

IFPRI — WELCOME & INTRODUCTION

Judith Bonsall — Unilever
IFPRI Technical Chair

IFPRI COMPETITION CAUTION

Participants shall not enter into any discussion, activity or conduct that may infringe any applicable competition law.

By way of example, participants shall not discuss, communicate or exchange any commercially sensitive information, including non-public information relating to proprietary equipment, processes and formulations.

This applies not only to discussions in formal meetings but also to informal discussions before, during and after meeting.

The recommendations coming out of this consortium are just that. Individual companies remain free to make independent, competitive decisions.

Any standards endorsed by this consortium are voluntary standards and any business practice recommendation developed are also voluntary.

MEETING ETIQUETTE

- Please ensure your Zoom name also includes your Company name – click on ... at the top of your picture and select rename.
- We will mute all but the designated speaker – Designated speakers please unmute yourself then remember to mute yourself once your update is given.
- If you have a question please raise your hand via the zoom button, or put it in the chat section – Willie, Jim & I will be monitoring this during the meeting. Click on Participants Panel then click raise hand at the lower RHS
- We will try to keep to the time allowed, but forgive us if we are not quite as good as usual!

	Sunday	Monday	Tuesday	Wednesday	Thursday
am	Members only business meeting	Posters from current Technical Program	Review Presentations & Round Robin/Workshop Update	Refining Ideas for future Technical Program Briefs Scientific Screening and pre-selection of Proposals for future Technical Program	Rank order vote for next years new Technical Program. Selection of Project Briefs, Review Briefs & Workshops to progress
pm	Presentation From Current Technical Program	Posters From Current Technical Program & Feedback	Ideas session to generate new Project Briefs for Future Technical Program	Non- IFPRI funded Technical Presentations & Academic Poster Session	Members only business meeting Final Budget Decision Making

IFPRI MEETINGS – THE NORMAL PROCESS FOR TECHNICAL MEETING

Current Program Activities

Scene setting presentations

In-depth poster talks

Review presentations – chapter outlines

Feed back and critique of the projects & Reviews

Updates from consultants

Future Program Activities

Ideas generation – projects/reviews/workshops

Idea refinement and brief generation

Voting for briefs (n+1)

Discussion on merits of new project proposals

Voting for new proposals

PROJECT PHASING- 2019/2020

17 PAID PROJECTS, 1 COLLABORATION GRANT PROJECT

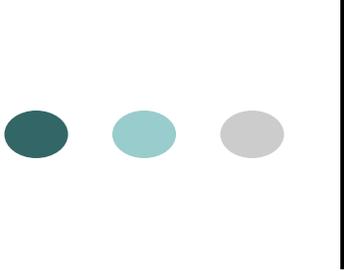
	Project	Research Associate	Institution	End	Term
1	Creating Tuneable Agglomerates via 3D Printing	K. Hapgood	Monash University	2020	2
2	Prediction of Segregation	J. McCarthy	U. Pittsburgh	2020	2
3	Flowability Assessment of Weakly Consolidated Particles	C. Hare A. Hassanpour	U. Surrey	2020	2
4	Molecular Self-Assembly	U. Wiesner	Cornell U.	2022	2
5	Dry Powder Rheology	K. Daniels	NCSU	2022	2
6	Model-Based Control of Crystallisation	Z. Nagy	Purdue U.	2023	2
7	Crystal Shape Prediction	M. Doherty	California	2021	1
8	Powder Mixing Rules	I. Govender	Kwazulu-Natal	2021	1
9	Cake Filtration	U. Peuker	Freiberg	2021	1
10	Wetting and Dispersion of powders	Gaiani	Lorraine	2022	1
11	Slurry & Paste Rheology	E. Koos	KIT (Karlsruhe)	2022	1
12	Powder Adhesion to Metal Surfaces	C. Sinka	Leicester Uni	2022	1
13	Characterisation of spray nozzles	N. Ashgriz	Toronto	2022	1
14	Model-based Design of Granular Products	R Smith	Sheffield	2023	1
15	Precision powder feeding: Theoretical understanding and predictive model to link material properties to performance of twin screw feeders	P. Nott	Indian Institute of Science	2023	1
16	Bridging the gap between model and industrial colloidal formulations	J. Vermant	ETHZ	2023	1
17	A Systems Engineering Approach to Dry-Milling with Grinding Aid Additives	A. Kwade	TU Braunschweig	2023	1
18	SIF collaboration	L. Hsiao	NC State	2021	1 yr



IFPRI VIRTUAL AGM 2020 SIZE REDUCTION AREA

Consultant's Review
Mojtaba Ghadiri

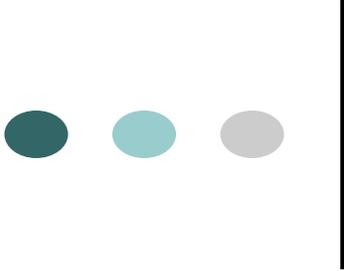
University of Leeds



2019 Comminution Highlights

European Symposium on Comminution and Classification:



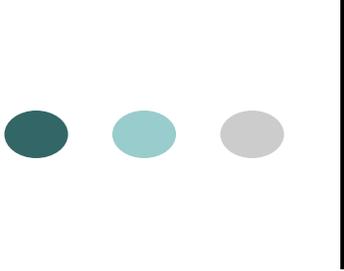


2019 Comminution Highlights

ESCC2019

80 Contributions in two parallel session covering:

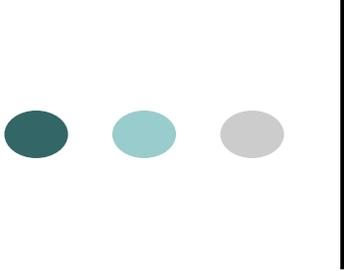
- **Fundamentals of size reduction**
- **Innovations in milling and classification**
- **Nanomilling**
- **Mechano-chemistry and solid state transformations**
- **Pharmaceuticals and foods**
- **Attrition and wear**
- **Modelling: mechanistic, population balance, DEM and coupling with CFD**



2019 Comminution Highlights ESCC2019

Book of abstracts has been archived at the following repository:

- <http://eprints.whiterose.ac.uk/150219/>
- Work is in progress publishing a special issue of Powder Technology based on the ESCC2019 contributions
- Next ESCC will be in Toulouse, hosted by Profs Christine Frances and Alain Chamayou



2019 Comminution Highlights

ESCC2019 Plenary and Keynote Talks



Prof. Arno Kwade

Technical University of Brunswick

Production, tailoring, formulation of nano and micro sized particles and their use for the design of structured products like battery electrodes, pharmaceutical active ingredients and nano-composites.



Dr Michael Juhnke

Novartis Pharma AG, Basel

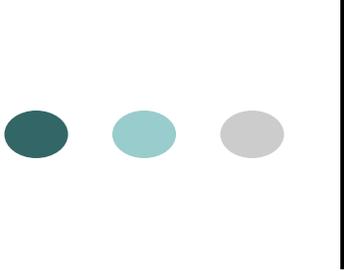
Process development of engineered drug particles for oral, parenteral and respiratory applications from pre-clinical to production scale.



Prof. Malcolm Powell

University of Queensland

Milling of minerals, linking fundamental research into applied outputs in liner design, SAG mill modelling and control, the unified comminution model (UCM), ore characterisation, flexible circuits and application of novel processes to reducing the environmental impact of mining.



2019 Comminution Highlights

ESCC2019 Plenary and Keynote Talks



Prof. Aubrey Mainza
University of Cape Town

Comminution and classification, using DEM and CFD and PEPT as tools in his modelling methods.



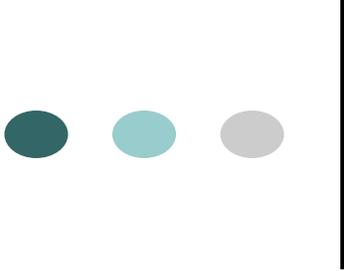
Dr Lian Liu
University of Surrey

Comminution, granulation. powder flow and compaction



Dr.-Ing. Steffen Sander
Hosokawa Alpine

Powder and particle processing business with a strong focus on size reduction and classification



2019 Comminution Highlights

ESCC2019 Plenary and Keynote Talks



Prof. Wolfgang Peukert

University of Erlangen-Nuremberg

Formulation of functional particle systems, involving milling, classification and characterisation with a unifying approach in the design of particulate products using modelling and optimization strategies, and covering both dry and wet systems.



Prof. Marcelo Luis Tavares

Federal University of Rio de Janeiro

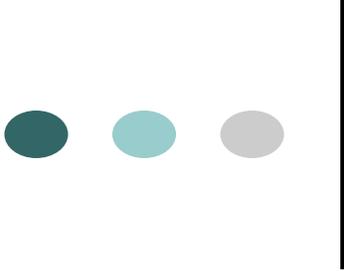
Milling research is focussed on Mineral Processing, working mainly in the topics of modelling and simulation of comminution and mineral concentration processes and fundamentals of particle breakage.



Prof. Jerry Heng

Imperial College London

Research is focussed on control of nucleation and crystallisation of organic solids (polymorphism), the role of surface properties in processability and manufacturability of powders, with emphasis on surface energy distributions.



Some of the Rising Stars in Size Reduction and Classification to Follow



Prof. Sergiy Antonyk

TU Kaiserslautern

Particle Technology, with a focus on fundamentals of breakage, granulation and coating using modelling and simulation by DEM



A/Prof. Ecevit Bilgili

New Jersey Institute of Technology

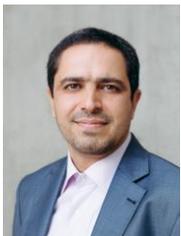
Particle Technology, modelling and simulation of milling by PBM, drying



Prof. Thomas Mütze

University of Freiberg

Milling, grinding and flow of bulk solids



A/Prof. Mohsen Yahyaei

University of Queensland

Modelling, optimisation, and control of comminution circuits

2019 Comminution Highlights

ESCC2019 Sponsors

Gold Sponsors



HOSOKAWA MICRON LTD



IFPRI

International Fine Particle Research Institute

Silver Sponsors



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a **micromeritics** company

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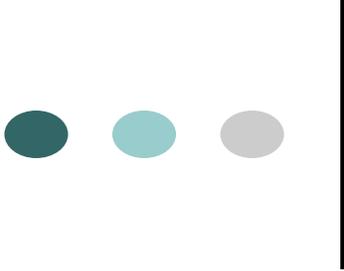


IFPRI
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EDEM[®]

Simulate material. Deliver results.

MEi

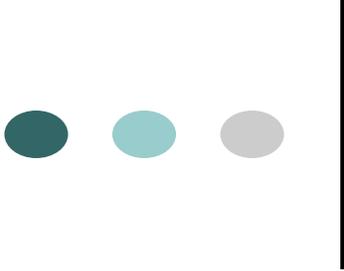


Recently Concluded Projects:

1. Grindability testing: modelling (**Ooi's work**)
2. Review of dry/wet grinding and processing aids (**Kwade's report**), now led to a full project

Comments:

- Addition of grinding aids: mass basis or surface area basis? This necessitates a study of the effect of particle size using the same material
- How to decouple the role of grinding aid from flow aid?



Plan for 2021 and Beyond

Two unfunded proposals:

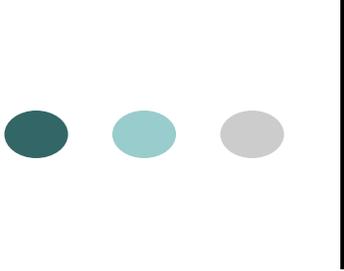
- Molecular modelling of mechanical properties and fracture
- Stress-induced transformations due to milling

Past Review Proposals for Fresh Consideration:

- Milling of soft matter
- Milling of multicomponent materials/ comilling
- Engineering scaling of mills

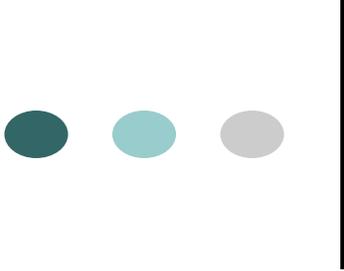
Workshop: **Not supported last year!**

- Challenges and trends in comminution & classification



What is Ongoing on Milling at Leeds?

- Modelling of spiral jet mills (AZ)
- Grindability inferred from breakability testing using Scirocco and G3 dispersers of Malvern Pananalytical
- Attrition in CLC systems (TOTAL & IFPEN)
- For more information:
<https://ghadiri-group.leeds.ac.uk/>



Related Activities at Leeds

- Virtual Formulation Laboratory (EPSRC)
PI:Csaba Sinka, Leicester, Leeds, ICL, Greenwich
- Centre for Manufacturability Design (AZ, Syngenta, UCB
Pharma, Merck)
Ali Hassanpour & John Blacker
- Centre of Doctoral Training for Complex Particulate
Products and Processes (EPSRC)
Kevin Roberts & Frans Muller
- New CDT Centre: From Molecules to Product (EPSRC)
Elaine Martin

Particle Formation Consultant report 2020

Jim Litster

Particle formation projects

- Predicting crystal shape (Doherty)
- Molecular self assembly (Wiesner)
- ~~Tunable agglomerates by 3-D printing (Hapgood)~~
- Spray nozzles (Ashgriz)
- Adhesion (Sinka)
- Process/Product design models (Smith)
- Crystalliser control (Nagy)

Formation Project Mix

Process	Existing projects
Crystallisation	2 (3)
Granulation	0 (1)
Spray drying	1
Compaction/adhesion	1
Extrusion	0
Product/characterisation	1
Additive manufacture	0
Coating/modification	0
Smart Particles	0

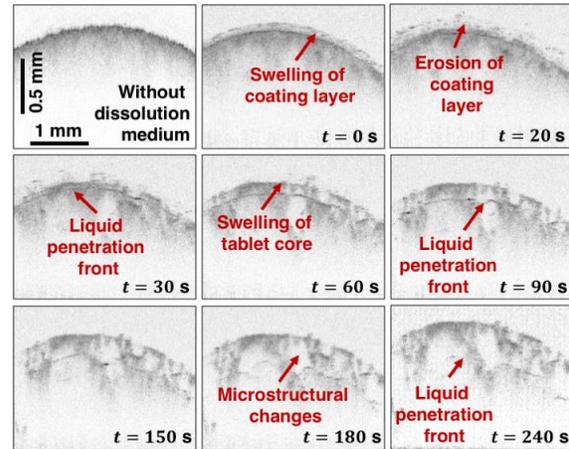
Future Areas?

- Particle coating following on from the Buck review
- Smart particles following Oxley review
- Additive manufacturing
- Insitu measurement of structure development (and destruction)

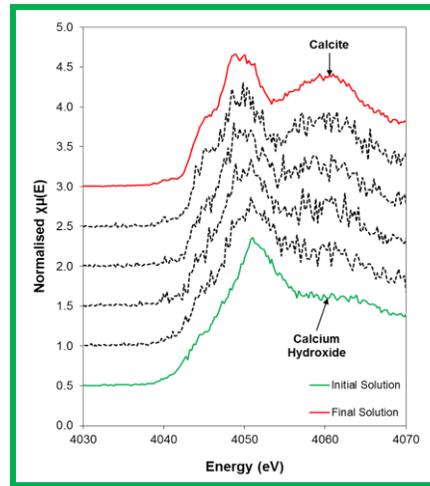
Workshops are very effective in generating good project ideas.

The UK Scene

- Daniel Markl (Strathclyde) – in situ characterisation



- Sven Schroder (Leeds)
- – in situ spectroscopy



The UK scene

- Ricky Wildman (Nottingham) – formulation for 3D printing
- Jonathan Reid (Bristol) – particle formation from aerocolloidal suspension
- Pablo Garcia-Trinanes – powder cohesion and flow

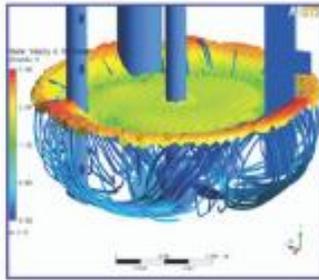


The UK Scene – major hubs

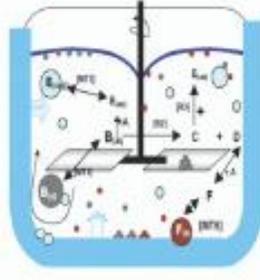
- CMAC <https://www.cmac.ac.uk/>
- MAPP <https://www.cmac.ac.uk/>
- Faraday <https://faraday.ac.uk/>

SSPC - Ireland

- <https://sspc.ie/>
 - Gavin Walker (Limerick) Manufacturing theme director



CFD



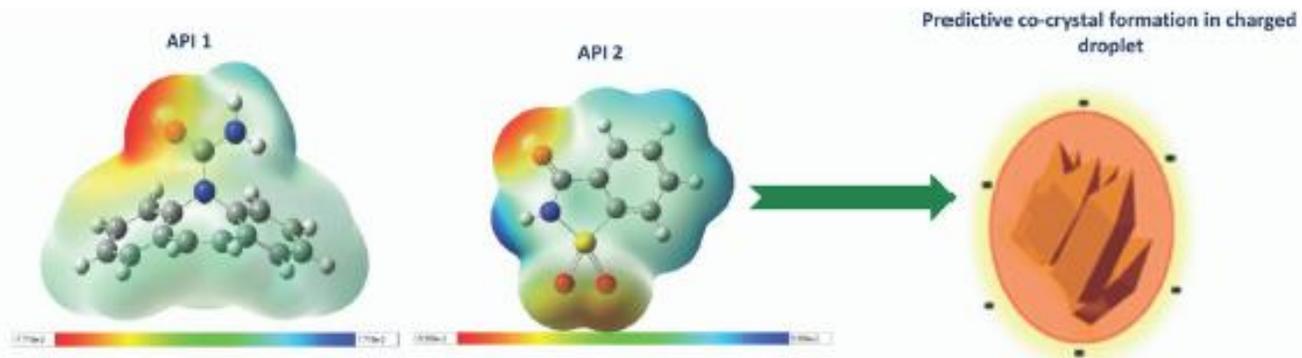
Modelling



DCS



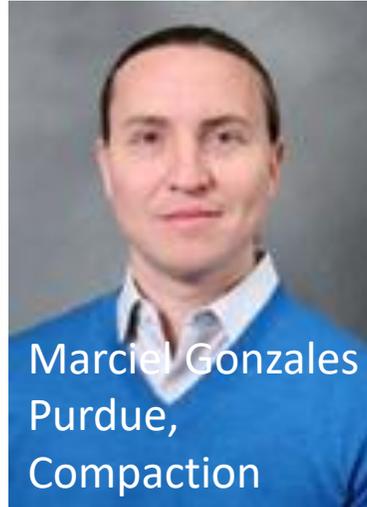
FPM



Other faces



Heather Emady
ASU, Granulation



Marciel Gonzales
Purdue,
Compaction



Tony Zhu
Purdue
Aerosols



James Elliott
Cambridge
Compaction



Cordelia Selmoulya
UNSW
Encapsulation



Lynne Taylor
Purdue
Amorphous products

Diversity in the IFPRI program - contractors

- By gender:
 - Male 12 (2 to finish)
 - Female 5 (1 to finish)
- By geography
 - North America 6 (1 to finish)
 - Europe 8 (1 to finish)
 - Asia/Pacific 2 (1 to finish)
 - Africa 1



Dry Systems
Engineering Systems
Wet Systems

Education Perspectives and Outreach IFPRI 2020 AGM

- Education trends, needs, opportunities

$$\begin{bmatrix} \text{Modular} \\ \text{Process} \end{bmatrix} \times \begin{bmatrix} \text{Matrix} \\ \text{Learning} \end{bmatrix}$$

- Elsevier Powder Technology, IFPRI Corner
- Review opportunities
- Systems Framework

Paul Mort

pmort@purdue.edu

Purdue University

Dept of Materials Engineering,

Center for Particulate Products and Processes (CP3)

7/1/2020

PURDUE
UNIVERSITY.

Personal perspective

- IFPRI representative for Procter & Gamble, 1995-2018

- Particle Formation ————| Granulation, Extrusion, Compaction
- Dry Flow ——————| Dense flow rheology (Tardos, Behringer,
- Systems ——————| Daniels/Vrend); IFPRI Collaboratory

- Continuing IFPRI association

- Elsevier outreach (IFPRI Corner) ————| Perspectives and reviews:
academic/industrial partnership
- Consultant: Systems / Education

- Purdue University, 2019-current

- Department of Materials Engineering
- Center for Particulate Products and Processes (CP3)
 - Training and education
 - Research, systems focus (modular processes, PAT, control)
 - Industrial outreach

Strong IFPRI influence on teaching and research

Trends in Education

- On-line is here:
 - Synchronous and
 - Asynchronous, on-demand
- Higher Ed “iron triangle” of inter-dependent challenges: affordability, accessibility, excellence.
 - Added pandemic challenge
- Professional and continuing education:
 - On-line can be integrated with on-campus.

On-line content enables:

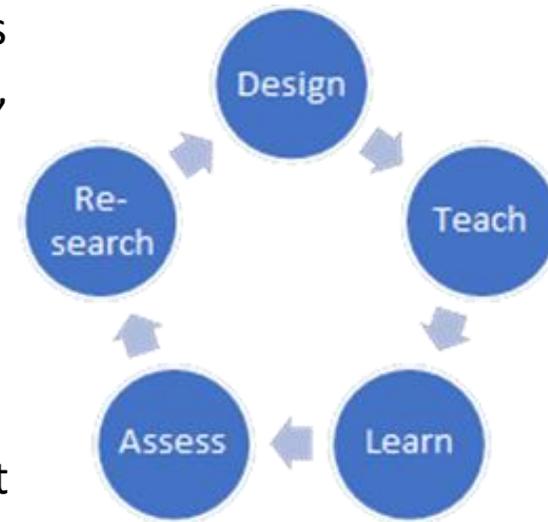
- Diverse population of students having a broad range of background and experience levels
- Business and educational innovation:
 - Research renewal.
 - Knowledge changes more rapidly than careers.
 - Lifetime education.

Online Curriculum Development

Continuous improvement on a regular frequency.

Example, Georgia Tech programs developed to meet needs of business and industry (Computer Science, Data Analysis, Cyber-security):

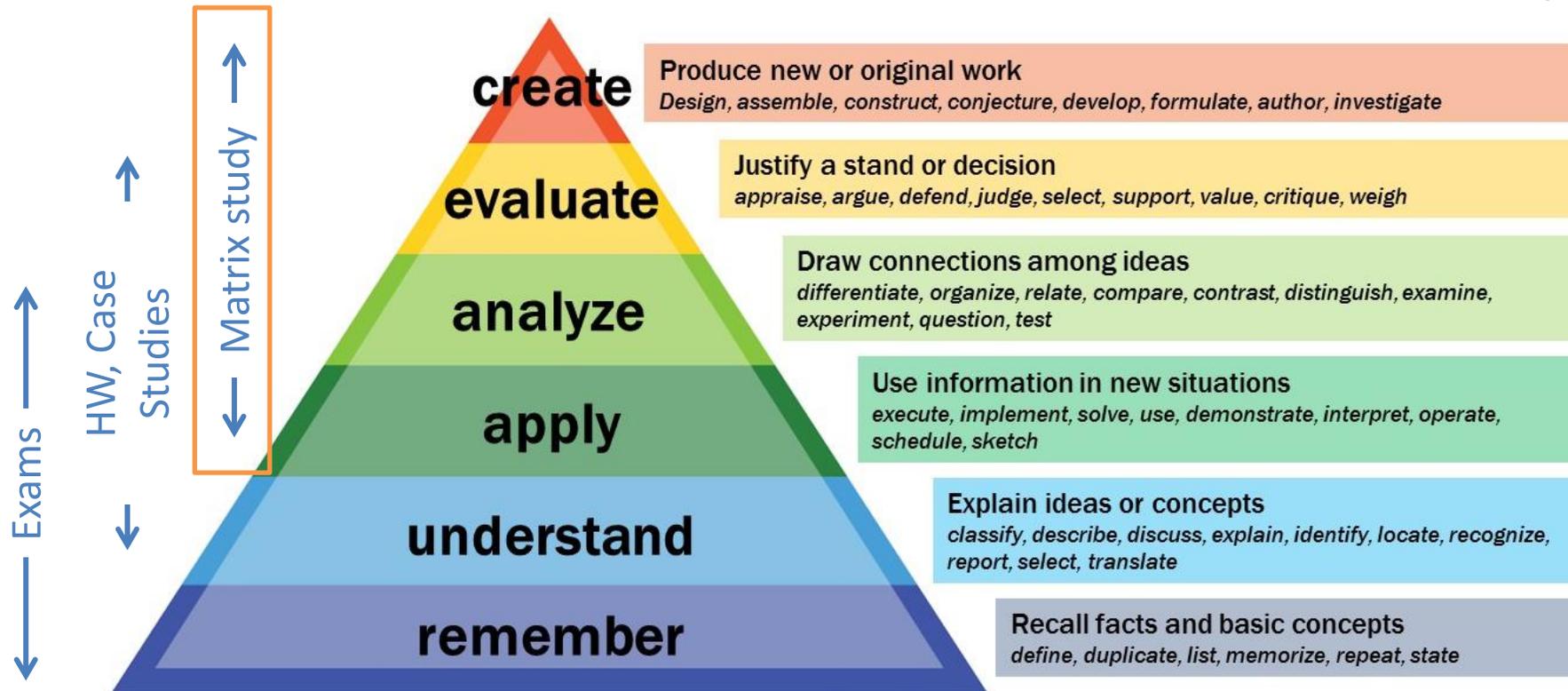
- 4 to 5-month development period with a multi-functional team including subject-matter and production experts
- 3-year refresh and renewal cycle where the development cycle is re-applied to include new content and other changes.
- ~50:1 student/TA ratio. Experimenting with AI agents as TA's.
- Matrix design, i.e., customization of content
- Credit for accomplishments
- Blockchain transcript, with student input (i.e., to add additional content) and institutional validation.



Matrix Study:

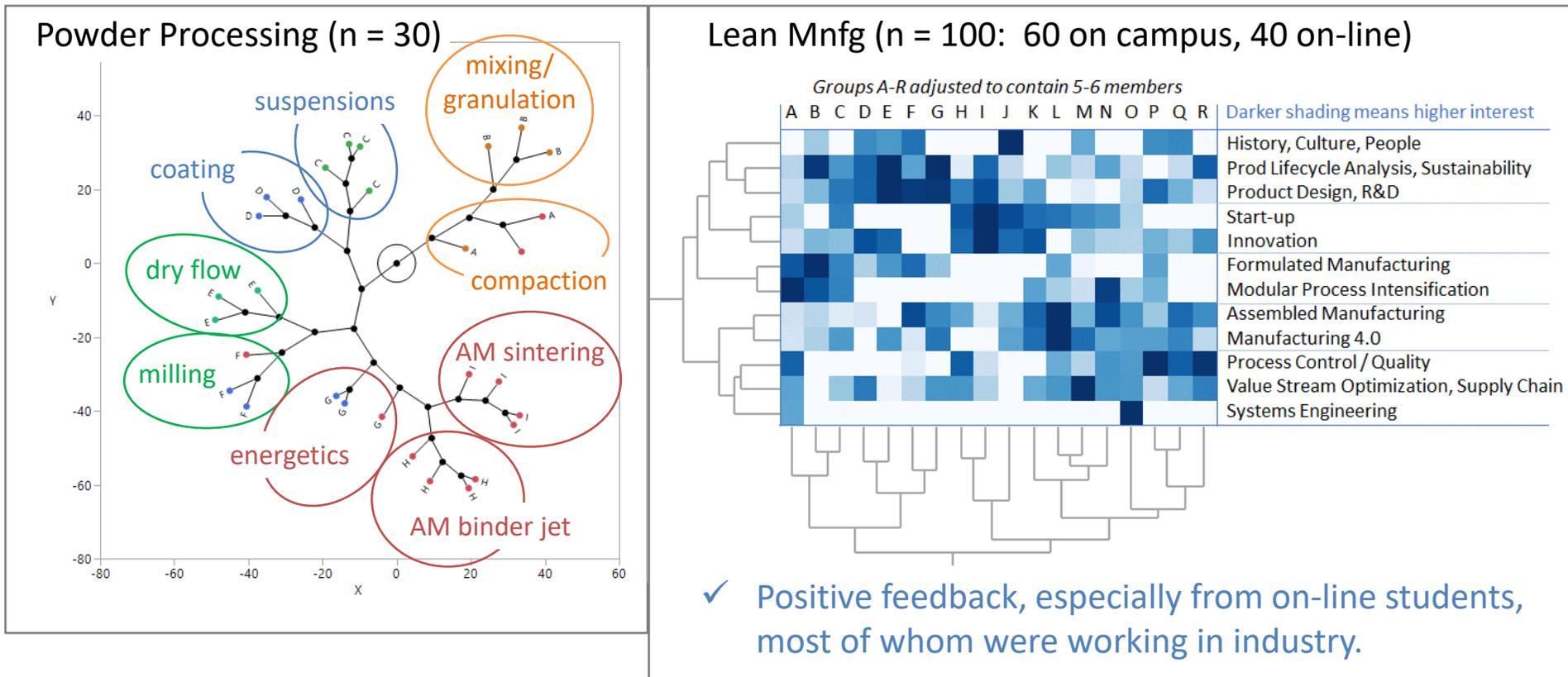
A deep dive into specific area of student's need or choosing

...in context of Bloom's Taxonomy



Matrix Study: Deep dive into specific interest area

- Individual survey assignments according to students' specific areas of interest.
- Form groups based on content clustering of individual specific interest areas.
 - Hypothesis: Group work clustered by common interests can foster a sense of identity within each group & access the value-in-diversity of group members.



“modular solids process”

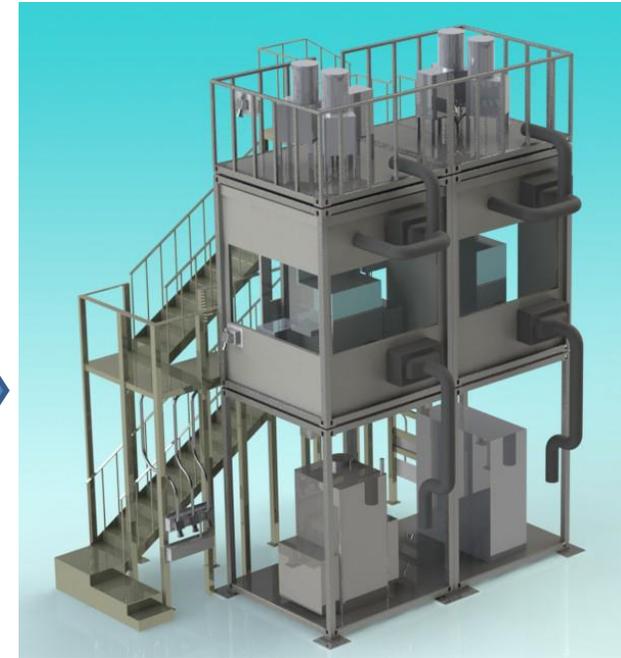
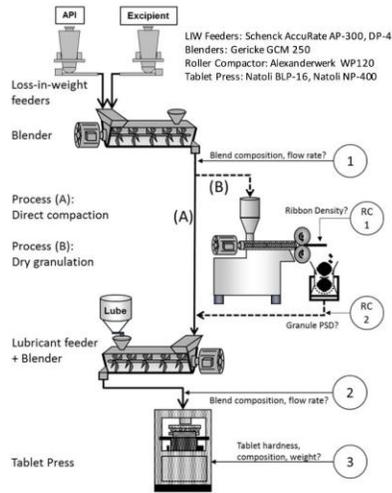
- Small footprint, plug & play
- Effective throughput
- Continuous flow
(process intensification)
- Instrumented for remote sensing and control

- Matrix of processes, systems focus
- On-line access

Consider as a topical focus and enabler for IFPRI educational outreach

Purdue CP3

Continuous Tableting at Purdue Pilot Plant – Direct Compaction + Dry Granulation



6 modules, stackable
3-high

FLEX building High-Bay,
Purdue Discovery Pk



- Education,
- Training,
- Research,
- Industrial outreach

PCMM

Portable, Continuous,
Miniature and Modular

Modular Technologies & Integration

- Formulation components
- Material Transfer Systems
- Gravimetric Feeders
- Vertical Powder Mixer
- NIR Feed Frame probe
- Rotary Tablet Press
- Integrated Control w Real-time decision making
- POD-based facilities

Dan Blackwood, Pfizer



Breakthroughs that
change patients' lives

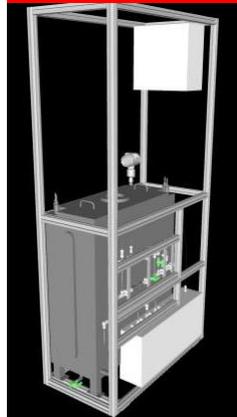
Modular processing in Pharmaceutical Manufacturing

Paul Collins, Eli Lilly



CSTR Skid

**Plug Flow
Reactor Skid**



**Feed System
Skid**



Skids are part of a platform to support chemical unit operations in any product

- Modular to be combined into unit operations (ie, mix and match as needed).
- Flexible and adaptable – simple skids with standard components (where possible)
- Plug into Distributed Control System (DCS)

Integrated Continuous Manufacturing, Salvatore Mascia, Continuous Pharmaceuticals

nature



A drug-making facility built from bespoke parts takes up no more space than a boxing ring. Credit: Studio Baraldi sas

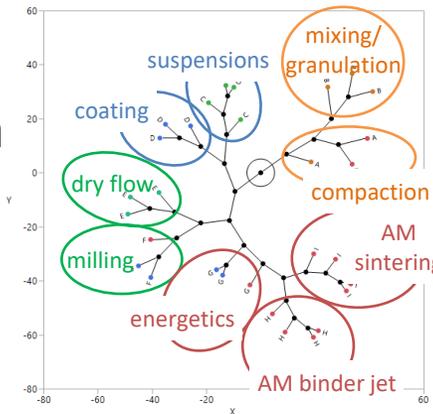
CHEMISTRY • 20 DECEMBER 2019

Mini-factory churns out drug cheaply and at a furious pace

A small, fully automated assembly line can produce 4,800 tablets an hour and could make drugs more widely available.

IFPRI Educational Outreach

- On-line capability
 - Broad access
 - Diverse participation
- Industry pull
 - Research renewal
 - Continuing education, training
- Continuous improvement
 - Regular content renewal
 - Explore using matrix approach (w/ clustering)



Modular approach & matrix design, enablers for education:

- Product-Process relations and models
 - Attribute definition,
 - Characterization
- Modular systems, matrix of processes
 - Plug & play
- On-line access
 - Monitoring & control
- Accessible toolkits
 - Hands-on



Elsevier update, Powder Technology

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Journal Metrics

> CiteScore: 6.4

Impact Factor: 3.413

IFPRI Corner

J. Michaels, J. Litster,
K. Jacob

Particle technology education in the 21st century

In April 2017, IFPRI sponsored a workshop at the University of Sheffield to assess the current state of global particle technology education and chart a course forward. There is a clearly demonstrated need for trained graduates at all levels across a broad spectrum of industries.

Launch of IFPRI Corner

We are pleased to inform that a new section called the “IFPRI Corner” is launched in Powder Technology. The “IFPRI Corner” highlights pre-competitive research, perspectives, and topical reviews that are industrially relevant.

Highlights pre-competitive research, perspectives, and topical reviews that are industrially relevant.

- Grinding Aids Review in progress (Kwade & Prziwara)

Elsevier provides 1-yr open access

Consider review pipeline in association w/ Powder Technology

Selected Powder Technology review articles since June 2019 (1 year):

- P. Bhalode, M. Ierapetritou, “[A review of existing mixing indices in solid-based continuous blending operations,](https://doi.org/10.1016/j.powtec.2020.06.043)” doi.org/10.1016/j.powtec.2020.06.043.
- S. Tang, J. Huang, L. Duan, P. Yu, E. Chen, “[A review on fractal footprint of cement-based materials,](https://doi.org/10.1016/j.powtec.2020.05.065)” doi.org/10.1016/j.powtec.2020.05.065.
- L. Taylor, D. Skuse, S. Blackburn, R. Greenwood, “[Stirred media mills in the mining industry: Material grindability, energy-size relationships, and operating conditions,](https://doi.org/10.1016/j.powtec.2020.04.057)” doi.org/10.1016/j.powtec.2020.04.057.
- M. Ahmed, M. Pasha, W. Nan, M. Ghadiri, “[A simple method for assessing powder spreadability for additive manufacturing,](https://doi.org/10.1016/j.powtec.2020.04.033)” doi.org/10.1016/j.powtec.2020.04.033.
- R. Maharjan, S. H. Jeong, “[High shear seeded granulation: Its preparation mechanism, formulation, process, evaluation, and mathematical simulation,](https://doi.org/10.1016/j.powtec.2020.03.020)” doi.org/10.1016/j.powtec.2020.03.020.
- D. Minglani, et al, “[A review of granular flow in screw feeders and conveyors,](https://doi.org/10.1016/j.powtec.2020.02.066)” doi.org/10.1016/j.powtec.2020.02.066.
- S. Wang, et al, “[Numerical investigation on the effects of operating conditions and configuration parameters in industrial risers,](https://doi.org/10.1016/j.powtec.2019.12.043)” doi.org/10.1016/j.powtec.2019.12.043.
- S. K. Nielsen, M. Mandø, A. B. Rosenørn, “[Review of die design and process parameters in the biomass pelleting process,](https://doi.org/10.1016/j.powtec.2019.10.051)” doi.org/10.1016/j.powtec.2019.10.051.
- R. de Souza Lima, M.-I. Ré, P. Arlabosse, “[Drying droplet as a template for solid formation: A review,](https://doi.org/10.1016/j.powtec.2019.09.052)” doi.org/10.1016/j.powtec.2019.09.052.
- R. Sharma, G. Setia, “[Mechanical dry particle coating on cohesive pharmaceutical powders for improving flowability - A review,](https://doi.org/10.1016/j.powtec.2019.08.009)” doi.org/10.1016/j.powtec.2019.08.009.
- W. Goossens, “[Review of the empirical correlations for the drag coefficient of rigid spheres,](https://doi.org/10.1016/j.powtec.2019.04.075)” doi.org/10.1016/j.powtec.2019.04.075.

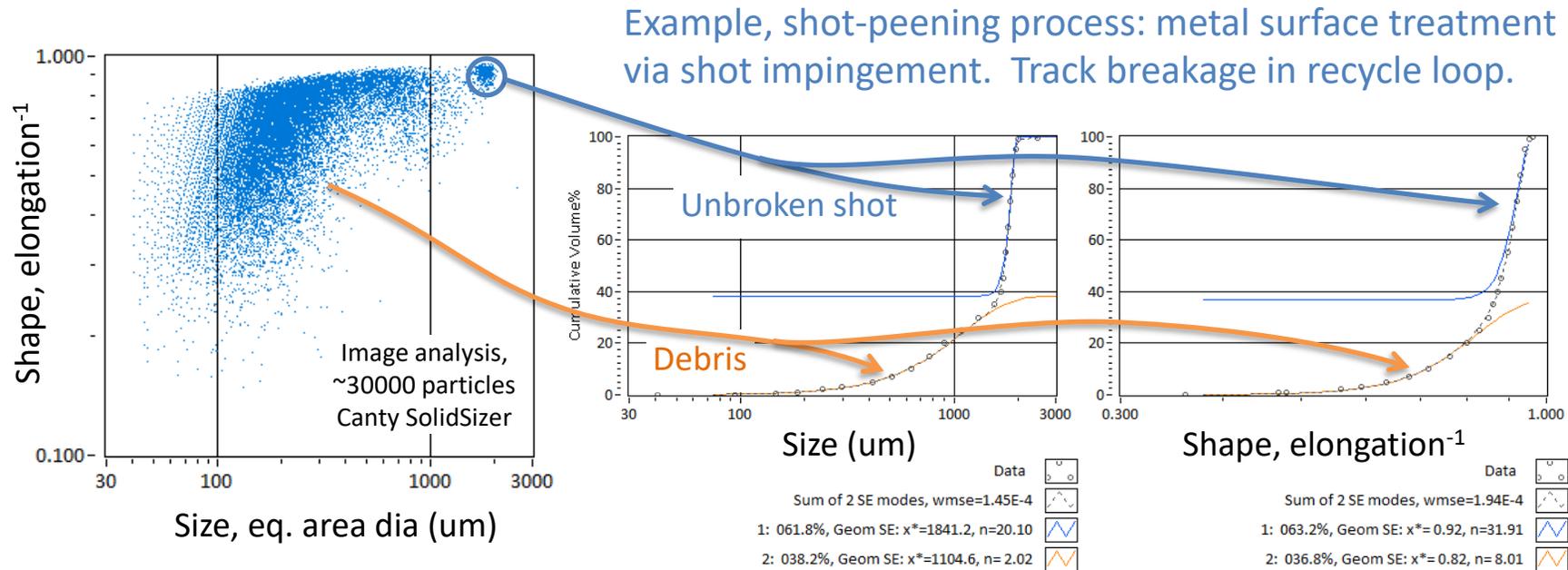
A sampling of unsolicited reviews: Powder Technology

Academics have offered to write reviews. Are any of interest to IFPRI members?

- “Powder-based 3D printing of pharmaceuticals: excipient properties and their influence on the drug product,”
 - J. Quodbach, Heinrich Heine University, Germany.
 - J. Lindh, Uppsala University, Sweden.
- “Additive Manufacturing of Metal Alloys by Selective Laser Melting of Elemental Metal Powders,”
 - P. Gokuldoss, Tallinn University of Technology, Estonia
- “A review on gas-solid cyclones,”
 - E. Dehdarinejad and M. Bayareh, Shahrekord University, Iran.
- “Effects of different geometric, kinematic, material and physical quantities on the coefficient of restitution,”
 - K. Hashemnia, Shiraz University, Iran.

Closing comment, Systems Framework

- Final report on Systems Framework is still pending
- Focus of the report: Compare and contrast of optimization and regression methods for analysis of particle size and shape data (2D image analysis)
- Multimodal analysis:
 - Simplified analysis via residual regression and optimization;
 - System perspective, modal dynamics in integrated processes.
- Seeking collaboration, test data, input formats, etc.
- Outcome: Make analysis tools available to membership.





New developments and directions in characterization

Wilson Poon

School of Physics & Astronomy

and

The Edinburgh Complex Fluids Partnership (ECFP)

The University of Edinburgh

System Engineering

```
graph TD; SE[System Engineering] --- SR[Size reduction]; SE --- DS[Dry Systems]; SE --- WS[Wet Systems]; SE --- PF[Particle Formation]; SR --- C[Characterization]; DS --- C; WS --- C; PF --- C; C --- E[Education];
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Size
reduction

Dry
Systems

Wet
Systems

Particle
Formation

Characterization

Education

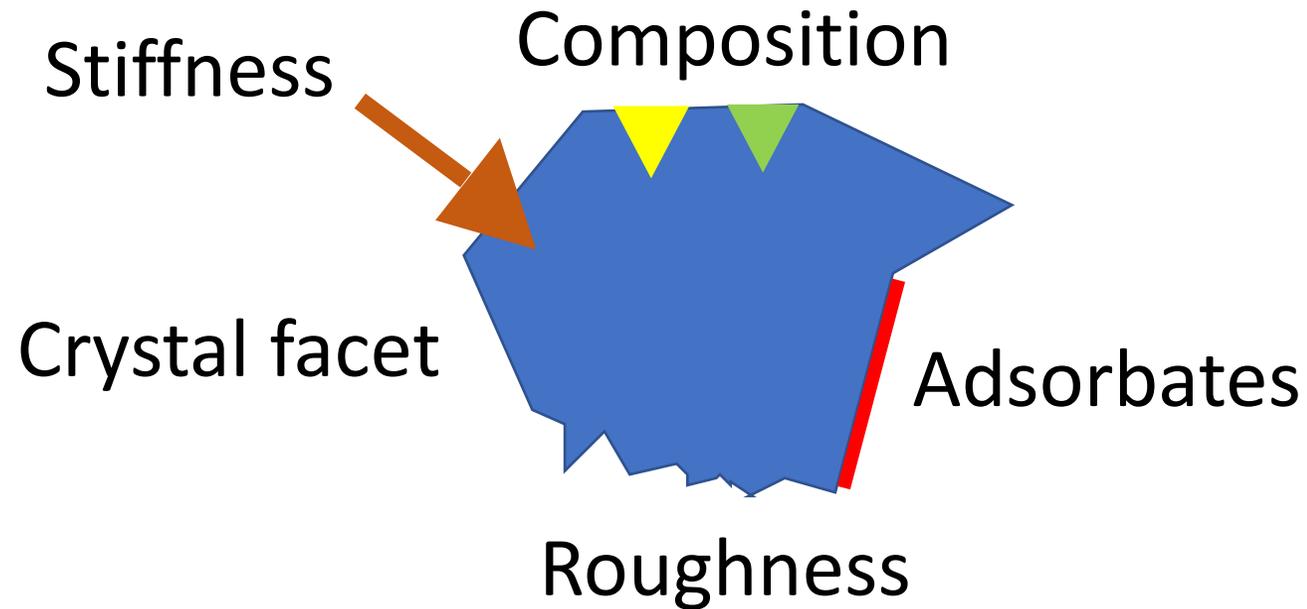
Some new directions and developments in wet suspensions characterization

Members: see slides of commissioned review for much more!

1. Wet-dry convergence of interest
2. Turbid wet systems
 - (a) Sizing
 - (b) Flow imaging

1. Wet-dry convergence

Surface properties are crucial for multiple applications of *powders*

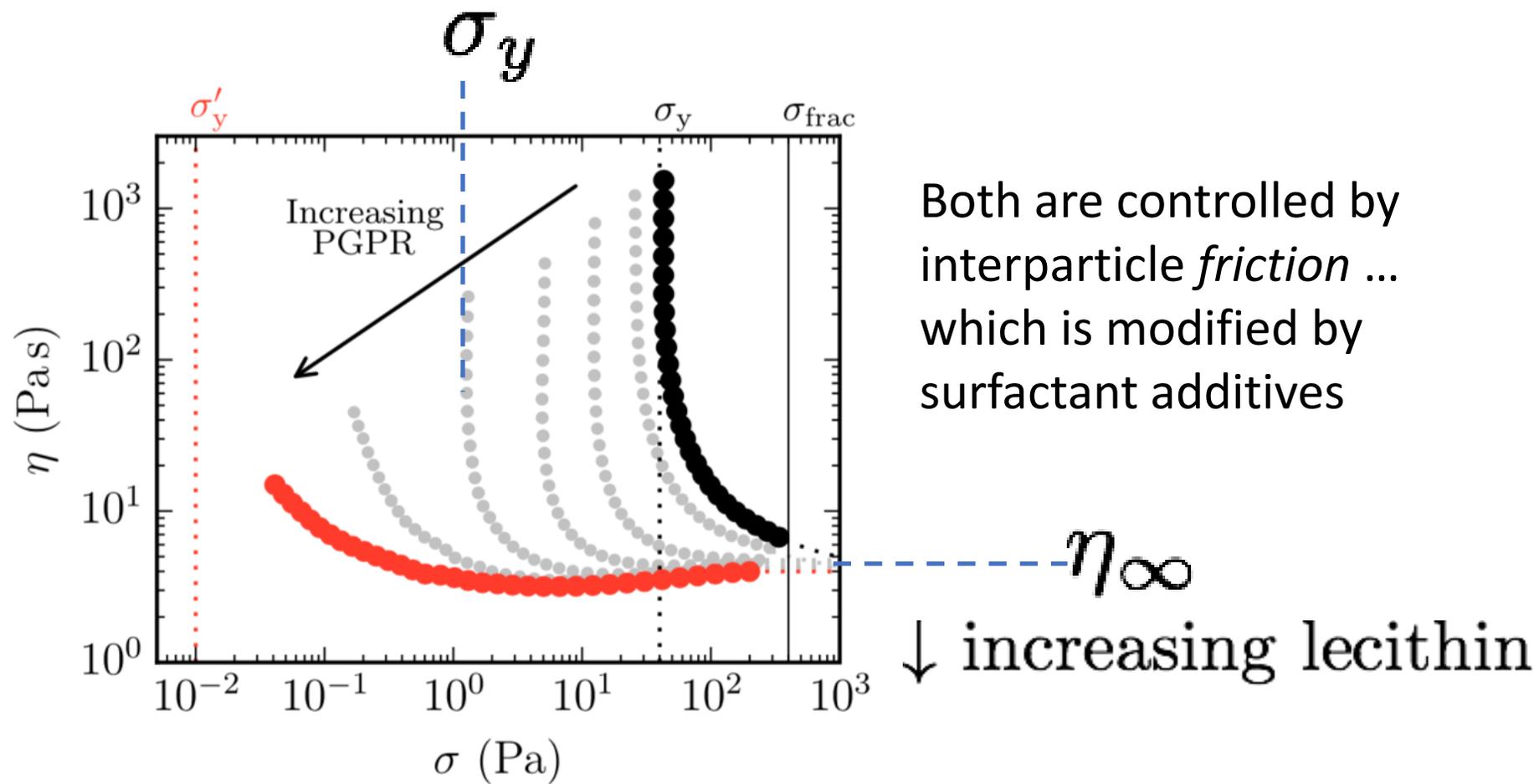


Different dry milling methods gives different surface properties

Kinetics of powder reconstitution is sensitive to surface properties

New: importance of surface properties for suspension rheology

Flow curve of molten chocolate



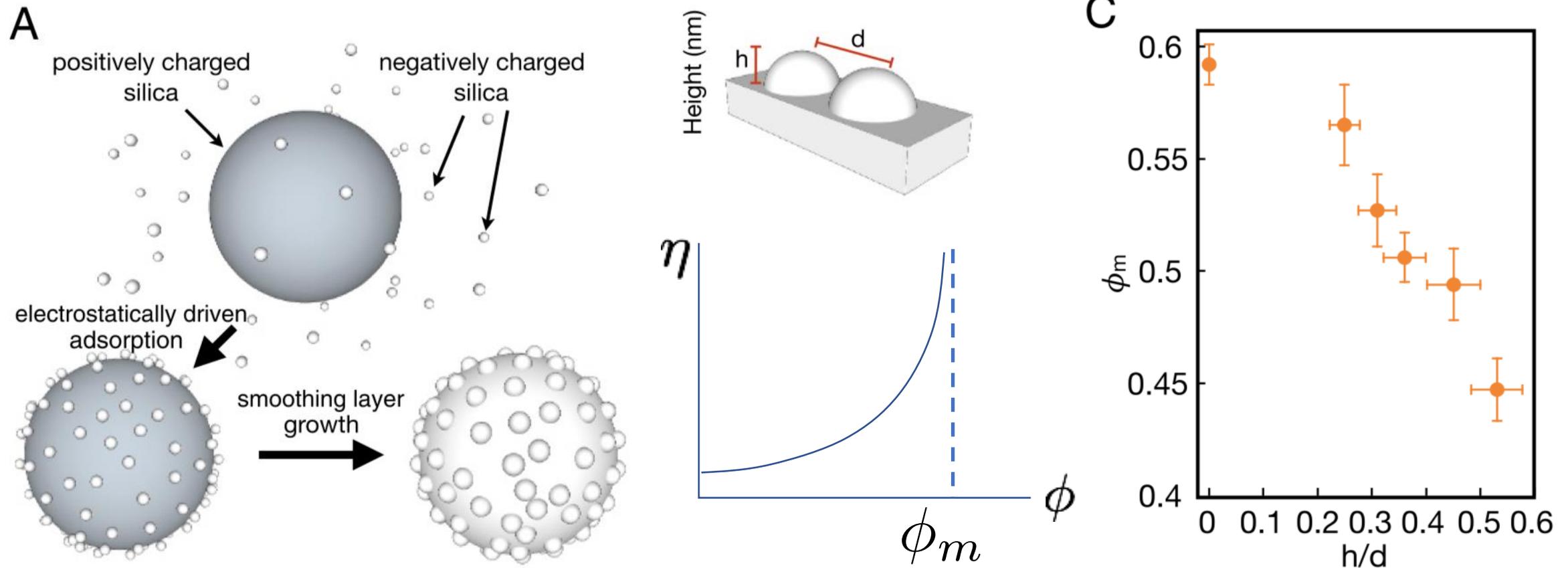
Both are controlled by interparticle *friction* ... which is modified by surfactant additives

η_∞
↓ increasing lecithin

Roughness-dependent tribology effects on discontinuous shear thickening

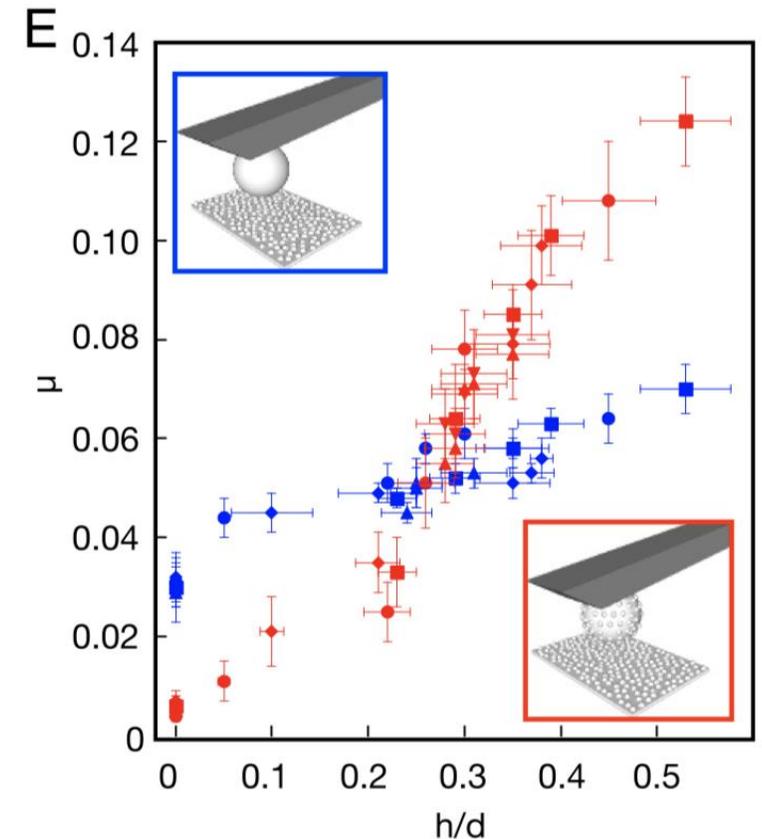
Chiao-Peng Hsu^{a,b}, Shivaprakash N. Ramakrishna^b, Michele Zanini^a, Nicholas D. Spencer^b, and Lucio Isa^{a,1}

^aLaboratory for Interfaces, Soft Matter and Assembly, Department of Materials, ETH Zurich, 8093 Zurich, Switzerland; and ^bLaboratory for Surface Science and Technology, Department of Materials, ETH Zurich, 8093 Zurich, Switzerland



Particle contacts are here to stay for suspension rheology

- wet-dry convergence in the need to characterize particle surfaces carefully
- the importance of tribological characterization
- dialogue with tribologists should lead to important advances



2(a) Turbid wet systems: sizing



125 nm polystyrene in water, $\phi = 0.0001\%$ to 10%

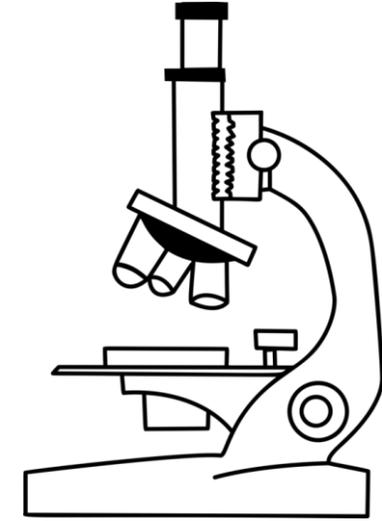
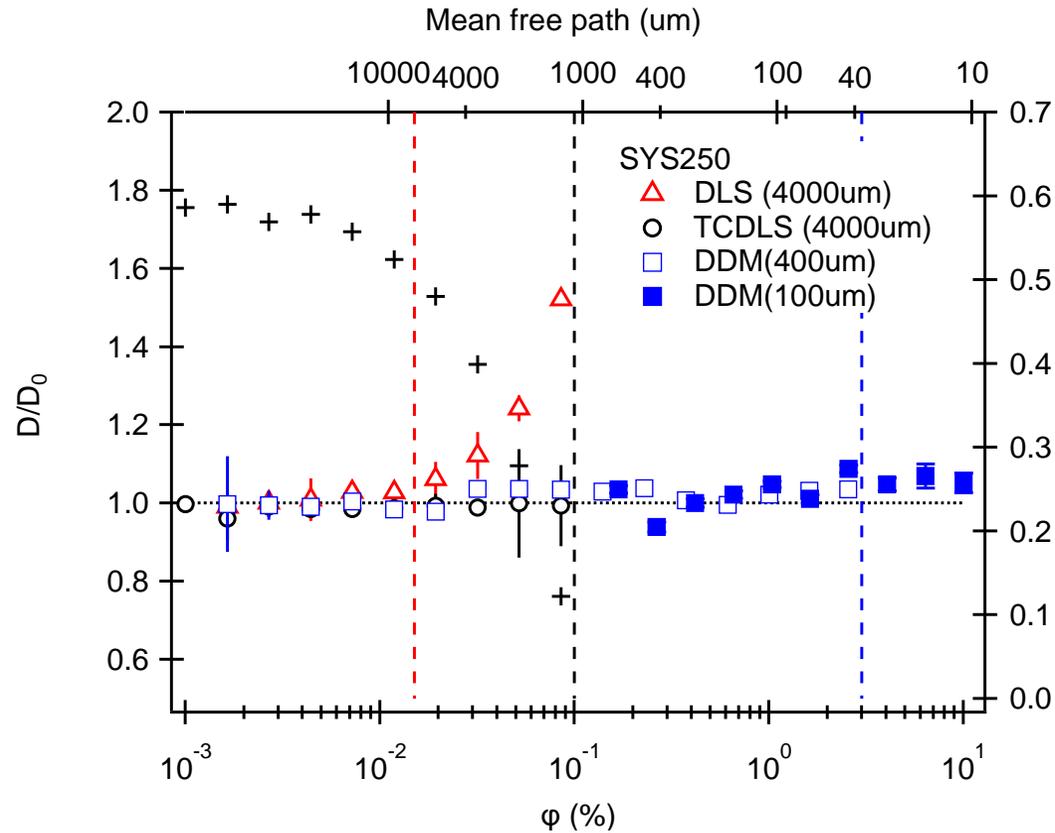
Dynamic light scattering (DLS): diffusivity \rightarrow diameter

OK

Dodgy

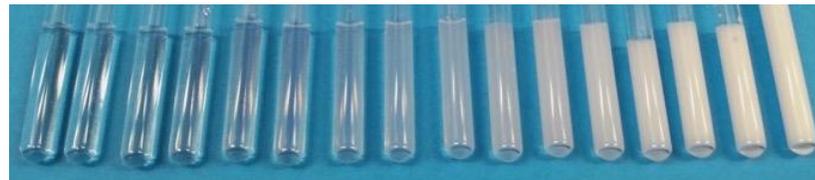
Wrong

New technique (1): Differential dynamic microscopy (DDM)

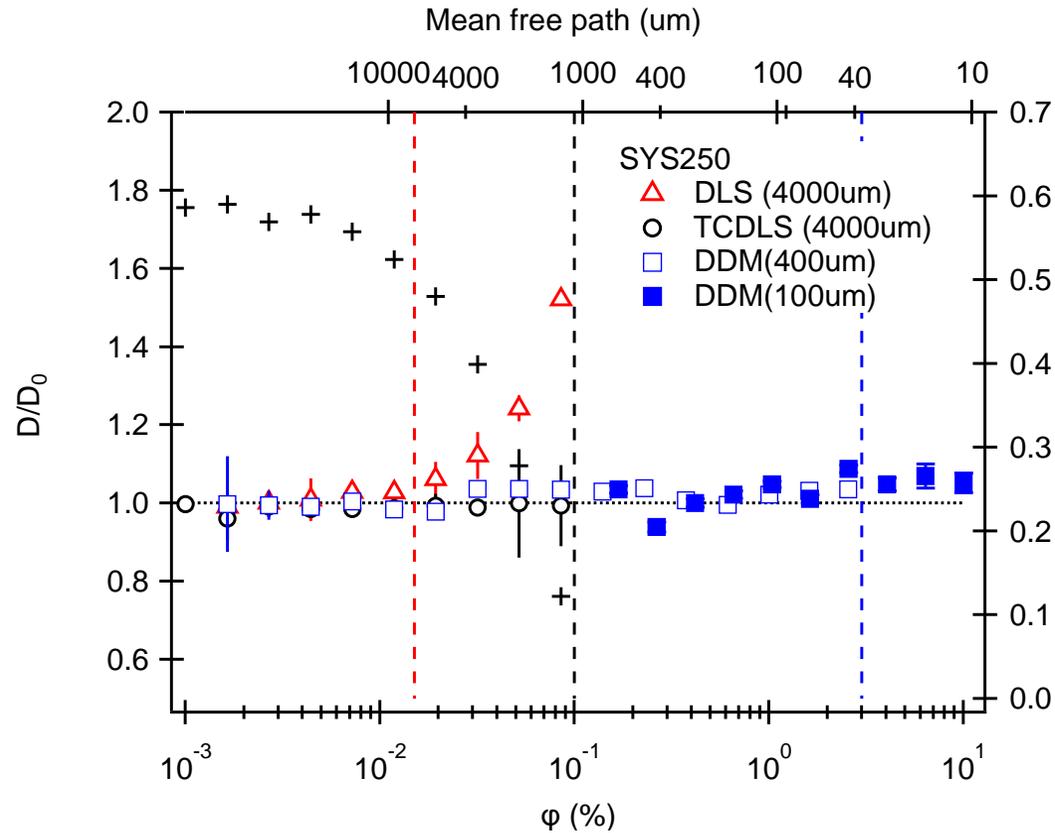


+ fast camera takes low-res movie
 + clever data processing
 (Correlate images in Fourier space)
 → diffusivity → size

Vincent Martinez (Edinburgh)



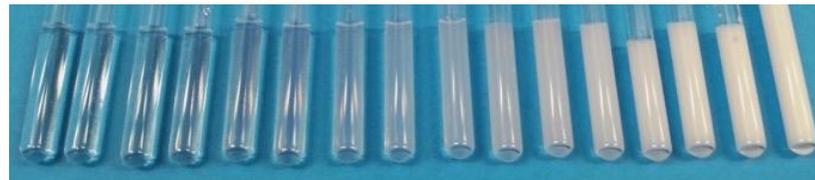
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Tiffany Wood (Edinburgh)

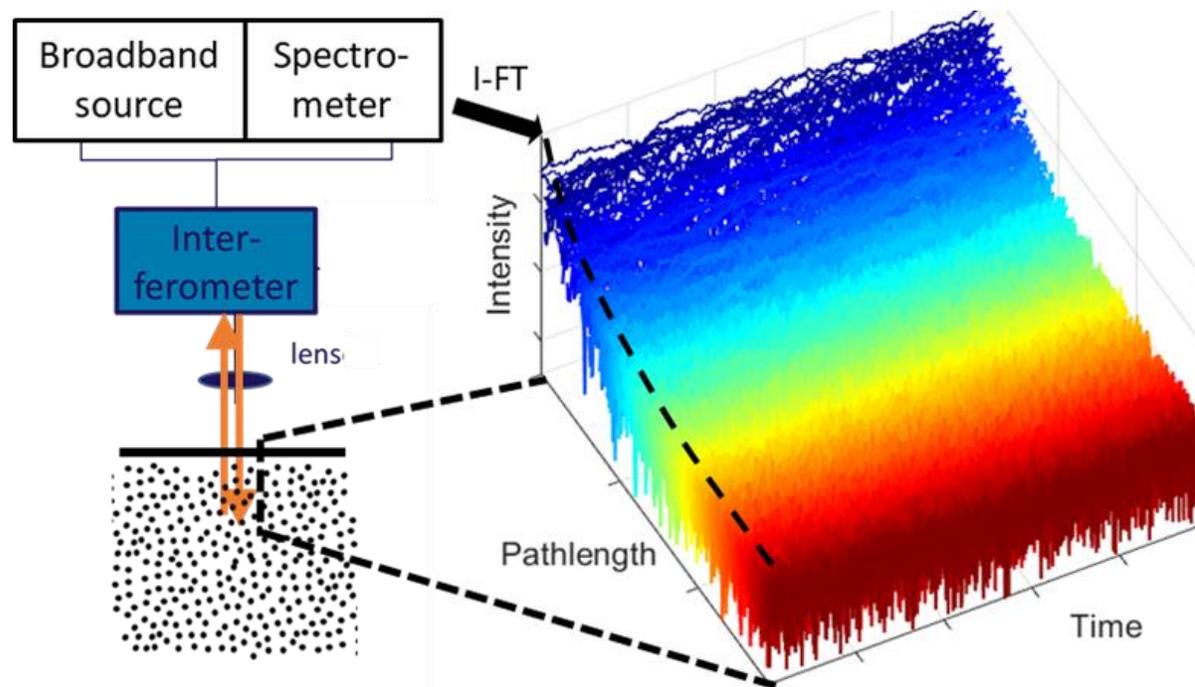


New technique (2): Spatially-resolved DLS

Low-coherence interferometry → signal from particles at different depths

→ Optical Coherence Tomography for biomedical imaging

→ rejection of multiple scattering



Rut Besseling

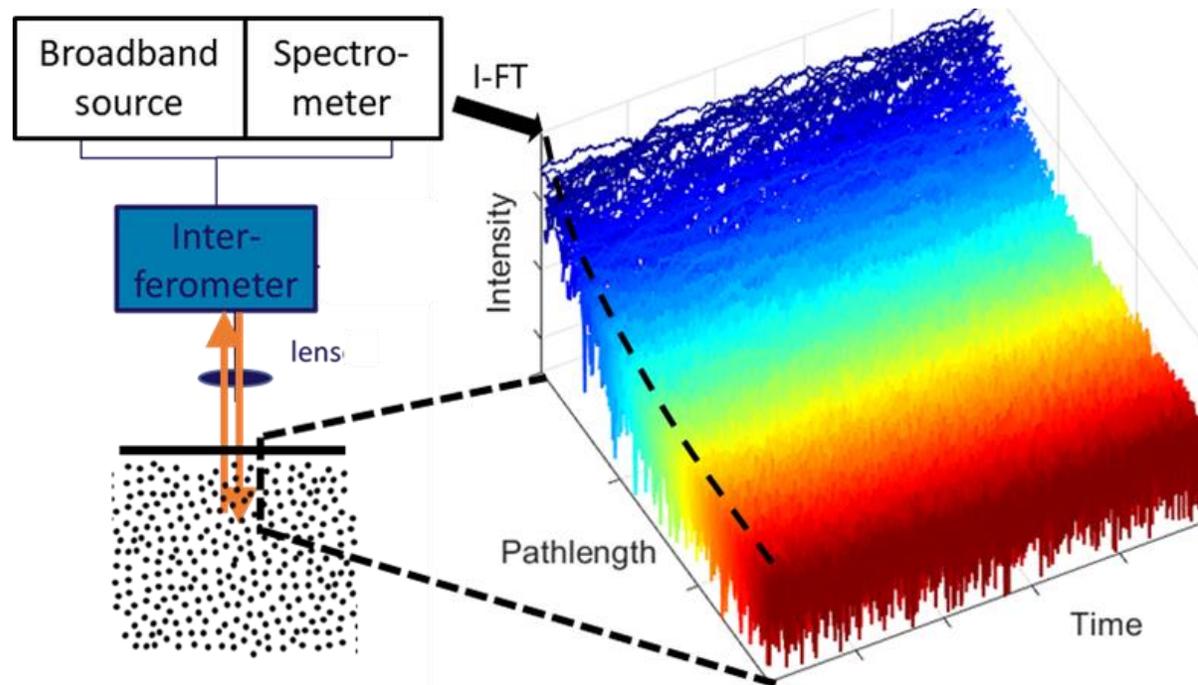
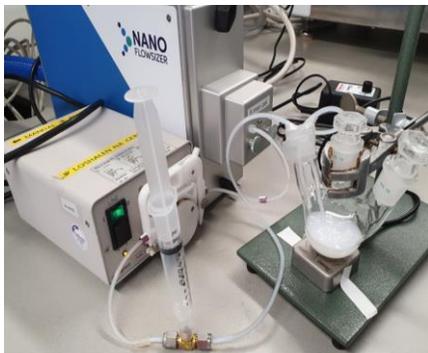
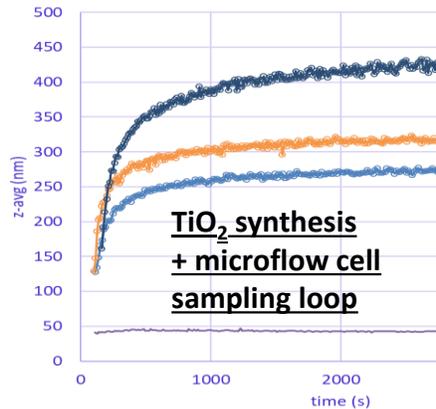
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Low-coherence interferometry → signal from particles at different depths

→ Optical Coherence Tomography for biomedical imaging

→ rejection of multiple scattering

→ flow correction for real-time in-line use

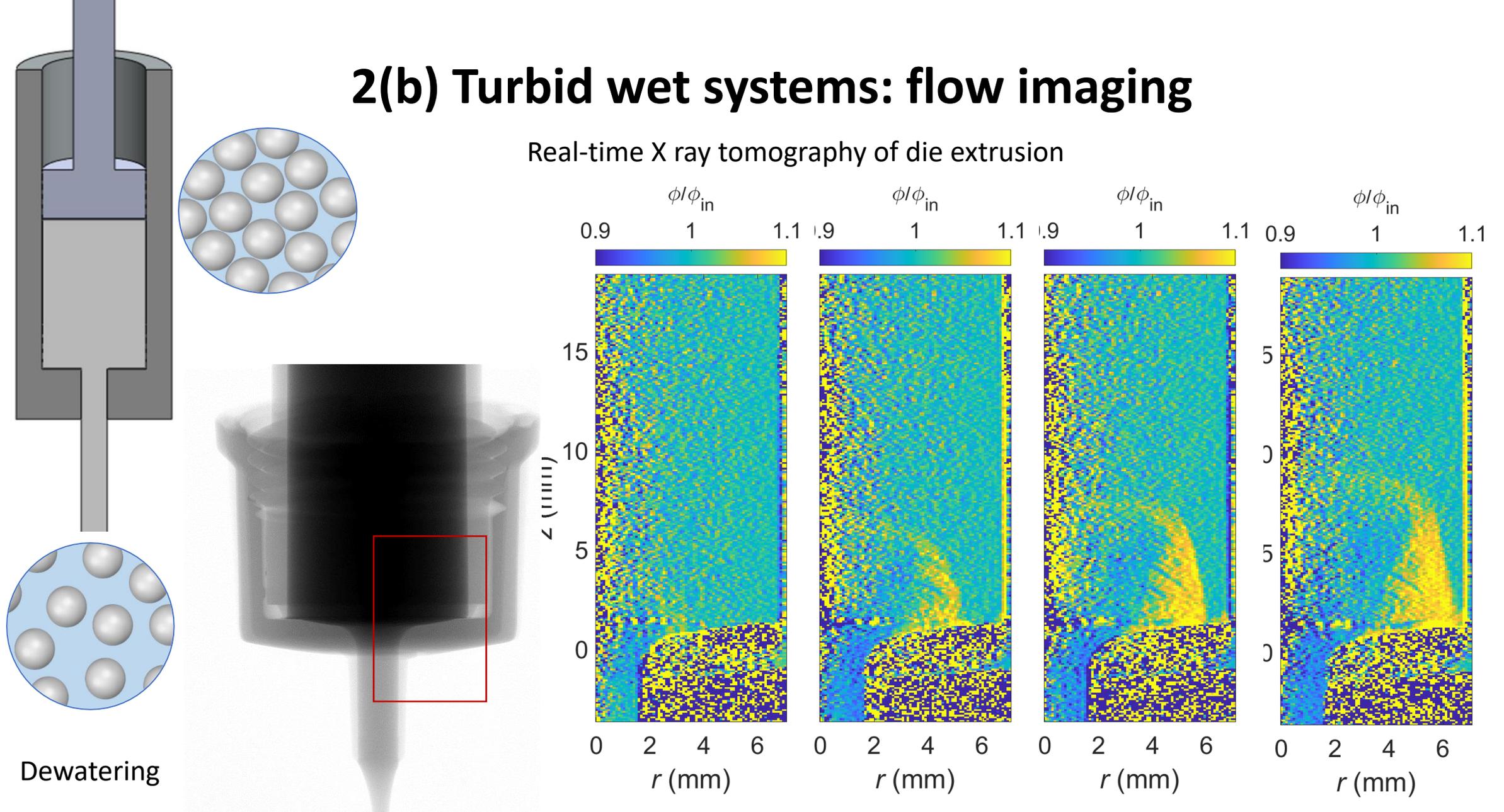


Rut Besseling

Detailed science explained in webinar available to members on IFPRI website

2(b) Turbid wet systems: flow imaging

Real-time X ray tomography of die extrusion



Rory O'Neill (Edinburgh) and Guillaume Ovarlez (Solvay-CNRS Laboratoire du Futur, Pessac)

Summary

1. Characterization underpins all areas of particle technology
2. Wet-dry convergence on the importance of surface & tribology
3. Two new optical techniques
4. Real-time X ray tomography of flows in complex geometries

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