



Standard Test Method for Surface Area of Catalysts and Catalyst Carriers¹

This standard is issued under the fixed designation D3663; 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 surface areas of catalyst and catalyst carriers that have Type II or IV nitrogen adsorption isotherms, and at least 1 m²/g of area. A volumetric measuring system is used to obtain at least four data points which fit on the linear BET² equation line.

1.2 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

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:³

D3766 Terminology Relating to Catalysts and Catalysis

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

3. Terminology

3.1 Consult Terminology D3766 for definitions of other terms used.

3.2 Definitions:

3.2.1 *surface area of a catalyst*—the total surface of the catalyst. It is expressed in square metres per gram.

3.3 Symbols:

¹ This test method is under the jurisdiction of ASTM Committee D32 on Catalysts and is the direct responsibility of Subcommittee D32.01 on Physical-Chemical Properties.

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² Brunauer, Emmett, Teller, *Journal of American Chemical Society*, JACS, No. 60, 1938, p. 309.

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.

P_{H_1}	= initial helium pressure, torr
P_{H_2}	= helium pressure after equilibration, torr
T_{H_1}	= temperature of manifold at initial helium pressure, °C
T_{H_2}	= temperature of manifold after equilibration, °C
P_1	= initial N_2 pressure, torr
T_1	= manifold temperature at initial N_2 pressure, K
T_1'	= manifold temperature at initial N_2 pressure, °C
P_2	= pressure after equilibration, torr
P_0	= liquid nitrogen vapor pressure, torr
T_s	= liquid nitrogen temperature, K
X	= relative pressure, P_2/P_0
V_d	= volume of manifold, cm ³
V_x	= extra volume bulb, cm ³
V_s	= dead-space volume, cm ³
W_s	= mass of sample, g
W_1	= tare mass of sample tube, g
W_2	= sample + tare mass of tube, g
V_{ds}	= volume of nitrogen in the dead-space, cm ³
V_1	= see 10.4.4
V_2	= see 10.4.6
V_t	= see 10.4.7
V_a	= see 10.4.9
V_m	= see 10.8
T_{1x}	= initial extra-volume bulb temperature, K
$T_{1x}(i)$	= initial extra-volume bulb temperature, °C
T_{2x}	= extra-volume bulb temperature after equilibrium, K
$T_{2x}(i)$	= extra-volume bulb temperature after equilibrium, °C

4. Summary of Test Method

4.1 The surface area of a catalyst or catalyst carrier is determined by measuring the volume of nitrogen gas adsorbed at various low-pressure levels by the catalyst sample. Pressure differentials caused by introducing the catalyst surface area to a fixed volume of nitrogen in the test apparatus are measured and used to calculate BET surface area.

5. Apparatus⁴

5.1 A schematic diagram of the apparatus is shown in Fig. 1. It may be constructed of glass or of metal. It has the following features:

⁴ Automated equipment is commercially available.