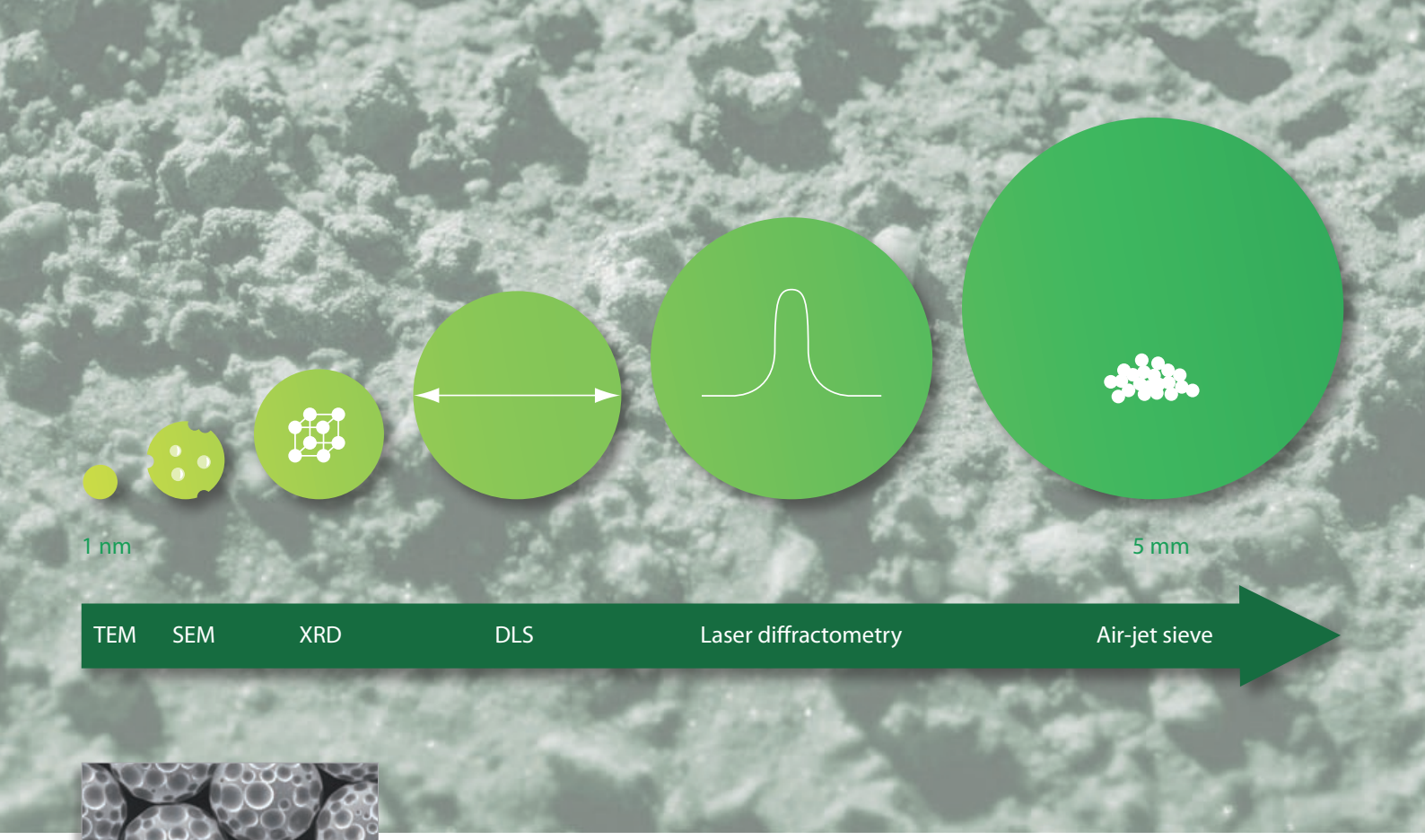

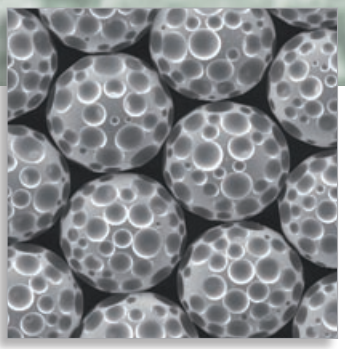

Particle size characterization

- Size distribution
- 1 nm to 5 mm
- Powders, suspensions, emulsions

Particle size is an important parameter for many industrial processes. The chemical, optical and mechanical properties, the mixing behavior and the bio-distribution of many raw materials and end-products are affected by the size and shape of the particles they consist of.
Therefore, monitoring particle dimensions is an important step in product optimization. MiPlaza offers a full portfolio of particle size measurement techniques, covering a range of more than six orders of magnitude.

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PHILIPS

	Sample type	Information obtained	Sizes
Air jet sieve	Powders	Weight fraction distribution	20 - 5600 µm
Laser diffractometry	Powders Suspensions	Size distribution	0.02 – 2000 µm
DLS	Suspensions Emulsions	Size distribution	1 - 1000 nm
XRD	Powders Polycrystalline material	Average grain size Crystal structure	2 - 100 nm
SEM	Powders Suspensions	Size distribution Shape Surface morphology	10 nm – mm's
TEM	Powders Suspensions Emulsions	Size distribution Shape Crystal structure Core/shell structure	1– 400 nm

Techniques

Air-jet sieve analysis

Dry powders are placed on a sieve. This sieve is mounted in an airtight container. Air is blown upwards through the sieve from a rotating nozzle to fluidize the sample. The exit airflow carries undersized particles downward through the sieve to a collection canister. Starting with the finest sieve, the amount of material passing is determined by weighing. The retained sample is transferred to the next larger sieve size, and the procedure is repeated until sieving has been done on all required sieves in succession.

Laser diffractometry

A suspension is pumped through a measuring cell and illuminated by a laser beam. When particles of different sizes pass a laser beam they cause the laser light to be scattered at angles that are inversely proportional to the particle size. Applicable to both suspensions and powders.

Dynamic Light Scattering (DLS)

A laser shines on a liquid containing particles (a suspension, emulsion, …). The Brownian motion of the particles causes the intensity of the scattered light to vary in time. This fluctuation in intensity is related to the size of the particles; smaller particles move quicker than larger particles. Analyzing the intensity fluctuations yields diffusion coefficients and – by using the Stokes-Einstein relation – particle sizes.

X-ray Diffraction (XRD)

When X-rays are directed on a material of which the atoms are regularly arranged, the radiation is diffracted in specific directions. XRD uses this phenomenon to study the crystal structure and microstructure of crystalline solids. The limited sizes of crystallites in a powder or polycrystalline material broaden the peaks in the diffraction profile. This effect can be used to determine the size of small (<100 nm) crystallites, i.e. the size of single crystalline domains within a particle or bulk material.

Scanning Electron Microscopy (SEM)

SEM is an imaging and analysis technique based on the detection of electrons and X-rays that are emitted from a material when irradiated by a scanning electron beam. Both topographical and compositional information can be obtained with high spatial resolution. Imaging allows us to distinguish between primary particle and agglomerate sizes. Dedicated software allows for automated image analysis, e.g. to determine particle size distributions.

MiPlaza Materials Analysis
offers a full range of analytical methods and expertise to support both research and manufacturing, serving customers by taking an integral, solution-oriented approach.

World-class expertise – working for you

For more information:
Tel./fax: +31 -40-2748044/42944
E-mail: materials@miplaza.com
www.miplaza.com/materials

Technical Note 29
March 2010

Applications

- Powders
  (phosphors, ceramics, raw materials for glass production, …)
- Suspensions of ceramic materials
- Colloidal suspensions
  (nanoparticles for bio-applications, …)
- Emulsions
- Liposomes
- Poly-crystalline material

Transmission Electron Microscopy (TEM)

TEM is a microscopy technique that allows for high resolution imaging as well as for chemical and structural studies on an atomic scale. An image is formed by electrons that have passed through the sample. Suspensions can either be studied after drying on a supporting film or can be quench-frozen, allowing for inspection of particle properties in the aqueous state.

And more...

Apart from techniques for size measurements, MiPlaza offers a large portfolio of analytical techniques to determine many parameters of particles, such as chemical composition, crystallinity, crystal structure, specific surface, shape, aspect ratio, core/shell properties, and more…