



CAPILLARY FLOW POROMETER *CFP-1500AL*

Not just products... solutions.

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

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

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.

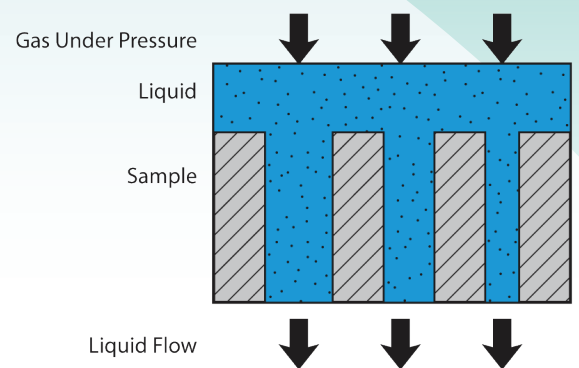


Figure 1
Principle of liquid permeability test

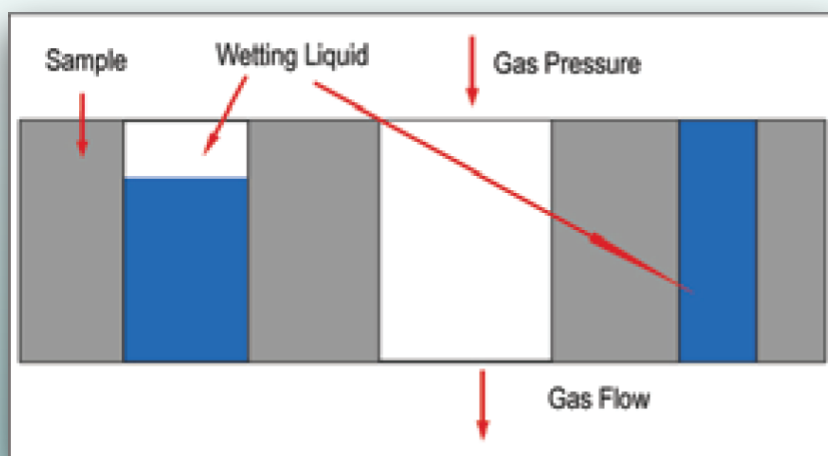


Figure 2
Basic principle behind analyzing pore structure

APPLICATIONS

Advanced Capillary Flow Porometers yield very objective, accurate and reproducible results, considerably reduce test duration, and require minimal operator involvement. Advanced Porometers are fully automated and are designed for linear turbulence-free test gas flow. The pressure is measured close to the sample and therefore, the correction term in the differential pressure measurement is minimized. Required amount of pressure is uniformly applied on the o-ring seals on the sample and the need for hand tightening the cap on the sample chamber to apply pressure on the o-ring is eliminated. Automatic addition of wetting liquid reduces test time appreciably. This sophisticated instrument has found applications in a wide variety of industries.

UNIQUE ADVANTAGES

- Turbulence free test gas is introduced through a hollow piston rod (shaft)
- Pneumatically opened piston cylinder arrangement is used to uniformly apply desired pressure on o-rings
- The pressure transducer measures pressure close to the sample so the pressure drop correction is minimized
- Measured amounts of wetting liquid are automatically added to the samples at the desired time during the rest so that the same amount of wetting liquid is added each time, which makes the tests more accurate
- Easier to use
- More reproducibility - the sample never moves during the test as everything is automated
- Allows testing of flat membranes and hollow Fibers

UNIQUE FEATURES

- Liquid Permeability Function is by Weight method
- No need to undo the sample chamber assembly for wetting the sample
- Considerable reduction in test duration
- The sample is not disturbed during wetting
- Exactly the same area is tested
- Results are more accurate and reproducible
- The sample chamber at the bottom of the piston rod contains o-rings on the outside (circumference) to prevent leak between the insert and the sample housing of the sample chamber
- The sample chamber prevents sideways leak through thick samples because of circumferential o-rings
- Inserts with different opening sizes allow different size samples to be tested
- The need for cutting samples for testing is eliminated with the use of spacers so that damage of the test material is eliminated and test time is further reduced

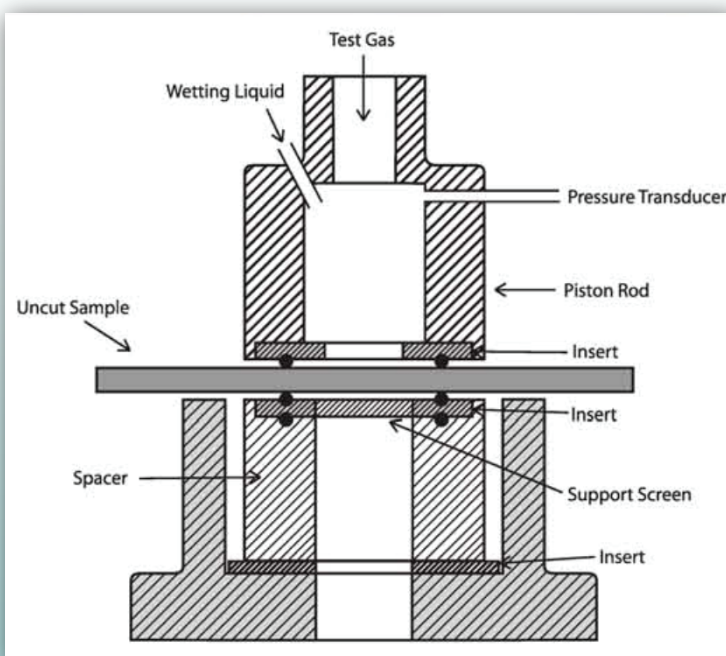


Figure 3
Sample Chamber

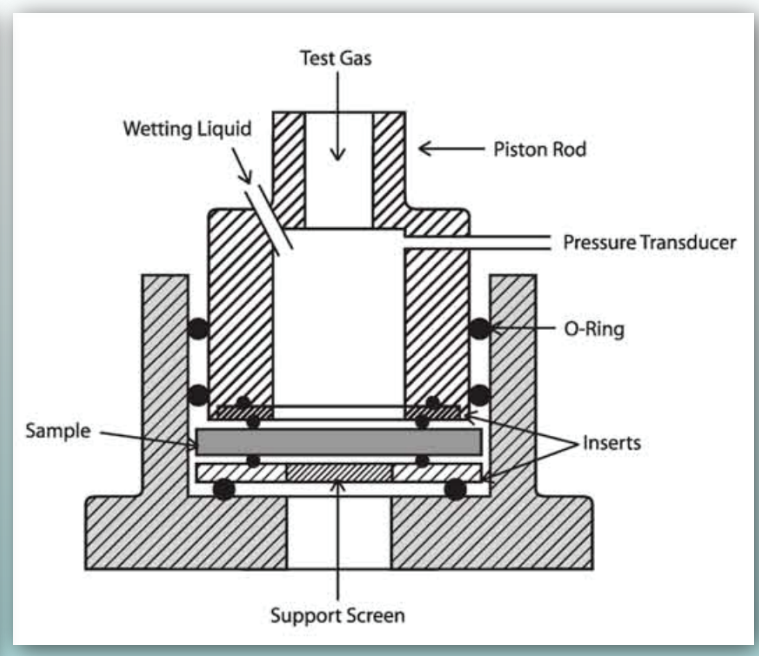


Figure 4
Sample Chamber with Spacer

FEATURES

- Testing of small samples as well as complete parts
- Any sample geometry (Example: sheets, rods, tubes, hollow fibers, cartridges, & powders)
- Any nonwetting liquid
- Tests in QC, research, or any number of user defined modes
- See-through sample chamber for visual observation of test available
- Real time graphic display
- Window based software for all control, measurement, data collection, data reduction, and report preparation

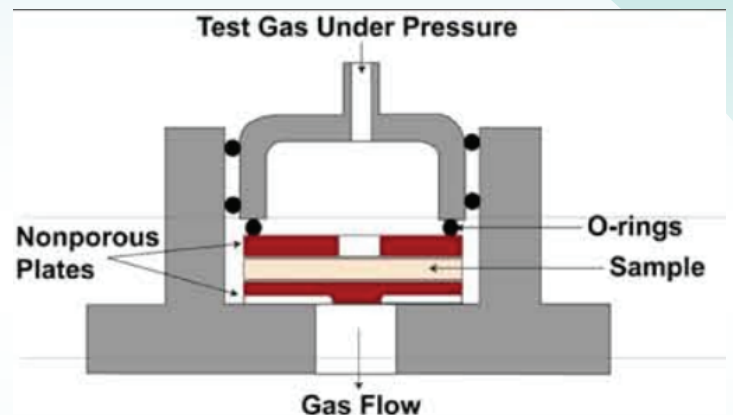


Figure 5

In-Plane Pore Structure Measurement

CAPABILITIES

- Diameter of the most constricted part of a through pore (pore throat)
- Bubble Point (the largest through pore throat diameter)
- Mean flow pore diameter (50% of flow is through pores smaller than the mean flow pore)
- Pore diameter range
- Pore distribution: $f = -d[(f_w/f_d) \times 100] / dD$
 - f_w = flow rate through wet sample
 - f_d = flow rate through dry sample
- Gas Permeability in many desired units including Frazier, Gurley, Rayl, and Darcy

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 penetrometer
- 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
- 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

Additional function:

- P Pneumatic clamp-on device
- X Extended Range (Extra Pressure Gauge): up to 4 set pressure gauge
- E Extended Accuracy (Extra Flow Meter): up to 4 set Flow meter
- I Integrity Test
- S Surface Area/ Fiber Diameter
- CR Chemical Resistance Option (KOH)
- L Liquid Permeability (Penetrometer Type)
- ALD Automated Wetting Liquid Dispenser
- TL High Temperature for Liquid Permeability
- TG High Temperature for Gas Permeability
- F Frazier Permeability
- G Gurley Permeability
- R Rayles Permeability
- M Sheffield Smoothness Test
- N In-Plane
- CC Cyclic Compression Test
- C Compression Test
- HC Bubblers with Humidity Control
- B Burst Pressure Test
- H Hydrohead Test
- D Microflow (Low Flow)
- HF High Flow (up to 10,000 L/min)

SPECIFICATIONS

- Liquid Permeability Function is by Weight method
- Pore Size Range: 13 nM - 500 microns
- Permeability Range: 1×10^{-10} , 1×10^{-6} (Micro Flow in cc/sec/m/torr)
- Pressure Accuracy: 0.15% of reading
- Maximum Pressure: 500 psi
- Pressure Transducer Range: 0 - 500 psi
- Pressure & Flow Resolution: 1/20,000 of full scale
- Mass Flow Transducer Range: 10 cc/min - 500 L/min
- Flow Rates: 200 LPM
- Sample Size: 0.45" - 2.5" diameter
- Standards: Meets ASTM F316
- Sample Geometry: Sheets, Rods, Tubes, Hollow Fibers, Cartridges, Powders

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



Head Office

20 Dutch Mill Rd, Ithaca, NY 14850, USA

Toll Free (US & Canada): 1-800-TALK-PMI (1-800-825-5764)

Phone: 607-257-5544 Fax: 607-257-5639

Email: info@pmiapp.com

www.pmiapp.com

Regional Office

Kevin Ku

6F, No.12, Jin Zhou St.,
Taipei City, Taiwan, R.O.C.