Think SYNC: Taking Laser Diffraction to the Next Level

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Particle size measurement by laser diffraction (LD) has become the most used technology in research and industry and is the de facto standard for incoming and outgoing product quality control. The SYNC particle analyser by Microtrac MRB provides traditional users of laser diffraction technology with exciting new capabilities to characterise their materials. The proven tri-laser technology provides accurate and repeatable laser diffraction results from light collected over 163 degrees of angular scatter. When combined with state-of-the-art camera technology, enabling simultaneous image capture, the SYNC offers not only size data but significantly more information as described below. With the SYNC, the laser diffraction analysis and image recording take place in the same measuring cell at the same time: one sample, one optical bench, one flow path, one analysis.

Figure 1. The SYNC analyser is a hybrid instrument that combines Laser Diffraction and Dynamic Image Analysis.

Think SYNC: Laser diffraction enhanced by shape analysis

The power of simultaneous size and shape analysis is shown in *Figure 2*. The size distributions of two metal powder samples measured by laser diffraction were determined to have median sizes of 34 µm and 37 µm. From this result one might conclude that the powder quality is very similar. However, images reveal that one sample consists almost entirely of round particles, while the other sample contains many elongated or fused particles, and the two samples are in fact very different. This information would not have been available with laser diffraction alone.

Think SYNC: Laser diffraction and oversize detection

Laser diffraction has only limited ability to detect very small amounts of oversize particles. However, this is a particular strength of dynamic image analysis because each detected particle generates a measurement event that is included in the result. The example in *Figure 3* shows how oversize particles added to a sample can be detected by combining laser diffraction with image analysis. Oversize particle detection is one of the most important issues in particle measurement technology and is highly relevant for many practical applications.

Think SYNC: Length and Width distribution

In laser diffraction, only one size distribution is output at a time, with all measurement signals referenced to spherical particles. A separate measurement of length and width is not possible. As a result, very wide or bimodal distributions are often calculated for real samples with irregularly shaped particles. This can be misinterpreted as a mixture of two components with different sizes. By examining the images in *Figure 4*, it becomes obvious that the bimodal distribution of laser diffraction is in fact due to the acicularity of the particles. With the image analysis, separate distributions can even be determined for length and width.

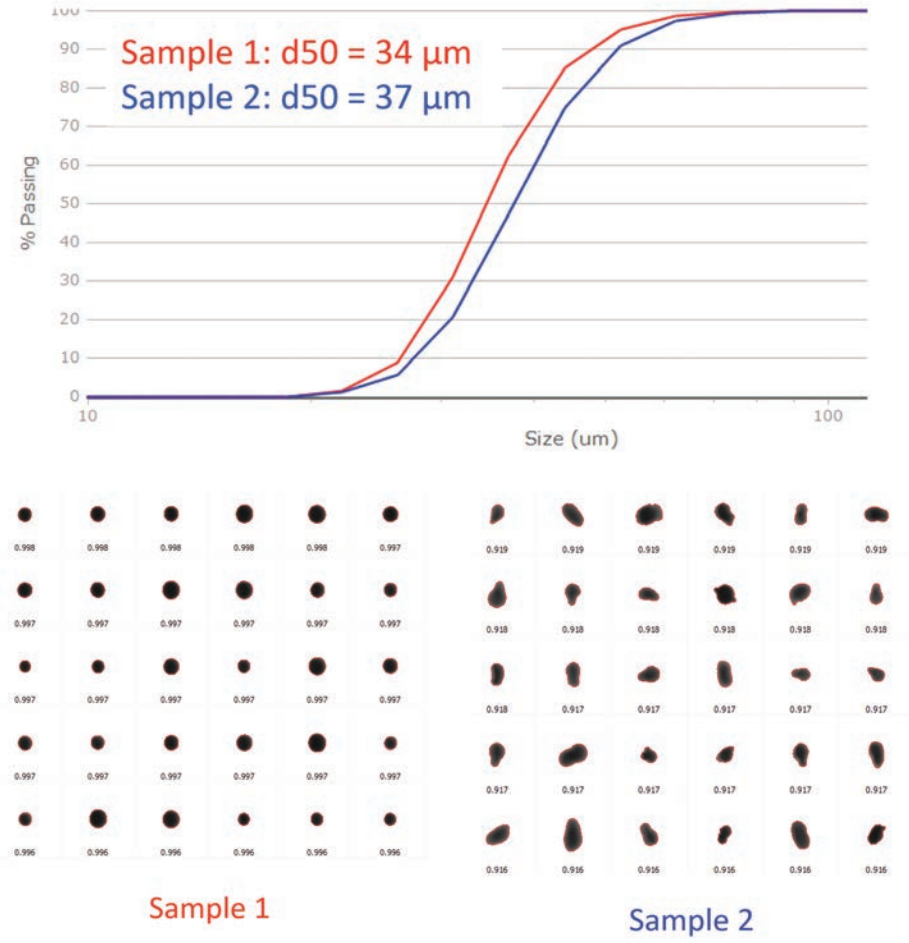

Figure 2. Two metal powder samples with very similar size distributions but different shape.

Diffraction Only:

Combination:

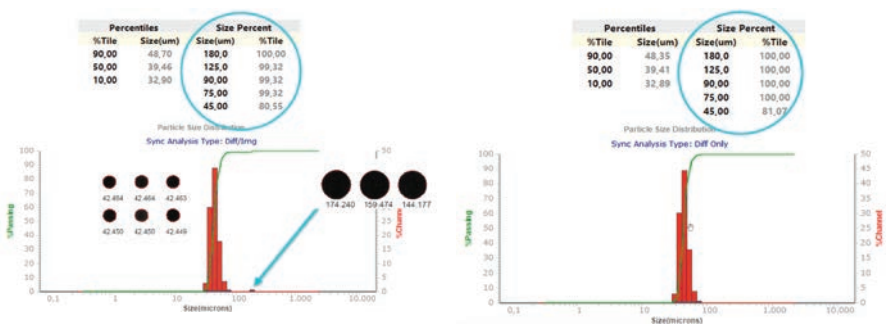

Figure 3. 0.8 % of particles > 125 µm have been added to a 20-75 µm sample of glass beads. The laser diffraction result does not report the oversize material. Thanks to the combination with image analysis (blend algorithm), the large particles are included in the distribution.

Figure 4. Analysis of needle-shaped crystals with laser diffraction results in a bimodal distribution (left) representing both width and length. With Image analysis, individual distributions for width and length can be measured (red and green curve on the right).

Conclusion

Laser diffraction is the most popular method for particle characterisation due to its ease of use, robustness, and versatility. A wide measurement range from 10 nm to the low millimetre range is another advantage. Image analysis is perfectly suited to compensate for some limitations of laser diffraction and provides scientists with valuable additional information to better understand their materials. With the SYNC analyser, Microtrac MRB has become the pioneer of combined measurement technologies.