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APPLICATION NOTE

Measuring Particle Size Distribution of Gypsum Using Laser Diffraction

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Abstract: The performance of gypsum is influenced by many factors, among which the particle size distribution is particularly significant. This application note was intended for investigating the particle size distribution of gypsum before and after grinding process with a laser particle size analyzer. Measurements show the difference in particle size distribution between two gypsum samples and outstanding repeatability of the particle size analyzer.

Keywords: Particle size distribution, laser diffraction, gypsum

Performance of Gypsum Depends on Particle Size Distribution

The widespread application of gypsum is always astonishing, from construction of ancient Roman architecture to medicinal agent in traditional Chinese medicine.[1] Gypsum can be mined from gypsite or extracted from evaporite. The main application area of gypsum is construction. General processing of the gypsum in construction industry starts from crushing for a preliminary fragmentation, then grinding and heating process are carried out towards acquisition of plaster namely hemihydrate gypsum, which presents incredible property of setting in a hard mass after addition of water. There are many factors that can affect the properties of gypsum, e. g., the amount of water added, the type of filler utilized or particle size distribution. In practical application, plenty of important performance such as setting time, compressive strength or density deeply relies on particle size distribution.[2] Consequently, the control of particle size is crucial in gypsum production.

Bettersizer ST as a Guard for Quality Control

As a leading particle size analyzer for quality control, Bettersizer ST guarantees excellent performance of your products. Laser diffraction technology utilized in Bettersizer ST is combined with its patented DLOS optical system, which allows rapid measurements to yield repeatable and accurate results. In this note, two commercial gypsum powder applied in construction area, were measured with Bettersizer ST.

Particle Size Distribution Measurement of Gypsum

The samples were dispersed under ethanol in corrosion-resistance circulation tank. The measurement results were illustrated graphically within seconds. The state of the two samples were different, one was before grinding, while the other was after grinding. Figure 1 shows the particle size distribution of the two samples reported by Bettersizer ST. As can be noticed, the range of particle size distributions are similar. However, finer particles can be observed after grinding process. The uniformity of particle size was good before grinding. Although the average particle size became smaller after grinding, an even distribution of particle size was not realized. It can be inferred from the figure that the grinding process was probably not fully carried out, since numerous particles were still relatively larger. Rapid and accurate measurements of particle size distribution with Bettersizer ST can be easily achieved, with which the processing can be demystified towards quality control.

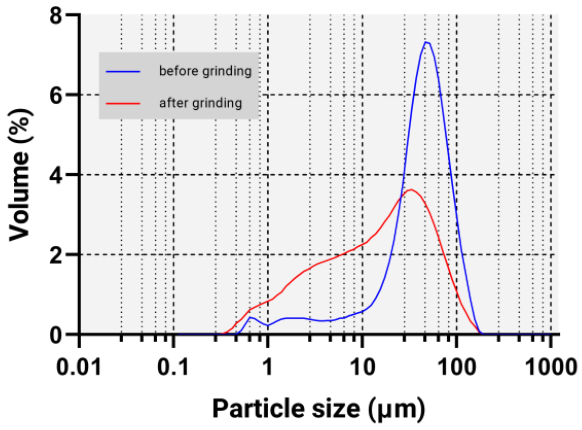

Figure 1: Particle size distribution of gypsum before and after grinding process measured with Bettersizer ST

Outstanding Measurement Repeatability

Repeatability is an important parameter of particle size analyzer. A sample was obtained from ground gypsum and measured five times with Bettersizer ST. Results are shown below in Figure 2. It can be observed that the five distribution curves almost completely overlap, which demonstrates the outstanding repeatability of the measurements with Bettersizer ST. Table 1 shows the corresponding repeatability of D10, D50 and D90. The particle size of gypsum was experimentally determined with a variability of less than 0.5%.

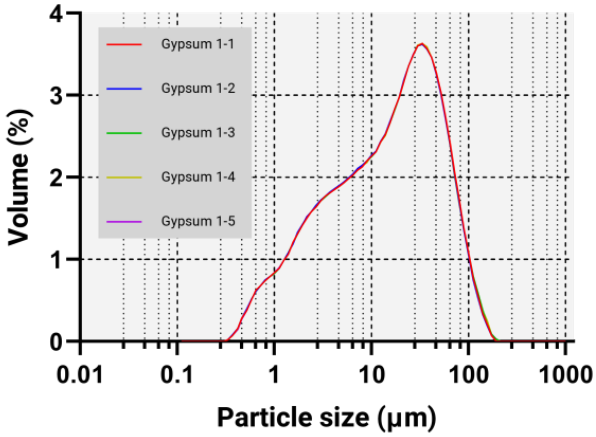

Figure 2: Particle size distribution of five measurements of a ground sample

Table 1: Comparison of D10, D50 and D90 of five measurements and corresponding repeatabilities

Sample	D10 (μm)	D50 (μm)	D90 (μm)
Gypsum 1-1	1.654	15.34	59.31
Gypsum 1-2	1.646	15.18	58.76
Gypsum 1-3	1.653	15.33	59.42
Gypsum 1-4	1.651	15.31	59.19
Gypsum 1-5	1.652	15.28	59.26
Repeatability	0.19%	0.42%	0.43%

Conclusion

The particle size distribution of two gypsum samples were rapidly and accurately measured with Bettersizer ST. Outstanding repeatability was presented subsequently by measurements of a ground sample, which indicates its excellent reliability. The capability of providing convincing results with convenient measurements makes Bettersizer ST an ideal particle size analyzer for quality control.

References

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