



Standard Test Method for Metal Powder Specific Surface Area by Physical Adsorption¹

This standard is issued under the fixed designation B 922; 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 determination of surface area of metal powders. The test method specifies general procedures that are applicable to many commercial physical adsorption instruments. The method provides specific sample outgassing procedures for listed materials. It includes additional general outgassing instructions for other metals. The multipoint equation of Brunauer, Emmett and Teller (BET)², along with the single point approximation of the BET equation, forms the basis for all calculations.

1.2 This test method does not include all existing procedures appropriate for outgassing metallic materials. The procedures included provided acceptable results for samples analyzed during interlaboratory testing. The investigator shall determine the appropriateness of listed procedures.

1.3 This method uses SI units as standard. State all numerical values in terms of SI units unless specific instrumentation software reports surface area using alternate units. In this case, present both reported and equivalent SI units in the final written report. Many instruments report surface area as m^2/g , instead of using correct SI units (m^2/kg).

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:

B 215 Practices for Sampling Finished Lots of Metal Powders³

B 243 Definitions of Terms Used in Powder Metallurgy³

E 691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method⁴

3. Terminology

3.1 *Definitions*—Refer to Terminology B 243 for additional terms specific to metal powders.

3.2 *Definitions of Terms Specific to This Standard:*⁵

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

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

3.2.3 *adsorption, n*—a process in which fluid molecules are concentrated or collected on a surface by chemical or physical forces, or both.

3.2.4 *adsorptive, n*—any substance available for adsorption.

3.2.5 *outgassing, n*—the evolution of gas from a material in a vacuum or inert gas flow, at or above ambient temperature.

3.2.6 *physical adsorption (van der Waals adsorption), n*—the binding of an adsorbate to the surface of a solid by forces whose energy levels approximate those of condensation.

3.2.7 *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). 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 mass of sample (m^2/kg).

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

3.2.9 *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.

4. Summary of Test Method

4.1 An appropriately sized sample (to provide at least the minimum surface area required for reliable results for the instrument used) is outgassed under appropriate conditions prior to analysis.

¹ This test method is under the jurisdiction of ASTM Committee B09 on Metal Powders and Metal Powder Products and is the direct responsibility of Subcommittee B09.03 on Refractory Metal Powders.

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² Brunauer, S., Emmett, P. H., and Teller, E. "Adsorption of Gases in Multimolecular Layers." *Journal of the American Chemical Society*, Vol. 60, 1938, pp. 309-319.

³ *Annual Book of ASTM Standards*, Vol 02.05.

⁴ *Annual Book of ASTM Standards*, Vol 14.02.

⁵ ASTM. *ASTM Dictionary of Engineering, Science, and Technology*, 9th ed. West Conshohocken, PA: ASTM, 2000.