



Advanced Macro/ Micro/ Nano Porometer *MMN-1500A*

DESCRIPTION

The new PMI Advanced Macro-Micro-Nano Porometer combines the of the benefits of our Capillary Flow Porometer and our Liquid-Liquid Porometer conveniently into one product. The machine yields objective, accurate and reproducible results, considerably reduces test duration, and requires minimal operator involvement. Advanced Porometers are fully automated and are designed for linear turbulence-free test has flow. Trusted PMI porometers, like the Advanced Macro-Micro-Nano Porometer, have been used for R&D and quality control in many industries worldwide for over 3 decades.

PRINCIPLE OF POROMETRY

A wetting liquid is allowed to spontaneously fill the pores in the sample and a nonreacting gas is allowed to displace liquid from the pores. The gas pressure and flow rates through wet and dry samples are accurately measured. The gas pressure required to remove liquid from the pores and cause gas to flow is given by the following equation:

$$D = 4 \gamma \cos \theta / p$$

Where:

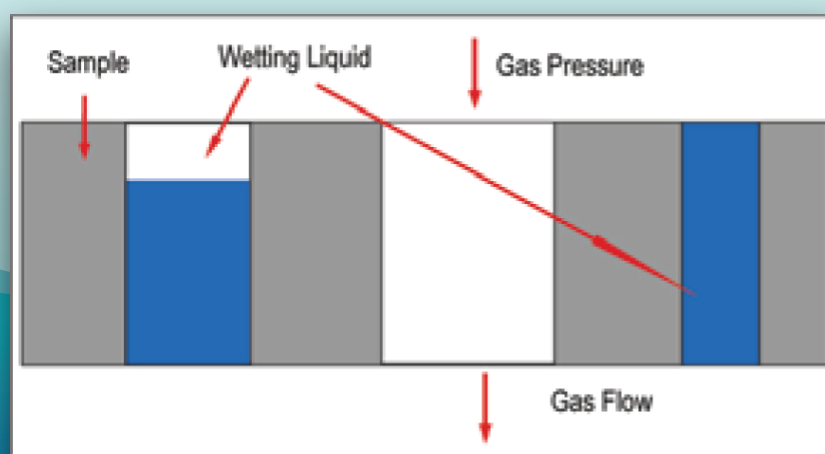
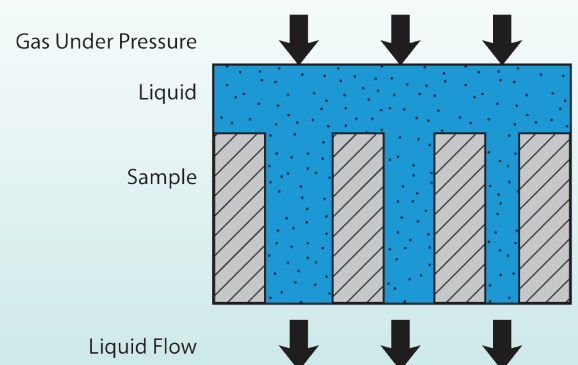
D = pore diameter

γ = surface tension of liquid

θ = contact angle of liquid

p = differential gas pressure

From measured pressure and flow rates, the pore throat diameters, pore size distribution, and gas permeability are calculated.

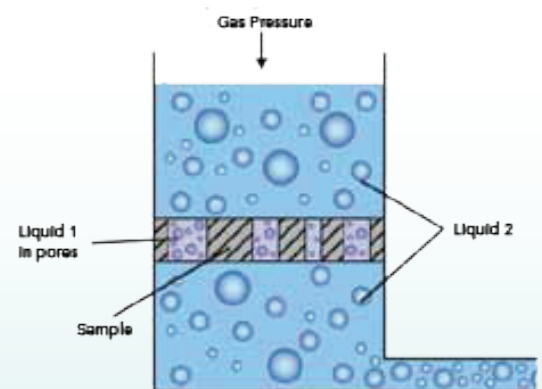


APPLICATIONS

This sophisticated instrument has found applications in a wide variety of industries including (but not limited to) Pharmaceutical, Biotechnology, Healthcare, Household, Food, Hygienic Products, Fuel Cell, Water Purification, and Battery. Samples often tested include filter media, membranes, paper, powders, ceramics, battery separators, textile, and health care products. It is capable of measuring a wide variety of pore characteristics such as pore diameter, pore distribution and liquid flow rate. The Advanced Macro-Micro-Nano Porometer is also designed to calculate pore structure of materials having a wide spectrum of pore sizes from relatively large to relatively small (please see specifications section for further details).

TESTING PROCEDURE

Two immiscible & saturated wetting liquids such as silwick and alcohol are taken. Pores are filled with silwick and alcohol is pressurized to displace the silwick and flow through the pores. Automatic addition of wetting liquid greatly reduces test time. The amount of liquid flowing out is measured in balance. Alcohol flow rate and differential pressure are measured. Because surface tension of silwick and alcohol are low, contact angles are taken as zero. Mean flow pore diameter and pore distribution are computed like CFP.



TESTING CAPABILITIES

- Diameter of the most constricted part of a through pore (pore throat)
- Mean flow pore diameter (50% of flow is through pores smaller than the mean flow pore diameter range)
- Pore distribution:

$$f = -d[(f_w/f_d) \times 100] / dD$$

Where:

f_w = flow rate through wet sample

f_d = flow rate through dry sample

PMI SOFTWARE

We work closely with our customers to provide the most user friendly software for porometry. PMI Capwin software is updated to meet customer needs & requirements. The comprehensive software can be used for all PMI porometers. The software is customized to offer convenient operation with default setting for beginners & full access to all relevant measuring parameters for advanced researchers:

- Capwin user manager for comprehensive user management regarding user access, control & assignment of specific jobs
- On line diagnostic from anywhere in the world
- Links to data Bases (SAP, Lims, etc.)
- User defined definitions of paths & sub directories for data filling Component:
- Capwin manages manual instrument control, automated measuring routines ("jobs") and report print out or graph
- Capwin Data manager for interactive evaluation of measured data as well as providing sophisticated tools for creating reports & generating templates for graphs, tables & screen views

Name	Value
Gauge Zeroing Time	5.0
LP Filling Time	7.0
LP Filling Level	85.0
LP Reading Delay Time	5.0
LP Minimum Reading Time	6.0
LP Maximum Reading Time	16.0
LP Maximum Reading Volume Change	12.0
LP Maximum Test Volume Change	70.0
LP Maximum Number of Data Points	300
LP Pressure Step Mode	1
LP constant k in Mode 4	0.05
LP Sensitivity in Mode 3	5.0
LP Beginning Pressure for Mode 1 and 4	0.0
LP Ending Pressure for Mode 1 and 4	120.0
LP Increment Pressure for Mode 1 and 4	0.5
Equilibrium Time	10.0
Target Pressure Tolerance	1.0
Head Pressure	0.0
Drain Time	20.0
Compression Pressure	150.0
Air Line	500
Ramp Pressure Rate	1.0

Description:
The increment pressure for Mode 1 and 4, specified by user

Apply Cancel

Style number: Sample ID
Operator ID: PMI
Lot Number:

Sample Diameter (cm): 0.545
Thickness (cm): 0.02
BP Fluid Name: IPA
Interfacial Tension (dynes/cm): 4.6

BP Detection Method: Detect F/PT Detect Delta F/PT
Tortuosity Factor: Default (0.715) User Defined:

Test Fluid Name: Galwick
Fluid Density (gm/cc): 0.973
Wetting Fluid Name: IPA

Data File:
C:\Users\PC 1\Desktop\Testing\7-16\Sample-Name.txt

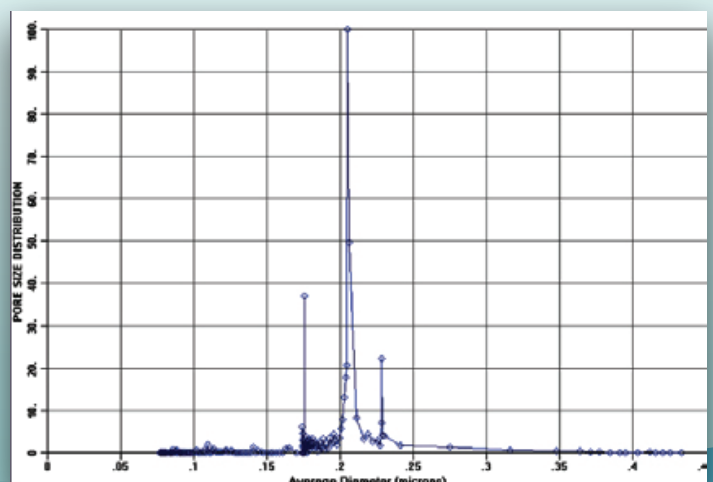
Select
Edit Test Parameters Load Test Parameters Set Up Pressure
Start Test

UNIQUE FEATURES

- Pore diameters down to 2 nanometers are measurable
- Application for Ultra Filtration and Nano Filtration
- Mercury Free, Non-destroy testing
- Very low liquid permeability measured
- Fully automated, user friendly operation

TESTING REPORTS

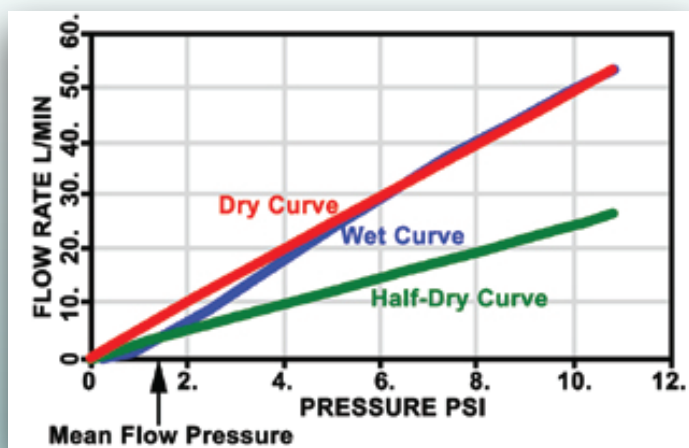
- 1) Single File Analysis
- 2) Multiple File Analysis, can graph up to 11 data sets simultaneously
- 3) Porometry Text Report and graph
- 4) Permeability Text Report and Graph (for Darcy, Gurley, Frazier, Rayl calculations)
- 5) Porometry Summary Report:
 - a) Flow Rate vs. Pressure
 - b) Cum. Filter Flow vs. Diameter
 - c) Pore Size Distribution
 - d) Pore Size Distribution vs. Diameter
 - e) Pore Size Distribution and Cum. Filter Flow
 - f) Frequency Distribution and Cum. Filter Flow
 - g) Frequency Distribution (Log Scale)
 - h) Cumulative and Differential Filter Flow



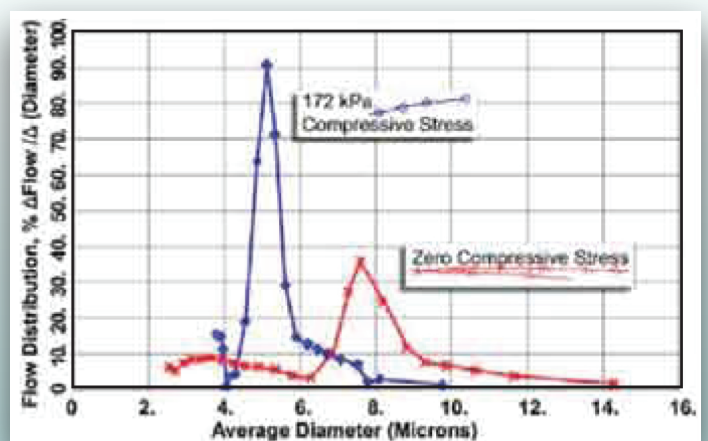
Pore size distribution vs average diameter (PTFE Membrane 0.1 um)

OPTIONAL CAPABILITIES

- Liquid Permeability: Measures liquid flow rate through the sample when pressure is applied on excess liquid on the sample. Volume of liquid measured using a pentrometer
- Pressure hold test
- Hydro-head (break through pressure) test
- Integrity test
- Envelope surface area, average particle size and average fiber diameter obtained from gas flow rate through dry sample
- Multiple sample chamber
- Sheffield smoothness tester
- Burst pressure test
- Use of strong chemicals as working fluid like KOH solution and saline solution
- Elevated temperature test up to 200°C
- Upgrades for:
 - Characterization of in-plane pores
 - Characterizing very low permeability samples
 - Sample under compression during test



Wet, Dry, and Half Dry Curves



Effects of Compressive Stress on Pore Distribution

FEATURES

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SPECIFICATIONS

- Pressure Range: 0 - 500 psi
- Pressure Accuracy: .15% of reading
- Pore Size Range: 2 nanometers - 500 microns
- Resolution: 1 in 60,000
- Flow Resolution: 0.0001 cc/min
- Flow Rate: Up to 200 SLPM (liters per minute)
- Sample Geometry: Sheets, rods, tubes, hollow fibers, cartridges, powders
- Sample Size:
Standard: 0.25_ - 2.5_ diameter (up to 1.5_ thick)
Standard: 5 mm - 60 mm diameter (up to 40 mm thick)
Others available

SALES & SERVICE

Our sales team is dedicated to helping our customers find which machine is right for their situation. We also offer custom machines for customers with unique needs. To find out what we can do for you, contact us. We are committed to customer support including specific service products, short response times & customer specific solutions. To quickly & flexibly meet our customer's requirement, we offer a comprehensive range of services.



*Customize your Machine
Today*

The most advanced, accurate, easy to use
and reproducible Porometers in the world.

Celebrating



of solutions



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