



Designation: ~~D4438 – 13 (Reapproved 2018)~~^{ε1} D4438 – 24

Standard Test Method for Particle Size Distribution of Catalysts and Catalyst Carriers by Electronic Counting¹

This standard is issued under the fixed designation D4438; 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.

^{ε1} NOTE—Keywords revised editorially in May 2018.

1. Scope

1.1 This test method covers the determination of particle size distribution of catalyst and catalyst carrier (see Terminology [D3766](#)) particles using an electroconductive sensing method and is one of several valuable methods for the measurement of particle size.

1.2 The range of particle sizes investigated was ~~20 to 150 μm~~ 20 μm to 150 μm (see [IEEE/ASTM SI 10](#)) equivalent spherical diameter. The technique is capable of measuring particles above and below this range. The instrument used for this method is an electric current path of small dimensions that is modulated by individual particle passage through an aperture, and produces individual pulses of amplitude proportional to the particle volume.

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

1.4 *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. Referenced Documents

2.1 ASTM Standards:²

[B215 Practices for Sampling Metal Powders](#)

[D1193 Specification for Reagent Water](#)

[D3766 Terminology Relating to Catalysts and Catalysis](#)

[E105 Guide for Probability Sampling of Materials](#)

[E122 Practice for Calculating Sample Size to Estimate, With Specified Precision, the Average for a Characteristic of a Lot or Process](#)

[E177 Practice for Use of the Terms Precision and Bias in ASTM Test Methods](#)

[E456 Terminology Relating to Quality and Statistics](#)

[E691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method](#)

[E1272 Specification for Laboratory Glass Graduated Cylinders](#)

[IEEE/ASTM SI 10 Standard for Use of the International System of Units \(SI\): The Modern Metric System](#)

¹ This test method is under the jurisdiction of ASTM Committee [D32](#) on Catalysts and is the direct responsibility of Subcommittee [D32.02](#) on Physical-Mechanical Properties.

Current edition approved ~~May 1, 2018~~ ^{March 15, 2024}. Published ~~June 2018~~ ^{March 2024}. Originally approved in 1985. Last previous edition approved in ~~2013~~ ²⁰¹⁸ as ~~D4438 – 13~~ ^{D4438 – 13 (2018)}^{ε1}. DOI: ~~10.1520/D4438-13R18E01~~ ^{10.1520/D4438-24}.

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. Summary of Test Method

3.1 A carefully dispersed, dilute suspension of the representative sample in a beaker filled with an electrolyte is placed in the counting position on the instrument sample stand. The suspension is forced through a restricting aperture. Each passing particle is recorded on an electronic counter, and the data are accumulated according to selected particle size intervals for subsequent processing.

3.2 The instrument response is proportional to liquid displacement by the particle volume. Equivalent spherical diameter is commonly used to express the particle size.

4. Significance and Use

4.1 This test method can be used to determine particle size distributions for material specifications, manufacturing control, and research and development work in the particle size range usually encountered in fluidizable cracking catalysts.

5. Apparatus³

5.1 *Electronic Particle Counter*, with sample stand and stirring motor.

5.2 *Aperture Tubes*, with varying diameters. The diameter required is dependent upon the particle size distribution of the sample. Generally, any given tube will cover a particle size range from 22 % to 40 % of its aperture diameter.

5.3 *Ultrasonic Tank*, 100 W.

5.4 *Beaker*, 100-mL.

5.5 *Graduated Glass Pipet*, 5-mL.

5.6 *Wash Bottles*.

5.7 *Membrane Filtering Device* with 0.22- μ m filters. [ASTM D4438-24](#)

<https://standards.iteh.ai/catalog/standards/astm/9f1481e9-db7e-4202-8e76-0fd9492c063c/astm-d4438-24>

5.8 *Round-Bottom Sample Beakers*, 250-mL.

5.9 *Micro-Riffler or Chute Riffler*.

6. Reagents

6.1 *Purity of Reagents*—Reagent grade chemicals shall be used in all tests. Unless otherwise indicated, it is intended that all reagents shall conform to the specifications of the Committee on Analytical Reagents of the American Chemical Society, where such specifications are available.⁴ Other grades may be used, provided it is first ascertained that the reagent is of sufficiently high purity to permit its use without lessening the accuracy of the determination.

6.2 *Purity of Water*—Unless otherwise indicated, references to water shall be understood to mean reagent water conforming to Specification **D1193**, Type II.

6.3 *Electrolyte*—Dissolve 10.0 g of reagent grade sodium chloride (NaCl) in 1 L of distilled or deionized water and filter twice through a 0.22- μ m filter. (See Specification **E1272**)

³ Supporting data have been filed at ASTM International Headquarters and may be obtained by requesting Research Report RR:D32-1011.

⁴ *“Reagent Chemicals, American Chemical Society Specifications,” Am. ACS Reagent Chemicals, Specifications and Procedures for Reagents and Standard-Grade Reference Materials, American Chemical Society, Washington, DC.* For suggestions on the testing of reagents not listed by the American Chemical Society, see *“Analar Standards for Laboratory U.K. Chemicals, Chemicals,”* BDH Ltd., Poole, Dorset, U.K., and the *“United States Pharmacopeia,” United States Pharmacopeia and National Formulary, U.S. Pharmacopeial Convention, Inc. (USPC), Rockville, MD.*