Designation: B822 – 02

Standard Test Method for Particle Size Distribution of Metal Powders and Related Compounds by Light Scattering[1]

This standard is issued under the fixed designation B822; 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.

1. Scope

1.1 This test method covers the determination of the particle size distribution by light scattering, reported as volume percent, of particulate materials including metals and compounds.

1.2 This test method applies to analyses with both aqueous and nonaqueous dispersions. In addition, analysis can be performed with a gaseous dispersion for materials that are hygroscopic or react with a liquid carrier.

1.3 This test method is applicable to the measurement of particulate materials in the range of 0.4 to 2000 μm, or a subset of that range, as applicable to the particle size distribution being measured.

1.4 The values stated in SI units are to be regarded as the standard.

1.5 *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:*[2]

B215 Practices for Sampling Metal Powders

B243 Terminology of Powder Metallurgy

B821 Guide for Liquid Dispersion of Metal Powders and Related Compounds for Particle Size Analysis

E1617 Practice for Reporting Particle Size Characterization Data

2.2 *ISO Standard*[3]*:*

ISO13320-1 Particle Size Analysis—Laser Diffraction Methods—Part 1: General Principles

3. Terminology

3.1 *Definitions*—Definitions of powder metallurgy terms can be found in Terminology B243.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *background*—extraneous scattering of light by elements other than the particles to be measured; includes scattering by contamination in the measurement path.

3.2.2 *Fraunhofer Diffraction*—the optical theory that describes the low-angle scattering of light by particles that are large compared to the wavelength of the incident light.[4]

3.2.3 *Mie Scattering*—the complex electromagnetic theory that describes the scattering of light by spherical particles. It is usually applied to particles with diameters that are close to the wavelength of the incident light. The real and imaginary indices of light refraction of the particles are needed.[4]

3.2.4 *multiple scattering*—the rescattering of light by a particle in the path of light scattered by another particle. This usually occurs in heavy concentrations of a particle dispersion.

4. Summary of Test Method

4.1 A prepared sample of particulate material is dispersed in water, or a compatible organic liquid, and circulated through the path of a light beam or some other suitable light source. A dry sample may be aspirated through the light in a carrier gas. The particles pass through the light beam and scatter it. Photodetector arrays collect the scattered light that is converted to electrical signals, which are then analyzed in a microprocessor. The signal is converted to a size distribution using Fraunhofer Diffraction or Mie Scattering, or a combination of both. Scattering information is analyzed assuming a spherical model. Calculated particle sizes are therefore presented as equivalent spherical diameters. Additional information pertaining to the general principles of particle size distribution analysis by light scattering can be found in ISO Standard 13320-1.

5. Significance and Use

5.1 Reported particle size measurement is a function of both the actual particle dimension and shape factor as well as the

[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 B09.02 on Base Metal Powders.

Current edition approved April 10, 2002. Published June 2002. Originally published as B822 – 92. Last previous edition B822 – 97. DOI: 10.1520/B0822-02.

[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[3] Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, http://www.ansi.org.

[4] Muly, E. C., Frock, H. N., "Industrial Particle Size Measurement Using Light Scattering," *Optical Engineering*, Vol 19, No 6, 1980, pp. 861–869.