Average Fiber Diameter Analyzer

Applications

Performance of many fibrous products such as filter media, membranes, battery parts, and household products is determined primarily by factors such as fiber diameter and packing density. For many applications quick estimation of the average fiber diameter is required. The techniques that are used for fiber diameter measurements are often involved and time consuming. The PMI's completely automated average fiber diameter analyzer has the unique ability to measure average fiber diameter of bulk samples in a few minutes. It is used in industry for production control, quality control, and performance evaluation.

Principles of Operation

The flow rates of gas through the sample as a function of differential pressure are accurately measured and these results are used to compute average fiber diameter on the basis of the relationship reported by C.N. Davies. (C.N. Davies, The Separation of Airborne Dust and Particles, Proceedings of the Institute of Mechanical Engineers, London, 1B, 1952, pp.185-194).

According to Darcy's law, the permeability, k of a porous material to a gas is given by:

$$(F \mu \; l)/(A \Delta p) = k$$

where F is volume flow rate through the material at average pressure, A is area of the sample, μ is viscosity of gas, Δp is differential pressure, and l is thickness of sample. Models of gas flow through fibrous materials suggest that permeability, k is a function of square of fiber diameter, R, and packing density, c. Packing density is fractional volume occupied by fibers and is equal to (1-P), where P, the porosity, is the fractional pore volume. Davies has shown that the following relationship holds for a wide variety of fibrous materials in which the porosity P is in the range, 0.7 - 0.99.

$$(4 \Delta p \, A \, R^2)/(\mu F l) = 64 \, c^{1.5} [1 + 52 \, c^3]$$
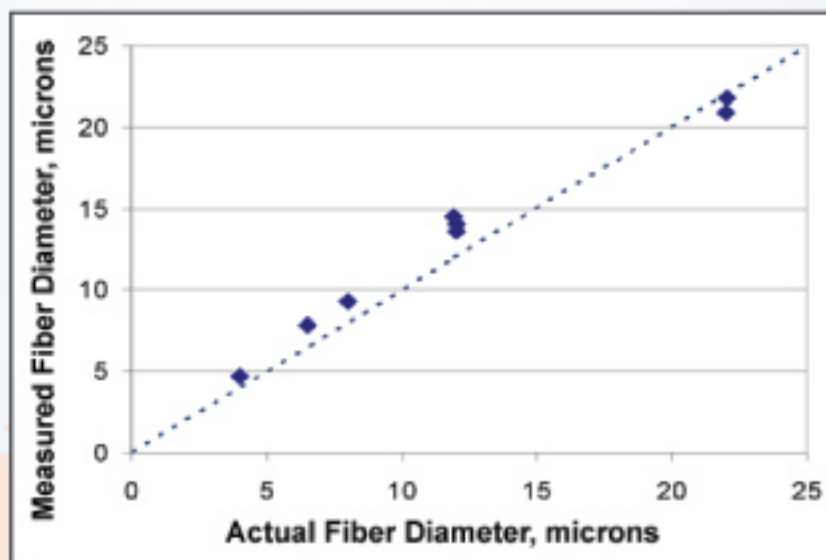
Measured fiber diameters plotted against the actual fiber diameters

Average fiber diameter by permeability technique.			
Nonwoven	Porosity, P	Actual fiber diameter, microns	Measured fiber diameter, microns
#1	0.79	4.0	4.7
#2	0.79	6.5	7.8
#3		8.0	9.3
#4	0.77	12	14.0
#5	0.74	22	21.3

Other Products

Average Fiber Diameter Analyzer
Bubble Point Tester
Capillary Flow Porometer
Capillary Condensation Flow Porometer
Complete Filter Cartridge Analyzer
Clamp-On Porometer
Compression Porometer
Custom Porometer
Cyclic Compression Porometer
Envelope Surface Area Analyzer
Filtration Media Analyzer
High Flow Porometer
Integrity Analyzer

In-Plane Porometer
Microflow Porometer
Nanopore Flow Porometer
QC Porometer
Diffusion Permeameter
Gas Permeameter
Liquid Permeameter
Vapor Permeameter
Water Vapor Transmission Analyzer
Liquid Extrusion Porosimeter
Mercury/Nonmercury Intrusion Porosimeter
Vacuapore
Water Intrusion Porosimeter (Aquapore)

BET Liquisorb
BET Sorptometer
Gas Pycnometer
Mercury Pycnometer

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