



APPLICATION NOTE

SILICON CARBIDE POWDERS

Particle Size Distribution according to ISO 13318-1 and ISO 13318-2 Correlation between specific surface area and PSD

Introduction

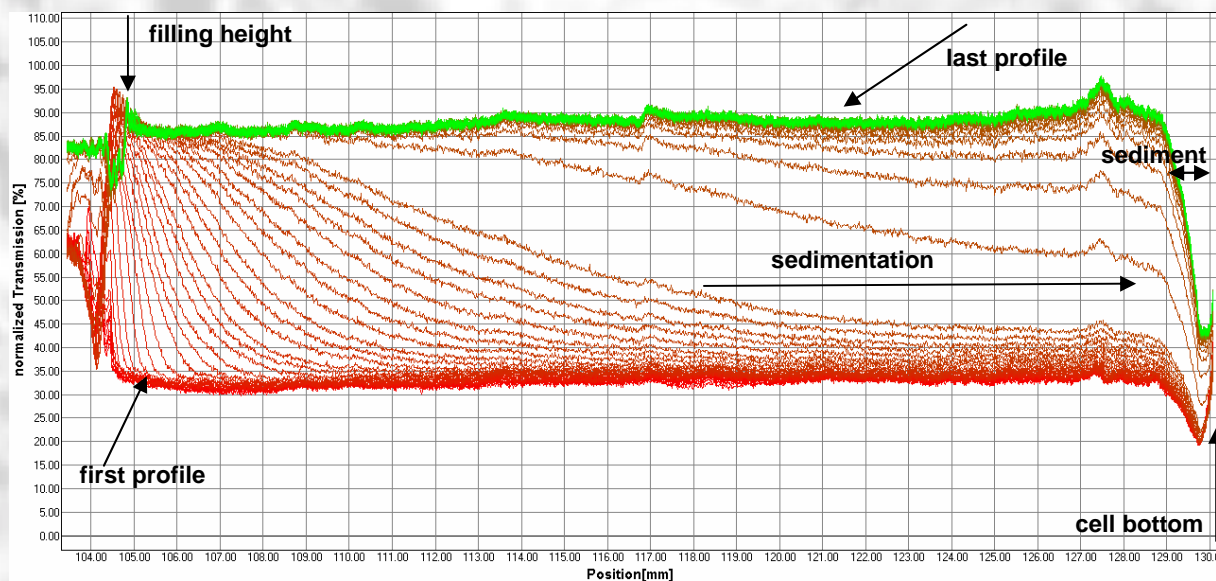
Silicon carbide is a widely used material in the ceramic industry, featuring a high hardness, a light weight and a compressive strength. The particle size distribution (PSD) of Silicon carbide powder samples is used as a parameter for quality control and process optimization.

Particle size analysis conducted by multisample analytical centrifugation based on STEP®-technology according to ISO 13318, is suitable for qualitative and quantitative characterization of silicone carbide powders. A correlation between specific surface area and particle size distribution is shown.

Measurement

The powders were dispersed in aqueous tetrasodium diphosphate solution prior to the measurement with the Dispersion Analyser LUMiSizer®.

The principle separation behaviour of the powder dispersions is characterized by a very polydisperse sedimentation (no sharp front), particles move with different speed. Polydisperse sedimentation is characteristic for colloidal stable dispersions (stable against particle aggregation). This is a prerequisite for obtaining the particle size distribution from sedimentation measurements.



Evolution of transmission profiles with time for silicon carbide sample A in tetrasodium diphosphate, centrifugation at 36 - 2300 g (centrifugal speed ramp to cover entire range of particle sizes), at 7°C.

On the basis of two analysis modi different distribution types are calculated from one measurement:

1. "Constant position" – concentration detection over time at one position and
2. "Constant time" – concentration detection over the entire sample length at least for one time.

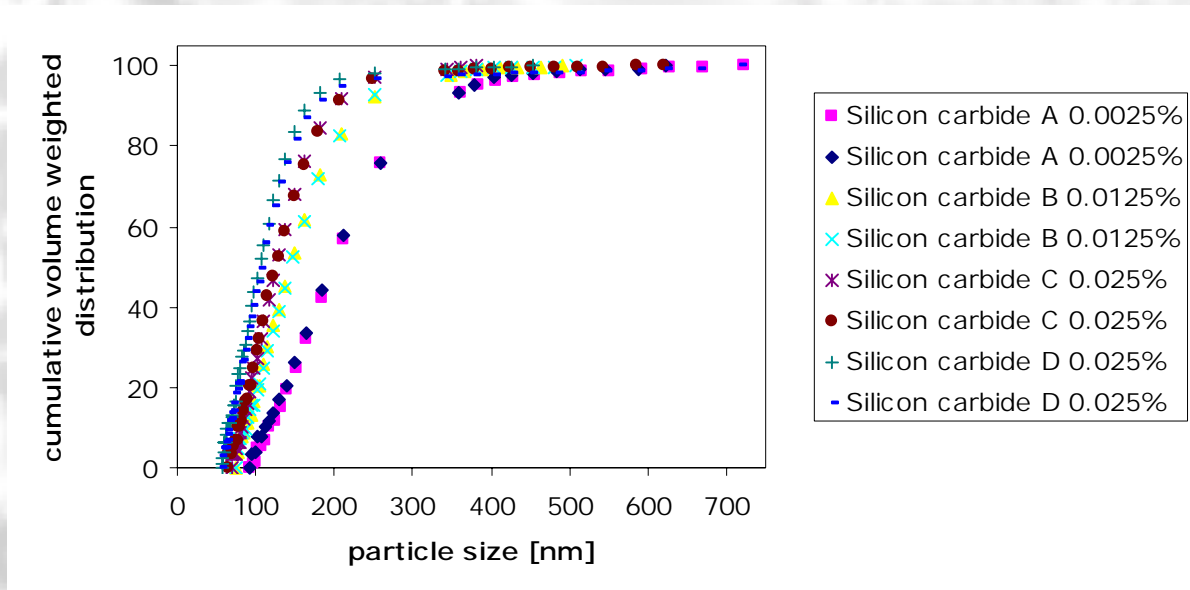


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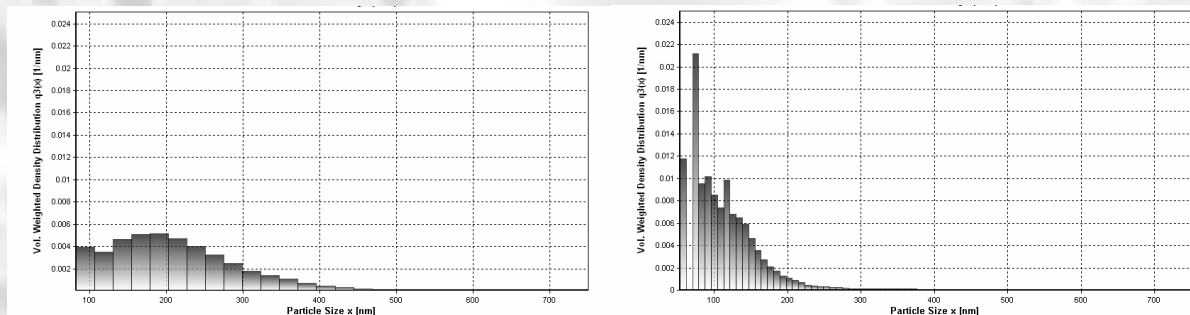
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Results

The volume weighted particle size distributions, calculated according to ISO 13318, derived by analysing the time course of transmission at the constant position of 126 mm are shown in the following figures.



Comparison of cumulative volume weighted distributions, according to ISO 13318, specific surface area is increasing from A to D



Volume weighted density distributions of Silicon carbides A (left) and D (right)

Summary

All samples have a broad particle size distribution as expected from the shape of the transmission profiles. With the increasing surface area the particle size decreases. Repeat determination proves the excellent reproducibility.

Within the analysis protocol of SEPView® software further details, including measurement protocol, different distribution types, harmonic mean values, standard deviations, fit functions etc. are provided.

References

- Particle Size Distribution by Space or Time Dependent Extinction Profiles obtained by Analytical Centrifugation, T. Detloff, T. Sobisch, D. Lerche, Part. Part. Syst. Charact. 23 (2006), 184-187
- STEP-Technology see www.lum-gmbh.com/pages/technology.htm
- Dispersion Stability and Particle Characterization by Sedimentation Kinetics in a Centrifugal Field, D. Lerche, J. Dispersion Sci. Technol. 23 (5), 699-709, 2002