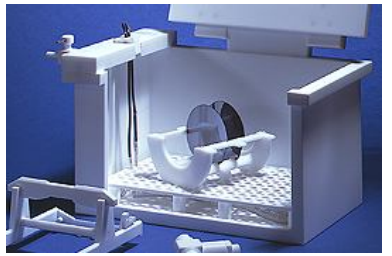
Fluoropolymeres - Basis of our Products

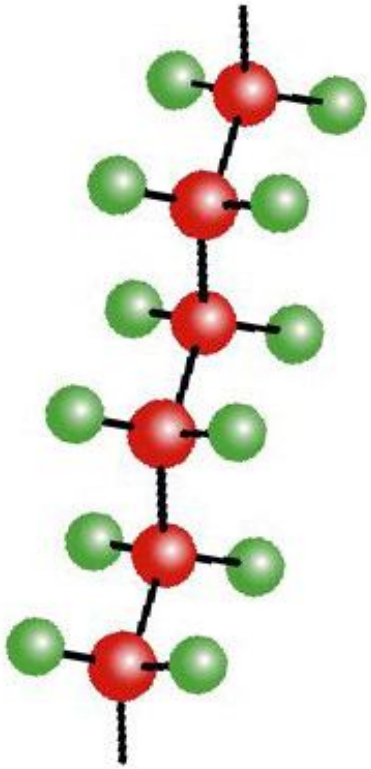


Fluoropolymeres

- 物理性质
- 耐腐蚀
- 表面性质
- 纯度 (浸取)
- 渗透性 **Permeation**
- **PTFE**
- **TFM-PTFE**
- **PFA**

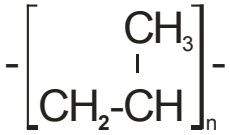
Fluoropolymeres

- 杰出的化学稳定性
- 耐温高达 **260° C**
- 表面光滑、绝无吸附
- 超高纯
- 优异绝缘性
- 不沾水

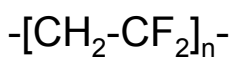


氟聚物 – 材料性质

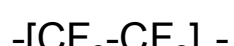
PP



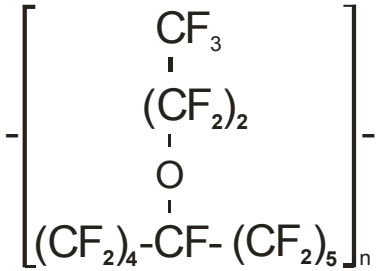
PVDF



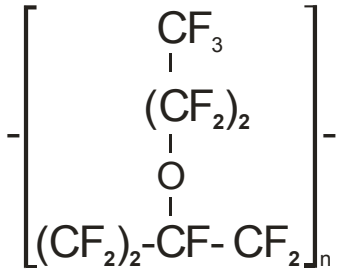
PTFE

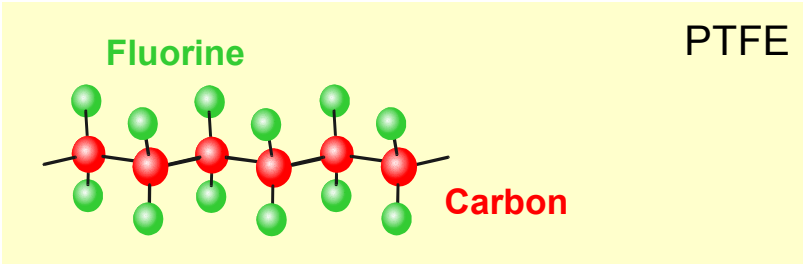


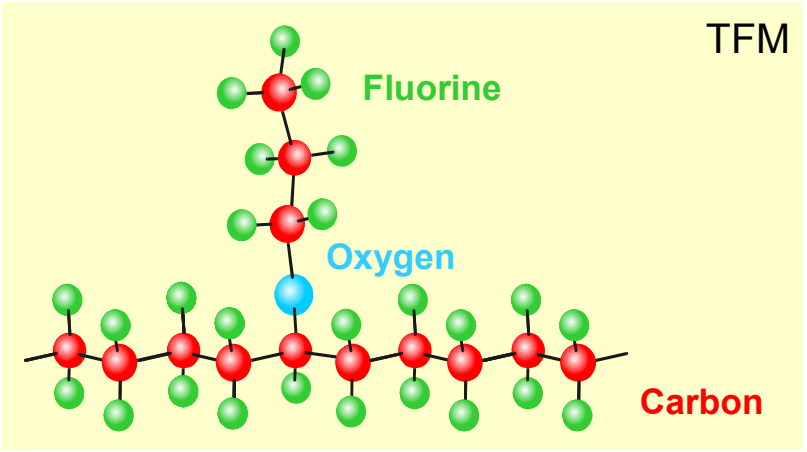
TFM

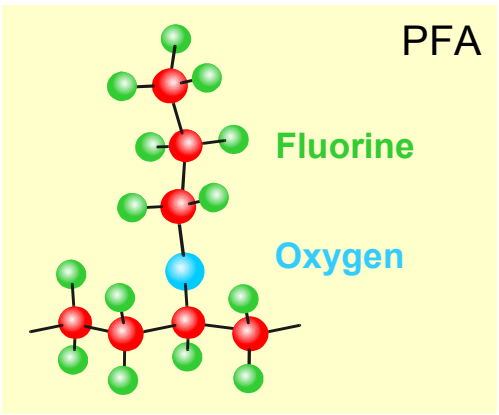


PFA









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PTFE 的组成

- Perfluorinated plastic with melting point of 327 ° C, molecular weight approx. 10^8 g/mol
- Complete protection of C-C-bonds by F-atoms
- Processable by pressing, sintering and chip removing technics
- Nearly universal resistance to chemicals
- Service temperature: - 250 ° C to + 250 ° C
- High purity, excellent dielectrical properties
- No embrittlement, no aging

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改性 PTFE: TFM-PTFE

- Molecular weight is about 1/5 of the molecular weight of PTFE
- Contains the same perfluorinated modifier as PFA, but less than 1 %
- Therefore TFM-PTFE closes the cap between classical PTFE and PFA
- Weldable by special technics, thanks to the „shift versus thermoplastic properties“
- Cold-flow, pore content and stretch-void-index are improved

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PFA 的组成

- Thermoplastic processable perfluorinated polymere
- Molecular weight approx. 1 % of PTFE, therfore processable by fusion
- 4 to 10 % modifier
- melting point: 305 to 290° C
- Highly modified ⇒ highly amorph: high transparency, improved alternate bending and good chemical resistance to stress crack
- Chemical stability and service temperature comparable with PTFE
- Processing methods: injection molding, extrusion, transfer molding
- Thermoplastic processing technics open up new applications for this „material with PTFE-properties“

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Fluoropolymeres - Material Properties

	PTFE	TFM	PFA	PVDF
温度范围 [° C]	- 250 to + 250	- 250 to + 250	- 250 to + 250	-60 to + 150
耐化学腐蚀	很高	很高	很高	高;与强碱有反应 (NH_3)
分子量	~ 10^8 g/mol	2 x 10^7 g/mol	10^6 g/mol	
抗张强度 **(ISO 12 086)**	20 - 40 N/mm²	41 N/mm²	15 - 30 N/mm²	40 - 60 N/mm²

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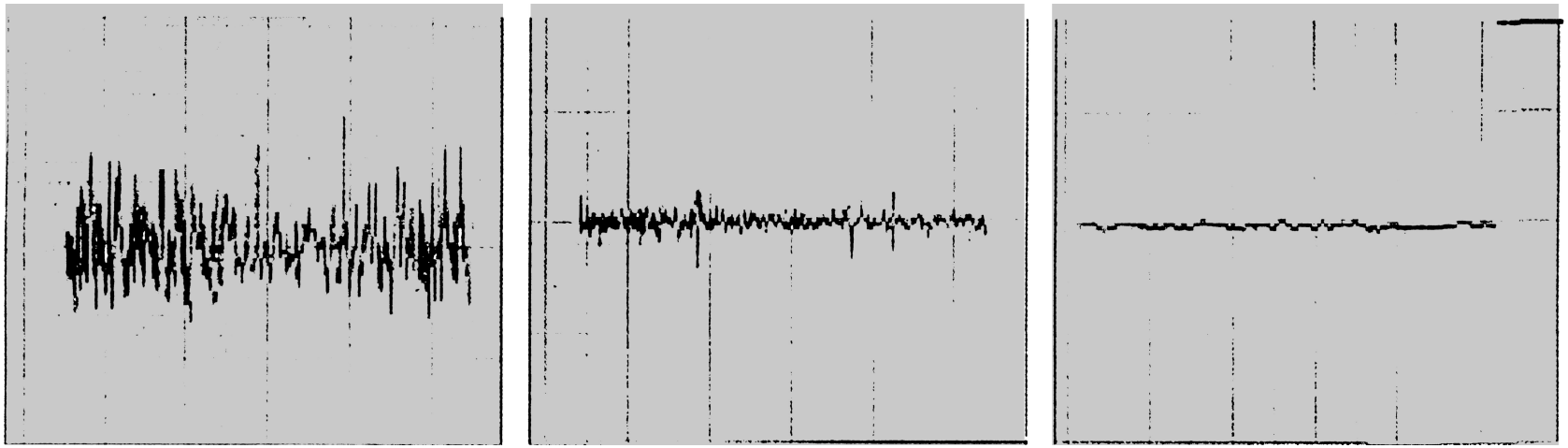
Fluoropolymeres - Resistance to Chemicals

Chemical	Effect
fluorinated hydrocarbons	swelling, reversible at short-term exposition
alkali metals, dissolved or molten	elimination of fluorine and polymere decomposition
halogenes, elemental fluorine, chloro trifluoride	chem. reaction possible at elevated temperatures, material decomposition, possibly violent reaction
nitrating acid (H_2SO_4 / HNO_3)	above 100° C slow material decomposition, carbonisation
monomeres: styrene, butadiene, acrylnitrile ...	could penetrate into the material; at spontanous polymerisation: swelling or polymere decomposition. popcorn-effect
high-energy radiation	γ-radiation: dose of 10kGy could reduce the mechanical properties by more than 50%

Fluoropolymeres - Surface Condition

Chip removing production without polishing

Injection molding



PTFE

TFM

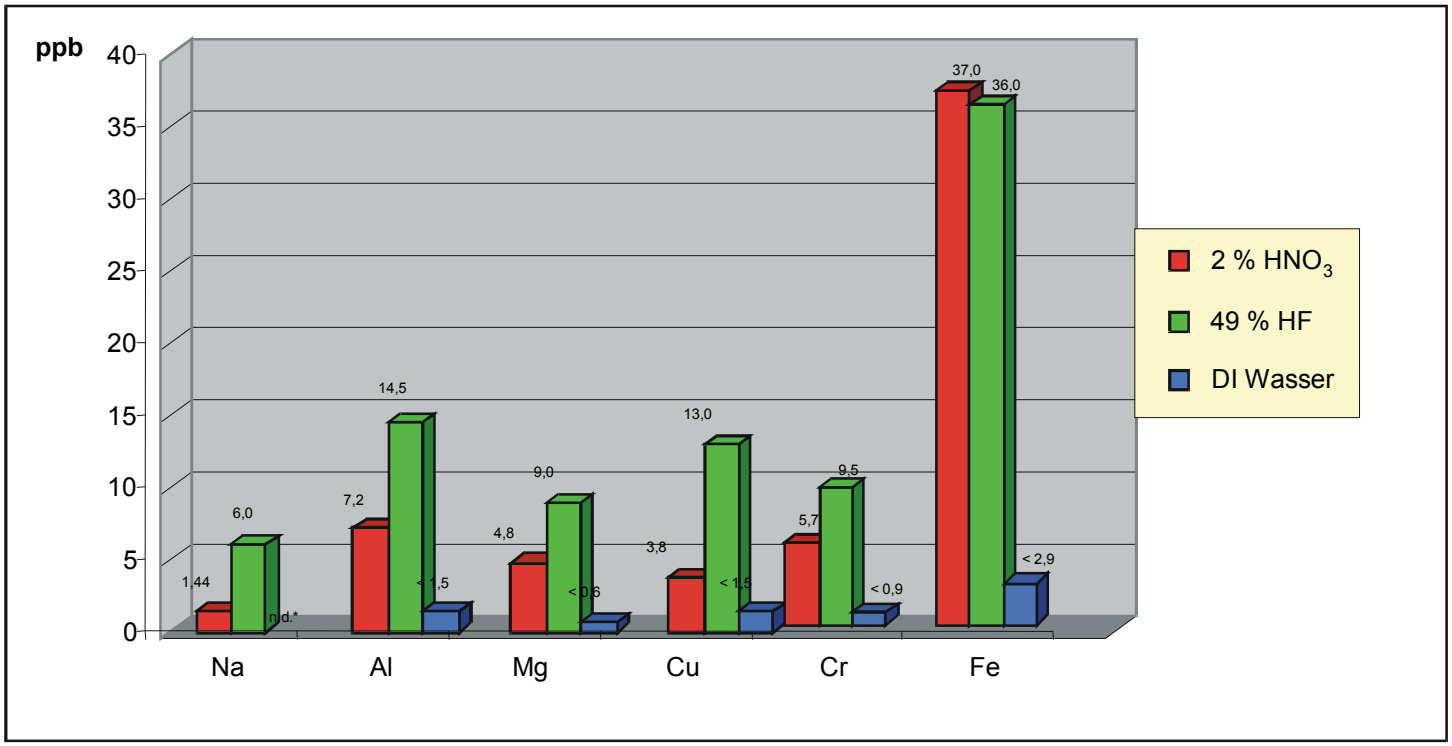
PFA

Fluoropolymeres – 纯度(Leaching of Fluoropolymeres)

浸取时间: **2 days**
2% HNO_3
温度: **20 ° C**
结果: **ng/cm²**

	PTFE	TFM	PFA-HP
Mg	2,58	1,40	1,18
Al	3,73	2,20	5,00
Li	< 0,0002	< 0,0002	< 0,002
B	0,085	0,091	< 0,01
F	**1173**	**1320**	**3522**
Na	18,10	10,00	5,38
P	< 4	< 4	< 5
S	**598**	**500**	**1164**
Cl	21	21	27
K	18,40	10,00	5,32
Ca	21,90	11,00	14,00
Cr	0,085	0,10	0,19
Mn	0,098	< 0,002	< 0,002
Fe	5,04	3,10	2,97
Ni	**0,63**	**0,38**	**< 0,003**
Cu	**21,4**	**24,3**	**0,049**
Zn	6,43	4,00	1,23
Br	4	4	5
Mo	**0,31**	**0,061**	**< 0,001**
Pb	**2,52**	**1,80**	**0,33**

Fluoropolymeres - Purity (Leaching of PTFE-TFM)



Conditions:

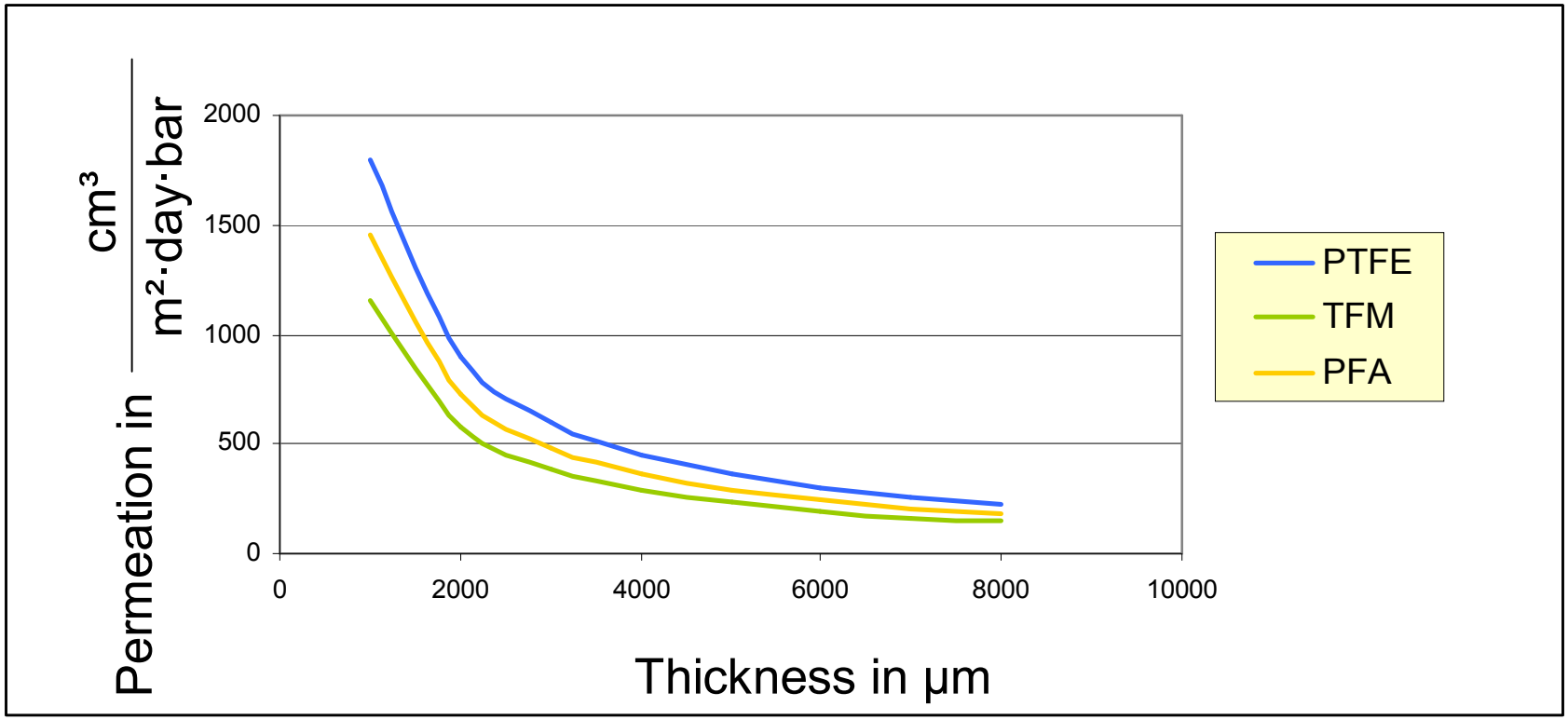
- **2 mm plate material**
- **2% HNO_3, 49% HF : 20 ° C, 7 days**
- **DI water 80° C, 7 days**

Conclusion:

- **Purity in accordance with specification for PFA-HP**
- **lower concentrations of Cr, Ni, Mo than in PFA-HP**

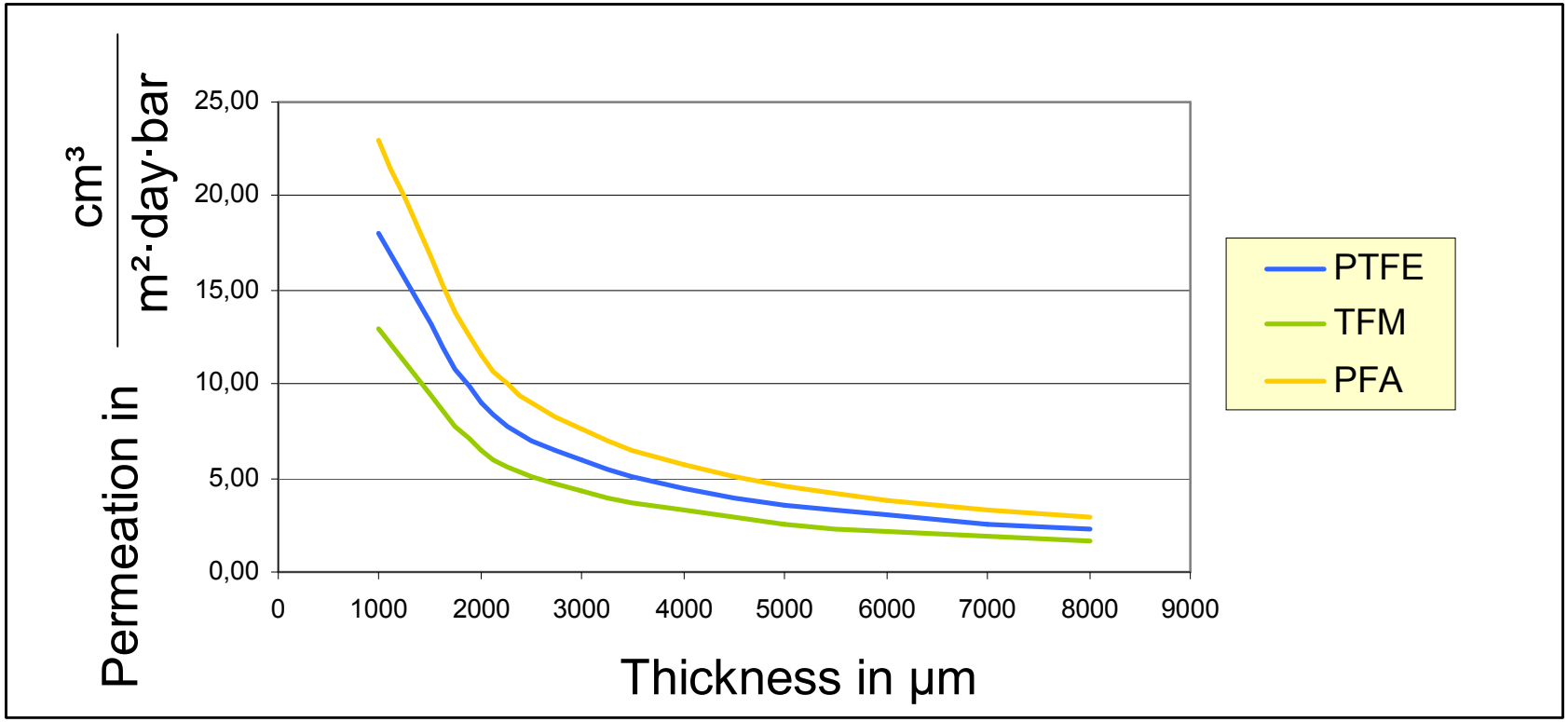
Fluoropolymeres - Permeation

- **Permeation of HCl-Gas at 100° C**



Fluoropolymeres - Permeation

- **Permeation of water vapour at 100° C**



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Your Benefit

- Hiogh competence through in house production
- Customized solutions possible
- PTFE and TFM-PTFE comparable with PFA
- Solid, longevity PTFE-TFM-products (inserts, pressure vessels etc.)