Calculation basis for
SIPERM® materials

Δp

The volume flow of a medium through a filter depends on the existing pressure difference and increases up to a maximum value which is reached asymptotically. The permeability measurement is usually performed in accordance with DIN ISO 4022 using gases. The measured values include the pressure difference Δp upstream and downstream of the filter and the flow rate at constant pressure and temperature. Filter surface and filter thickness are also constant in this test set-up so that the filter material coefficients can be determined based on the test curves.

Permeability / Volume flow / Pressure drop

To estimate the pressure drop for a given volume flow, Darcy's equation is to be used which illustrates the relationship in a simplified manner:

$$\Delta p = \frac{\dot{V} \cdot s \cdot \eta}{A \cdot \alpha}$$

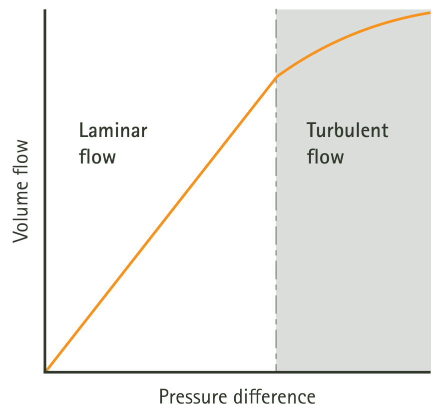
- Δp = pressure drop in the filter [N/m^2]
- $\dot{V}$ = volume flow (average volume of the flowing medium) [m^3/s]
- s = thickness of the filter [m]
- A = flow-through cross section of the filter [m^2]
- η = average dynamic viscosity of the flowing medium [Ns/m^2]
- α = specific laminar permeability coefficient [m^2]

This formula applies to low flow velocities if there is only a laminar flow. At higher pressure differences and higher flow velocities, the relation between pressure drop and volume flow is no longer linear but can be divided into a laminar and a turbulent proportion. This, however, only applies to very high Reynolds numbers.

$$\Delta p = \frac{\dot{V} \cdot s}{A} \cdot \left[\frac{\eta}{\alpha} + \frac{\rho}{\beta} \cdot \frac{\dot{V}}{A} \right]$$

- β = specific turbulent permeability coefficient [m]
- ρ = average density of the flowing medium [kg/m^3]

Specific permeability



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