



Designation: D4780 – 23

Standard Test Method for Determination of Low Surface Area of Catalysts and Catalyst Carriers by Multipoint Krypton Adsorption¹

This standard is issued under the fixed designation D4780; 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 specific surface area of catalysts and catalyst carriers in the range from 0.05 m²/g to 10 m²/g. A volumetric measuring system is used to obtain at least three data points which fall within the linear BET region.

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:*²

D3663 Test Method for Surface Area of Catalysts and Catalyst Carriers

D3766 Terminology Relating to Catalysts and Catalysis

E105 Guide for Probability Sampling of Materials

E122 Practice for Calculating Sample Size to Estimate, With Specified Precision, the Average for a Characteristic of a Lot or Process

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 *Definitions*—Consult Terminology D3766.

3.2 *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 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_{H1}	= initial helium pressure, torr.
P_{H2}	= helium pressure after equilibration, torr.
T_{H1}	= temperature of manifold at initial helium pressure, °C.
T_{H2}	= temperature of manifold after equilibration, °C.
P_1	= initial Kr pressure, torr.
T'_1	= manifold temperature at initial Kr pressure, K.
T_1	= manifold temperature at initial Kr pressure, °C.
P_2	= Kr pressure after equilibration, torr.
T'_2	= manifold temperature at P_2 , K.
T_2	= manifold temperature at P_2 , °C.
$P_{o,N}$	= liquid nitrogen vapor pressure, torr.
$P_{o,krypton}$	= calculated krypton vapor pressure, torr.
T'_s	= liquid nitrogen temperature, K.
X	= relative pressure, $P_2/P_{o,krypton}$.
V_d	= volume of manifold, cm ³ .
V_s	= the apparent dead-space volume, cm ³ .
W_s	= weight of sample, g.
W_1	= tare weight of sample tube, g.
W_2	= weight of sample plus tare weight of tube, g.
V_{ds}	= volume of krypton in the dead space, cm ³ .
V_1	= See 12.3.5.
V_2	= See 12.3.6.
V_f	= See 12.3.7.
V_a	= See 12.3.9.
V_m	= See 12.6.

4. Summary of Test Method

4.1 A catalyst or catalyst carrier sample is degassed by heating in vacuum to remove absorbed vapors from the surface. The quantity of krypton adsorbed at various low pressure levels is determined by measuring pressure differentials after introduction of a fixed volume of krypton to the sample at liquid nitrogen temperature. The specific surface area is then calculated from the sample weight and adsorption data using the BET equation.

5. Significance and Use

5.1 This test method has been found useful for the determination of the specific surface area of catalysts and catalyst carriers in the range from 0.05 m²/g to 10 m²/g for materials specification, manufacturing control, and research and development in the evaluation of catalysts. The determination of