



Standard Test Method for Advanced Ceramic Specific Surface Area by Physical Adsorption¹

This standard is issued under the fixed designation C1274; 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 the determination of the surface area of advanced ceramic materials (in a solid form) based on multilayer physisorption of gas in accordance with the method of Brunauer, Emmett, and Teller (BET) (1)² and based on IUPAC Recommendations (1984 and 1994) (2) and (3). This test method specifies general procedures that are applicable to many commercial physical adsorption instruments. This test method provides specific sample outgassing procedures for selected common ceramic materials, including: amorphous and crystalline silicas, TiO₂, kaolin, silicon nitride, silicon carbide, zirconium oxide, etc. The multipoint BET (1) equation along with the single point approximation of the BET equation are the basis for all calculations. This test method is appropriate for measuring surface areas of advanced ceramic powders down to at least 0.05 m² (if in addition to nitrogen, krypton at 77.35 K is utilized as an adsorbent).

1.2 This test method does not include all existing procedures appropriate for outgassing of advanced ceramic materials. However, it provides a comprehensive summary of procedures recommended in the literature for selected types of ceramic materials. The investigator shall determine the appropriateness of listed procedures.

1.3 The values stated in SI units are to be regarded as standard. State all numerical values in terms of SI units unless specific instrumentation software reports surface area using alternate units. In this case, provide both reported and equivalent SI units in the final written report. It is commonly accepted and customary (in physical adsorption and related fields) to report the (specific) surface area of solids as m²/g, and, as a convention, many instruments (as well as certificates of reference materials) report surface area as m² g⁻¹, instead of using SI units (m² kg⁻¹).

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:³

D1993 Test Method for Precipitated Silica-Surface Area by Multipoint BET Nitrogen Adsorption

E177 Practice for Use of the Terms Precision and Bias in ASTM Test Methods

2.2 ISO Standards:⁴

ISO 9277 Determination of specific surface area of solids by gas adsorption using the BET method

ISO 15901-2:2006 Pore size distribution and porosity of solid materials by mercury porosimetry and gas adsorption - Part 2 Analysis of mesopores and macropores by gas adsorption

ISO 8213:1986 Chemical products for industrial use - Sampling techniques-Solid chemical products in the form of particles varying from powders to coarse lumps

ISO 18757 Fine ceramics (advanced ceramics, advanced technical ceramics) – Determination of specific surface area of ceramic powders by gas adsorption using the BET method

3. Terminology

3.1 Definitions:⁵

3.1.1 *adsorbate, n*—material that has been retained by the process of adsorption.

3.1.2 *adsorbent, n*—any solid having the ability to concentrate significant quantities of other substances on its surface.

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 Non-Destructive Evaluation.

Current edition approved Aug. 1, 2012. Published November 2012. Originally approved in 1994. Last previous edition approved in 2010 as C1274 – 10. DOI: 10.1520/C1274-12.

² The boldface numbers in parenthesis refer to the list of references at the end of this standard.

³ 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 Available from International Organization for Standardization (ISO), 1, ch. de la Voie-Creuse, Case postale 56, CH-1211, Geneva 20, Switzerland, <http://www.iso.ch>.

⁵ *Compilation of ASTM Standard Terminology*, 8th ed, 1994.

*A Summary of Changes section appears at the end of this standard