

POWDER CHARACTERISATION AND PARTICLE SIZE ANALYSIS

November 15–16, 2010
Malmö–Sweden



The Öresund bridge, Malmö–Copenhagen

CALMIA
EDUCATION CENTER

POWDER CHARACTERISATION AND PARTICLE SIZE ANALYSIS

AS A TOOL FOR
PROCESS DESIGN,
DEVELOPMENT AND
QUALITY ASSURANCE

November 15–16, 2010
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Course outline

Day 1

General Introduction

There are many ways of characterizing individual particles and bulk powders and there are many ways of using this information in process design, development and quality assurance. The objective of this course is to direct the participant to the most appropriate characterization technique for a specific process application.

The characterisation of individual particles

The particle size and distribution is an essential property for understanding powder behaviour. Definitions of particle size and shape are given. Methods are presented for describing distributions and obtaining mean values to characterise a powder pertinent for different powder properties.

How to describe a bulk powder

The free-flowing and cohesive flow characteristics of powders and the problem of achieving both mobility and texture. Segregation and possible tests for segregation. Bulk density and porosity determinations.

Particle size analysis in practice

Inventory of the different techniques available for measuring particle size and size distribution and how to choose a suitable technique for a given problem.

How to take representative samples

The quantity of powder required for the primary sample. Avoiding biased selection and retrieval of samples for both existing and new processes. Thief samplers. Golden rules of sampling. Sub-division of primary samples by riffing. The collaboration of production and analytical departments in devising sampling procedures.

Day 2

Particle size analysis for process analysis

Application of particle size measurement in several situations. The use of particle size measurements for process analysis, optimisation and quality control.

How to describe a bulk powder

The flow characteristics and structure of intermediate and cohesive powders. Aerated and tapped bulk densities to define intermediate flow. The determination of the Critical Relative Humidity of a powder. The transport of cohesive powders. The effect of structural aggregation and coating of powders on product quality.

Static bulk powder

Storing powders. Silo design. Shear testing. Jenike, Peschl and Freeman. Formulation of powder products.

Bulk powders in flow

Mixing and fluidization operations. Mixer choice. Powders suitable for fluidization. Health and safety in powder handling.

Course description

The physical nature of a powder is usually complex in comparison to that of gaseous and liquid systems and has frequently lead to great unpredictability in the modeling, design and quality assurance of powder based processes.

Predictability is achieved by the measurement of the properties of both the individual particles and the interaction of these particles in bulk. The measurement could be either to help develop a new product with novel and very specific characteristics requiring very specialist and often delicate laboratory measurement techniques or for the real time control of an existing process where a robust, rapid and operator insensitive measurement is needed.

The objective of this course is not only to outline the range of both simple and complex tests available in the analytical market for the characterization of powders but also to give guidance as to which test best meets the needs of a specific application. The shape of individual particles is of fundamental value in determining the covering capability of a pigment but would give little information about the potential of the same powder to flow smoothly from a hopper. The most expensive analytical equipment is not necessarily the most appropriate!

The flow characteristics of bulk powders are important as they can result in either a finely textured but cohesive powder or a free-flowing and potentially segregating powder. These differences are significant and measurable and will influence design techniques for many process operations as well as for the representative sampling required for any quality assurance or characterization measurement.

In brief, the objective of the course is to help you make the best characterization choice applicable to your specific application.

Course lecturers

Prof. John A. Dodds

John Dodds recently retired as professor at the Ecole des Mines d'Albi and director of the CNRS laboratory RAPSODEE in Albi. He is currently active as a consultant in particle technology and a visiting professor in particle technology at the University of New South Wales in Sydney Australia, and the University of Leeds.

Dr Dodds obtained a degree and Ph.D. in Chemical Engineering from the University of Loughborough. He moved to France in 1968 and was a CNRS research worker at the Laboratoire des Sciences du Génie Chimique in Nancy for 25 years before moving to Albi, France in 1996. He has had sabbatical periods as lecturer at Princeton University and as visiting professor at the Universities of New South Wales and Leeds

He is the author, or co-author of over a 170 scientific papers, co-editor of the book "*The Physics of Granular Media*", is a member of the editorial committee of the journals: *Powder Technology*, *Particle & Particle Systems Characterisation*, *Chemical Engineering Research and Design*, *Journal of Process Mechanical Engineering*. He was chairman of the European Federation of Chemical Engineering working group on "Particle Characterisation", and has been president of the organising committees several national and international conferences in particle technology. Prof. Dodds is a Chartered Engineer and was elected a Fellow of the Institution of Chemical Engineers in 2001, and Fellow of the Royal Academy of Engineering in 2005.

Prof. Norman Harnby

Norman Harnby is a visiting Professor in Particle Technology at the Universities of Bradford and Leeds.

He obtained a B.Sc. degree in Chemical Engineering from Imperial College, London and his Ph.D. degree from the University of Bradford.

Dr Harnby has been active in powder mixing research for over forty years and throughout this period has also been active in industry as both a consultant and as a presenter of in-house training sessions. He gives annual public courses on 'Powder Mixing Technology' in the USA and Europe.

Prior to his academic career he was employed by ICI Ltd. in roles of plant operation and design.

Prof. Harnby has been a Visiting Professor at Iowa State University and the recipient of both a NATO research Travel Scholarship and a Senior Fulbright Scholarship. He was awarded the title of 'Distinguished American Engineering Educator' by the American Society of Engineering Education.

He is the editor and co-author of the text book 'Mixing in the Process Industries' and is a Fellow of the Institution of Chemical Engineers.

Course Fee and Payment

EUR 1480

EUR 1410*

** **Discounted fee:** is valid for two or more enrolments from the same company, at the same time, for the same course. And for enrolments from Universities and Government Institutes.*

The course fee includes: Tuition, copies of all Power Point presentations, certificate and meals. Two lunches, beverages at breaks and course dinner the first day. VAT (Moms) will be added for applicants domicile in Sweden.

The registration will be confirmed with a course schedule and some practical information. We will send an **Invoice** to the amount of the Course Fee.

Accommodation is not included in the course fee.

Course Location and Hotel

The course is held at

Radisson BLU Hotel, Malmö – Sweden
November 15–16, 2010

To obtain the reduced price for accommodation, reservations must be made through Calmia.

Weekday nights

SEK 1575 (about **EUR 157**) for a single or double room per night incl. breakfast and VAT.

Nights between Saturday/Sunday/Monday

SEK 950 (about **EUR 95**) for a single or double room per night incl. breakfast and VAT.

Radisson BLU Hotel

Östergatan 10

211 25 Malmö, Sweden

Tel. +46-40-698 4000

www.radissonblu.com/hotel-malmo

Transport Information

Copenhagen Airport, Kastrup, is the nearest international airport. There are trains running several times each hour (20 min. journey) from Copenhagen Airport to Malmö Central Station. The course location is only 5–10 min. away from the station in Malmö. The airport bus from **Malmö Airport, Sturup**, stops outside the station in Malmö.

Course Time Table

Registration on Monday at 08:30–08:45

The course ends on Tuesday at 16:30

How to register

• **On-Line registration**

www.calmia.se

• **Fax or Mail**

A Registration Form can be printed from each PDF-file.

Registration must be made before October 15, 2010

Substitutions are allowed at any time from the same company or institute.

Cancellation

Participants may cancel up to 15 working days prior to Course starting date for a refund.

No refunds will be made for those who do not attend the scheduled course and/or cancel less than 15 working days before the start date.

Questions

For General questions please contact:

Mrs G Tånge-Henderson

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tel/fax: +46-46 211 00 20

For Scientific questions please contact:

Prof. John A. Dodds

John.Dodds@enstimaac.fr

Prof. Norman Harnby

N.Harnby@bradford.ac.uk

Registration Form

Registration before October 15, 2010

Please print!

The number of participants is limited.

I wish to attend the course:

**POWDER CHARACTERISATION
AND PARTICLE SIZE ANALYSIS**

**November 15–16, 2010
Malmö – Sweden**

Reserve on my behalf a single room at the Radisson BLU Hotel in Malmö

From (date) _____ To (date) _____ Number of nights: _____

Late arrival (after 18:00)

The hotel bill should be paid directly to Radisson BLU Hotel on the day of departure

Surname _____

Given Name _____

Job Title _____ Ms Mr

Company/Institute _____

Address _____

Country _____

Tel/fax _____ E-mail _____

Purchase Order number _____ (If required by your company)

Invoice address if different from the one above: