Designation: C1070 – 01 (Reapproved 2020)

Standard Test Method for Determining Particle Size Distribution of Alumina or Quartz by Laser Light Scattering[1]

This standard is issued under the fixed designation C1070; 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 particle size distribution of alumina or quartz using laser light-scattering instrumentation in the range from 0.1 to 500 μm.

1.2 The procedure described in this test method may be applied to other nonplastic ceramic powders. It is at the discretion of the user to determine the method's applicability.

1.3 This test method applies to analysis using aqueous dispersions.

1.4 *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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.5 Quartz has been classified by IARC as a Group I carcinogen. For specific hazard information in handling this material, see the supplier's Material Safety Data Sheet.

1.6 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Terminology

2.1 *Definitions of Terms Specific to This Standard:*

2.1.1 *background*—extraneous scattering of light by elements other than the particles to be measured. This includes scattering by contamination in the measurement zone.

2.1.2 *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.

2.1.3 *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 the imaginary indices of light diffraction are needed.[2]

2.1.4 *multiple scattering*—the rescattering of light by a particle in the path of light scattered by another particle. This may occur in heavy concentrations of a particle dispersion.

3. Summary of Test Method

3.1 A sample dispersed in an aqueous medium is circulated through the path of a light beam. As the particles pass through the light beam, the particles scatter light at angles inversely proportional to their size and with an intensity directly proportional to their size. Detectors collect the scattered light which is converted to electrical signals and analyzed in a microprocessor. The signal is converted to size distribution using Fraunhofer diffraction or Mie scattering, or a combination of both. The scattering information is then processed, assuming the particles to be spherical, using algorithms or models proprietary to the particular instrument manufacturer. Calculated particle size distributions are presented as equivalent spherical diameters.

4. Significance and Use

4.1 It is important to recognize that the results obtained by this method or any other method for particle size distribution utilizing different physical principles may disagree. The results are strongly influenced by the physical principles employed by each method of particle size analysis. The results of any particle sizing method should be used only in a relative sense, and should not be regarded as absolute when comparing results obtained by other methods.

4.2 Light scattering theory that is used for determination of particle size has been available for many years. Several manufacturers of testing equipment have units based on these principles. Although each type of testing equipment utilizes the same basic principles for light scattering as a function of particle size, different assumptions pertinent to applications of the theory and different models for converting light measurements to particle size may lead to different results for each

[1] This test method is under the jurisdiction of ASTM Committee C28 on Advanced Ceramics and is the direct responsibility of Subcommittee C28.03 on Physical Properties and Non-Destructive Evaluation.

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[2] Muly, E. C. and Frock, H. W., "Industrial Particle Size Measurement Using Light Scattering," *Optical Engineering*, Vol 19, No. 6, 1990, pp. 861–69.