Is this something you’ve seen recently?
An Answer to Corrosion
Non-Fluorinated Polymers

Ultra High Molecular Weight Polyethylene (UHMW-PE)

- Melting point 130°C. Application temp. range -140°C to 90°C

- Tradenames (manufacturers): RCH100 (Celanese)
Non-Fluorinated Polymers

Polypropylene (PP)

- Melting point 160 °C. Application temp. range -20 °C to 90 °C
- Very limited chem. resistance
- Tradenames (manufacturers): Hostalen PP (Basell)
  Vestolen (Sabic)
  etc....

\[
\begin{align*}
\text{C} & \quad \text{C} \\
\text{H} & \quad \text{CH}_3 \\
\text{H} & \quad \text{H} \\
\text{C} & \quad \text{C} \\
\text{H} & \quad \text{CH}_3
\end{align*}
\]
Polyvinylidenefluoride (PVDF)

- Melting point range about 170 to 180°C
  Application temperature range approx. –100 °C to 130 °C.

- Limited chem. resistance but considerably better than PE and PP.

- PVDF is attacked e.g. by ketone, ester and organic amines.

- Tradenames (manufacturers): Kynar (Arkema)
  Solef, Hylar (Solexis)
**Partially fluorinated plastics**

**Ethylene-Tetrafluoroethylene-Copolymer (ETFE)**

- Semi-crystalline copolymer made of tetrafluoroethylene (TFE) and ethylene.
- Very high toughness, tear strength and good abrasion resistance.
- Good chemical resistance, Application temperatures up to 150 °C.
- Processing: transfermoulding, extrusion, injection moulding, rotomoulding.
- Tradenames (manufacturers): Tefzel (DuPont), Dyneon (Dyneon), Aflon (AGF), Neoflon (Daikin)

![Chemical structure of ETFE](image)
Polytetrafluorethylene (PTFE)

- Semi-crystalline material, polymerised TFE monomer
- Extremely strong bond btw. fluorine and carbon atoms
- Melting point 327°C. Application temperature range –200 °C to 260 °C
- Tradenames (manufacturers): Dyneon (Dyneon)
  Teflon (DuPont) …
Fully fluorinated plastics

Polytetrafluorethylene (PTFE)

- Semi-crystalline material, polymerisation of monomer tetrafluoroethylene (TFE).
- Extremely stable link btw. fluorine and carbon atoms. Fluorine atoms form a tight protection around the carbon chain.
- Melting point 327°C. Application temperature range –200 °C to 260 °C (for valve / pump designs max. 200 °C)
Fully fluorinated plastics

Perfluoroalkoxy – Copolymer (PFA)

- PTFE with approx. 4 % modifier perfluoropropylvinylether (PPVE)
- Melting point 310 °C. Application temperature range approx. –200 °C to 260 °C (for valves / pumps max. 200 °C).
- best chemical and high thermal resistance, nearly identical to PTFE
- Tradenames (manufacturer): Dyneon (Dyneon)
  Teflon (DuPont)
## Summary

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fully fluorinated</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PTFE</td>
<td>universal</td>
<td>200 (400)</td>
<td>good</td>
<td>good</td>
<td>limited</td>
</tr>
<tr>
<td>PFA</td>
<td>universal</td>
<td>200 (400)</td>
<td>good</td>
<td>good</td>
<td>limited</td>
</tr>
<tr>
<td><strong>Partially fluorinated</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PVDF</td>
<td>limited ³)</td>
<td>120 (250)</td>
<td>good</td>
<td>good</td>
<td>fairly good</td>
</tr>
<tr>
<td>ETFE</td>
<td>limited ³)</td>
<td>120 (250)</td>
<td>good</td>
<td>good</td>
<td>fairly good</td>
</tr>
<tr>
<td><strong>Not fluorinated</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PP</td>
<td>limited ³)</td>
<td>90 (195)</td>
<td>good</td>
<td>good</td>
<td>limited</td>
</tr>
<tr>
<td>UHMW-PE</td>
<td>limited ³)</td>
<td>90 (195)</td>
<td>good</td>
<td>good</td>
<td>good</td>
</tr>
</tbody>
</table>

¹) for applications in Richter valves and pumps
²) attention to exceptions for temperatures > 100 °C (210 °F)
³) also depending on temperature
The Company

Products: Lined Valves

Ball Valves
The Company

Products: Lined Valves

**Ball Valves**

One piece ball/stem design, PFA lined.

Two-piece: Al$_2$O$_3$ with lined SS stem

Metal core = one piece stainless steel 1.4462 or 1.4542

Ceramic ball
The Company

Products: Lined Valves

Control Ball Valves

$K_{v100}$ values:

from 0.8 to 400 m$^3$/h
The Company

Products: Lined Valves

Butterfly Valves:

- Wafer Design
- Lug Design
- Double Flange
The Company

Products: Lined Valves

Globe Control Valves
Globe Control Valve RSS
Sectional Drawing

Safety stuffing box, manually adjustable

PTFE bellows, protects the valve stem from corrosion and seals the valve body to the atmosphere.

Seat and plug, made of modif. PTFE (TFM 1600), interchangeable
The Company

Products: Lined Valves

Diaphragm Valves
The Company

Products: Lined Valves

**Diaphragm Valves**

- **Upper parts of stainless steel**: bonnet, handwheel, stem, compressor, tube nut and screws
- **Diaphragms**:
  - TM (PTFE) + EPDM
  - Conductive
  - 3-layer (TM + PVDF + EPDM)
- **Lining**: PFA, PFA-P or PFA-L
- **Various face-to-face dimensions available**: ISO/DIN, MSS, BS, ANSI

*01-Company  22 February 2010*
The Company

Products: Lined Valves

Safety Valves
Series KSE/F
Valve Design

- Standard-Safety Valve for highly corrosive fluids vapours / gases / liquids
- Spring loaded
- Valve body - pressure rating PN 16
- Valve Sizes (Inlet / Outlet)
  - DN 25/50,
  - DN 50/80,
  - DN 80/100,
  - DN 100/150
- Set pressures 0.1 bar - 13 bar
- Type Test No. -871- D/G/F Vapours / Gases / Liquids
The Company

Products: Lined Valves

Overflow and Pressure Relief Valves
The Company

Products: Lined Valves

Ball Check Valves:

Strainers:

01-Company

22 February 2010
The Company

Products: Lined Process Pumps

• **Standards:**
  
  Both to ISO 2858/DIN EN 22858 and ASME/ANSI B 73

• **Sealing:**
  
  Both mechanical seal and sealless

• **Capacity / Delivery:**
  
  up to 600 m3/h / up to 90 m
The Company

Kempen

01-Company 22 February 2010
The Company
Kempen, Germany

• Established 1957

• Staff: 260 worldwide (220 in Kempen)

• Processing of PTFE & PFA (transfer moulding and press-sintering)

• CNC machining centres for metal parts

• Research & Development, Manufacturing and Testing of Pumps & Valves
Typical Applications

- manufacture / processing
  base / intermediate chemicals:

  Hydrofluoric acid
  Sulfuric acid
  Phosphoric acid
  Hydrochloric acid
  Caustic soda
  Potassium hydroxide

  Chlorine
  Bromine
  Fluorine
Typical Applications

• Fertiliser industry
  
  Phosphoric acid
  Sulfuric acid
  Nitric acid
  Ammonia

• Production of TiO₂ pigments
  
  Chlorine
  Sulfuric acid
Typical Applications

- Desalination / Water Treatment
  
  Sea Water
  Chlorine

- Electro-Chlorination
  
  Chlorine
  Caustic soda
  Brine
  Dryer Acid