

**PARTICLE CHARACTERISATION INTEREST GROUP
NEWSLETTER
December 2008**

FORTHCOMING MEETINGS



**Particle Characterisation Interest Group of RSC
Analytical Division
The Royal Society of Chemistry
and The Joint Pharmaceutical Analysis Group**

**Training Meeting on Particle Size Analysis
With emphasis on obtaining good data and interpreting analyses.
At the Royal Pharmaceutical Society,
Lambeth High Street, London SE1 7JN
Wednesday 11th March 2009**

Particle Sizing is one of the most important components of understanding the physical properties of materials, and thereby how they are likely to perform in industrial processes, and in product use. Whilst many techniques and methods are available for conducting such analyses it is necessary to have a good understanding of the principles, practicalities and pitfalls that surround this type of measurement. It is also important to have confidence in the interpretation and presentation of results.

This more advanced training day, provided by some of the most experienced members of the Particle Sizing community, aims to offer a comprehensive and practical view of the measurement of particle size distributions. Comprehensive notes and a Certificate of Training for Professional Development will be provided

Who should attend ?

The meeting content is aimed at:

Those working in laboratories responsible for the particle size analysis of materials; the development and validation of methods to achieve this; and those wishing to update themselves on the regulatory aspects involved.

Those required to interpret and understand the significance of results arising from particle size determination.

**Particle Characterisation Interest Group of RSC
Analytical Division
The Royal Society of Chemistry
Surface Area, Pore Structure and related measurements.
At Imperial College London,
Department of Materials, London SW7 2AZ
Thursday September 17th 2009**

A knowledge of the surface area and pore structure of a material is often crucial to our understanding of how a material works. The techniques used to make these measurements are not new; the BET equation was first published in 1938, but over recent years there have been many advances in both the instrumentation used for the measurements, and in the modelling of the data.

This one day meeting aims to make participants aware of the various techniques which are available, and how best to interpret and use the data. As such it should be of interest to anyone involved in either making the measurements or using/interpreting the data. Care has been taken to ensure that all of the speakers are highly respected in their field, and sufficient time will be available throughout the day for informal discussions with both the speakers and technical experts in this field.

A certificate of attendance will be available for all participants at the end of the day.



EXHIBITION AT PSA2008.



AWE PRIZE PRESENTATION

Student Travel Bursaries were awarded for this year's conference. The subsequent reports are included below:

Report from Iwan Edwards
Particulate Systems Analysis 2008
September 2nd - 4th, Stratford-upon-Avon

Introduction

The Particulate Systems Analysis (PSA) series of conferences is organised by the Particle Characterisation Interest Group of the Royal Society of Chemistry and is held every 3 years. The 2008 meeting was attended by 170 registered delegates, along with 26 exhibitors.

A series of seven plenary lectures were delivered as part of the conference, with the remaining oral presentations split into three parallel sessions under six subjects:

- Nanoparticles – Characterisation and Kinetics
- Concentrated Dispersions
- Bulk Powder Characterisation
- Measurement Methods for Size, Shape and Surface Structure
- Tracking and Monitoring Particles in Processes including Modelling
- On-line Analysis and Control of Particulate Processes and Acoustics

The majority of the papers presented were split between contributors from academic institutions and those representing providers of equipment, with a few papers those based in industry.

This report includes a brief summary of the plenary lectures and other papers of interest.

Exhibitors

The exhibitors represented at the meeting were:

Heat Scientific	Meritics	MicroMeritics	Micropore Technologies
Buchi UK	Agilent Technologies	Brightwell Technologies	Mettler Toledo
Whitehouse Scientific	PMT (GB) ltd	Nanosight	Hosokawa Micron
LGC	Particles CIC	Sympatec	Stable Micro Systems
Analytik Ltd & CPS	Malvern	Freeman Technology	Horiba Jobin Yvon
Quantachrome	Particle Technology	Ankersmid	HEL ltd
Scimed	Adaptive Instruments		

Plenary Lectures

Mud Glorious Mud - Simon Biggs, University of Leeds

Described how the additions of ions can influence particulate dispersions through depletion flocculation, which is particularly applicable to waste management within the mining industry. Zeta potential measurement was used to show the effect of cations. Creep testing can be used to measure yield stresses, which give an indication of bond stress. Cations were shown to reduce the maximum yield stress.

Rheology of Particulate Gels - Richard Buscall, MSACT Consulting

Flocculated suspensions will have gel points for solids concentrations anywhere between 2-15%. The lecturer showed how compression and shear strengths can be compared, with compression yield being greater than shear yield. Compression is irreversible due to the poroelasticity of the material. Filtration was cited as an example, where cake diffusivity combines permeability with compressive strength.

Environmental Particulate Systems - Stefaan Simons, University College London

This lecture suggested how accelerated carbonation technology can be used to capture CO₂ through the carbonation of incinerator ash waste. This technology converts hazardous waste to a non-hazardous state and prevents the leeching of heavy metals.

The quality of the carbonation is determined by the diffusivity and reactivity CO₂ and needs a porous material. Increasing the CO₂ concentration was shown to reduce effectiveness. This was attributed to carbonates blocking the pores.

Acoustical Measurements - Andrei Dukhin, Dispersion Technology Inc.

How ultrasound can be used for characterising liquids, nano- and micro particulates. Acoustics transmit and measure sound and can be used to measure particle size and rheology. Electroacoustics transmit sound and measure an electrical signal and can be used to measure zeta potential.

Why is it useful to characterise powders? - John Dodds, Ecole des Mines d'Albi

Reliable values of properties are required when designing a process. Too much emphasis is placed upon characterisation rather than measuring properties. Characteristics are not properties. Although characterisation is useful, measuring properties is better. Characteristics therefore have to be converted into properties.

For example, Mohr's scale describes grindability, but does not give a property to aid design. Impact tests can be used to measure a damage property through the change in particle size upon impact, which is a function of material, particle size and particle velocity.

The measurement of particle size itself does not provide a property. The type of particle size measured should depend on the application, for example the particle size of a paint should be defined by a projected area.

Nanoparticulate Systems - James Adair, Pennsylvania State University

The use of ceramic colloidal dispersions to produce mesoscale materials (1mm – 10 μm) for nanomedical applications. Aggregation of the colloidal material is driven by solid deposition at the contact point between particles and happens very rapidly.

Chemically aided milling can be used to reduce these aggregates to their primary particles. This employs a titration system to control the pH away from the isoelectric point to prevent aggregation. This milling process can be described as deaggregation rather than fracturing. The pH set point depends upon the solubility of the material. For example, alumina has a set point of pH 4, whilst silica has a set point of pH 3.

Selected Oral Presentations

057 Measurement of induction time for nucleation of barium sulphate by nanoparticle detection- J A S. Cleaver, D Lane, A G Jones

The measurement of induction time during the precipitation of barium sulphate using a Nanosight Halo device. The induction time is the formation of viable nuclei from the onset of supersaturation. It is a combination of a relaxation time, a nucleation time and a growth time.

The Nanosight Halo allows the size analysis of particle from 10nm to 1 μ m and combines an optical microscope with image analysis.

The precipitation was carried out by injecting reactant into a y-mixer, where they were considered to be instantaneously mixed. The addition via syringe was uncontrolled.

The measured induction time of the order of 5 seconds compares well with literature values measured for similar supersaturation levels.

060 Online characterisation of nano particle suspensions using dynamic light scattering, ultrasound spectroscopy and process tomography – L Liu, R F Li, X Z Wang, R J Tweedie et al

A multimodal approach to the online characterisation of concentrated suspensions using a multiple sensor system combining DLS, ultrasound and ERT.

Inline ERT and ultrasound sensors in a recirculation loop from the main vessel, with DLS in a bypass line.

The DLS was used to measure Brownian motion to obtain a diffusion coefficient to calculate particle size, as well as measuring electrophoretic mobility to calculate a zeta-potential.

Ultrasound was used to measure attenuation to obtain the particle size distribution.

ERT was used to measure mixing and obtain the particle concentration derived from conductivity.

The combination of these techniques allows the online measurement of zeta potential, particle size, mixing and particle concentration, although a discrepancy was shown between the particle size measured by DLS and that measured by ultrasound. This disagreement increases with increasing concentration.

002 Non-Intrusive Monitoring of Particulate Processes in the Nuclear Sector. Some Recent Examples. – S Stanley, D Rhodes, S Murphy, T York et al.

The use of acoustics as a process monitoring tool in an unbaffled precipitation vessel mixed with a magnetic stirrer. Currently a conductivity probe is used to monitor the presence of a vortex in the vessel to confirm the stirrer is running – with no reading from the probe indicating a vortex has been created. Splashing on the probe causes problems however. Acoustic sensors have been used to image the vortex. This also increases the depth of data compared to the single point measurement of the probe.

Acoustics can also be used to measure sedimentation based on linking the peak-to-peak heights of the acoustic signal to solids concentration.

A more deployable EIT sensor has been developed for the imaging of solid-liquid suspensions.

Three linear probes cross-communicating provided the optimum measurement strategy as a deployable sensor electrode array for ease of retrofitting. A relatively slow data capture rate of 1 frame per minute was required, although the system does have a dynamic referencing capability.

083 The influence of colloidal forces on the re-slurrying and flow behaviour of fine particulate slurries – D Harbottle, D Rhodes, M Fairweather, S Biggs

The investigation focused on dilute suspensions of silica spheres, with a view to a waste management application. Particle interactions were altered by changing the ionic strength, with AFM used to characterise the interparticle forces, such as the frictional forces during re-suspension. Gel points and shear yield stress also measured. The electrolyte concentration was shown to affect the yield stress.

Flow visualisation techniques were used to study a flow loop. PIV was used to measure the minimum transport velocity, which decreased in the presence of aggregates. UDVP was used to measure velocity profiles, which were shown to be independent of electrolyte concentration.

021 Rheological and Zeta Potential Analysis of Oxide Particulates in Mixed Electrolytes – Q Omokanye, S Biggs

Study linking particle interactions to rheology in concentrated electrolyte solutions with a view to a waste management application. Increasing the salt concentration (KNO_3) was shown to shift the isoelectric point. The yield stress was shown to correlate with the iep and falls linearly with the zeta potential squared. Reliable data has been obtained for concentrations up to 0.5M (highly reliable up to 0.2M).

044 Online characterisation of high concentration particulate systems by using ultrasonic pulse methods – R Weser, F Hinze, A Richter, B Wessely

The use of an ultrasound pipe fitting that links attenuation trend to particle size during a wet milling operation. The attenuation was shown to correlate with the droplet size during emulsification of silicon oil.

088 Particle Characterisation : From Single Particle to Product Performance: What do We Know, and Where Should it be Applied? – R Iacocca, X Dong

Some insights into how data can be turned into useful information, which may mean collecting less data, but in a targeted way. There should be a drive to work with non-model systems.

A deeper understanding of the product is needed to enable changes to be made easier.

098 Influence of Ultrasound on the precipitation and deposition of calcium carbonate – A Shaikh, W N Al Nasser, M J Hounslow, A D Salman

An FBRM instrument was used to measure the effect of ultrasound on chord length and particle concentration. Ultrasound was shown to increase the number of particles and decrease the chord length. Ultrasound therefore may induce nucleation.

The FBRM was also used to determine the deposition rate. Ultrasound was shown to reduce the deposition of CaCO_3 .

Report from Peter Hamilton: Particulate Systems Analysis Conference

Stratford Upon Avon, 2nd – 4th September 2008

www.psa2008.co.uk

PSA 2008 was my first experience of an international conference after beginning my PhD only a month before. I was therefore very grateful on receiving a travel bursary to attend, and thoroughly enjoyed the day I spent in attendance. I found all of the presentations that I viewed informative and also discovered some of specific interest to work I intend to carry out during my own project. Some of the particular highlights were: firstly, the plenary talk given by Andrei Dukhin titled “Ultrasound for characterizing fluids, nano and micro-particulates. Having limited experience during my undergraduate course of acoustic techniques”, his talk gave me an insight into the kind of measurements that can be made and also ways to carry them out. Secondly, I found the presentation titled “Development of the relationship between powder properties and mixing performance” excellent also as I gained a perspective of technologies that can be used to characterise powders that again, I previously had very limited experience. Furthermore, the exhibition gave me a great chance to meet with some vendors and to see what instruments are available to help me with my project. Lastly I would like to thank the people at PSA for giving me the chance to attend and I hope that at future PSA events I will be able to present some of my own work to the particle science community.

Peter Hamilton

PhD Student

Department of Pure and Applied Chemistry, University of Strathclyde

295 Cathedral Street, Glasgow G1 1XL

Tel: 0141 548 2139

Email: peter.hamilton.100@strath.ac.uk

Report from David Harbottle

Institute of Particle Science and Engineering, University of Leeds, Leeds, LS2 9JT

Particulate Systems Analysis 2008

2nd-4th September 2008

Particulate Systems Analysis organised by the Particle Characterisation Interest Group of the Royal Society of Chemistry is held every 3 years, designed to establish academic / industrial links, encouraging the development of multi-disciplinary projects. PSA presents a diverse portfolio of research from the ‘trendy’ nanotechnology to the more familiar, but equally as important, engineering characterisation. Several esteemed research figures delivered excellent plenaries which guided the focus of the meeting. The conference was opened by Prof. Simon Biggs who spoke about fine particle dispersions in a talk titled “Mud, mud, glorious mud.....there’s nothing quite like it!” The presentation highlighted the value of colloid science to overcome many of the processing problems encountered in the wastewater, nuclear and pharmaceutical industries.

PSA is a meeting that is recognised internationally for attracting eminent researchers who are leaders in their field. With a delegate list approaching nearly 200 it is somewhat surprising, yet pleasing, to see that the meeting was geared towards encouraging young researchers. Many of the talks were given by postgraduate and post-doctoral researchers, with awards given for the best poster and presentation.

My paper titled “The re-suspension and turbulence properties of colloidal suspensions” was well received by the conference delegates, generating significant discussion around developing a greater understanding of the flow and turbulence properties of dispersed and aggregated suspensions on a more practical scale, at high solids concentrations.

The conference which ran from the 2nd – 4th September with 3 parallel sessions per day provided a reasonable overview of the work currently ongoing in particle science. The technical program sessions were: Nanoparticles – characterisation and kinetics, Concentrated dispersions and rheology, Bulk powder characterisation, Measurements methods for size, shape and surface structure, Tracking and monitoring particles in processes including modelling and On-line analysis and control of particulate processes and acoustics.

In summary, PSA is a friendly international conference on a relatively small scale, providing a positive environment for delegates to interact, supporting the idea of collaboration and the development of young researchers.



PRIZE WINNERS AT PSA2008



MIXER EVENT DURING THE EXHIBITION

The Brian Scarlett Scholarship Fund

For over 40 years Professor Brian Scarlett made a major contribution to the Particulate Sciences. During this period many hundreds of students of many nationalities have gained from Brian’s tutoring and lively stimulation of debate. Over the years, Brian made a habit of taking with him on conference and overseas visits, as many of his students as the budget would permit and sometimes more. He reasoned that exposure to new people with other stimulating ideas would build the students character, broaden their understanding and improve their confidence. When one looks at the positions former students of Brian now command one can see that this philosophy was well founded.

We are therefore seeking to mark Brian's contribution to society and to the discipline of particle science and engineering, by setting up a ring-fenced fund that will be devoted to supporting student travel in this specific area. The fund will be administered by the Particle Characterisation Interest Group, under the umbrella of the Royal Society of Chemistry, who are experienced in this field and registered as a charity.

Initial Sponsors:

Prof Rose Amal (University of New South Wales)
Dr Judith Bonsall (Unilever)
Prof Reg Davies (Du Pont Fellow)
Prof John Dodds (Ecole de Mines)
Professor Leslie Ford
Prof Kari Heiskanen (University of Helsinki)
Prof Ko Higashitani (University of Kyoto)
Dr Sue Ion (BNFL)
Dr Nikolaas de Jaeger (President, International Fine Particle Research Institute)

Prof George Klinzing (University of Pittsburgh/AIChE)
Dr Henk Merkus (Delft TU)
Prof Brij Moudgil (University of Florida)
Prof R Pfeffer (NIJT)
Prof Wolfgang Peukert (University of Erlangen)
Prof Dr Sotiris Pratsinis (ETH)
Mr Maurice Wedd (Malvern Instruments)
Prof. Richard Williams (University of Leeds)

Further Information can be obtained from:

The Administrator of The Brian Scarlett Scholarship Fund, c/o PCIG, Station Yard Industrial Estate, Hatton, Derbyshire, DE65 5DU UK, Tel: +44 (0) 1283 810091 Fax: +44 (0) 1283 520412.
Email particles@btconnect.com

Bursaries have already been awarded to students for travel to PSA2008.

One of the reports received follows.

1. Wei Yang, chewy@leeds.ac.uk
2. Name of Meeting: Particulate Systems Analysis 2008
3. Location and Date: 2 – 4th September 2008, Stratford upon Avon
4. Web site corresponding to the meeting: www.psa2008.co.uk

Review

The Particulate Systems Analysis 2008 conference was held at Holiday Inn hotel in Stratford upon Avon, UK, and was supported by over 170 conferees from all over the world. There were about 90 oral presentations and 8 plenary talks. Amongst these talks, I found Luca Mazzei's talk on mathematical modelling by using the direct quadrature method of moments very interesting. This work focused on combining conventional computational fluid dynamics with population balance model, which is relevant to the modelling of a number of multiphase systems involving polydispersed solids phase.

My own talks were on experimental and numerical investigations to solids phase chromatography which is a novel invention developed in Leeds. They were followed by interesting and useful discussions.

Overall the conference was wide-ranging, fascinating and very well hosted. I would like to thank the Brian Scarlett Scholarship Fund for supporting my attendance at this conference.

Bursaries

PCIG AWARDS in the form of bursaries, which may be up to £250.00 each, are available to student members of the Particle Characterisation Interest Group of the RSC in order to attend Conferences.

GENERAL BURSARY AWARDS: Consideration will be given on a case by case basis to full Particle Characterisation Interest Group members who by the receipt of such a bursary may make a contribution for the benefit of the particle characterisation community that would otherwise not be possible. These may be for travel expenses etc for attending conferences or standards meetings. The applicant must have been a full member of the PCIG for at least 1 year. Further information on either of these awards can be obtained from the Secretary (see back page for contact details).

Useful Web Links
Royal Society of Chemistry
<http://www.rsc.org/>

Particle Characterisation Interest Group
<http://www.rsc-particles.org>

CHEMSOC, the Royal Society of Chemistry's Chemical Science Network
<http://www.chemsoc.org/events/conhome.htm>

ISO, International Organisation for Standardisation
<http://www.iso.ch/iso/en/aboutiso/introduction/index.html>

Institute of Particle Science & Engineering, University of Leeds
<http://www.leeds.ac.uk/speme/ipse/events-frame.html>

EventsWeb
<http://www.particlescic.com/eventsweb.php>

PCIG COMMITTEE 2007/2008

CHAIRMAN:

DR DOMINIC RHODES

Nexia Solutions
Tel: 019467 79257
Fax: 019467 79007
Pager 01426 408279
Email: dr33@nexasolutions.com

**VICE CHAIRMAN /
SECRETARY:**

MR RON BUXTON

Particle Technology Ltd
Tel: 01283 520365
Fax: 01283 520412
Email:
ronbuxton@btconnect.com

TREASURER:

MR MAURICE WEDD

Tel: 01905 640861
Email:
maurice.wedd@malvern.co.uk

**ADMINISTRATIVE
ASSISTANCE:**

MRS NICKI TONKINSON

Particle Technology Ltd
Tel: 01283 810091
Fax: 01283 520412
Email
particles@btconnect.com

COMMITTEE MEMBERS:

DR NAYLAND STANLEY-WOOD

Tel: 01481 721615
Fax: 01481 721615
Email: ngstanle@guernsey.net
or
nayland.stanley-wood@icheme.org

MR KEITH BROCKLEHURST

LGC
Tel: 01928 513977
Fax: 01928 500125
Email: keith.brocklehurst@lgc.co.uk

DR SIMON LAWSON

PARTICLESCIC
Tel: 0113 343 2376
Email: s.lawson@leeds.ac.uk

COMMITTEE MEMBERS:

DR CHRISTIAN SEILER

Merck Sharp & Dohme Ltd
Tel 01992 452776
Fax 01992 460078
Email Christian_seiler@merck.com

MR ANDREW MARK

Beckman Coulter UK Ltd
Tel: 01494 429196
Fax: 01494 463843
Email: amark@beckmancoulter.com

PROFESSOR YULONG DING

University of Leeds
Tel: 0113 3432747
Fax: 0113 3432405
Email: y.ding@leeds.ac.uk

Further Information

For further information on meetings or the group, please contact:
Mrs Nicki Tonkinson, Particle Characterisation Interest Group
c/o Particle Technology Ltd, Unit 1, Station Yard Industrial Estate, Hatton, Derbyshire
DE65 5DU
Tel 01283 810091, Fax 01283 520412 Email: particles@btconnect.com

This newsletter is published by the Particle Characterisation Interest Group of the Analytical Division of the
Royal Society of Chemistry and edited by

Mr.R.E.Buxton
Particle Technology Ltd, Unit 1, Station Yard Industrial Estate, Hatton, Derbyshire DE65 5DU
Tel 01283 520365 Fax 01283 520412 E-mail ronbuxton@particletechnology.com

Comments on the newsletter or items for inclusion in the next edition should be sent to the editor.