**cav**
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# Interior Lining for Containers

## Anti-corrosion layers based on modified PTFE

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Corrosion-resistant lining of a steel container with laminates based on modified

**Corrosion of process apparatus has several undesirable consequences. For one, the damage caused to the apparatus itself and for the other, the contamination of process media by drag-in of metal ions. With modified PTFE, it is possible to protect equipment from corrosion, and media from contamination. Its chemical resistance and operating range from 250 to 260°C as well as its very high purity make this material suitable for a wide range of applications.**

New, accelerated processes frequently require higher chemical and thermal resistance of apparatus and containers. Improved product properties and higher production output are contingent upon clean, uncontaminated systems. Often, these requirements can only be met by fluoropolymers.

With fluoropolymers, there is a distinction made between partially and fully fluorinated plastics. Partially fluorinated plastics (e. g. PVDF, ECTFE) have relatively good processing properties and are therefore widely used. Their chemical and thermal resistance, though, is limited. Fully fluorinated plastics (e. g. TFMTM-PTFE, PTFE, PFA, FEP) on the other hand offer nearly unlimited chemical resistance. From the range of fully fluorinated polymers, modified PTFE – due to its exceptional profile of properties – is particularly well-suited for corrosion protection in modern chemical equipment engineering.

### Molecular structure of modified PTFE

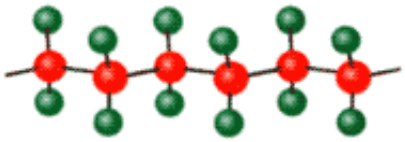
Modified PTFE (e.g. TFMTM-PTFE) has been in use around the world for years as film or sheet lining, loosely inserted material, or as permanent composites. The co-polymerization with a small amount of a perfluorinated modifier, perfluoropropylvinylether (PPVE), and reduction of the molecular weight results in a new product which is processed using the typical methods for PTFE, but which has a clearly improved properties profile. In addition to PTFE s typical properties, such as nearly universal chemical resistance, wide temperature application range from -250 to 260°C, high purity, no tendency toward aging and excellent insulation capabilities, modified PTFE provides the following advantages:

- reduced cold flow
- lower permeation
- reduced pore volume
- lower Stretch Void Index (SVI), which assures the presence of a dense polymer structure even after shaping the material

In addition, further properties of the fluoroplastic, PFA, such as weldability, have been achieved with PTFE.

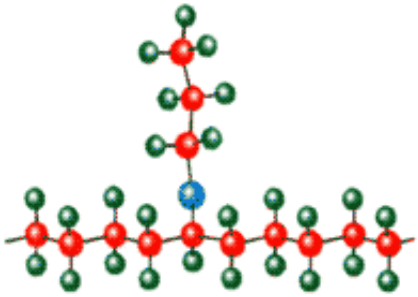
## Minimal Permeation and Extreme Purity

Compared to conventional PTFE, modified PTFE almost always has lower permeation values. At temperatures above app. 80°C the permeation values of modified PTFE vis-à-vis aggressive chemicals, such as HC1, are lower than those of the fully fluorinated thermoplastics, PIA and FEP. For container linings, semi-finished products like laminates with glass fabrics or carbon fiber backings, or tubes are used. The durability of a lining can only be ensured if, in addition to selecting the right polymer, proper processing is guaranteed as well.



Molecular structure of **standard PTFE**

By contrast, fluorothermoplastics processed by means of extrusion have a relatively high content of impurity ions. The reason: during processing, fluoropolymer melts may release small amounts of hydrofluoric acid, HF. This aggressive acid can attack the extruder s screw and cylinder, thus dissolving metal ions which are then dragged into the polymer melt. This type of contamination by impurity ions is deep-seated and may result in a gradual discharge of ions over the period of several years. When processing modified PTFE this effect has not been observed.

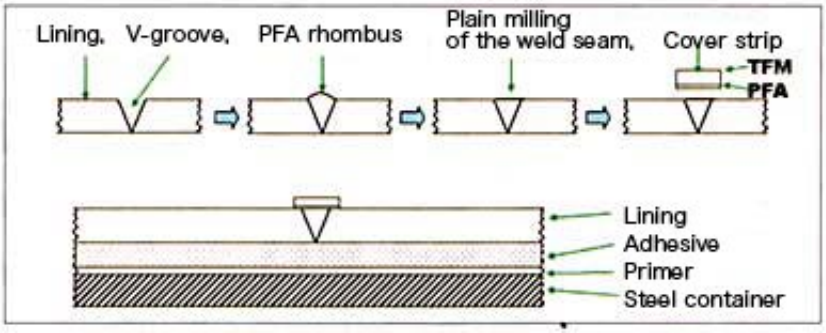


Molecular structure of **modified PTFE**

## Tailored Mechanical Properties

The mechanical properties of the PTFE material are influenced significantly by the ratio between amorphous and crystalline components. This ratio can be adjusted specifically via the type of processing used. For applications requiring a high level of reverse bending strength, a high content of amorphous components, for applications requiring low permeation, a high crystallite content is set. Here, the dialogue between the end user and the PTFE processor s know-how is of the essence. The suitable processing technique must be chosen according to the particular requirements profile. Both PTFE and modified PTFE are plastics with excellent electrical conductivity. For certain applications in the solvents area, or if special requirements regarding explosion protection (ATEX Directive) must be met, these materials may be adjusted to provide electrostatic dissipation through the addition of small quantities of conductive pigments.

After insertion of the lining laminates and adhesive bonding to the steel container, the individual segments need to be joined by welding. Special welding methods are available for this purpose. One example is hot gas welding using a PFA rhombus and subsequent application of a cover strip. Depending on gap width, laminate thickness or size of the V-groove, the work can be performed using either one or several PFA rhombuses. As a cover strip, a laminate of modified PTFE with PFA backing has proven to be highly suitable.




Welding of permanently bonded lining segments using PFA hot has welding and application of a cover strip.

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