



Standard Test Method for Determining Micropore Volume and Zeolite Area of a Catalyst¹

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1. Scope

1.1 This test method covers the determination of total surface area and mesopore area. From these results are calculated the zeolite area and micropore volume of a zeolite containing catalyst. The micropore volume is related to the percent zeolite in the catalyst. The zeolite area, a number related to the surface area within the zeolite pores, may also be calculated. Zeolite area, however, is difficult to interpret in physical terms because of the manner in which nitrogen molecules pack within the zeolite.

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.* For a specific precautionary statement, see [Note 3](#).

2. Referenced Documents

2.1 ASTM Standards:²

[D3663 Test Method for Surface Area of Catalysts and Catalyst Carriers](#)

[D3906 Test Method for Determination of Relative X-ray Diffraction Intensities of Faujasite-Type Zeolite-Containing Materials](#)

[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](#)

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.

3. Terminology

3.1 Definitions of Terms Specific to This Standard:

3.1.1 *mesopore (matrix) area of a catalyst*—the area determined from the slope of the t-plot.

3.1.2 *micropore volume of the catalyst*—the pore volume in pores having radii less than 1 nm, usually associated with the zeolite portion of the catalyst, and determined from the intercept of the t-plot.

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

3.1.4 *zeolite area of a catalyst*—the difference between total surface area and mesopore area.

3.2 Symbols:

P_{H_1}	= initial helium pressure, torr
P_{H_2}	= helium pressure after equilibration, torr
S_B	= slope of BET plot, 11.7
I_B	= intercept of BET plot, 11.7
S_t	= slope of t-plot, 11.13
I_t	= intercept of t-plot, 11.13
T_{H1}	= temperature of manifold at initial helium pressure, °C
T_{H2}	= temperature of manifold after equilibration, °C
$T_x'(i)$	= extra volume bulb temperature, °C
$T_x(i)$	= extra volume bulb temperature, K
$P_1(i)$	= initial N_2 pressure, torr
$T_1(i)$	= manifold temperature at initial N_2 pressure, K
$T_1'(i)$	= manifold temperature at initial N_2 pressure, °C
$P_2(i)$	= pressure after equilibration, torr
$T_2(i)$	= manifold temperature after equilibration, K
$T_2'(i)$	= manifold temperature after equilibration, °C
$P_0(i)$	= liquid nitrogen vapor pressure, torr
$T_s(i)$	= 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	= effective void volume, cm^3
W_s	= weight of sample, g
W_t	= tare weight of sample tube, g
W_2	= weight of sample + tare weight of tube, g
V_{ds}	= volume of nitrogen in the dead-space, cm^3
V_1	= see 11.4.3