



Designation: B 430 – 97

Standard Test Method for Particle Size Distribution of Refractory Metal Powders and Related Compounds by Turbidimetry¹

This standard is issued under the fixed designation B 430; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

This standard has been approved for use by agencies of the Department of Defense.

1. Scope

1.1 This test method covers the determination of particle size distribution of refractory metal powders with a turbidimeter **(1)**.² Experience has shown that this test method is satisfactory for the analysis of elemental tungsten, molybdenum, rhenium, tantalum metal powders, and tungsten carbide powders. Other refractory metal powders, for example, elemental metals, carbides, and nitrides, may be analyzed using this test method with caution as to significance until actual satisfactory experience is developed. The procedure covers the determination of particle size distribution of the powder in two conditions:

1.1.1 As the powder is supplied (as-supplied), and

1.1.2 After the powder has been de-agglomerated by rod milling (laboratory milled) according to Practice B 859.

1.2 Where dual units are given, inch-pound units are to be regarded as standard.

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 ASTM Standards:

B 330 Test Method for Average Particle Size of Powders of Refractory Metals and Their Compounds by the Fisher Sub-Sieve Sizer³

B 821 Guide for Liquid Dispersion of Metal Powders and Related Compounds for Particle Size Analysis³

B 859 Practice for De-Agglomeration of Refractory Metal Powders and Their Compounds Prior to Particle Size Analysis³

E 456 Terminology Relating to Quality and Statistics⁴

¹ This test method is under the jurisdiction of ASTM Committee B09 on Metal Powders and Metal Powder Products and is the direct responsibility of Subcommittee B09.03 on Refractory Metal Powders.

Current edition approved Sept. 10, 1997. Published February 1998. Originally published as B 430 – 65 T. Last previous edition B 430 – 95.

² The boldface numbers in parenthesis refer to the references listed at the end of this test method.

³ *Annual Book of ASTM Standards*, Vol 02.05.

⁴ *Annual Book of ASTM Standards*, Vol 14.02.

E 691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method⁴

3. Summary of Test Method

3.1 A uniform dispersion of the powder in a liquid medium is allowed to settle in a glass cell. A beam of light is passed through the cell at a level having a known vertical distance from the liquid level. The intensity of the light beam is determined using a photo cell. This intensity increases with time as sedimentation of the dispersion takes place.

3.2 The times at which all particles of a given size have settled below the level of the transmitted light beam are calculated from Stokes' law for the series of sizes chosen for the particle size analysis.

3.3 The intensity of the light beam at these times is measured as percent of the light transmitted through the cell with the clear liquid medium. The size distribution in the powder can be calculated from these relative intensities using the Lambert-Beer law in the modified form (also see Refs 2, 3, 4).

$$\Delta W_{1-2} = d_m (\log I_{d1} - \log I_{d2}) \quad (1)$$

where I_{d1} and I_{d2} are the intensities measured at the times when all particles having diameters larger than d_1 and d_2 respectively have settled below the level of the light beam, d_m is the arithmetic mean of particle sizes d_1 and d_2 , and ΔW_{1-2} refers to the relative weight for the particle size range between d_1 and d_2 . Values of ΔW are determined for each of the particle size ranges chosen. The sum of these values is $\Sigma \Delta W$. The weight percent of particles in the size range from d_1 to d_2 can then be calculated as:

$$\text{Weight, \%} = (\Delta W_{1-2} / \Sigma \Delta W) \times 100 \quad (2)$$

4. Significance and Use

4.1 Knowledge of the particle size distribution of refractory metal powders is useful in predicting powder-processing behavior, and ultimate performance of powder metallurgy parts. Particle size distribution is closely related to the flowability, compressibility, and die-filling characteristics of a powder, as well as to the final structure and properties of the finished parts. However, the degree of correlation between the results of this test method and the quality of powders in use has not been fully determined quantitatively.