



Standard Test Method for Determining the Particle Size Distribution of Advanced Ceramics by Centrifugal Photosedimentation¹

This standard is issued under the fixed designation C 1282; 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 determination of the particle size distribution of advanced ceramic powders specifically silicon nitride and carbides, in the range of 0.1 to 20 μm, having a median particle diameter from 0.5 to 5.0 μm.

1.2 The procedure described in this test method may be applied successfully to other ceramic powders in this general size range, provided that appropriate dispersion procedures are developed. It is the responsibility of the user to determine the applicability of this test method to other materials.

1.3 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

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

2. Referenced Documents

2.1 *ASTM Standards:*²

C 242 Terminology of Ceramic Whitewares and Related Products

E 177 Practice for Use of the Terms Precision and Bias in ASTM Test Methods

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

3. Terminology

3.1 *Definitions*—Refer to Terminology C 242 for definitions of terms used in this test method.

4. Summary of Test Method

4.1 A homogeneous aqueous dispersion of the powder is prepared. While kept in a thoroughly mixed condition, a small aliquot is transferred to the analyzer sample cell, which is placed in the instrument and subjected to a controlled centrifugal acceleration at a known or controlled temperature. At predetermined times related to the sedimentation of specific Stokes' diameters (Note 1), the optical absorbance is recorded and compared to the initial value to determine the fraction of the total sample that has sedimented a specific distance. A volume-based size distribution is calculated from the absorbance-time data. The results are reported as equivalent diameter (spherical) (Note 2) since particles in these powders are not truly spherical.

NOTE 1—This diameter in μm is referred to as D in the equation given below.

NOTE 2—Refer to Terminology C 242 for the ASTM definition of this term. Most equipment manufacturers refer to this as the equivalent spherical diameter.

$$D^2 = \frac{18\eta \cdot \log \frac{X_1}{X_2}}{(p_s - p_f)u^2 t} \times 10^8 \quad (1)$$

where:

η = viscosity of the fluid, cP,

X_1 = distance from the middle of the centrifugal disc cell to the point in the cell where sedimentation starts,

X_2 = distance from the center of the centrifugal disc cell to the point where the light beam intersects the particle

t = time for the particle to settle, s

ρ_s = particle density, g/cm³,

ρ_f = fluid density, g/cm³, and

u = rotational angular velocity, rad/s.

4.2 The instruments that have been found suitable for this test method incorporate microcomputers that control instrument operation and perform all required data acquisition and computation functions.

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 Performance.

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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.