Particle Size: Why Two Reports Disagree

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Abstract. Resolve inconsistent particle-size reports by checking sampling, dispersion and distribution basis. This note provides a sequence for comparing D50 values without assuming that the powder has changed. A median alone does not describe the full distribution or its agglomerates.

Keywords: particle size; D50; dispersion; sampling; measurement basis

1. Check what the instrument weights

Number-based and volume-based distributions weight the same population differently. A comparison of sizing methods illustrates why method and sample preparation belong with the reported result [1]. Do not convert one median into another using a simple scale factor.

Original example: consider 999 ideal spheres of diameter 1 µm and one sphere of diameter 10 µm. The large sphere has the same volume as 1000 small spheres. It therefore represents about 50.0% of total particle volume despite being only 0.1% of the particle count. A rare large particle can strongly affect a volume-weighted result.

Also compare the complete curve. Two powders can have the same D50 and different coarse tails. A delivery or surface-finish problem may follow the tail or occasional clusters while the median stays within its usual range.

2. Build a comparable measurement

2.1 Reconcile the report fields. Confirm wet or dry measurement, distribution basis, optical model where applicable, dispersant and energy input. Record D10, D50 and D90 with the curve. A method identifier is useful only when it resolves to the actual preparation and analysis settings.

2.2 Use an energy ladder cautiously. Compare the initial dispersion with one or more controlled increases in energy. A decreasing coarse tail may indicate deagglomeration, but continued size reduction can also indicate particle damage. Examine morphology or another integrity measure before declaring the smallest result the true size.

2.3 Test a representative sample. Mix and split the bulk powder using a suitable reproducible procedure. Compare aliquots from the same split before comparing supplier and customer laboratories. If within-container variation dominates, changing the instrument will not resolve the underlying sampling problem.

3. Development decision

Agree a common method and retained reference sample before narrowing the D50 limit. If the functional failure tracks D90 or an image-based defect population, include that metric rather than relying on the median alone.

Table 1. Development comparison and interpretation controls.

Proposed check	Hold constant	Interpretation
Repeat one aliquot	Instrument method	Short-term measurement variation
Measure fresh aliquots	Preparation protocol	Sampling and segregation
Change dispersion energy	Powder and medium	Agglomerate sensitivity
Compare with images	Representative sampling	Shape and large-particle check

Scope. The particle-count example is idealized. The cited method comparison used metal powder; ceramic-specific dispersion and optical settings require their own assessment.

References

1. Whiting JG, Garboczi EJ, Tondare VN, Scott JHJ, Donmez MA, Moylan SP. A comparison of particle size distribution and morphology data acquired using lab-based and commercially available techniques: Application to stainless steel powder. Powder Technol. 2022;396:648-662. doi:10.1016/j.powtec.2021.10.063.

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