Metal Powders

Particle size analysis of metal powders with the CAMSIZER XT®

Application

Metal powders are produced and used in a wide range of industries, and for a variety of applications such as:

- solder powders for the electronics industry for reflow soldering of SMD (surface mounted devices) (Sn, Pb, Ag, Cu alloys)
- raw materials for sintering or metal injection moulding of automotive and aerospace parts (Fe, W, Ni alloys)
- batteries (Sn)
- welding fluxes, for example for submerged arc welding (Si, Mn, Al, Mg)
- powder coating (Fe, Co, Ni –alloys)
- construction materials: Aluminium powder is mixed with concrete for production of porous beton

The size range of the metal powders varies from a few µm to mm size, depending on the applications. Different processes are used for the production of the powders, including grinding and various atomization processes (gas, water, spinning disc).

Most commonly the wide size range of the initial production step is narrowed down by sieving or sifting techniques to final products with narrow size ranges.

QC and research requirements

For most applications a narrow size range is preferred, with a carefully controlled average particle size and strict limitations for the amount of oversized and undersized (dust) particles.

The size range is important for the handling and flow behavior of the powder, but also for process properties like film thickness and homogeneity, annealing temperatures, or even the electric discharging characteristics of batteries.

In addition to the size measurements, a controlled particle shape is also important for some applications. Round, compact particles enable a smoother, more homogenous particle flow, and they feature a lower surface area. Lower surface area may be a benefit if surface oxides are to be avoided, but it may be drawback if high reaction rates are required.

Example I: solder powders

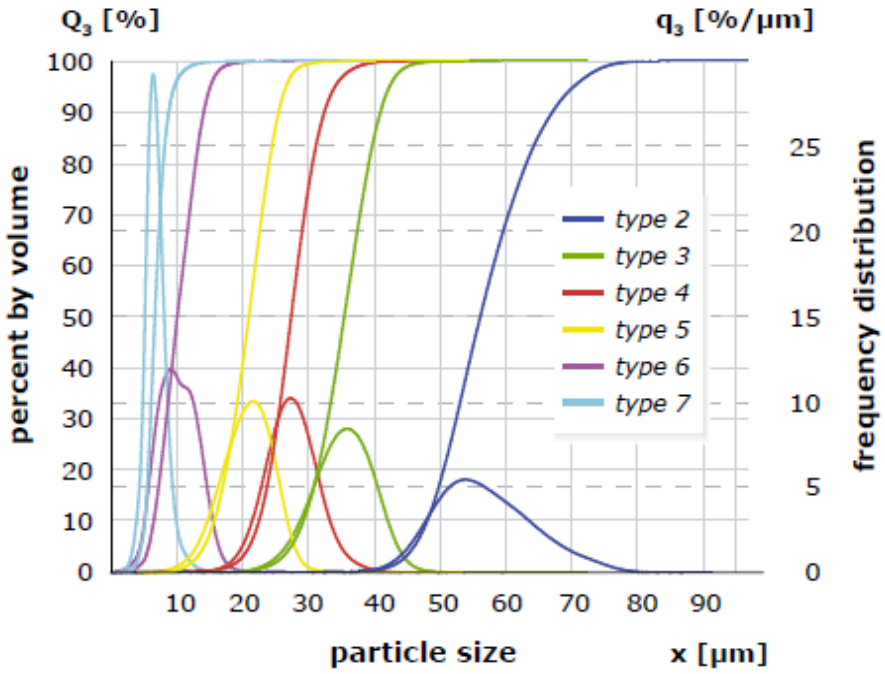


Fig. 1
Measurement results of 6 typical solder powders obtained from different manufacturers. Displayed are the cumulative distributions (Q3, left y-axis) and the corresponding frequency density distribution (q3, right y-axis).

Fig 1. shows results from 6 typical solder powders, ranging from 2 microns to about 80 microns.

Example II: solder powders

Figure 2 demonstrates the outstanding reproducibility of the results obtained by the CAMSIZER XT. About 5 kg of sample was divided into equal, representative aliquots of about 20g each, with a PT 100 rotary sample divider. These samples were analyzed with 4 different CAMSIZER XT instruments, in 8 different places on 3 continents. The average particle size differs by less than ±0.1 µm.

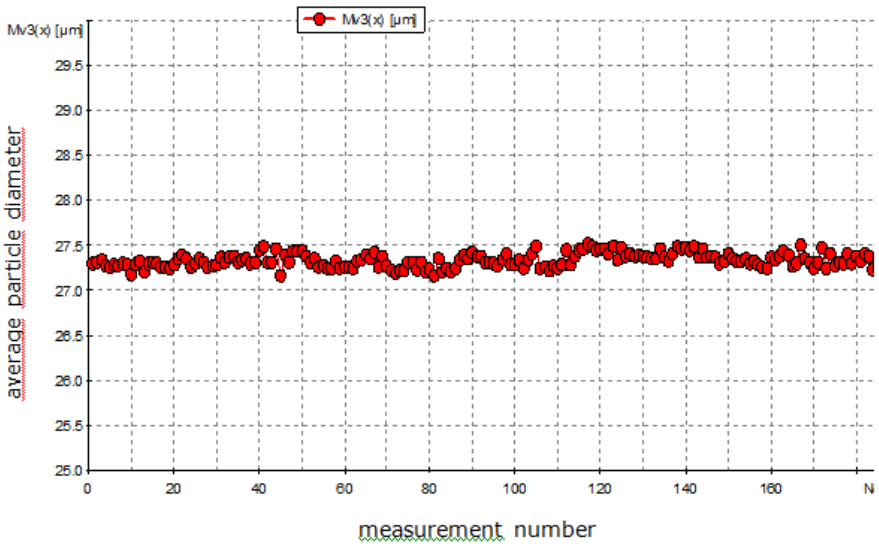


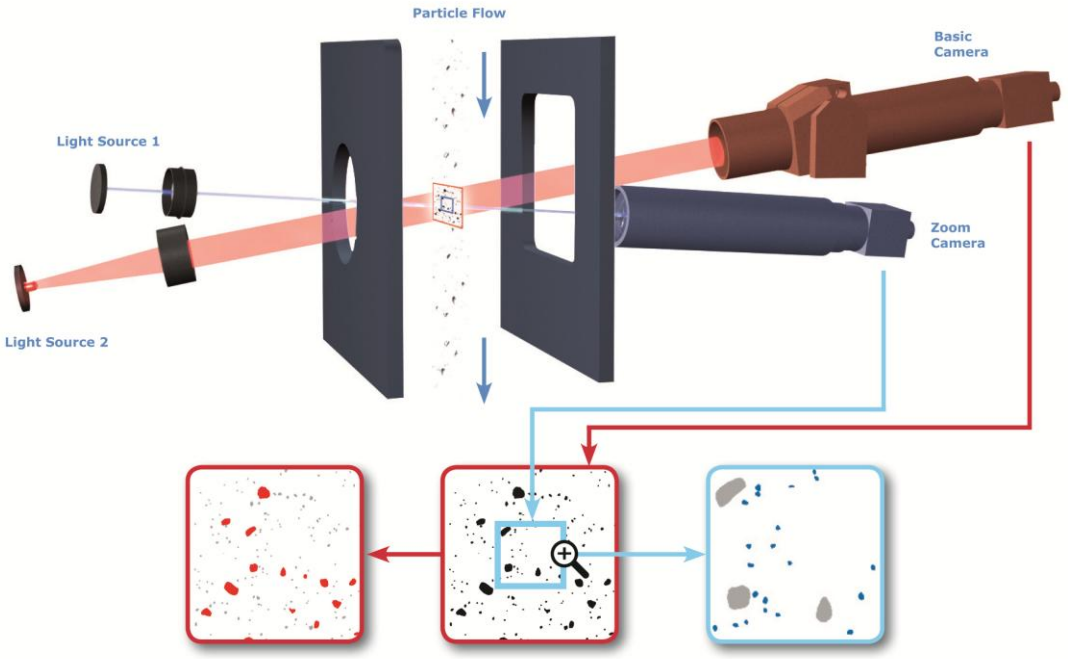
Fig 2: 180 different measurements of the same sample type, with 4 different instruments. The X-Axis shows the measurement number, the y-Axis the average particle diameter. Samples were tested on each instrument in 2 different locations. The average measured particle size varies by less than ±0.1 µm.

CAMSIZER XT® - Benefits at a glance

- Unique, almost 100% agreement with sieve results (optional)
- reliable detection of oversized and undersized particles down to 0.01% (much more precise than laser particle sizers)
- Fast: typically 1-3 minutes per measurement
- Flexible dispersion options (air pressure, liquid, free fall)
- Shape analysis (roundness, aspect ratio, etc)
- Surface area calculation
- Independent measurement of particle length and width provides more details than the "equivalent circle area" measurement of laser particle sizers.
- Very repeatable and reproducible results, with excellent instrument to instrument agreement.
- Very high resolution (excellent capability to detect multimodal distributions!)
- Easy to operate, results independent from operators

CAMSIZER XT – Measurement principle

Patented measurement principle



With Dynamic Image Processing, the particles move with the help of gravity, compressed air or dispersed in liquid through the measuring field. A light source illuminates them from one side while a camera takes their picture from the other side. The software evaluates the projections of the particles to determine the size distribution of all particles of the sample in a very short time. A few hundred particles per picture are evaluated in real time, more than 275 pictures per second.

The maximum dynamic measuring range, i.e. the difference between the smallest and largest detectable particle, is substantially extended by using two aligned cameras.

A high resolution camera detects small particles in a small measuring field. A camera with lower resolution but a wider measuring field simultaneously detects the larger particles, allowing for rapid measurement with good statistics.