



Permeameters

Gas & Liquid



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Applications

Permeameters measure:

- Liquid Permeability
- Gas Permeability
- Microflow Permeability
- Diffusion Permeability
- Water Vapor Transmission rate

Permeameters are used in many industries such as chemical, biotech, pharmaceutical, food, beverage, fuel cells, batteries, and pollution control. Materials tested in permeameters include membranes, ceramics, filter media, sintered metal filters, hydrogels, paper, textiles, battery separators, powder beds, electrodes, foams, sponges, and pen tips.

Principle

Permeameters measure fluid flow rates. The measured flow rates are expressed in liters per minute (LPM) or any other desired unit. Flow rate is often used to compute permeability defined by Darcy's Law:

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

The flow at average pressure (F) per unit area (A) of the sample per unit pressure gradient ($\Delta p / l$) across the sample is defined as the ratio of permeability (k) of the samples and viscosity (μ) of the fluid. The cgs unit of permeability is cm^2 . Permeability is often given in terms of Darcy, Fraizer, Gurley, or Rayle.

Liquid Permeameter

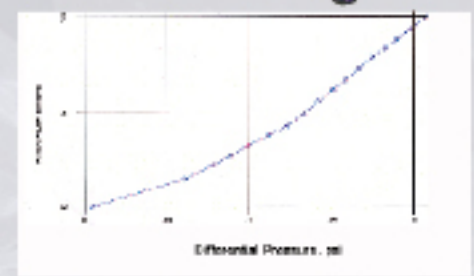
Instrument

Liquid from a penetrometer tube is forced through the sample. The Differential pressure on the liquid across the sample and the flow rate of the liquid are measured. Pressure is measured by a pressure transducer and liquid flow is measured by the penetrometer.

The fully automated instrument executes tests, acquires data, stores data, and displays data in the desired unit. Windows based operation of the instrument is simple.

Operational Features

- Permeability of a variety of chemicals like phosphoric acid, oil, salt solutions, fat, and body fluids.
- Multiple Sample Chambers for high volume testing
- Measurement at high pressures
- Measurement at elevated temperatures up to 200° C
- Permeability through sample under compression
- Sample chamber that does not require samples to be cut out from the bulk sample



Permeability of KOH solution

Microflow Liquid Permeameters

Instrument

A Microflow liquid permeameter is a liquid permeameter that uses a programmable microbalance to accurately measure a small amount of liquid that may permeate through the sample.

Gas Permeameters

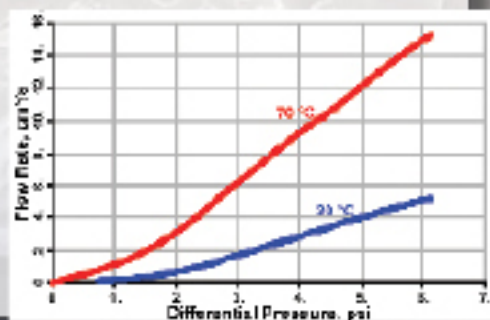
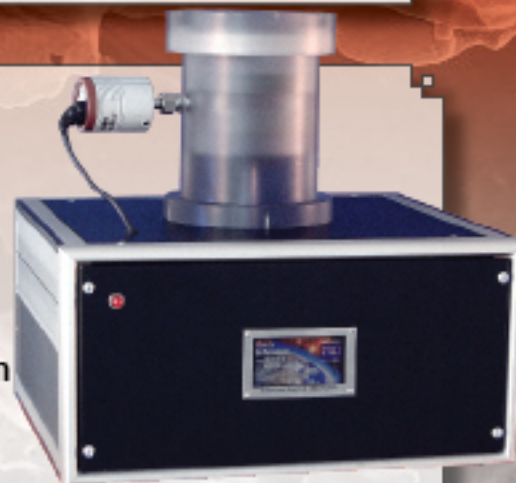
Instrument

Gas under pressure is forced through the sample. The differential pressure and the flow rate of the gas are measured with pressure and flow transducers.

The fully automated instrument executes test, acquires data, stores data, and displays data in the desired unit. Windows based operation of the instrument is simple.

Optional Features

- Permeability of a wide variety of gases
- Multiple sample chamber for high volume testing
- Measurement at high pressures
- Measurement at elevated temperatures
- Sample chamber that does not require samples to be cut out
- Permeability through sample under compression



Microflow Gas Permeameters

Instrument

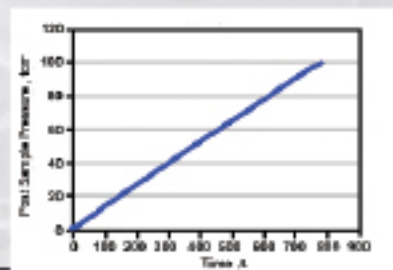
Gas permeameters cannot measure gas flow rate accurately when the flow rate through the sample is low. Such samples can be examined by microflow permeameters. In these instruments gas is brought to the inlet side of the sample at a known pressure and the increase in pressure on the outlet side is measured. The gas flow rate F at STP is computed from the following relation:

$$F = (T_g V / T_p s) (dp/dt)$$

Where V is volume of the outlet chamber, p_s is the standard pressure, (dp/dt) is the rate of pressure increase in the outlet chamber, the test temperature is T , the standard temperature is T_g . The instrument is fully automated. It can have many optional features.

Optional Features

- Microflow permeability can be part of capillary flow porometry
- Measurement at elevated temperatures
- Measurement while sample is under compressive stress
- A wide variety of test gases can be used

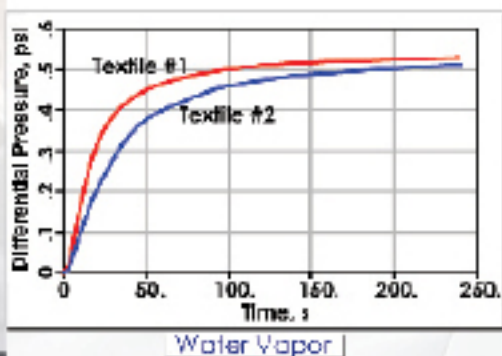


Diffusion Permeameter

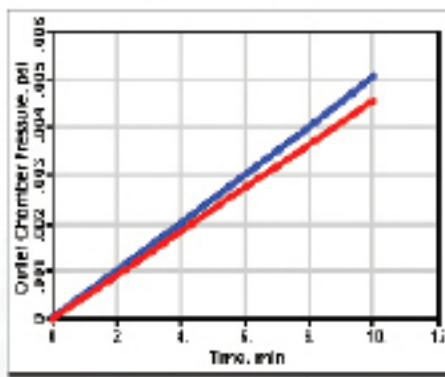
Instrument

When the gas flow rate through the sample is so low that a microflow permeameter cannot determine the permeability accurately, the diffusion permeameter can be used to measure gas permeability. The sample chamber of the instrument is evacuated first. Gas is maintained at a constant pressure in the inlet side and the increase in pressure in the outlet side is measured. Flow rates are computed as in microflow permeametry.

The instrument is fully automated. Because of evacuation, the instrument is capable of yielding very accurate results and permeability of a variety of gases is measurable. Flow rates as low as 10^{-4} cm³/s are measurable.



Water Vapor



Nitrogen

Water Vapor Transmission Analyzer

Instrument

This instrument uses the dynamic moisture cell (ASTM F2298-03) for measurement of water vapor transmission rate. Transmission across a sample due to imposed humidity gradient, pressure gradient, or both gradients can be measured. The instrument is capable of measuring transmission rate and flow resistance as functions of humidity, pressure, and temperature.

