Carbon Products: coal, graphite and activated carbon

Instrument: CAMSIZER X2

Application

The element carbon can appear in many different forms. Coal (>70% carbon), graphite, fullerenes and diamond are natural varieties of carbon. Activated coal, coke or carbon nanotubes are man-made varieties. Coal is used as energy source and raw material for other carbon products, e. g. coke. Petroleum Coke is made from crude oil by calcinating the residual bitumen after evaporation of the volatile hydrocarbons.

Other important applications are graphite electrodes for aluminium and steel production or carbon brushes and brush systems for electric motors. Workpieces made of graphite are used wherever great thermal and chemical resistance is required (Fig. 1).

Fig. 1: *Graphite crucibles used in ELTRA combustion analyzers. Graphite workpieces have outstanding thermal and chemical resistance.*

Sample Materials and Examples

The CAMSIZER X2 is perfectly suited for the size and shape analysis of graphite, powdered or crushed coal and coke, activated carbon even industrial diamonds which are used as abrasives. If the material is a fine powder or does not flow freely due to high dust content, the X-Jet module can be used. For coarser, dust-free material samples the X-Fall is an option (Fig. 2). If the focus is on large particles and the samples are pourable and dust free, using a CAMSIZER P4 should be considered. Application Notes 019 and 021 show some examples for the analysis of coarse-grained petroleum coke with the CAMSIZER P4.

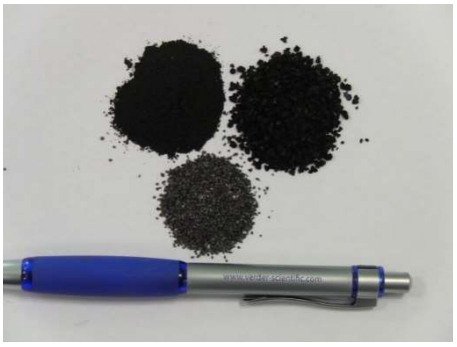

Fig. 2: *Typical carbon samples suitable for the CAMSIZER X2. Upper left: ground coal, upper right: activated carbon, bottom: petroleum coke.*

Solution: CAMSIZER X2

With Dynamic Image Analysis (DIA), 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 system 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 300 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 reliable results.

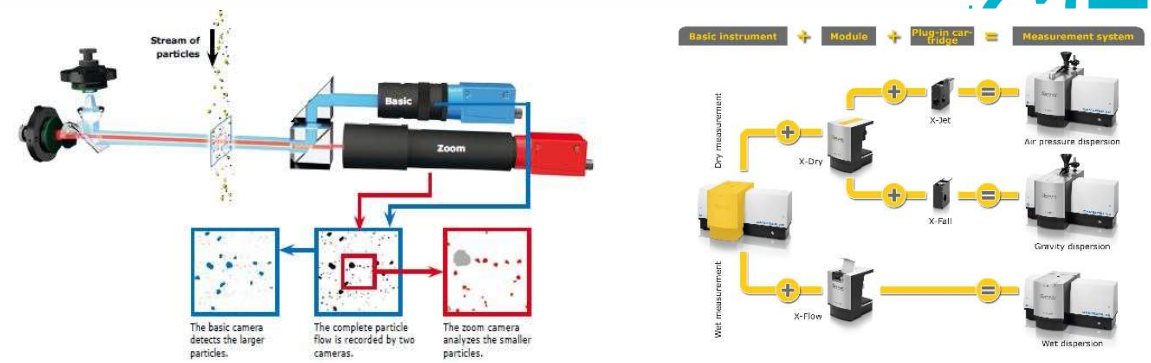

Fig. 3: *CAMSIZER X2 measurement principle with dual camera technology (left). The CAMSIZER X2 can process wet and dry samples. Dry samples can be dispersed in an air flow by compressed air. Pourable materials may be analyzed in free-fall mode (gravity dispersion). Switching the mode of analysis is easy thanks to the modular X-Change system (right).*

Example: Raw material for carbon brushes

Two samples of carbon powder have been measured with the CAMSIZER X2 using the X-Jet module and a dispersion pressure of 80kPa. Both materials are later used to produce brushes for electric motors. The distribution of the raw material is generally wide in order to achieve a dense packing of the powder. Sample 1 is a fine powder with a d50 of 25µm and a significant amount of oversize particles. By sieving it was determined that 89% of the sample is larger than 200µm. Note that the CAMSIZER X2 puts out the same percentage! Laser diffraction analysis correlates nicely with image analysis for the fine part of the distribution (d10 and d50), however the laser sizer fails to detect the oversize! The second sample has a size distribution from below 10 µm up to 1mm. This demonstrates the extremely wide measurement range of the CAMSIZER X2 thanks to the Dual-Camera-Technology. Note the perfect correlation of the CAMSIZER X2 data with sieve analysis. The instrument is therefore perfectly suited to preplace sieving without change of product speceifications.

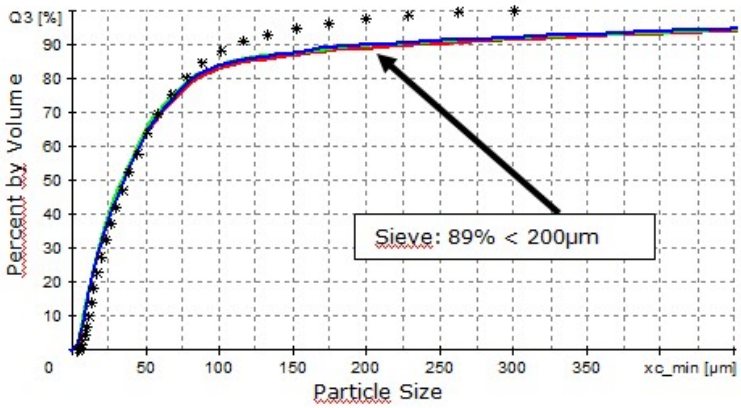

Fig. 3: *Three consecutive measurements of sample 1. Note the excellent repeatability. The black asterisks represent laser diffraction analysis. The laser results are in good agreement with the CAMSIZER X measurements, however, the laser doesn't accurately detect the oversize particles. Sieving proves that the oversize is for real.*

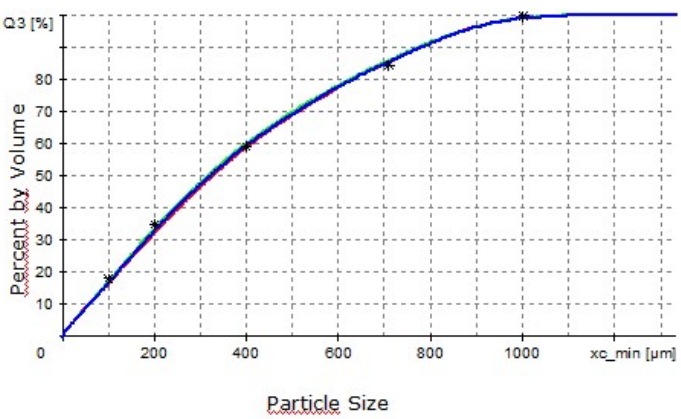

Fig. 4: *Three consecutive measurements of sample 2. Once again, the repeatability is excellent. Note the perfect correlation between CAMSITER X2 and sieve analysis (black asterisks).*

CAMSIZER X2: Benefits at a glance

- Measurement time 2-5 minutes
- Efficient air-jet dispersion 0 – 460 kpa
- Wet measurements using water, alcohol, org. solvent, brine, vegetable oil
- Option for gravity dispersion
- Higher resolution than sieving or laser diffraction
- High sample throughput
- Excellent reproducibility
- Objective, independent of operator
- No abrasion, non-destructive measurement
- Higher sensitivity for oversize particles than laser diffraction
- Shape analysis: length and diameter of particles
- Easy to use
- Low maintenance, robust design

For further information please contact us at:

www.microtrac.com