



# Standard Guide for Determination of Specific Surface Area of Advanced Ceramic Materials by Gas Adsorption<sup>1</sup>

This standard is issued under the fixed designation C 1251; 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.

## 1. Scope

1.1 This guide is intended to direct interested investigators to existing ASTM Test Methods that may be useful for determination of surface area of advanced ceramic materials.

1.2 This guide is not intended to endorse any particular test method or methods; nor does it intend to include all existing test methods that may be applicable. It shall be the option of the investigator to judge whether or not one or more of the listed test methods is appropriate for use with the materials of interest.

1.3 All numerical values shall be stated in terms of SI units and shall be considered as standard unless specific instrumentation software reports surface area using alternate units. In this case, both reported and equivalent SI units shall be presented in the final written report. Many instruments report surface area as square metres per gram, instead of using the correct SI units square metre per kilogram.

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:

- C 1069 Test Method for Specific Surface Area of Alumina or Quartz by Nitrogen Adsorption<sup>2</sup>
- D 3037 Test Methods for Carbon Black—Surface Area by Nitrogen Adsorption<sup>3</sup>
- D 3663 Test Method for Surface Area of Catalysts<sup>4</sup>
- D 4365 Test Method for Determining Zeolite Area of a Catalyst<sup>4</sup>
- D 4567 Test Method for Single-Point Determination of Specific Surface Area of Catalysts Using Nitrogen Adsorption by Continuous Flow Method<sup>4</sup>
- D 4820 Test Methods for Carbon Black—Surface Area by

<sup>1</sup> This guide is under the jurisdiction of ASTM Committee C-28 on Advanced Ceramics and is the direct responsibility of Subcommittee C28.05 on Processing and Characterization.

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<sup>2</sup> *Annual Book of ASTM Standards*, Vol 15.02.

<sup>3</sup> *Annual Book of ASTM Standards*, Vol 09.01.

<sup>4</sup> *Annual Book of ASTM Standards*, Vol 05.03.

Multipoint BET Nitrogen Adsorption<sup>3</sup>  
D 1993 Test Method for Precipitated Silica-Surface Area by  
Multipoint BET Nitrogen Adsorption<sup>3</sup>

## 3. Terminology

### 3.1 Definitions:

3.1.1 *guide, n*—a series of options or instructions that do not recommend a specific course of action.

3.1.2 *surface area, n*—the total area of the surface of a powder or solid including both external and accessible internal surfaces (from voids, cracks, open porosity, and fissures).

3.1.2.1 *Discussion*—The area may be calculated by the BET (Brunauer, Emmett, and Teller) equation from gas adsorption data obtained under specific conditions. It is useful to express this value as the specific surface area, for example, surface area per unit weight of sample ( $\text{m}^2/\text{g}$ ).

3.1.3 *surface area (BET), n*—the total surface area of a solid calculated by the BET equation, from nitrogen adsorption or desorption data obtained under specific conditions.

3.1.4 *surface area, specific, n*—the area, per unit mass of a granular or powdered or formed porous solid, of all external plus internal surfaces that are accessible to a penetrating gas or liquid.

3.1.5 Consult definitions in the referenced documents.

## 4. Summary of Referenced Test Methods

4.1 *Test Method C 1069, for Specific Surface Area of Alumina or Quartz by Nitrogen Adsorption*—This test method pertains to the determination of multipoint and single-point specific surface area of aluminas and silicas used in the manufacture of ceramics. This test method is under the jurisdiction of ASTM Committee C-21 on Ceramic Whitewares and Related Products and is the direct responsibility of Subcommittee C 21.07 on Nonplastics.

4.2 *Test Methods D 3037, for Carbon Black—Surface Area by Nitrogen Adsorption*—These test methods pertain to the determination of the single-point specific surface area of carbon blacks. These test methods are under the jurisdiction of ASTM Committee D-24 on Carbon Blacks and are the direct responsibility of Subcommittee D 24.21 on Adsorptive Properties of Carbon Black.

4.3 *Test Method D 3663, for Surface Area of Catalysts*—This test method pertains to the determination of multipoint specific surface area of catalysts that exhibit Type II and Type