



Designation: D5757 – 11

# Standard Test Method for Determination of Attrition of FCC Catalysts by Air Jets<sup>1</sup>

This standard is issued under the fixed designation D5757; 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 reappraisal. A superscript epsilon ( $\epsilon$ ) indicates an editorial change since the last revision or reappraisal.

## 1. Scope

1.1 This test method covers the determination of the relative attrition characteristics of FCC catalysts by means of air jet attrition. Other fine powder catalysts can be analyzed by this test method but the precision of this test method has been determined only for FCC catalysts. It is applicable to spherically or irregularly shaped particles which range in size between 10 and 180  $\mu\text{m}$ , have skeletal densities between 2.4 and 3.0  $\text{g}/\text{cm}^3$  (2400 and 3000  $\text{kg}/\text{m}^3$ ) (see [IEEE/ASTM SI-10](#)) and are insoluble in water. Particles less than 20  $\mu\text{m}$  are considered fines.

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

## 2. Referenced Documents

2.1 *ASTM Standards:*<sup>2</sup>

[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](#)

[IEEE/ASTM SI-10 Standard for Use of the International System of Units \(SI\): The Modern Metric System](#)<sup>2</sup>

## 3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *Air Jet Index (AJI)*—a unitless value numerically equal to the percent attrition loss at 5 h.

<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, 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.

## 4. Summary of Test Method

4.1 A sample of dried powder is humidified and attrited by means of three high velocity jets of humidified air. The fines are continuously removed from the attrition zone by elutriation into a fines collection assembly.

4.2 The AJI is calculated from the elutriated fines to give a relative estimate of the attrition resistance of the powdered catalyst as may be observed in commercial use.

## 5. Significance and Use

5.1 This test method is intended to provide information concerning the ability of a powdered catalyst to resist particle size reduction during use in a fluidized environment.

5.2 This test method is suitable for specification acceptance, manufacturing control, and research and development purposes.

## 6. Apparatus

6.1 The air jet attrition system consists of the following:

6.1.1 *Attrition Tube*, a stainless steel tube 710-mm long with a 35-mm inside diameter.

NOTE 1—NPS 1¼-in. pipe, Schedule 40 has the appropriate inside diameter.

6.1.2 *Three 2-mm Long Drilled Sapphire Square Edged Nozzles*, precision drilled  $0.381 \pm 0.005$  mm in diameter. They are mounted equidistant from each other, 10 mm from center and flush with the top surface in a circular orifice plate 6.4-mm thick. The plate is designed to be attached to the bottom of the vertical attrition tube within an air delivery manifold.

6.1.3 *Settling Chamber*, a 300-mm long cylinder with a 110-mm inside diameter and with conical ends reducing to 30-mm inside diameter. The upper cone is approximately 100-mm long and the lower cone is approximately 230-mm long. The chamber is mounted to the top of the attrition tube.

6.1.4 *Fines Collection Assembly*, made up of a 250-mL filtering flask, an extraction thimble connected to the side arms of the flask, and a 200 by 13-mm diameter metal tubing bent to an angle of 125° connecting the top of the flask to the top of the settling chamber.

NOTE 2—The flask may be eliminated and the thimble connected directly to the tubing if the attrition is expected to be low enough to avoid clogging the thimble and creating a backpressure in the settling chamber.