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Porous PTFE

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Due to its special properties profile, PTFE is used in a wide range of different applications, particularly in chemical plant and equipment engineering and laboratory applications. Thanks to its nearly universal resistance to chemicals and wide temperature application range, PTFE is ideally suited for use in an aggressive chemical environment, both at cryogenic temperatures and temperatures up to and even exceeding +200°C

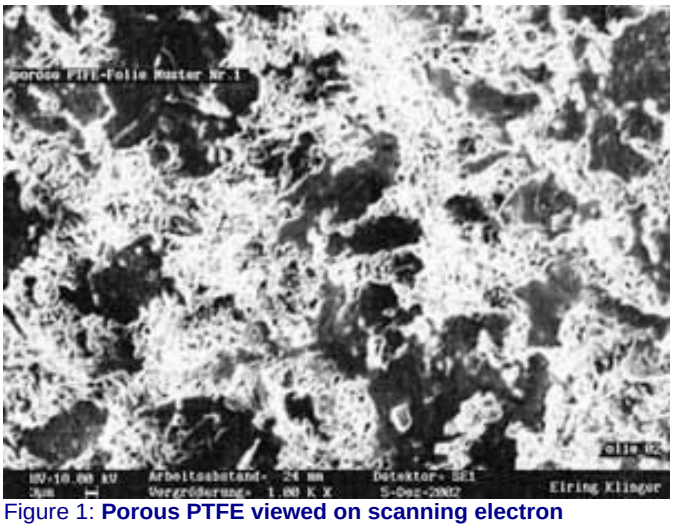

Figure 1: **Porous PTFE viewed on scanning electron microscope (SEM)**

Considering that in typical PTFE applications, in addition to chemical resistance, sealing performance plays a major role, the range of possible applications can be expanded significantly by producing a pre-defined porous content. Besides conventional filtering jobs, such solutions also master difficult media separation problems, such as ventilating fluids/liquids and containers, in a surprisingly easy, cost-effective and resource-saving manner.

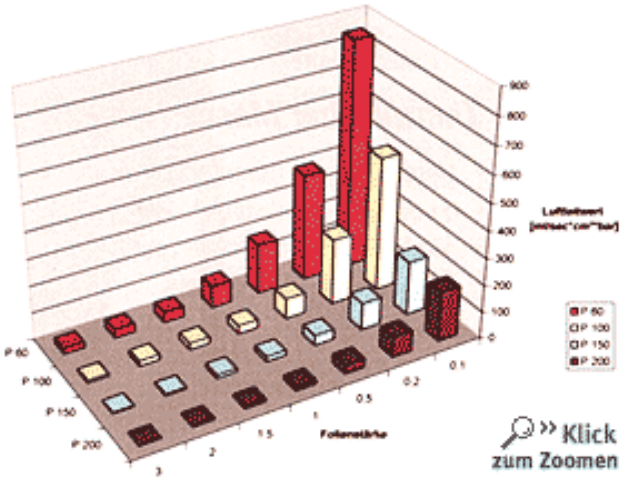

Figure 2: **Influence of filtering layer thickness and median pore diameter on air conductivity**

Application Criteria

The requirements placed on the filter medium regarding the pass-through component and the medium to be held back are exact opposites: large pore volume, combined with anti-adhesive properties, should facilitate passage of the medium to be filtered through the filtering layer. On the other hand, a high barrier effect, long filter life and easy filter cleaning are the requirements to be met with regard to the component to be separated.

Special Properties Profile

A picture of the compound, scanned by an electron scan microscope (Figure 1) is used to illustrate the functional performance of porous PTFE in filter applications. The compact PTFE matrix shows a distribution of statistically defined pores. While the median pore diameter is usually in the range

between 1 and 10µm, the integrated pore volume can be adjusted within a pinpoint range of a volumetric percentage between 5 and 65 %. Despite this high pore content, the compound has a high level of inherent strength, resulting from the specific manufacturing technology used. In terms of inherent strength, it is far superior to other PTFE filtering media produced by other manufacturing technologies. The air conductivity value describes the permeability of the porous compound vis-à-vis air or other gases. This characteristic property is required whenever the filtering application involves the separation of gases from other components, such as moisture, suspended substances/particles or germs.

Specific filter design and manufacturing technology allows the realization of air conductivity in a pinpoint and reproducible manner. Figure 2 depicts the influence of filtering layer thickness and median pore diameter on air conductivity. The mean pore diameter is expressed by P-values, i.e. P 60 to P 200. At nearly 1000 ml air/cm2.s.bar, thin, highly porous PTFE layers can be used to achieve high filter pass rates, while extremely thin pores and high layer thicknesses reduce permeability nearly to zero.

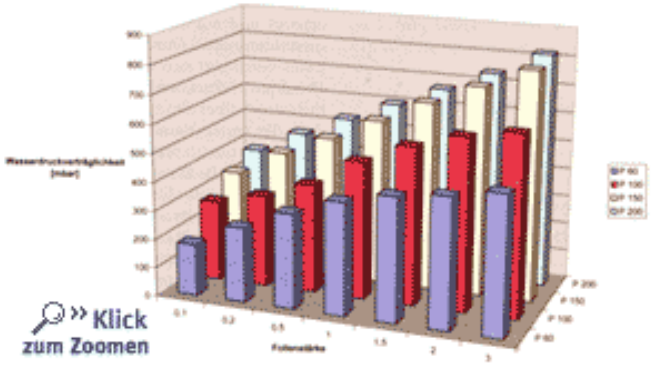

Figure 3: **Influence of layer thickness and P-value on water pressure compatibility**

Water pressure compatibility defines the pressure needed to push water through the porous PTFE layer. In field applications, at a layer thickness of 3 mm and a P-value of 200, a barrier effect of approximately 1 bar is achieved. Figure 3 depicts the influence of layer thickness and P-value on water pressure compatibility.


Figure 4: **Porous PTFE can be manufactured in form of plates, films, tubes and rods**

Manufacturing Techniques

Although PTFE is a member of the thermoplastic compound family, its high melting viscosity prevents PTFE from being molded by thermoplastic processes. Instead, techniques closely resembling powder processing in the ceramics industry are used: powder compression, sintering and, if required, subsequent shaping by machining/cutting (Figure 4).

It is the sintering process step that gives the compound its inherent strength and thus the resulting benefits vis-à-vis porous PTFE produced by alternative techniques. The following products are available as standard items: films with a thickness of 0.2 to 3 mm and a maximum width of 1000 mm. Plates starting at 3-mm thickness, up to dimensions of 1500 x 1500 mm.

In addition, sophisticated compression and machining/cutting techniques enable the manufacture of tailored filtering elements, e.g. filter cartridges or tubes. Consequently, these potentials offered by porous PTFE serve to cover a large part of plant and equipment as well as lab applications. Tailored solutions, though, are usually joint developments by the manufacturer and the respective industrial user.

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