

Invitation to an ENE-Seminar

Date: Thursday, 28.02.2013, 11:00h

Place: OSGA / EG6

Powder characterisation and Particle Size Measurement from nanometers to microns – towards Nanometrology

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After a short introduction to the Powder Technology Laboratory and the specific research interests of the presenter, a very brief overview of powder characterisation will be given. This will be followed by a brief introduction to particle sizes and distributions, results from rapid methods (laser diffraction, photon correlation spectroscopy) with sedimentation techniques (X-ray disc centrifuge, photocentrifuge) and image analysis will be compared.[1] The limitations of the various approaches will be discussed as a function of size range and powder properties. For nanometre powders (10-100 nm) comparison with image analysis for spherical silicas (20-80nm) illustrate the importance of the hydrodynamic density for accurate results. In the 0.1 to 5 micron range examples of commercial aluminas and a spherical silica show how the distribution width and particle shape can influence greatly the reported values from different instruments. The use of specific surface area to estimate the state of aggregation will also be illustrated. Examples of applications where size measurement in the sub micron range are of key importance will be presented which illustrate the importance of standard operating protocols (SOPs) and limitations of the various methods [2]. The examples will include, if time allows, nanosized alumina for ink-jet papers coating [3], dispersion of superparamagnetic iron oxides (SPIONS) for biomedical applications [4], nanosized zinc sulphides [5], sub-micron barium titanate from precipitation using a Segmented Flow Tubular Reactor (SFTR)[6] and nanosized zinc oxides [6].

1. Bowen, P. "Particle Size Distribution Measurement From Millimeters to Nanometers and From Rods to Platelets", *J. Dispersion Science and Technology*, 23(5) 631-662 (2002).
2. A. Aimable, P. Bowen, "Ceramic Nanopowder Metrology and Nanoparticle size measurement - towards the development and testing of protocols" *J. Processing and Application of Ceramics*, 4[3] 147-156 (2010)
3. P. Bowen, H. Hofmann, M. Staiger, R. Steiger, P.-A. Brugger, K. Peternell, "Colloidal Processing of Nanoceramic Powders for Porous Ceramic Film Applications", *Key Engineering Materials Vols. 206-213* (2002) pp. 1977-1980
4. P. Bowen, M. Chastellain, F. Juillerat, M. Coignac, H. Hofmann, "Inorganic Particle Size Measurement Below 100 nm - Where Life Gets Difficult" *"Science et Technologie des Poudres 4"* (Compiègne, May 4-6, 2004) *Progrès Recent en Genie de Procédés*, No. 91, 2004 (CD-ISBN No. 2-910239-65-9)
5. Y. Dieckmann et al "Synthesis of ZnS doped with Mn for bio-assay fluorescence applications stabilised with L- cysteine", *Anal. Chem.* 2009, 81, 3889.
6. Aimable N. Jongen, A. Testino, M. Donnet, J. Lemaitre, H. Hofmann and P. Bowen, "Precipitation of nanosized and nanostructured powders: process intensification using SFTR", applied to BaTiO₃, CaCO₃ and ZnO - *Chem. Eng. & Techn.*, 34(3) 344-352 (2011).