting Biomass Particle Size Reduction in Pilot-Scale Knife Mill | 109 |
| <i>Yidong Xia, Minglei Lu, Tiasha Bhattacharjee, Jordan Klinger, Zhen Li</i> | |

PARTICULATE SYSTEMS: DYNAMICS AND MODELING: DISCRETE/CONTINUUM MODELS

| | |
|--|-----|
| 87a Mechanistic Investigation of Preprocessing Specifications Impact on Flow Related Issues in Biomass Handling Systems Using Experiment and Discrete Particle Simulations | 110 |
| <i>Ahmed Hamed, Yidong Xia, Nepu Saha, Jordan Klinger</i> | |
| 87b Variability of Sphere- and Tetrapod-Based DEM-Simulations for Poorly Flowing Materials | 112 |
| <i>Lukas Maier, Michael Mitterlindner, Gregor Fasching, Stefan Radl</i> | |
| 87c A Machine Learning Assisted Hopper Flow Design for Handling Granular Biomass Materials | 113 |
| <i>Wencheng Jin, Abdallah Ikkarneh, Yumeng Zhao, Xuyang Li, Nepu Saha, Jordan Klinger, Yidong Xia</i> | |
| 87d Kinetic Theory Closures with Finite Contact Time for Electrostatic Charge Generation and Transport..... | 114 |
| <i>Saykat Poddar, Manjil Ray, Alberto Passalacqua</i> | |

PARTICULATE SYSTEMS: SOLIDS HANDLING, PROCESSING, CONVEYING, SEPARATION, AND HEAT TRANSFER

| | |
|--|-----|
| 421a A Novel Predictive Approach to Mitigate Tablet Film Coating Scuffing..... | 116 |
| <i>William Ketterhagen, Andreas Thomann, Florian Ries, Andreas Gryczke</i> | |
| 421b The Effect of Wall Friction and Baffles on Particle Flow and Heat Transfer in a Rotary Drum | 117 |
| <i>Carlin Leung, Marcella Alves, Elaheh Ardalani, William Borghard, Nina C. Shapley, Alberto Cuitino, Benjamin Glasser</i> | |
| 421c Application of Multi-Level Coarse-Grained Model for DEM Heat Transfer Simulation | 118 |
| <i>Tarun De, Ashok Das, Daniele Marchisio, Gianluca Boccardo</i> | |
| 421d Thermal Modeling of Poorly Flowing Bulk Solids Using Tetrapods Using the DEM | 119 |
| <i>Michael Mitterlindner, Lukas Maier, Gregor Fasching, Stefan Radl</i> | |
| 421e Caking Problems and the Role of Flow Aids – A Systematic Approach..... | 121 |
| <i>Kerry Johanson</i> | |
| 421f Flow Pattern Evolution Law and Mechanism Analysis of Biomass Particles in Horizontal Pipe..... | 122 |
| <i>Hui Du, Haifeng Lu, Xiaolei Guo, Haifeng Liu</i> | |

PHARMACEUTICAL POWDER AND PARTICULATE SYSTEMS

| | |
|---|-----|
| 653a Development of Spray-Dried Carriers for <i>in-Situ</i> Production of Volatile Phytochemicals..... | 123 |
| <i>Ondrej Kaspar, Lucie Maskova, Viola Tokarova</i> | |
| 653b Simple Experimental Methods to Calibrate DEM Input Parameters for Pharmaceutical Tablet Applications..... | 125 |
| <i>Tim Hoogenraad, Lucilla C. De Almeida, Edward Yost, Carl R. Wassgren, Ariel Muliadi</i> | |
| 653c DEM Simulations and Experiments: Study of Dry Impregnation and Its Dependence on Particle Morphology: Spheres Cylinders, Trilobes and Quadrilobes..... | 127 |
| <i>Maria Tomassone</i> | |

| | |
|--|-----|
| 653d Early-Stage Materials Characterization for Predicting Late-Stage Tablet Breakage during Film-Coating | 129 |
| <i>Jeffery Larson, Annika Lee, William Ketterhagen</i> | |
| 653e Assessment of Air Entrapment Related Tablet Defect Risk in Tablet Manufacturing..... | 130 |
| <i>Yaser Bozorgi, Subhash Thakur, Jeffrey Wang, Pingjun Tang</i> | |
| 653f M ² E ³ d: Evolutionary Equation Discovery and Its Applications in the Powder-Handling Industries | 131 |
| <i>Andrei-Leonard Nicusan, Owen Jones-Salkey, Kit Windows-Yule</i> | |

POSTER SESSION: PARTICLE TECHNOLOGY FORUM

| | |
|--|-----|
| 571b Optimal Control of Batch Crystallization Processes: New Methods for New Challenges | 132 |
| <i>Hao-Jen Pan, Wei-Ting Chien, Jeffrey Ward</i> | |
| 571c Polymer-Induced Aggregation of Hematite Under Shear by CFD-DEM Simulations | 134 |
| <i>Lequan Zeng, George Franks, Eirini Goudeli</i> | |
| 571d Investigating the Effect of Temperature on Calcium Sulfate Scale Formation Using a Novel Continuous Stirred Tank Reactor (CSTR) Laser Setup..... | 135 |
| <i>Glavic Tikeri, Ali Alshami</i> | |
| 571e Custom Fluidized Bed Reactor for Atomic Layer Deposition on Li-Ion Battery Cathode Powder..... | 136 |
| <i>Julie A. Nguyen, Michael Zaza, Kent J. Warren, Alan W. Weimer</i> | |
| 571f Production of Catalyst Tablets: Effect of Powder Properties | 137 |
| <i>Mingzhi Zhao, Sai Yellapragada, Christine Hrenya, Benjamin Glasser, Alberto Cuitino</i> | |
| 571g Evaluation of Microcrystalline Cellulose Powder Flowability with Varying Particle Properties and Moisture Content | 138 |
| <i>Jordan Monroe, Heather Emady</i> | |
| 571h Heat Transfer in a Rotary Drum: Effect of Equipment Design..... | 139 |
| <i>Carlin Leung, Marcella Alves, Elaheh Ardalani, William Borghard, Nina C. Shapley, Alberto Cuitino, Benjamin Glasser</i> | |
| 571i Innovative Design and Performance Assessment of a Novel Modular Reactor for One-Step Liquid Fuel Production from Stranded Natural Gas with Co-Utilization of Carbon Dioxide. | 140 |
| <i>Tanay Jawdekar, Sudeshna Gun, Congwen Lu, Anuj Joshi, Sonu Kumar, Joel Paulson, Liang-Shih Fan</i> | |
| 571j Highly Porous Coatings of Metal Nitrides on Electronic Circuitry for Sensing Applications | 141 |
| <i>Adrien Baut, Andreas Güntner</i> | |
| 571k CO ₂ Free Hydrogen Production Via Methane Pyrolysis Using a Moving Packed Bed Approach | 142 |
| <i>Shekhar Shinde, Danwyn Aranha, Ishani K. Kudva, Rushikesh Joshi, Krutarth Pandit, Liang-Shih Fan</i> | |
| 571l Novel Sorbent Particle for CO ₂ Capture and Utilization | 143 |
| <i>Seyedamin Razavi, Vahid Rahamanian, Runxia Cai, Mahe Rukh, Mohammadreza Kosari, Saad A. Khan, Fanxing Li</i> | |

| | |
|--|-----|
| 571m Particle Molecular Layer Deposition of Amine Films for CO ₂ Capture Materials..... | 144 |
| <i>Hailey Loehde-Woolard, Bergen Evans, Michael Zaza, Katarina Odak, Kent Warren, Alan W. Weimer</i> | |
| 571n CaCO ₃ Crystallization in the Presence of Polycarboxylated CMC: Insights into Kinetics, Mechanisms, and Crystal Morphology..... | 146 |
| <i>Nadhem Ismail, Ali Alshami</i> | |
| 571o Waste Valorization: High-Purity Syngas Generation from Co-Gasification of Waste Plastics and Biomass Via Chemical Looping Process | 147 |
| <i>Ishani K. Kudva, Shekhar Shinde, Tanay Jawdekar, Sudeshna Gun, Rushikesh Joshi, Sonu Kumar, Ashin Sunny, Liang-Shih Fan</i> | |
| 571p Dopant Modification to Vanadium Phosphorus Oxide Redox Carrier for Chemical Looping Methanol to Formaldehyde Conversion | 148 |
| <i>Sudeshna Gun, Falguni Akulwar, Sonu Kumar, Anuj Joshi, Liang-Shih Fan</i> | |
| 571q Silver Nanoparticle Sensor Array for the Detection of Sars-Cov-2 | 149 |
| <i>Benjamin Lam</i> | |
| 571r Stability of mRNA and Lipid Nanoparticles Stored in Single-Use Bags | 150 |
| <i>Yuji Takeda, Fujun Wang, Nina Perier, Xin Gu, Lucie Delaunay, Samin Akbari</i> | |
| 571s The Effect of Fines and Process Conditions on Particle Abrasion | 151 |
| <i>Alejandro G. Tovar</i> | |
| 571t Eco-Friendly Dual-Shell Fungal Chitosan-Silica Microcapsules with Enhanced Mechanical and Barrier Properties for Potential Consumer Applications..... | 152 |
| <i>Daniele Baiocco, Mohammed Al-Sharabi, Benjamin Lobel, Olivier J. Cayre, Alexander Routh, Zhibing Zhang</i> | |

POWDER AND PARTICULATE CHARACTERIZATION AND MEASUREMENT

| | |
|---|-----|
| 38a Systematic Study of Caking in Sintering and Soft Surface Systems – The Role of Particle Size, Temperature and Creep Effects | 154 |
| <i>Kerry Johanson</i> | |
| 38b Quantifying Cohesive, Frictional and Interlocking Effects for Universal Powder Flow Characterisation..... | 155 |
| <i>Amalia Thomas</i> | |
| 38c Insights into Vibrational Rheology for Determining the Stickiness of Food Powders | 156 |
| <i>Maria Cares</i> | |
| 38d Air Permeability of Powders at Process Conditions | 157 |
| <i>Marco Lupo, Geoffroy Lumay, Aurelien Neveu, Filip Francqui</i> | |
| 38e Investigating the Impact of AlO _x Atomic Layer Deposition on the Properties and Flow Behaviour of ZSM-5 Zeolites Toward Improved Powder Processing | 159 |
| <i>Angeliki Chalasti, Canan Güçlüyener, Ian Harkness, Jerry Heng</i> | |
| 38f Prediction of the Spreadability of Metal Powders: The Last Developements | 162 |
| <i>Aurelien Neveu, Filip Francqui, Geoffroy Lumay</i> | |

| | |
|--|-----|
| 38g Influence of Particle Properties and Moisture Content on the Flowability of Microcrystalline Cellulose Powder..... | 163 |
| <i>Jordan Monroe, Heather Emady</i> | |

POWDER HANDLING AND PROCESSING FOR BATTERY MATERIALS

| | |
|---|-----|
| 280a Conformal Protective Coating of Cathode Materials by Oxidative Chemical Vapor Deposition for Enhancing Lithium-Ion Batteries..... | 164 |
| <i>Mehran Seifollahi, Kenneth Lau</i> | |
| 280b Lithium-Sulfur Battery Performance Enhancement through the Integration of Porous Liquid-Based Electrolytes: Insights into Improved Ion Mobility and Ionic Conductivity | 167 |
| <i>Mehran Arzani, Kartikey Sharma, Anika H. Shinde, Hamidreza Mahdavi, Vikas Berry</i> | |
| 280c Dry Process for Battery Electrodes: The Role of Powders Mixture Properties and Mixing Conditions on Flowability and Electrode Performance Using Design of Experiments..... | 168 |
| <i>Alex Lemarinel, Graciela Cares, Thomas Philippe, Clément Paul, Lauréline Marchal, Philippe Marchal, Veronique Falk</i> | |
| 280d Powder Characterization for Electrode Production Improvement | 169 |
| <i>Filip Francqui, Salvatore Pillitteri, Geoffroy Lumay, Aurelien Neveu</i> | |
| 280e Comparative Study on the Compression Characteristics of Coal and Biomass Powder Bed during Gas Pressurization..... | 170 |
| <i>Shicheng Wang, Xiaolei Guo, Haifeng Liu, Haifeng Lu</i> | |
| 280f Experimental Research on the Compression Behavior of Ultrafine Alumina Powders Under Gas Pressurization | 171 |
| <i>Yunfei Yang, Xiaolei Guo, Shicheng Wang, Haifeng Lu, Haifeng Liu</i> | |

PARTICULATE PROCESS MODELING AND PRODUCT DESIGN SESSION 2

| | |
|--|-----|
| 420b Using Digital-Twins to Relate Microscopic Parameters of DEM Simulations and Macroscopic Measurables Characterizing Powder Behavior..... | 172 |
| <i>Geoffroy Lumay, Filip Francqui, Ben Jenkins, Aurelien Neveu, Kit Windows-Yule</i> | |
| 420a Comparison of Particle Breakage Models Accounting for Particle Size-Shape Evolution..... | 173 |
| <i>Priscilla Hill</i> | |
| 420c Machine Learning Based Prediction of Oilfield Scale Formation Kinetics. | 174 |
| <i>Glavic Tikeri, Ali Alshami</i> | |
| 420d An Innovative Approach to Studying Sifting Segregation: DEM Enabled Scale Down..... | 175 |
| <i>Mohammadreza Ebrahimi, Stefan Pantaleev, Christopher MacTaggart, Ilgaz Akseli</i> | |
| 420e A Novel Approach for Modeling Pharmaceutical Tablet Coating Using Coupled DEM-CFD Modeling | 176 |
| <i>Lucilla C. De Almeida, Tim Hoogenraad, Vinicius Daroz, Rahul Bharadwaj, Ariel Muliadi</i> | |
| 420f Predicting the Permeability of Porous Media Using Graph Neural Networks | 178 |
| <i>Jack I'Anson, Mark Simmons, E. Hugh Stitt, Robert Gallen</i> | |
| 420g Spray Drying for Uniform Sized Particle Formation: A Multiscale Modeling and Simulation Approach | 182 |
| <i>Jie Xiao</i> | |

PARTICLE TECHNOLOGY FOR PLASTICS RECYCLING, SURFACE MODIFICATION, ADDITIVE MANUFACTURING AND ENERGY STORAGE

| | |
|---|-----|
| 652a Spherical Agglomeration of Battery Materials: Mechanistic Understanding and Hollow Agglomerate Formation..... | 183 |
| <i>Rachel Smith, Jediah Capindale, Denis Cumming</i> | |
| 652b Interface Engineering for Optimizing Performance of the Ultra-High Nickel Cathode in All-Solid-State Batteries | 184 |
| <i>Wenjin Li, Kaiyuan Deng, Cheng Liu, Puxi An, Shaoyang Song, Lei Yao, Guangliang Liu</i> | |
| 652c A Two-Step Size Reduction Method for Fine Milling of Electronic Waste to Improve Recycling..... | 185 |
| <i>Yidong Xia, Noah Berglund, Jordan Klinger, Tiasha Bhattacharjee, Vicki Thompson, Zachary Diermyer, Jiaoyan Li</i> | |
| 652d Recycled Polyurethane Polyol Dispersion with Improved Stability..... | 186 |
| <i>En Wang, Craig Gorin, Kathryn Grzesiak, Hari Katepalli, Daniel Dermody, Hans Kramer, Kaoru Aou</i> | |
| 652e Leveraging Discrete Element Method Simulations for Studying Mechanochemical Depolymerization of Polystyrene Waste..... | 187 |
| <i>Jacob Sweet, Elisavet Anglou, Yuchen Chang, Carsten Sievers, Fani Boukouvala</i> | |
| 652f Investigation of Amine Silane Film Formation Via Particle Molecular Layer Deposition for CO ₂ Capture | 189 |
| <i>Hailey Loehde-Woolard, Bergen Evans, Michael Zaza, Katarina Odak, Kent J. Warren, Alan W. Weimer</i> | |

HONORARY SESSION: REG DAVIES SPECIAL TOPICS (INVITED TALKS)

| | |
|---|-----|
| 488a Fine Particle Systems – A Personal View on Multidimensional Particle Characterization..... | 190 |
| <i>Wolfgang Peukert</i> | |
| 488b Particle Formation as the Foundation of Processes to Produce Particulate Products | 191 |
| <i>Daniel A. Green, Lotfi Derdour</i> | |
| 488c 70 Years of Research and Application in Solid-Liquid Mixing | 192 |
| <i>Richard Grenville</i> | |
| 488d Solid-Liquid Separation – An Overview and the Challenges | 193 |
| <i>Karsten Keller</i> | |
| 488e Relevance of Particle Technology in Bio Based Manufacturing. | 194 |
| <i>Erik Gommeren</i> | |
| 488f Relevance of Solids Processing Expertise to the Chemical Industry – Past, Present and Future - A Perspective from Dow Chemical | 195 |
| <i>Shrikant Dhodapkar, Jorg Theuerkauf</i> | |
| 488g Effect of Particle Size, Shape and Structure on the Moisture Sorption Behaviors of Milk Powders | 196 |
| <i>Keisha W. McDowell, Steven F. Krakowski</i> | |

| | |
|--|-----|
| 488h Analysis of Concentrated Solar Energy Storage Using Packed and Fluidized Bed Systems..... | 197 |
| <i>Hamid Arastoopour, Zeyuan Gao, Javad Abbasian</i> | |

FLUIDIZATION: SUSTAINABILITY, RENEWABLES, AND DECARBONIZATION APPLICATIONS

| | |
|---|-----|
| 278a Production of Low Carbon Hydrogen Via Thermochemical Routes | 198 |
| <i>Ahmed Salem, Ellie Bales, Aimaro Sanna, Raffaella Ocone</i> | |
| 278b Chemical Looping for Low Carbon Energy and Chemical Production..... | 199 |
| <i>Luke Neal, Runxia Cai, Sherafghan Iftikhar, Vasudev Haribal, Fanxing Li</i> | |
| 278d Catalytic Methane Decomposition: Effect of Carbon Yield on Particle Properties and Fluidization Characteristics | 200 |
| <i>Dung Pham, Kang-Seok Go, Woohyun Kim, Hongjin Lee, Daewook Kim, Byungwook Hwang, Ho-Jung Ryu, Sang-Goo Jeon, Dong H. Lee, Nam S. Nho</i> | |
| 278e Catalytic Fast Pyrolysis (CFP) Regenerator Model Development..... | 201 |
| <i>Bruce Adkins, Mehrdad Shahnam, Yupeng Xu, Jordan Musser</i> | |
| 278f Enhancing Carbon Capture Efficiencies in Natural Gas Power Plants through Magnetic Stabilization of Fluidized Beds..... | 202 |
| <i>Ashin Sunny, Ishani K. Kudva, Shekhar Shinde, Danwyn Aranha, Krutarth Pandit, Sudeshna Gun, Pinak Mohapatra, Dawei Wang, Andrew Tong, Liang-Shih Fan</i> | |
| 278g Design and Operation of a Novel Aluminum/Water Reactor to Produce H_2 | 204 |
| <i>Oscar Punch, Christopher Spilater, Christopher Boyce</i> | |
| 278h Fluidized Bed Scale-up for Sustainability Challenges..... | 205 |
| <i>Ray Cocco, Jia W. Chew</i> | |

FLUIDIZATION: COHESIVE MATERIALS AND OTHER INTERPARTICLE FORCES

| | |
|--|-----|
| 340a Development of a Liquid Bridge Model for Particle Agglomeration and Defluidization in Plastic Pyrolysis | 206 |
| <i>Subhodeep Banerjee, Jean-Francois Dietiker, Mehrdad Shahnam</i> | |
| 340b Nuclear Techniques for Detailed Investigation of Cohesive Particle Flows..... | 207 |
| <i>J. R. Van Ommen, Kaiqiao Wu, Rens Kamphorst, P. C. Van Der Sande, Evert C. Wagner, Gabrie M. H. Meesters</i> | |
| 340c From Bouncing Space Probes to Toner Powders..... | 208 |
| <i>Denis Schütz, Helena Weingrill, Natali Unterberger</i> | |
| 340d Experimental Study and CFD-DEM Simulation of Vibrated Dry and Wet Spouted Beds | 209 |
| <i>Christopher Spilater, Oscar Punch, Briana N. Cabrera, Christopher Boyce</i> | |
| 340f Investigations on Dynamics of Agglomerates in a 2D Vibrated Fluidized Bed Using Pressure Signal and High-Speed Image Analysis | 210 |
| <i>Liang Zhang, Haifeng Lu, Haifeng Liu, Xiaolei Guo</i> | |

INDUSTRIAL APPLICATIONS OF COMPUTATIONAL AND NUMERICAL APPROACHES TO PARTICLE FLOW

| | |
|---|-----|
| 419a An Industry-Focussed, AI-Driven Approach to the Calibration, Validation, and Optimisation of DEM and CFD-DEM Simulations | 211 |
| <i>Kit Windows-Yule, Andrei-Leonard Nicusan, Dominik Werner, Ben Jenkins</i> | |
| 419b DEM Simulation of Particle Granulation in a Twin Screw Wet Granulator | 212 |
| <i>Yu Wang, Pankaj Doshi, Eldin W. C. Lim</i> | |
| 419c Effect of Triboelectric Charges on Powder Flow: DEM Simulation with Patchy Particles and Comparison with Experiments | 213 |
| <i>Nicolas Preud'Homme, Eric Opsomer, Aurelien Neveu, Geoffroy Lumay</i> | |
| 419d Complex Flow Patterns and Their Impact on the Performance of the Spiral Air Jet Mill | 214 |
| <i>Kunal Sharma, Devang Khakhar</i> | |
| 419f A CFD-DEM-VOF Model to Simulate Bubble-Liquid-Particle Three-Phase Flow..... | 216 |
| <i>Facheng Gong, Yimei Chen</i> | |
| 419g Industrial Practice and CFD Investigation of a Novel Fast Fluidized Bed for Fluid Catalytic Cracking | 217 |
| <i>Wenming Liu, Jianhong Gong, Jingxiao Wang, Jinquan Zhu</i> | |
| 419h CFD Modeling of Binary Mixing of Particles in Fluidized Bubbling Bed Reactors | 218 |
| <i>Kuochen Tsai, Guoqiang Yang, Piet Huizenga</i> | |

NANOSCALE MANUFACTURING: EXPERIMENTS, MODELING AND SIMULATION

| | |
|---|-----|
| 279a Dynamics of Molecular Collisions in Air and Its Mean Free Path | 220 |
| <i>Dimitrios Tsalikis, Vlasios Mavrandas, Sotiris E. Pratsinis</i> | |
| 279b Predictive Models for the Formation and Rigorous Design of Nanoparticles | 222 |
| <i>Wolfgang Peukert, Nabi Traore, Lukas Pflug</i> | |
| 279c Particle Size and Shape Analysis and Reconstruction Using Two-Point Correlation Function for a Nanoparticle System | 223 |
| <i>Puneet Koli, Rajdip Bandyopadhyaya, Abhijit Chatterjee</i> | |
| 279d Molecular Dynamics Simulations and Machine Learning Assisted Size and Temperature Dependent Shape Analysis of Metal Nanoparticles..... | 224 |
| <i>Huaizhong Zhang, Kristen Fichthorn</i> | |
| 279f Data Intensification in Flow for Accelerated Synthesis Space Mapping of Inorganic Nanomaterials..... | 225 |
| <i>Fernando D. Licona, Hannah Dickerson, Abdulrahman Alsaiari, Milad Abolhasani</i> | |
| 279g Modeling of Silver Nanoparticle Synthesis and Trapping at the Interface of an Aqueous Two-Phase Systems | 226 |
| <i>Jagadeesh Korukonda, Subramaniam Pushpavanam</i> | |
| 279h A Simulation Framework for Nanodroplet Breakup in Top-Down Nanoparticle Production..... | 227 |
| <i>Nick Morse, Johan Remmelgas, Johannes Khinast</i> | |

Author Index