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# Standard Test Method for Vibratory Packing Density of Large Formed Catalyst and Catalyst Carrier Particles<sup>1</sup>

This standard is issued under the fixed designation D4699; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

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<sup>ε1</sup> NOTE—Keywords updated editorially in May 2018.

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## 1. Scope

1.1 This test method covers the determination of the vibratory packing density of formed catalyst and catalyst carrier particles that will not break up significantly under test conditions. For the purpose of this test, catalyst particles are defined as extrudates, spheres or formed pellets greater than 4.8 mm.

1.2 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this 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, 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:*<sup>2</sup>

[B215 Practices for Sampling Metal Powders](#)

[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](#)

## 3. Terminology

3.1 *Definitions*—See Terminology [D3766](#).

<sup>1</sup> 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.

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

## 4. Summary of Test Method

4.1 A known sample of environmentally equilibrated formed catalyst or catalyst carrier particles is vibrated in a graduated cylinder. The vibratory packing density is determined for a specified drying condition.

## 5. Significance and Use

5.1 This test method is used for measuring the vibratory packing density of formed particles used in fixed bed reactors, driers, and so forth.

## 6. Apparatus

6.1 *Graduated Cylinder*, capacity 2000-mL.

6.2 *Vibratory Plate*.<sup>3</sup>

6.3 *Desiccator*, with a desiccant grade molecular sieve such as 4A.

6.4 *Balance*, having a sensitivity of 1.0 g.

6.5 *Balance*, having a sensitivity of 0.1 g.

6.6 *Drying Oven*.

## 7. Sampling

7.1 Test sample(s) shall be obtained from larger composites by riffing or splitting in accordance with subsection 5.12 of STP 447A<sup>4</sup> with the aim of obtaining a representative sample that mirrors the shape and size distribution of the larger composite. Guide E105 provides guidance on constructing a sampling plan and Practice E122 assists the analyst with determining the representative sample size. The analyst is also urged to consult Practice B215 which contains excellent sampling guidance.

## 8. Procedure

8.1 Equilibrate test sample to laboratory environment for 4 h.

8.2 Pour between 1000 to 2000 mL of the test specimen carefully into a tared beaker and weigh to the nearest 1 g. Record as  $W$ .

8.3 Separately weigh to the nearest tenth of a gram about ~~100 g~~ 100 g of additional test sample,  $W_T$ , that will be used for moisture loss. Heat this sample at ~~400 ± 15°C~~ 400 °C ± 15 °C for not less than ~~3 h~~ 3 h. Normally, this treatment can take place in air; however, in the case of materials that might react with air at elevated temperature (such as pre-reduced catalysts) the heat treatment should take place in an inert atmosphere. After heating, cool the test sample in a desiccator or other suitable container to eliminate the possibility of moisture adsorption prior to weighing. Weigh the sample to the nearest tenth of a gram,  $W_H$ .

NOTE 1—The conditions may not be appropriate for all materials.

NOTE 2—Since many catalyst formulations are strong adsorbents, the use of a 4A indicating (cobalt-treated) molecular sieve as a desiccating medium is recommended. The desiccant should be regenerated at ~~220 to 260°C~~ 220 °C to 260 °C, as required.

NOTE 3—Multiple samples can be pretreated but must be desiccated prior to analysis.

8.4 Clamp the cylinder to the vibratory plate (see example Fig. 1).

<sup>3</sup> The sole source of supply of the Syntron Vibrating Machine, Model V-2-B with Power Pulse Controller, known to the committee at this time is FMC Technologies, 57 Cooper Ave., Homer City, PA 15748-9234. If you are aware of alternative suppliers, please provide this information to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee<sup>1</sup>, which you may attend.

<sup>4</sup> Manual on Test Sieving Methods, ASTM STP 447A, ASTM International, 2005.