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Technologie-orientierte Partikel-, Analysen- und Sensortechnik

Pore Size Meter

PSM 165/H

Pore Size Meter PSM 165.

The Pore Size Meter PSM 165 serves for the porometric and permeametric characterisation of porous materials as used for numerous applications like filtration, hygiene and tissue engineering.

Filter papers, micro-sieves, nonwovens as well as fabrics and sintered materials made of paper, plastic or metal can be analysed by this instrument. Test routines are guided by the software PSMWin. The following parameters for the description of the material structure can be determined:

- bubble point: pressure at which the wetted sample becomes permeable for gas; corresponds to the largest single pore
- pore size distribution: permeability-weighted size distribution of pores based on the differential pressure – flow rate measurement between non-wetted (dry flow) and wetted (wet flow) sample
- specific gas flow rate: gas flow rate related to the analysed cross-sectional area at a selectable differential pressure of the dry sample

Applications

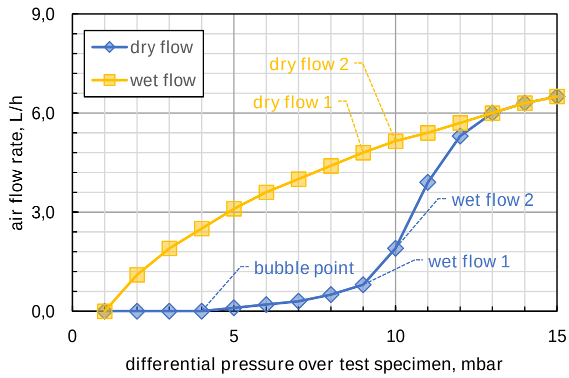
- development of porous materials
- inspection of incoming goods, quality control
- testing of membranes (ASTM F316-03) and geotextiles (ASTM D6767-11)
- analyses of sinter metals (ISO 4003) and sterilization packaging (EN 868-2)

Features

- high accuracy, especially for pores > 10 µm (relevant for non-woven and open-pore media)
- free sample holder concept (enables manual bubble point measurement for dense samples)
- customizable specimen holder
- computer-controlled test sequences with convenient data processing

Principle of operation

The PSM 165 determines the differential pressure as a function of the gas flow rate through the sample at non-wetted (dry) and wetted condition. Data acquisition and processing is automatically realised.



Gas flow rate over the differential pressure for a non-wetted (dry flow rate) and wetted (wet flow rate) porous specimen.

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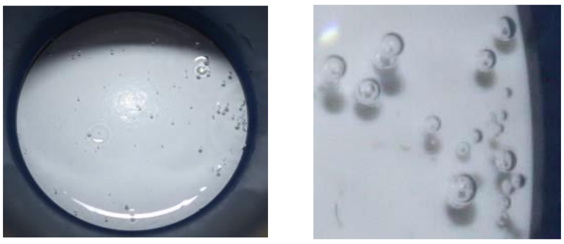
Details

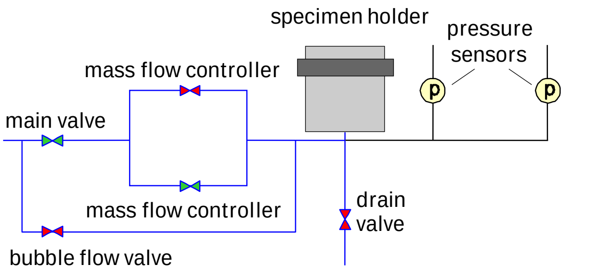
The basic principle for measuring the pore size distribution is that liquid-filled pores become gas permeable by liquid displacement at a certain flow pressure.

The opening pressure for a pore depends on the surface tension of the liquid and the pore diameter. Since real materials contain in general a pore size distribution, the pressure at which the previously liquid-filled sample becomes gas-permeable corresponds to the opening pressure of the largest pore (bubble point).



Starting gas permeability of a wetted sample.

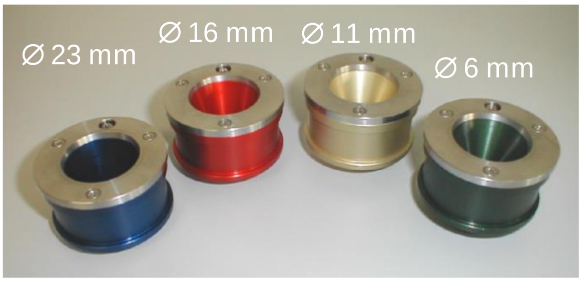
By further increase of the gas pressure, the pore size distribution can be determined from the course of differential pressure and gas flow rate. The applied measurement principle is accordance with the standards ASTM E 1294-89 and ASTM F 316-03. Beside the test fluid Topor, analyses can also be performed with other test liquids (e.g.: alcohol, DEHS, glycerine, petroleum, water). To achieve reliable results the surface tension of the test fluid must be known and a sufficient wetting of the test sample has to be guaranteed.



Schematic setup of the Pore Size Meter PSM 165.

Two high-precision mass flow controllers are used to provide a defined flowrate, which is passed through the test sample.

The resulting differential pressure is measured by relative pressure sensors.



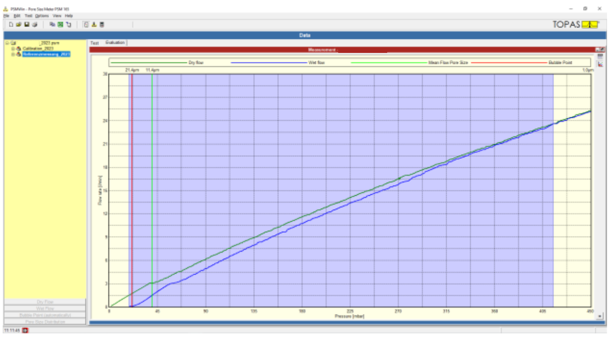
Colour-coded adaptors for clamping the samples.

<u>Software PSMWin</u>

The software PSMWin for control, data acquisition and processing provides the following features:

- guided and automated test procedures
- data representation with protocol printout
- dynamic data exchange with Excel (data transfer, copy & past function, data export)
- pore size calculator

The operator interacts via PSMWin with the instrument and has solely to provide the pressurised gas, prepare and insert the sample into the sample holder and define the measurement parameters. Test sequence and data acquisition are performed automatically by PSMWin.



PSMWin user interface with analytical example: dry flow data (green) und wet flow data (blue) of a test specimen, blue highlighted background = evaluated pressure range.

The figure above shows an analytical example. The dry flow curve (green) shows the typical continuous increase of the pressure drop across the sample with increasing flowrate.

Wir sind zertifiziert nach DIN EN ISO 9001.
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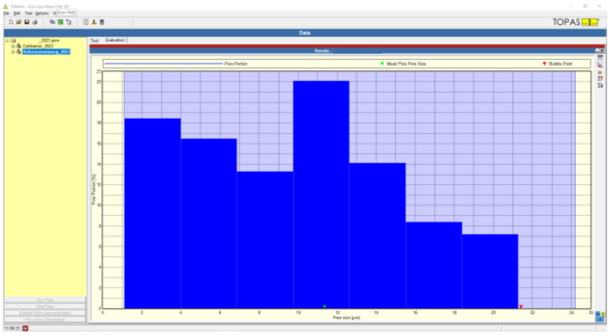
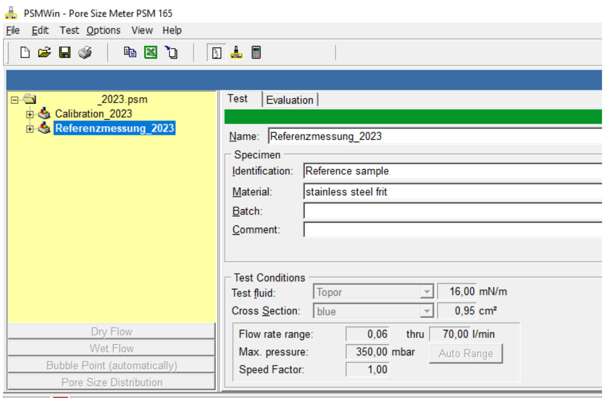
The wet flow curve (blue) starts to increase at the initial bubble point pressure and converges to the dry flow curve at increased flow rates. The resulting pore size distribution is depicted below.



Example of a pore size distribution of a stainless steel frit (test fluid: Topor).

Specific specimen data and individual test details can easily be entered and stored in PSMWin.



PSMWin user interface for specimen data and testing details.

Measurement results may be presented in customized reports using PSMWin. In addition, results can be exported to MS-office applications (Excel) and printed out as a clearly arranged measurement report.

Accessories (optional)

- Topor – test liquid for pore size analyses
- triple-staged compressed air cleaning assembly

References

Kocaman et al. (2018). New method for in-situ measurement of pore size deformation of barrier textiles under biaxial loading. J. Text. Sci. Eng., 8 (2). doi:10.4172/2165-8064.1000355

Li et al. (2019). Waterproof-breathable PTFE nano- and Microfiber Membrane as High Efficiency PM2.5 Filter. Polymers, 11(4). doi: doi:10.3390/polym11040590

Ullmann C et al. (2019). Microfiltration of Submicron-Sized and Nano-Sized Suspensions for Particle Size Determination by Dynamic Light Scattering. Nanomaterials, 9, 6. doi: dx.doi.org/10.3390/nano9060829

Technical specifications

measuring range	
pore size range:	0,25 ... 130 µm
differential pressure:	3,5 ... 200 mbar
air flow rate	3,6 ... 4200 L/h
specimen dimensions	
diameter:	10 – 40 mm
thickness:	≤ 15 mm
measuring adapters	exchangeable
diameter:	(6, 11, 16, 23) mm;
power supply	110 ... 230 V AC
air supply	dry, particle-free compressed air (4 bar, 5 m³/h)
interface	RS 232 (PSMWin)
dimensions (w × h × d)	390 × 310 × 480 mm
weight	12 kg
normative references	ISO 4003, ISO 2942, EN 868-2, DIN 66140, ASTM D6767-11, ASTM F316-03

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