# BOLA Materials

## Fluoroplastics

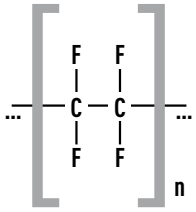
Belong to the family of thermoplastics. The higher the fluoric content, the better the thermal and chemical capacity of fluoropolymers.

Unique properties are:

- » universal chemical resistance
- » high thermal load capacity (-200 °C up to +260 °C)
- » resistance to all sterilisation temperatures
- » non-flammable
- » resistant to environmental changes (weather, light)
- » non-adhesive
- » ultra-low friction coefficient
- » unbreakable
- » physiologically safe
- » inert, no taste, odourless
- » UV-resistant

### PTFE – Polytetrafluoroethylene

Already discovered in 1938 by research-chemists of DuPont (USA) it was not introduced or marketed until 1946. A partly crystalline fluoroplastic that belongs to the family of thermoplastics (but not suitable for injection moulding).
The remarkable chemical and thermal resistance results from the linkage force between carbon atoms and fluorine atoms and from the nearly complete shielding of the carbon chain by fluorine atoms.
PTFE has a thermal resistance of -260 °C up to +300 °C (for example no brittleness in boiling helium at -269 °C). This temperature range is reached by no other commercial plastic material.
Permanent temperature resistance depends on the load. This means that PTFE can be used from -200 °C to +260 °C at moderate mechanical load.
PTFE labware has a white appearance, a non-adhesive surface and excellent slip characteristics. Its fabrication is done by isostatic pressing processes or by machining of extruded semi-finished PTFE material.



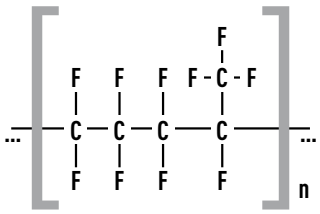

**Trade name**
Teflon®
by DuPont
Hostaflon®
by Dyneon
Fluon®
by ICI Fibres

### PTFE – TFM

A further development of the classic Polytetrafluoroethylene (PTFE), with additional modifier Perfluorpropylvinylether.
Due to a five times lower molecular weight and a more homogeneous crystal structure, the single particles merge a nearly pore-free polymer structure. Compared to PTFE, the tightness as well as the barrier effect at the same wall thickness are doubled. This is particularly advantageous at high working temperatures. PTFE-TFM has a universal chemical resistance. Sticking of any contaminations is prevented by an extreme smooth surface. Special methods allow a simple and safe heat seal. This material is ideal for e. g. digestion vessels or gaskets.

**FEP – Tetrafluoroethylene-Perfluoropropylene**

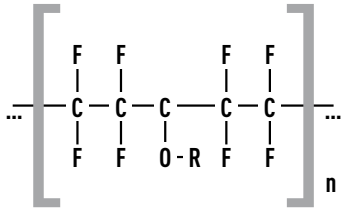
A molten copolymer of tetrafluoroethylene and perfluoropropylene with a high-molecular, partly crystalline structure which was introduced on the market in 1960.
Its mechanical and chemical properties are comparable with those of PTFE, however, the upper limit of the permanent working temperature is lower than that of PTFE (max. +205 °C).
FEP is a typical thermoplastic material which can be treated and machined by using established methods, although its high viscosity limits the speed of operation. FEP labware is translucent to transparent and non-porous.



**Trade name**
Teflon®
by DuPont
Neoflon®
by Daikin

**PFA – Perfluoroalkoxy**

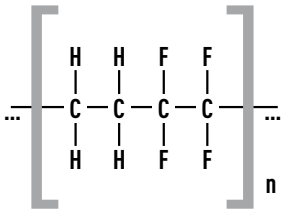
Fluorinated hydrocarbon with a high-molecular, partly crystalline structure.
Compared to PTFE it has additional side chains consisting of perfluorated alkoxy groups. The chemical and thermal properties of this thermoplastic fluoropolymer are equal to those of PTFE.
PFA labware is translucent to transparent, non-porous and particularly useful in high-purity work.



**Trade name**
Teflon®
by DuPont
Hostaflon®
by Dyneon

**ETFE – Ethylene-Tetrafluoroethylene**

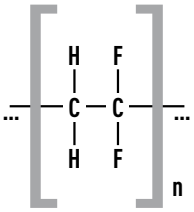
A modified copolymer of ethylene-tetrafluoroethylene. Unlike the homopolymer PTFE which can be treated only by means of pressing or sintering, ETFE can be thermoplastic processed. I. e. this plastic can be injection moulded with appropriate machines.
In laboratories, this material is mainly used for items reinforced with glass fibre such as screw caps or screw joints.



**Trade name**
Tefzel®
by DuPont
Hostaflon ET®
by Dyneon

**PVDF – Polyvinylidene Fluoride**

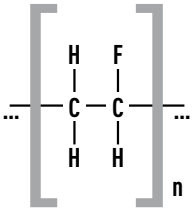
A fluoroplastic that can be machined or thermoplastic processed. Characterised by a good to excellent chemical resistance. Compared with PTFE, it is much harder and more rigid, but its functional temperature range is lower. Its advantages over other fluoroplastics are its easy processing, the high mechanical values and the low specific weight. Therefore it is used in many applications.



**Trade name**
Solef®
by Solvay
Dyflor®
by Dynamit

**PVF – Polyvinylfluoride**

Containing fluorine, it displays a stronger chemical linkage than common polymers and thus a better inherent stability. It shows its unique properties when used at temperatures ranging from -70 °C to +110 °C, whereas temperatures of up to max. +200 °C are withstood. Polyvinylfluoride does not contain any softener, is resistant to fading and can easily be cleaned due to its dirt-repelling surface. In particular, foils, films and bags for gas analysis are made of PVF.



**Trade name**
Tedlar®
by DuPont

# BOLA Materials

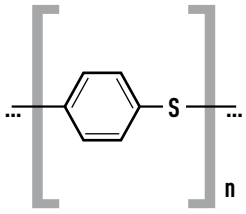
## Technical Plastics

Mainly used for high working temperature ranges.
Their best known advantages are:

- » low abrasion
- » no corrosion
- » excellent gliding properties
- » high rigidity
- » good chemical resistance
- » dimensional accuracy
- » high thermal resistance

### PPS – Polyphenylsiloxan

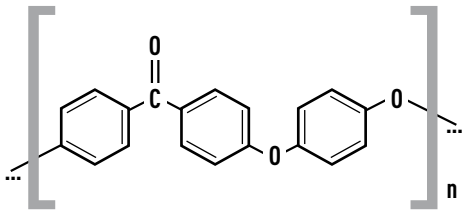
New technical high-performance plastic. This macromolecule consists of phenylene rings and one S-atom which provide a good chemical resistance even at high working temperatures. PPS is particularly suitable for the production of moulded pieces which are exposed to high mechanical and thermal stresses. Injection moulding is the most common processing technology for this material, in addition, single components can be made of semi-finished products by cutting. Special glass-fibre reinforced compounds offer an improved rigidity, sturdiness and dimensional stability under heat compared to non-reinforced compounds.



**Trade name**
Fortron®
by Hoechst
Ryton®
by Phillips
Petroleum
Chemicals
Alton®
by Intern.
Polymer Corp.

### PEEK – Polyetheretherketone

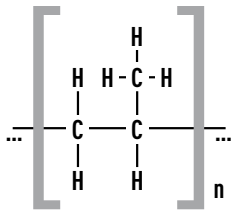
Partly crystalline thermoplastic that withstands high temperatures. Due to its unique properties, PEEK is mainly used for high-value and highly stressable components. The high upper working temperature (+250 °C), the good chemical stability and resistance to hydrolysis as well as the high mechanical values of this material will allow PEEK to become the material of the future. PEEK components are commonly used as HPLC fittings, screw joints or as tubing. Its natural colour is brown, its price is considerably higher than that of PTFE or PFA.



**Trade name**
Victrex®
by Victrex
Hostatec®
by Hoechst

### PP – Polypropylene

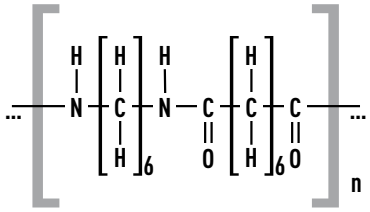
A polymer of ethylene with isostatic arrangement of methyl groups.
It does not belong to the family of fluoroplastics. PP can be autoclaved (at +121 °C) and is distinguished by good mechanical and chemical properties almost up to its softening point. PP labware is unbreakable and an economical alternative with, however, restricted chemical and thermal resistance.



**Trade name**
Norolen®
by BASF
Hostalen®
by BASF

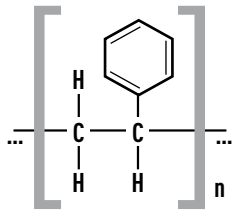
### PA – Polyamides

Condensation polymers obtained either from amino acids respectively from their lactams (e. g. caproic lactam) or diamine and dicarboxylic acid (e. g. adipic acid and hexamethylene-diamine). In general, polyamides are defined according to the number of carbon atoms of their monomers, e. g. PA 6 = polycarbonic lactam or PA 12 = polylauric lactam. PA 6 is the most commonly used polyamide. All polyamides are characterised by high strength and scuff resistance. The application range varies from simple turned parts such as screws or nuts to plain bearings or toothed wheels.



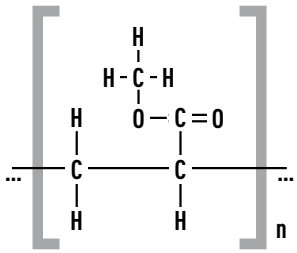
**Trade name**
Ultramid®
by BASF
Durethan®
by Bayer
Grilon®
by Ems Chemie

**PS – Polystyrene**
A polymerisation product of styrene. Polystyrene is one of the most commonly used plastic materials. For many years it has been processed by injection moulding, extruding or blowing. Because of its structure, it is transparent, hard and brittle. A disadvantage is its low thermal and chemical resistance.



**Trade name**
Lacqrene®
by ATO
Vestyron®
by Innovene
Edistir®
by Montedison

**PMMA – Polymethylmethacrylate**
An acrylic resin based on methyl methacrylate. It has become generally known under the trade name Plexiglas®. On the one hand, PMMA is approx. 60 times more elastic than window glass but on the other hand it is approx. 10 times more permeable than silicate glass. Of course, the hardness of its surface does not correspond to that of glass but compared with other materials it can easily be polished to high brilliance. As to weight, Polymethylmethacrylate is much more lightweight than normal window glass.



**Trade name**
Plexiglas®
by Röhm
Perspex®
by ICI
Oroglas®
by Rohm and Haas

## Elastomers

Their main characteristic is their elasticity: Elastomers can easily be stretched and bent and return to their original shape and size after being released. These synthetic materials are most commonly used for o-rings, flat gaskets or resilient elements.

**NBR – Acrylonitrile-Butadiene-Caoutchouc**
Elastomer on the base of acrylonitrile-butadiene-caoutchouc which is mainly used as budget-priced sealing material (e. g. O-rings for stop-cocks). This material has a good resistance to mineral oils and fats as well as to HFA, HFB and HFC-hydraulic fluids. It has a very good elasticity. PERBUNAN® (its well-known trade name of BAYER AG) is not resistant to brake fluids on the basis of glycol, HFD liquids, aromatic compounds (e. g. Benzole), ester, keton and amines as well as in concentrated acids and caustic solutions. Due to its restricted chemical resistance, PERBUNAN® is not the ideal material for chemestry.

**FPM – Fluorocaoutchouc**
Elastomer on the base of fluorocaoutchouc, more familiar as VITON® (DuPont). Many O-rings, lip seals and sleeves are made of FPM. It has a very good resistance to heat, chemicals, weather and ozone. Furthermore, it is resistant to sulphurated mineral oils and fats and to hardly inflammable HFD liquids (basis phosphor ester or chlorinated hydrocarbon). It is not resistant to anhydrous ammonia, caustic soda, potassium, ketones, ether, dioxane, as well as some amines and organic acids. For BOLA products, FPM is mainly used as sealing material, mostly protected from the medium by a PTFE sealing lip.

**EPDM**
EPDM 3 is an elastomer on the base of ethylene-propylene-diene-caoutchouc which is mostly used for gaskets and O-rings. The main applications are in the area of hot water, steam and suds. It is not resistant to hydraulic fluids on the base of mineral oil but it is weather-proof, non-ageing and resistant to ozone. At BOLA, EPDM O-rings are mainly used for applications where VITON® O-rings are not sufficient.

**FFKM – Perfluoro-Caoutchouc**
An elastic sealing material with natural recovery and good accommodation to the sealing surfaces and a chemical resistance comparable with PTFE. FFKM O-rings have a very high chemical and thermal resistance. Such seals can withstand virtually all kinds of chemicals and can be used at long duration conditions with temperatures up to +260 °C. Perfluoro-caoutchouc is better known under the trade names KALREZ® by DuPont respectively CHEMRAZ® by Greene Tweed.

# Materials - Physical Properties

| Property | Standard | Unit | PTFE[1] | PFA | FEP | ETFE | ECTFE | PVDF | PP | PA | PS | PMMA[3] | PPS | PEEK |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Density** | DIN 53 479 | g/cm³ | 2.14–2.19 | 2.12–2.17 | 2.12–2.17 | 1.71–1.78 | 1.67–1.70 | 1.75–1.78 | 0.904–0.907 | 1.10–1.15 | 1.04–1.05 | 1.19 | 1.65 | 1.32 |
| **Service temperature** without loading | | °C | 250–260 | 250–260 | 200–205 | 150–180 | 150–180 | 150–170 | 90–100 | 80–100 | 55–70 | 80 | 250 | 260 |
| **Inflammability** | | | non-flammable | non-flammable | non-flammable | self extin-guishing | self extin-guishing | self extin-guishing | flammable | flammable | flammable | yes | self extin-guishing | V–0 |
| **Water absorption** | DIN 53 495 | % | <0.01 | 0.03 | <0.01 | <0.1 | <0.1 | 0.03 | <0.05 | 9–10 | <0.3 | – | 0.02 | 0.5 |
| **Transparency** | | | opaque | milky opaque | milky opaque | milky opaque | milky opaque | opaque | milky opaque | milky opaque | transparent | transparent | black | |
| **Radioresistance** | | MGy | 0.006 | 0.040 | 0.010 | 0.030 | 0.010 | 0.100 | 0.020 | 0.040 | 10 | 0.050 | – | |
| **Food suitability** | | | Yes | Yes | Yes | No | No | Yes | Yes | Yes | Yes | Yes | No | |
| **Mechanical** | **Standard** | **Unit** | **PTFE[1]** | **PFA** | **FEP** | **ETFE** | **ECTFE** | **PVDF** | **PP** | **PA** | **PS** | **PMMA[3]** | **PPS** | **PEEK** |
| **Tensile strength** 23 °C | DIN 53 456 | N/mm² | 29–39 | 27–32 | 19–25 | 36–48 | 41–54 | 38–50 | 25–40 | 40–60 | 35–60 | 72 | 195 | |
| at 70°C | | | – | – | – | – | – | – | 18–28 | 18–28 | 28–38 | 35 | 150 | |
| at 150°C | | | 14–20 | 15–21 | 4–6 | 8–12 | 3.5–4.5 | 7.5–10.5 | – | – | – | – | 70 | |
| **Limit of elasticity** 23 °C | DIN 53 455 | N/mm² | 10 | 14 | 12 | 24 | 34 | 46 | 25–40 | 40–80 | 32–57 | – | – | 97 |
| **Elongation a. tear** 23 °C | DIN 53 455 | % | 200–500 | 300 | 250–350 | 200–500 | 200–300 | 20–250 | 400–800 | 40–280 | 2–4 | – | 1.9 | 50 |
| **Tension E-module** 23 °C | DIN 53 457 | N/mm² | 400–800 | 650 | 350–700 | 500–1200 | 1200–1800 | 800–1800 | 1100–2100 | 1600–2000 | 2900–3500 | 3300 | 14700 | 3600 |
| **Limit of bending stress** at 23 °C | DIN 53 452 | N/mm² | 18–20 | 15 | – | 25–30 | 50 | 55 | 45–60 | 40–60 | breaks | – | – | |
| **Bending E-module** | DIN 53 457 | N/mm² | 600–800 | 650–700 | 660–680 | 1000–1500 | 1700 | 1200–1400 | 800–1500 | 1000–1600 | 3000–3400 | – | – | |
| **Ball hardness** 132/60 | DIN 53 456 | N/mm² | 25–30 | 25–30 | 23–29 | 34–40 | 55–65 | 62–68 | 58–80 | 50–80 | 110–160 | – | – | 200 |
| **Rockwell hardness R** | ASIM d-785 | | – | – | – | 45–55 | 85–95 | 100–115 | – | 90–100 | – | – | 100 | 99 |
| **Shore hardness D** | DIN 53 505 | | 55–72 | 60–65 | 55–60 | 63–75 | 70–80 | 73–85 | 70–75 | – | – | – | – | |
| **Coefficient of friction** dyn. against steel, dry | [2] | | 0.05–0.2 | 0.2–0.3 | 0.3–0.35 | 0.3–0.5 | 0.65 | 0.2–0.4 | 0.3–0.5 | 0.3–0.35 | – | 0.5 | 0.4 | |
| **Thermal** | **Standard** | **Unit** | **PTFE[1]** | **PFA** | **FEP** | **ETFE** | **ECTFE** | **PVDF** | **PP** | **PA** | **PS** | **PMMA[3]** | **PPS** | **PEEK** |
| **Melting temperature** | ASTM 2116 | °C | 327 | 300–310 | 253–282 | 265–275 | 240–247 | 165–178 | 158–167 | 215–221 | – | – | 285 | 335 |
| **Dimensional stability** u. heat A (18,5)Kp/cm² | DIN 53 461 | °C | 50–60 | – | 51 | 71–74 | 76 | 80–92 | 55–60 | 55–80 | 70–88 | 105 | – | 152 |
| heat B (4,6) Kp/cm² | DIN ISO R 75 | | 130–140 | – | 70 | 104 | 115 | 146–150 | 85–95 | 165–195 | 76–100 | – | – | |
| **Coeff. of linear thermal expansion** | | 1K x $10^{-5}$ | 10–16 | 10–16 | 8–14 | 8–12 | 4–8 | 8–12 | 15–18 | 6–12 | 6–8 | 7 | 2.6– 4.8 | |
| **Thermal conductivity** at 23 °C | DIN 52612 | W/K x m | 0.23 | 0.22 | 0.20 | 0.23 | 0.15 | 0.17 | 0.22 | 0.21–0.23 | 0.15–0.16 | 0.19 | 0.20 | 0.25 |
| **Specific heat** at 23 °C | | Kj /Kg x K | 1.01 | 1.09 | 1.17 | 1.95 | – | 1.38 | 1.68 | 1.5–2.1 | 1.18–1.34 | – | – | 2.16 |
| **Oxygen value** | | % | >95 | >95 | >95 | 30 | 60 | 43 | <30 | <30 | <30 | 1.47 | 56 | 35 |
| **Electrical** | **Standard** | **Unit** | **PTFE[1]** | **PFA** | **FEP** | **ETFE** | **ECTFE** | **PVDF** | **PP** | **PA** | **PS** | **PMMA[3]** | **PPS** | **PEEK** |
| **Dielectric constant** at $10^3$ | DIN 53 483 | | 2.0–2.1 | 2.06–2.1 | 2.1 | 2.6 | 2.6 | 7.8–9.0 | 2.26–2.4 | 4–12 | 2.4–2.74 | 3.6 | 4.0 | 3.2 |
| at $10^6$ | | | 2.0–2.1 | 2.06–2.1 | 2.06–2.1 | 2.6 | 2.5 | 6.4–7.6 | 2.25 | 3.5–9 | 2.5 | 2.7 | 4.1 | 3.2 |
| **Dielectric loss factor** at $10^3$ | DIN 53 483 | $10^{-4}$ | 0.3–0.5 | 0.2 | 2–8 | 6–8 | 90 | 120–200 | <4 | 270–2700 | 1–20 | 0.06 | 2 | 3.0 |
| at $10^6$ | | | 0.7–1.0 | 0.8 | 2–8 | 50 | 90 | 1500–1900 | <5 | 300–3300 | 1–14 | 0.02 | 20 | |
| **Volume resistivity** | DIN 53 482 | Ω x cm | $10^{18}$ | $10^{18}$ | $10^{18}$ | $10^{16}$ | $10^{15}$ | $10^{14}$ | $>10^{16}$ | $10^{12}$ | $>10^{11}$ | $10^{15}$ | $>10^{13}$ | $5x10^{16}$ |
| **Surface resistivity** | DIN 53 482 | Ω | $10^{17}$ | $10^{17}$ | $10^{16}$ | $10^{14}$ | $10^{14}$ | $10^{13}$ | $>10^{13}$ | $10^{10}$ | $>10^{13}$ | $5 x 10^{13}$ | $>10^{15}$ | $10^{12}$ |
| **Creep resistance** | DIN 53 480 | | KA3c | – | KA3c | – | – | KA1 | KA3c | KA3a-b | KA2-1 | 600 | – | KC 150 |
| **Arc resistance** | ASTM 495 | sec | >360 | – | >300 | >75 | 135 | >30 | – | – | – | – | – | |
| **Dielectric strength** | DIN 53 481 | KV/mm | 40–80 | 50–80 | 50–80 | 60–90 | 50–80 | 40–80 | 60–90 | 30–80 | 60–90 | 30 | 25–28 | 25 |
| **Gas permeability** | **Standard** | **Unit** | **PTFE[1]** | **PFA** | **FEP** | **ETFE** | **ECTFE** | **PVDF** | **PP** | **PA** | **PS** | **PMMA[3]** | **PPS** | **PEEK** |
| **Nitrogen permeability** | | cm³/m² d/bar | 0.7 | – | 3.8 | 4.7 | 1.5 | 0.06 | 4.3 | 0.5 | 0.27 | 1 | – | |
| **Oxygen permeability** | | cm³/m² d/bar | 2.05 | – | 30 | 15.6 | 0.39 | 0.05 | 19 | 1.2 | 2.35 | 1 | – | |
| **Carbon dioxide permeability** | | cm³/m² d/bar | 5.7 | – | 60 | 38 | 17 | 0.2 | 61 | 4 | 8 | – | 4 | |
| **Water vapor permeability** | | g/m²/d | 0.03 | – | 2 | 0.6 | 9 | 4.5 | 2.1 | 1 | 14 | 300 | – | |

[1] Not extrudable thermoplastic » [2] Not a standardised test. Friction coefficient is subject to different effects and can therefore only be used as a guide.
[3] Tested partially by methods other than those stated; upon request additional physical characteristics available based on the actual test methods used.

**All information stated without engagement.**

# Materials - Chemical Resistance



## Please note:

All information in our catalogue is based on current technical knowledge, experience and manufacturers' data. Users should check the suitability of parts and materials described in the catalogue before purchase.

BOLA does not accept any warranty claims as to suitability and fitness of purpose of the materials and products described in this catalogue. Users should avoid making any assumptions on, or interpretation of, the data herein. **Therefore we cannot provide warranty and cannot accept responsibility for any damage.**

## Categories of substances

| Classes of substances at +20 °C | PTFE | PFA | FEP | ETFE | ECTFE | PVDF | PP | PA | PS | PMMA |
|---|---|---|---|---|---|---|---|---|---|---|
| Aldehydes | + | + | + | + | + | + | o | o | – | – |
| Alcohols | + | + | + | + | + | + | + | – | o | o |
| Amines | + | + | + | + | + | o | o | o | + | – |
| Bases/Caustic solutions | + | + | + | + | + | + | + | o | o | – |
| Esters | + | + | + | + | + | o | + | + | – | – |
| Ether | + | + | + | o | o | o | o | o | – | – |
| Glycols | + | + | + | + | + | + | + | + | + | o |
| Ketones | + | + | + | o | o | o | o | + | – | – |
| Hydrocarbons, aliphatic | + | + | + | + | + | + | o | + | – | – |
| Hydrocarbons, aromatic | + | + | + | + | + | + | o | + | – | – |
| Hydrocarbons, halogenated | o | + | + | + | + | + | o | o | – | – |
| Mineral oils | + | + | + | + | + | + | – | + | + | o |
| Oxidizing agents, strong | + | + | + | o | o | + | o | – | – | – |
| Vegetable oils | + | + | + | + | + | + | o | + | + | o |
| Acids inorganic | + | + | + | o | o | + | + | – | + | o |
| Acids organic | + | + | + | o | o | + | + | – | o | + |
| Lubricating oils | + | + | + | + | + | + | + | + | + | + |

## Substances

| Substance at +20 °C | Conc. in % | PTFE | PFA | FEP | ETFE | ECTFE | PVDF | PP | PA | PS | PMMA |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Accumulator acid | 20 | + | + | + | + | + | + | + | – | + | – |
| Acetaldehyde | 100 | + | + | + | + | + | + | o | – | – | o |
| Acetamide | 100 | + | + | + | + | + | + | + | + | + | o |
| Acetic acid | 100 | + | + | + | + | + | + | + | – | o | – |
| Acetic acid amide | 100 | + | + | + | + | + | + | + | + | + | o |
| Acetic acid anhydride | 100 | + | + | + | + | + | – | o | – | – | – |
| Acetic acid butyl ester | 100 | + | + | + | + | + | + | o | + | – | – |
| Acetic acid chloride | 100 | + | + | + | + | + | + | o | o | – | – |
| Acetic acid ethyl ester | 100 | + | + | + | + | + | – | o | + | – | – |
| Acetic acid pentyl ester | 100 | + | + | + | + | + | + | + | + | – | + |
| Acetic anhydride | 100 | + | + | + | + | + | – | o | – | – | – |
| Acetone | 100 | + | + | + | + | + | – | + | + | – | – |
| Acetonitrile | 100 | + | + | + | + | + | o | + | + | – | – |
| Acetophenone | 100 | + | + | + | + | + | + | + | – | – | – |
| Acetyl benzene | 100 | + | + | + | + | + | + | + | – | – | – |
| Acetyl chloride | 100 | + | + | + | + | + | + | o | o | – | – |
| Acetylene tetrachloride | 100 | + | + | + | – | – | + | – | + | – | – |
| Acetylsalicylic acid | 100 | + | + | + | + | + | + | + | + | + | – |
| Acetone-2 | 100 | + | + | + | + | + | – | + | + | – | – |
| Acrylic acid butyl ester | 100 | + | + | + | + | + | o | o | + | – | – |
| Acrylic acid ethylic ester | 100 | + | + | + | + | + | o | o | + | – | – |
| Acrylonitrile | 100 | + | + | + | + | + | o | o | + | – | – |
| Adipic acid | 100 | + | + | + | + | + | + | + | + | + | – |
| Alcohol | 100 | + | + | + | + | + | + | + | – | o | o |
| Alcohol denatured | 100 | + | + | + | + | + | + | + | – | o | o |
| Alkyl acetone | 100 | + | + | + | + | + | + | + | – | o | – |
| Alkyl alcohol | 100 | + | + | + | + | + | + | + | – | o | – |
| Alkyl chloride | 100 | + | + | + | + | + | o | o | – | – | – |
| Allylether acetate | 100 | + | + | + | + | + | + | + | – | o | – |
| Alum | 100 | + | + | + | + | + | + | + | – | o | – |
| Alumina | 100 | + | + | + | + | + | + | + | + | o | o |
| Aluminium acetate | 100 | + | + | + | + | + | + | + | + | o | o |
| Aluminium chloride | 100 | + | + | + | + | + | + | + | o | + | o |
| Aluminium fluoride | 100 | + | + | + | + | + | + | + | + | + | – |
| Aluminium hydroxide | 100 | + | + | + | + | + | + | + | + | o | o |
| Aluminium hydroxidacetate | 100 | + | + | + | + | + | + | + | + | o | o |
| Aluminium nitrate | 100 | + | + | + | + | + | + | + | + | o | o |
| Aluminium oxide | 100 | + | + | + | + | + | + | + | + | o | o |
| Aluminium sulfate | 100 | + | + | + | + | + | + | + | + | o | o |
| Amino acid | 100 | + | + | + | + | + | + | + | + | + | o |
| Aminoacetic acid | 100 | + | + | + | + | + | + | + | + | + | o |
| Aminobenzene | 100 | + | + | + | o | o | + | + | + | – | o |
| Amino methane | 100 | + | + | + | + | + | + | + | – | o | + |
| Ammonia | 100 | + | + | + | + | + | + | + | o | o | – |
| Ammonia solution | 100 | + | + | + | + | + | + | + | o | o | – |
| Ammonium acetate | 100 | + | + | + | + | + | + | + | + | + | + |
| Ammonium alum | 100 | + | + | + | + | + | + | + | + | o | – |

**Definitions and abbreviations:**

+ **Excellent chemical resistance** – continuous exposure for more than 30 days does not cause any damage or only minor damages.
o **Limited chemical resistance** – depending on the plastic material, a continuous exposure for a longer period of time may cause damages such as cracks, decrease of mechanical strength, discoloration, etc.
– **Poor resistance** – the plastic material can be deformed or destroyed.

# Materials - Chemical Resistance

## Substances

| Substance at +20 °C | Conc. in % | PTFE | PFA | FEP | ETFE | ECTFE | PVDF | PP | PA | PS | PMMA |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Ammon.aluminiumsulfate | 100 | + | + | + | + | + | + | + | + | o | – |
| Ammonium carbonate | 100 | + | + | + | + | + | + | + | + | + | – |
| Ammonium chloride | 100 | + | + | + | + | + | + | + | o | + | – |
| Ammonium fluoride | 100 | + | + | + | + | + | + | + | o | + | – |
| Ammonium hydroxide | 25 | + | + | + | + | + | + | + | o | o | – |
| Ammonium nitrate | 100 | + | + | + | + | + | + | + | o | o | o |
| Ammonium oxalate | 100 | + | + | + | + | + | + | + | o | + | o |
| Ammon. peroxodisulfate | 100 | + | + | + | + | + | + | + | – | + | – |
| Ammonium persulfate | 100 | + | + | + | + | + | + | + | – | + | – |
| Ammonium phosphate | 100 | + | + | + | + | + | + | + | – | + | o |
| Ammonium sulfate | 100 | + | + | + | + | + | + | + | + | o | o |
| Ammonium sulfide | 100 | + | + | + | + | + | + | + | + | o | – |
| Ammon nitrate | 100 | + | + | + | + | + | + | + | o | o | o |
| Ammon salpeter | 100 | + | + | + | + | + | + | + | o | o | o |
| Ammon sulfate | 100 | + | + | + | + | + | + | + | + | o | o |
| Amyl acetate | 100 | + | + | + | + | + | + | + | + | – | + |
| Amyl alcohol | 100 | + | + | + | + | + | + | + | o | + | o |
| Aniline | 100 | + | + | + | o | o | + | + | + | – | o |
| Anisole | 100 | + | + | + | + | + | + | o | + | – | – |
| Anone | 100 | + | + | + | + | + | + | o | + | – | – |
| Antichlor | 100 | + | + | + | + | + | + | + | o | + | + |
| Antifreezing compound | 100 | + | + | + | + | + | + | + | + | o | o |
| Antimonous chloride | 100 | + | + | + | + | + | + | + | – | + | o |
| Antimony butter | 100 | + | + | + | + | + | + | + | – | + | o |
| Antimony trichloride | 100 | + | + | + | + | + | + | + | – | + | o |
| Aqua Regia | 100 | + | + | + | + | + | o | – | – | – | – |
| Arsenic acid | 100 | + | + | + | + | + | + | + | o | + | – |
| Arsenic (V)-oxide hydrate | 100 | + | + | + | + | + | + | + | o | + | – |
| Asphalt | 100 | + | + | + | + | + | + | o | + | + | o |
| Aviation gasoline | 100 | + | + | + | + | + | + | o | + | – | – |
| Azotic acid | 65 | + | + | + | + | + | o | – | – | – | – |
| **B** | | | | | | | | | | | |
| Barium carbonate | 100 | + | + | + | + | + | + | + | + | + | + |
| Barium chloride | 100 | + | + | + | + | + | + | + | + | + | + |
| Barium cyanide | 100 | + | + | + | + | + | + | – | + | + | o |
| Barium hydroxide | 100 | + | + | + | + | + | + | o | + | + | – |
| Barium sulfate | 100 | + | + | + | + | + | + | + | + | + | o |
| Barium sulfide | 100 | + | + | + | + | + | + | o | + | + | o |
| Baryta hydrate | 100 | + | + | + | + | + | + | o | + | + | – |
| Battery acid | 20 | + | + | + | + | + | + | + | – | + | + |
| Beer | 100 | + | + | + | + | + | + | + | + | + | + |
| Benzaldehyde | 100 | + | + | + | + | + | + | + | + | – | o |
| Benzoic acid | 100 | + | + | + | + | + | + | + | – | o | o |
| Benzene | 100 | + | + | + | + | + | + | o | + | – | – |
| Benzene diol-1,3 | 50 | + | + | + | + | + | + | + | – | o | o |
| Benzyl acetate | 100 | + | + | + | + | + | + | + | + | – | o |
| Benzyl alcohol | 100 | + | + | + | + | + | + | – | – | – | – |

| Substance at +20 °C | Conc. in % | PTFE | PFA | FEP | ETFE | ECTFE | PVDF | PP | PA | PS | PMMA |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Benzyl chloride | 100 | + | + | + | + | + | + | – | – | – | – |
| Benzoic aldehyde | 100 | + | + | + | + | + | + | + | + | – | o |
| Benzoyl chloride | 100 | + | + | + | + | + | + | – | – | – | – |
| Benzylsulfonic acid | 100 | + | + | + | + | + | + | o | – | – | – |
| Benzyl acetate | 100 | + | + | + | + | + | + | + | + | – | o |
| Bisulfite $SO_2$ | 100 | + | + | + | + | + | + | + | o | o | o |
| Bitumen | 100 | + | + | + | + | + | + | o | + | + | o |
| Bone glue | 100 | + | + | + | + | + | + | + | + | o | o |
| Borax | 100 | + | + | + | + | + | + | + | + | + | o |
| Boric acid | 100 | + | + | + | + | + | + | + | o | + | o |
| Bornanone-2 | 100 | + | + | + | + | + | + | + | + | + | o |
| Brake fluid | 100 | + | + | + | + | + | + | + | + | + | o |
| Brine | 25 | + | + | + | + | + | + | + | + | + | + |
| Bromine | 100 | + | + | + | + | + | + | – | – | – | – |
| Bromomethane | 100 | + | + | + | + | + | + | o | o | – | – |
| Butadiene-1,3 | 100 | + | + | + | + | + | + | – | o | – | – |
| Butane | 100 | + | + | + | + | + | + | + | + | o | o |
| Butane acid | 100 | + | + | + | + | + | + | – | o | – | o |
| Butane diacid | 100 | + | + | + | + | + | + | + | + | – | – |
| Butanol | 100 | + | + | + | + | + | + | + | o | + | o |
| Butyl acetate | 100 | + | + | + | + | + | + | o | + | – | – |
| Butyl alcohol | 100 | + | + | + | + | + | + | + | o | + | o |
| Butyl glycolate | 100 | + | + | + | + | + | + | + | + | + | + |
| Butyl ether | 100 | + | + | + | + | + | + | – | + | – | – |
| Butyl phenol | 100 | + | + | + | + | + | + | o | – | – | – |
| Butyric acid | 100 | + | + | + | + | + | + | – | o | – | o |
| **C** | | | | | | | | | | | |
| Calcium acetate | 100 | + | + | + | + | + | + | + | + | o | o |
| Calcium bicarbonate | 100 | + | + | + | + | + | + | + | + | + | + |
| Calcium carbonate | 100 | + | + | + | + | + | + | + | + | + | + |
| Calcium chloride | 100 | + | + | + | + | + | + | + | + | o | – |
| Calcium hydrogen carbonate | 100 | + | + | + | + | + | + | + | + | + | + |
| Calcium hydroxide | 100 | + | + | + | + | + | + | + | + | o | – |
| Calcium hypochloride | 100 | + | + | + | + | + | + | + | – | o | – |
| Calcium nitrate | 100 | + | + | + | + | + | + | + | + | + | – |
| Calcium oxide | 100 | + | + | + | + | + | + | + | + | + | + |
| Calcium sulfate | 100 | + | + | + | + | + | + | + | – | – | – |
| Calcium sulfide | 100 | + | + | + | + | + | + | + | – | – | – |
| Camphor | 100 | + | + | + | + | + | + | + | + | o | o |
| Camphora | 100 | + | + | + | + | + | + | + | + | o | o |
| Camphoric oil | 100 | + | + | + | + | + | + | + | + | + | o |
| Carbamide | 100 | + | + | + | + | + | + | + | + | + | + |
| Carbolic acid | 100 | + | + | + | + | + | + | o | – | – | – |
| Carbon disulfide | 100 | + | + | + | + | + | + | – | + | – | – |
| Carbon tetrachloride | 100 | + | + | + | + | + | + | o | – | – | – |
| Carbonic acid | 100 | + | + | + | + | + | + | + | + | o | o |
| Caustic baryta | 100 | + | + | + | + | + | + | o | + | + | – |

**Definitions and abbreviations:**

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o **Limited chemical resistance** – depending on the plastic material, a continuous exposure for a longer period of time may cause damages such as cracks, decrease of mechanical strength, discoloration, etc.
– **Poor resistance** – the plastic material can be deformed or destroyed.

# Materials - Chemical Resistance

| Substance at +20 °C | Conc. in % | PTFE | PFA | FEP | ETFE | ECTFE | PVDF | PP | PA | PS | PMMA |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Caustic potash | 100 | + | + | + | + | + | + | + | o | o | o |
| Caustic potash solution | 100 | + | + | + | + | + | + | + | o | o | o |
| Caustic soda | 85 | + | + | + | + | + | + | + | o | + | – |
| Cellosolve® | 100 | + | + | + | + | + | + | + | – | – | – |
| Cetyl alcohol | 100 | + | + | + | + | + | + | + | + | + | + |
| Chalk | 100 | + | + | + | + | + | + | + | + | + | + |
| Chlorine | 100 | + | + | + | + | + | + | o | – | – | – |
| Chloral hydrate | 100 | + | + | + | + | + | + | o | – | – | – |
| Chloric acid | 25 | + | + | + | + | + | + | + | – | – | – |
| Chloroacetic acid | 100 | + | + | + | + | + | + | + | – | o | – |
| Chlorobenzene | 100 | + | + | + | + | + | + | o | + | – | – |
| Chloroethane | 100 | + | + | + | + | + | + | o | o | – | – |
| Chloroethanol-2 | 100 | + | + | + | + | + | + | o | – | – | – |
| Chloroethyl | 100 | + | + | + | + | + | + | o | o | – | – |
| Chlorethylene | 100 | + | + | + | o | o | + | – | – | – | – |
| Chloroform | 100 | + | + | + | o | o | + | + | o | – | – |
| Chlorofluorocarbon (FFC) | 100 | + | + | + | + | + | + | + | – | o | o |
| Chloromethane | 100 | + | + | + | + | + | – | o | o | – | – |
| Chloropropene-3 | 100 | + | + | + | + | + | o | o | – | – | – |
| Chlorosulfonic acid | 100 | + | + | + | + | + | + | – | – | – | – |
| Chlorotoluene | 100 | + | + | + | + | + | + | – | – | – | – |
| Chromium(VI) oxide | 100 | + | + | + | + | + | + | + | – | o | – |
| Chromic acid | 50 | + | + | + | + | + | + | o | – | – | – |
| Chromic anhydride | 100 | + | + | + | + | + | + | + | – | o | – |
| Chromic sulfuric acid | 100 | + | + | + | + | + | + | o | – | – | – |
| Chromium trioxide | 100 | + | + | + | + | + | + | + | – | o | – |
| Citric acid | 10 | + | + | + | + | + | + | + | – | + | o |
| Coal tar particles | 100 | + | + | + | + | + | + | o | + | + | o |
| Cod liver oil | 100 | + | + | + | + | + | + | + | + | + | + |
| Copper chloride | 100 | + | + | + | + | + | + | + | – | + | + |
| Copper(I) cyanide | 50 | + | + | + | + | + | + | + | + | + | o |
| Copper(II) nitrate | 100 | + | + | + | + | + | + | + | o | + | + |
| Copper(II) sulfate | 100 | + | + | + | + | + | + | + | + | o | o |
| Cresol | 100 | + | + | + | + | + | + | o | – | – | – |
| Cumene | 100 | + | + | + | + | + | + | o | + | – | – |
| Cyclohexane | 100 | + | + | + | + | + | + | o | + | – | – |
| Cyclohexanol | 100 | + | + | + | + | + | + | o | + | – | – |
| Cyclohexanone | 100 | + | + | + | + | + | + | o | + | – | – |
| **D** | | | | | | | | | | | |
| D-Glucose | 100 | + | + | + | + | + | + | + | + | + | + |
| Decahydronaphthalene | 100 | + | + | + | + | + | + | o | + | – | o |
| Decalin | 100 | + | + | + | + | + | + | o | + | – | o |
| Decane | 100 | + | + | + | + | + | + | o | + | o | – |
| Denatured alcohol | 100 | + | + | + | + | + | + | + | – | o | o |
| Desiccator grease | 100 | + | + | + | + | + | + | + | o | – | – |
| Dextrin | 100 | + | + | + | + | + | + | + | + | + | + |
| Dextrose | 100 | + | + | + | + | + | + | + | + | + | + |

| Substance at +20 °C | Conc. in % | PTFE | PFA | FEP | ETFE | ECTFE | PVDF | PP | PA | PS | PMMA |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Diacetone | 100 | + | + | + | + | + | – | + | – | o | o |
| Diacetone alcohol | 100 | + | + | + | + | + | – | + | – | o | o |
| Diaminoethane | 100 | + | + | + | + | + | + | + | – | – | – |
| Dibutyl ether | 100 | + | + | + | + | + | + | – | + | – | – |
| Dichloroacetic acid | 100 | + | + | + | + | + | + | + | – | o | – |
| Dichlorobenzene | 100 | + | + | + | + | + | + | o | + | – | – |
| Dichloroethane | 100 | + | + | + | + | + | + | – | + | – | – |
| Dichloromethane | 100 | + | + | + | o | o | – | o | o | – | – |
| Diesel fuel | 100 | + | + | + | + | + | + | + | + | – | o |
| Diethanolamine | 100 | + | + | + | + | + | – | + | + | o | o |
| Diethyl ether | 100 | + | + | + | + | + | + | – | + | – | – |
| Diethylamine | 100 | + | + | + | + | + | – | + | + | o | o |
| Diethyle ketone | 100 | + | + | + | o | o | – | o | + | – | – |
| Diethylene glycol | 100 | + | + | + | + | + | + | + | + | o | o |
| Diethylene oxide | 100 | + | + | + | + | + | – | o | + | – | – |
| Diglycol | 100 | + | + | + | + | + | + | + | + | o | o |
| Dihydroxybenzene | 100 | + | + | + | + | + | + | + | – | – | + |
| Dihydroxybenzene-1,3 | 50 | + | + | + | + | + | + | + | – | o | o |
| Diisobuthyl ketone | 100 | + | + | + | o | o | – | o | + | – | – |
| Dimethyl benzene | 100 | + | + | + | + | + | + | o | + | – | – |
| Dimethyl ether | 100 | + | + | + | + | + | + | – | + | – | – |
| Dimethyl formamide | 100 | + | + | + | o | o | – | + | o | – | – |
| Dimethyl sulfoxide | 100 | + | + | + | + | + | – | + | + | + | o |
| Dimethylamine | 100 | + | + | + | + | + | – | + | + | o | o |
| Dioxane | 100 | + | + | + | + | + | – | o | + | – | – |
| Diphenyl ether | 100 | + | + | + | + | + | + | – | + | – | – |
| Diphenyl oxide | 100 | + | + | + | + | + | + | – | + | – | – |
| Dipropylene glycol | 100 | + | + | + | + | + | + | + | + | + | + |
| Disodium tetraborate | 100 | + | + | + | + | + | + | + | + | + | o |
| Disulfide | 100 | + | + | + | + | + | + | – | + | – | – |
| DMSO | 100 | + | + | + | + | + | – | + | + | + | o |
| **E** | | | | | | | | | | | |
| Eau de Javelle | 20 | + | + | + | + | + | + | o | – | + | – |
| Ethanal | 100 | + | + | + | + | + | + | o | – | – | o |
| Ethane diacid | 100 | + | + | + | + | + | + | o | + | – | – |
| Ethane diamine-1,2 | 100 | + | + | + | + | + | + | + | – | – | – |
| Ethane diol-1,2 | 100 | + | + | + | + | + | + | + | + | + | + |
| Ethanol | 100 | + | + | + | + | + | + | + | – | o | o |
| Ether | 100 | + | + | + | + | + | + | – | + | – | – |
| Ethyl acetate | 100 | + | + | + | + | + | – | o | + | – | – |
| Ethyl acrylate | 100 | + | + | + | + | + | o | o | + | – | – |
| Ethyl alcohol | 100 | + | + | + | + | + | + | + | – | o | o |
| Ethyl benzene | 100 | + | + | + | o | o | o | o | + | – | – |
| Ethyl chloride | 100 | + | + | + | + | + | + | o | o | – | – |
| Ethyl ether | 100 | + | + | + | + | + | + | – | + | – | – |
| Ethylene chlorohydrine | 100 | + | + | + | + | + | + | o | – | – | – |
| Ethylene glycol | 100 | + | + | + | + | + | + | + | + | + | + |

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– **Poor resistance** – the plastic material can be deformed or destroyed.

# Materials - Chemical Resistance

## Substances

| Substance at +20 °C | Conc. in % | PTFE | PFA | FEP | ETFE | ECTFE | PVDF | PP | PA | PS | PMMA |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Ethylene glycol ethyl ether | 100 | + | + | + | + | + | + | + | – | – | – |
| Ethylene methyl ketone | 100 | + | + | + | + | + | + | + | + | – | – |
| Ethylene oxide | 100 | + | + | + | + | + | + | o | + | – | – |
| Ethylenediamine | 100 | + | + | + | + | + | + | + | – | – | – |
| **F** | | | | | | | | | | | |
| Fatty acids | 100 | + | + | + | + | + | + | + | + | + | + |
| Ferric chloride | 100 | + | + | + | + | + | + | + | + | + | o |
| Ferric nitrate | 100 | + | + | + | + | + | + | + | + | + | + |
| Ferric sulfate | 100 | + | + | + | + | + | + | + | + | + | o |
| Fertilizer | 100 | + | + | + | + | + | + | + | + | o | o |
| Fixing baths | 100 | + | + | + | + | + | o | + | + | – | – |
| Fluorhydric acid | 45 | + | + | + | + | + | + | + | – | – | – |
| Fluorine | 100 | + | + | + | + | + | + | o | – | – | – |
| Fluosilicic acid | 100 | + | + | + | + | + | + | + | – | o | o |
| Formaldehyde | 40 | + | + | + | + | + | + | + | o | – | – |
| Formic acid | 100 | + | + | + | + | + | + | + | – | + | o |
| Formic acid amide | 100 | + | + | + | + | + | + | + | o | – | – |
| Formalin | 40 | + | + | + | + | + | + | + | o | – | – |
| Formamide | 100 | + | + | + | + | + | + | + | o | – | – |
| Fruit juice | 100 | + | + | + | + | + | + | + | + | o | + |
| Fuel oil | 100 | + | + | + | + | + | + | + | + | + | + |
| Furfural | 100 | + | + | + | + | + | o | – | o | – | – |
| Furfurol | 100 | + | + | + | + | + | o | – | o | – | – |
| Furfuryl aldehyde | 100 | + | + | + | + | + | o | – | o | – | – |
| **G** | | | | | | | | | | | |
| Gasoline, aromatic | 100 | + | + | + | + | + | + | o | + | – | – |
| Gasoline, leaded | 100 | + | + | + | + | + | + | o | + | – | – |
| Gasoline, test | 100 | + | + | + | + | + | + | o | + | – | – |
| Gasoline, unleaded | 100 | + | + | + | + | + | + | o | + | – | – |
| Gelatine | 100 | + | + | + | + | + | + | + | + | + | o |
| Glacial acetic acid | 100 | + | + | + | + | + | + | + | – | o | – |
| Glauber's salt | 100 | + | + | + | + | + | + | + | o | + | + |
| Glue | 100 | + | + | + | + | + | + | + | + | o | o |
| Glycerin | 100 | + | + | + | + | + | + | + | + | + | + |
| Glycine | 10 | + | + | + | + | + | + | + | + | + | o |
| Glycocoll | 10 | + | + | + | + | + | + | + | + | + | o |
| Glycol | 100 | + | + | + | + | + | + | + | + | + | + |
| Glycolic acid | 100 | + | + | + | + | + | + | + | + | o | o |
| Grape sugar | 100 | + | + | + | + | + | + | + | + | + | + |
| Grease and oil | 100 | + | + | + | + | + | + | + | + | + | + |
| Gypsum | 100 | + | + | + | + | + | + | + | – | – | – |
| **H** | | | | | | | | | | | |
| Heptane | 100 | + | + | + | + | + | + | o | + | – | – |
| Hexadecanol | 100 | + | + | + | + | + | + | + | + | + | + |
| Hexafluorosilicic acid | 100 | + | + | + | + | + | + | + | – | o | o |
| Hexane | 100 | + | + | + | + | + | + | o | + | – | – |
| Hexane diacid | 100 | + | + | + | + | + | + | + | + | + | – |

| Substance at +20 °C | Conc. in % | PTFE | PFA | FEP | ETFE | ECTFE | PVDF | PP | PA | PS | PMMA |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Hexane triol-1,2,6 | 100 | + | + | + | + | + | + | + | + | + | + |
| Hexanol | 100 | + | + | + | + | + | + | + | o | + | o |
| Hexyl alcohol | 100 | + | + | + | + | + | + | + | o | + | o |
| Hydrazine hydrate | 100 | + | + | + | o | o | – | – | – | – | o |
| Hydrobromic acid | 100 | + | + | + | + | + | + | + | – | – | – |
| Hydrochloric acid | 37 | + | + | + | + | + | + | + | – | o | o |
| Hydrocyanic acid | 100 | + | + | + | + | + | + | + | o | o | o |
| Hydrofluorocarbons | 100 | + | + | + | + | + | + | + | – | o | o |
| Hydrofluoric acid | 45 | + | + | + | + | + | + | + | – | – | – |
| Hydrogen peroxide | 90 | + | + | + | + | + | + | + | – | + | – |
| Hydrogen sulfide | 100 | + | + | + | + | + | + | – | + | – | – |
| Hydrogen sulfite | 100 | + | + | + | + | + | + | + | o | o | o |
| Hydroquinone | 100 | + | + | + | + | + | + | + | – | – | + |
| Hydrosulfide | 100 | + | + | + | + | + | + | – | + | – | – |
| Hydroxybenzoic acid | 100 | + | + | + | + | + | + | + | + | + | + |
| Hydroxyacetic acid | 100 | + | + | + | + | + | + | + | + | o | o |
| Hydroxypropionic acid-2 | 100 | + | + | + | + | + | + | + | o | + | o |
| **I** | | | | | | | | | | | |
| Iodine | 100 | + | + | + | + | + | + | o | – | – | – |
| Iodine tincture | 100 | + | + | + | + | + | + | o | – | – | – |
| Isobutyl acetate | 100 | + | + | + | + | + | + | o | + | – | – |
| Isobutyl alcohol | 100 | + | + | + | + | + | + | + | – | o | o |
| Isooctane | 100 | + | + | + | + | + | + | + | + | – | o |
| Isopropanol | 100 | + | + | + | + | + | + | + | o | + | + |
| Isopropyl acetate | 100 | + | + | + | + | + | o | o | + | – | – |
| Isopropyl alcohol | 100 | + | + | + | + | + | + | + | o | + | + |
| Isopropyl benzene | 100 | + | + | + | + | + | + | o | + | – | – |
| Isopropyl ether | 100 | + | + | + | + | + | + | – | + | – | – |
| Isovaleron | 100 | + | + | + | o | o | – | o | + | – | – |
| **J** | | | | | | | | | | | |
| Javelle water | 20 | + | + | + | + | + | + | o | – | + | – |
| **K** | | | | | | | | | | | |
| Kerosene | 100 | + | + | + | o | o | + | o | + | – | – |
| Kerosine | 100 | + | + | + | o | o | + | o | + | – | – |
| **L** | | | | | | | | | | | |
| Lactic acid | 100 | + | + | + | + | + | + | + | o | + | o |
| Lanoline | 100 | + | + | + | + | + | + | + | + | + | + |
| Lead(II) acetate | 100 | + | + | + | + | + | + | + | + | o | o |
| Lead sugar | 100 | + | + | + | + | + | + | + | + | o | o |
| Lead tetraethyl | 100 | + | + | + | + | + | + | + | + | o | – |
| Lime | 100 | + | + | + | + | + | + | + | + | + | + |
| Linseed oil | 100 | + | + | + | + | + | + | + | + | + | + |
| Lubricating oil | 100 | + | + | + | + | + | + | + | + | + | + |
| **M** | | | | | | | | | | | |
| Machinery oil | 100 | + | + | + | + | + | + | + | + | + | o |
| Magnesium carbonate | 100 | + | + | + | + | + | + | o | + | + | + |
| Magnesium chloride | 100 | + | + | + | + | + | + | + | + | o | o |

**Definitions and abbreviations:**

+ **Excellent chemical resistance** – continuous exposure for more than 30 days does not cause any damage or only minor damages.
o **Limited chemical resistance** – depending on the plastic material, a continuous exposure for a longer period of time may cause damages such as cracks, decrease of mechanical strength, discoloration, etc.
– **Poor resistance** – the plastic material can be deformed or destroyed.

# Materials - Chemical Resistance

| Substance at +20 °C | Conc. in % | PTFE | PFA | FEP | ETFE | ECTFE | PVDF | PP | PA | PS | PMMA |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Magnesium hydroxide | 100 | + | + | + | + | + | + | + | + | o | o |
| Magnesium nitrate | 100 | + | + | + | + | + | + | + | + | o | o |
| Magnesium sulfate | 100 | + | + | + | + | + | + | + | + | o | o |
| Maleic acid | 100 | + | + | + | + | + | + | + | o | o | o |
| Marble lime hydrate | 100 | + | + | + | + | + | + | + | + | o | – |
| MEK | 100 | + | + | + | + | + | + | + | + | – | – |
| Menthol | 100 | + | + | + | + | + | + | + | o | o | + |
| Mercury | 100 | + | + | + | + | + | + | o | + | o | + |
| Mercury(II)-chloride | 100 | + | + | + | + | + | + | + | + | + | + |
| Mercury(II)-cyanide | 50 | + | + | + | + | + | + | + | + | + | o |
| Mercury(II)-nitrate | 100 | + | + | + | + | + | + | + | o | + | + |
| Methacrylic ester | 100 | + | + | + | o | o | o | – | + | – | – |
| Methanal | 40 | + | + | + | + | + | + | + | o | – | – |
| Methanol | 100 | + | + | + | + | + | + | + | – | o | o |
| Methoxyethanol | 100 | + | + | + | + | + | + | + | + | + | + |
| Methoxybenzene | 100 | + | + | + | + | + | + | o | + | – | – |
| Methoxybutanol | 100 | + | + | + | o | o | o | o | + | – | – |
| Methyl acetate | 100 | + | + | + | + | + | – | o | + | – | – |
| Methyl alcohol | 100 | + | + | + | + | + | + | + | – | o | o |
| Methyl amine | 100 | + | + | + | + | + | + | + | – | o | + |
| Methyl benzene | 100 | + | + | + | + | + | + | o | + | – | – |
| Methyl bromide | 100 | + | + | + | + | + | + | o | o | – | – |
| Methyl butyl ketone | 100 | + | + | + | o | o | o | o | + | – | – |
| Methyl cellosolve | 100 | + | + | + | + | + | + | + | + | + | + |
| Methyl chloride | 100 | + | + | + | + | + | – | o | o | – | – |
| Methyl cyanide | 100 | + | + | + | + | + | o | + | + | – | – |
| Methyl ether | 100 | + | + | + | + | + | + | – | + | – | – |
| Methyl ethyl ether | 100 | + | + | + | + | + | + | – | + | – | – |
| Methyl ethyl ketone | 100 | + | + | + | + | + | + | + | + | – | – |
| Methyl ethyl ketone-2 | 100 | + | + | + | + | + | + | + | + | – | – |
| Methyl glycol | 100 | + | + | + | + | + | + | + | + | + | + |
| Methyl isobutyl ketone | 100 | + | + | + | o | o | + | o | + | – | – |
| Methyl methacrylate | 100 | + | + | + | o | o | o | – | + | – | – |
| Methyl phenylketone | 100 | + | + | + | + | + | + | + | – | – | – |
| Methylenchlorid | 100 | + | + | + | o | o | – | o | o | – | – |
| Methyl pentanone | 100 | + | + | + | o | o | + | o | + | – | – |
| Milk | 100 | + | + | + | + | + | + | + | + | + | + |
| Mineral oil | 100 | + | + | + | + | + | + | + | + | + | + |
| Mineral oil, non-aromatic | 100 | + | + | + | + | + | + | + | + | + | o |
| Monochloroacetic acid | 100 | + | + | + | + | + | + | + | – | o | – |
| Montanic wax | 100 | + | + | + | + | + | + | o | + | + | o |
| **N** | | | | | | | | | | | |
| Naphta | 100 | + | + | + | o | o | + | o | + | – | – |
| Nickel chloride | 100 | + | + | + | + | + | + | + | o | + | + |
| Nickel sulfate | 100 | + | + | + | + | + | + | + | o | + | + |
| Nitrate of sodium | 100 | + | + | + | + | + | + | + | o | + | + |
| Nitril triethanol | 100 | + | + | + | + | + | + | + | + | + | + |

| Substance at +20 °C | Conc. in % | PTFE | PFA | FEP | ETFE | ECTFE | PVDF | PP | PA | PS | PMMA |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Nitrobenzene | 100 | + | + | + | + | + | + | – | o | – | – |
| Nitrogen monoxide | 100 | + | + | + | + | + | + | + | + | + | + |
| Nitromethane | 100 | + | + | + | + | + | + | o | o | – | – |
| Nitrous acid | 50 | + | + | + | + | + | + | + | – | o | o |
| Nitrous oxide | 100 | + | + | + | + | + | + | + | o | – | – |
| Nonyl alcohol | 100 | + | + | + | + | + | + | + | o | + | o |
| **O** | | | | | | | | | | | |
| Octadecan acid | 100 | + | + | + | + | + | + | + | + | + | + |
| Octane | 100 | + | + | + | + | + | + | + | + | – | o |
| Oil, essential | 100 | + | + | + | + | + | + | o | + | – | o |
| Oleic acid | 100 | + | + | + | + | + | + | o | + | – | – |
| Oleum | 100 | + | + | + | – | – | – | – | – | – | – |
| Oleum Jecoris | 100 | + | + | + | + | + | + | + | + | + | + |
| Oxalic acid | 100 | + | + | + | + | + | + | o | + | – | – |
| Oxalic acid diammonium salt | 100 | + | + | + | + | + | + | + | o | + | o |
| Oxidiethanol | 100 | + | + | + | + | + | + | + | + | o | o |
| Oxirane | 100 | + | + | + | + | + | + | o | + | – | – |
| Oxolane | 100 | + | + | + | o | o | o | o | + | – | – |
| Ozocerite | 100 | + | + | + | + | + | + | o | + | + | o |
| Ozone | 100 | + | + | + | + | + | + | + | + | o | o |
| **P** | | | | | | | | | | | |
| Palmitic acid | 100 | + | + | + | + | + | + | o | + | – | – |
| Paraffins | 100 | + | + | + | + | + | + | + | + | + | + |
| Pentanol | 100 | + | + | + | + | + | + | + | o | + | o |
| Pentanol-1 | 100 | + | + | + | + | + | + | + | o | + | o |
| Pentanone-3 | 100 | + | + | + | o | o | – | o | + | – | – |
| Pentyl acetate | 100 | + | + | + | + | + | + | + | + | – | + |
| Perchloric acid | 100 | o | o | o | o | o | + | o | – | o | – |
| Perchloroethylene | 100 | + | + | + | – | – | + | – | + | – | – |
| Perfume | 100 | + | + | + | + | + | + | o | + | – | o |
| Peroxide of hydrogen | 90 | + | + | + | + | + | + | + | – | + | – |
| Petroleum | 100 | + | + | + | o | o | + | o | + | – | – |
| Petroleum ether | 100 | + | + | + | + | + | + | – | + | – | – |
| Phenol | 100 | + | + | + | + | + | + | o | – | – | – |
| Phenyl ether | 100 | + | + | + | + | + | + | – | + | – | – |
| Phenylamine | 100 | + | + | + | o | o | + | + | + | – | o |
| Phenylethanon-1 | 100 | + | + | + | + | + | + | + | – | – | – |
| Phenylmethanol | 100 | + | + | + | + | + | + | – | – | – | – |
| Phosphoric acid | 85 | + | + | + | + | + | + | + | – | o | – |
| Phosphorous chloride | 100 | + | + | + | + | + | + | o | o | – | – |
| Phosphorus trichloride | 100 | + | + | + | + | + | + | o | o | – | – |
| Phthalate | 100 | + | + | + | + | + | + | + | + | – | o |
| Phthalate ester | 100 | + | + | + | + | + | + | + | + | – | o |
| Pikric acid | 100 | + | + | + | o | o | + | + | – | o | – |
| Potash | 100 | + | + | + | + | + | + | + | o | o | + |
| Potassium acetate | 100 | + | + | + | + | + | + | + | o | o | o |
| Potass. aluminium sulfate | 100 | + | + | + | + | + | + | + | – | o | – |

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# Materials - Chemical Resistance

## Substances

| Substance at +20 °C | Conc. in % | PTFE | PFA | FEP | ETFE | ECTFE | PVDF | PP | PA | PS | PMMA |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Potassium bicarbonate | 100 | + | + | + | + | + | + | + | + | + | + |
| Potassium bichromate | 100 | + | + | + | + | + | + | + | o | o | o |
| Potassium bromide | 100 | + | + | + | + | + | + | + | o | o | + |
| Potassium carbonate | 100 | + | + | + | + | + | + | + | o | o | + |
| Potassium chlorate | 100 | + | + | + | + | + | + | + | + | + | + |
| Potassium chloride | 100 | + | + | + | + | + | + | + | + | + | + |
| Potassium chromate | 100 | + | + | + | + | + | + | + | o | + | + |
| Potassium cyanide | 50 | + | + | + | + | + | + | + | + | + | o |
| Potassium dichromate | 100 | + | + | + | + | + | + | + | o | o | o |
| Potassium ferrocyanide | 100 | + | + | + | + | + | + | + | o | + | o |
| Potassium ferricyanide | 100 | + | + | + | + | + | + | + | o | + | o |
| Pota. hexacyanoferrate(II) | 100 | + | + | + | + | + | + | + | o | + | o |
| Pota. hexacyanoferrate(III) | 100 | + | + | + | + | + | + | + | o | + | o |
| Potassium hydroxide | 100 | + | + | + | + | + | + | + | o | o | o |
| Potassium hypochlorite | 20 | + | + | + | + | + | + | o | – | + | – |
| Potassium iodide | 100 | + | + | + | + | + | + | + | + | o | + |
| Potassium nitrate | 100 | + | + | + | + | + | + | + | o | + | + |
| Potassium perchlorate | 25 | + | + | + | + | + | + | + | + | + | + |
| Potassium permanganate | 100 | + | + | + | + | + | + | + | – | o | + |
| Potassium persulfate | 100 | + | + | + | + | + | + | + | + | o | o |
| Propane | 100 | + | + | + | + | + | + | – | o | – | – |
| Propanediol-1,2 | 100 | + | + | + | + | + | + | + | + | + | + |
| Propanoic acid | 100 | + | + | + | + | + | + | + | – | o | o |
| Propanol | 100 | + | + | + | + | + | + | + | o | + | + |
| Propan-2-ol | 100 | + | + | + | + | + | + | + | o | + | + |
| Propantriol | 100 | + | + | + | + | + | + | + | + | + | + |
| Propen-2-ol-1 | 100 | + | + | + | + | + | + | + | – | o | – |
| Propyl alcohol | 100 | + | + | + | + | + | + | + | o | + | + |
| Propylene glycol | 100 | + | + | + | + | + | + | + | + | + | + |
| Propylene oxide | 100 | + | + | + | o | o | o | + | + | – | o |
| Prussiate of potash , red | 100 | + | + | + | + | + | + | + | o | + | o |
| Prussiate of potash , yell. | 100 | + | + | + | + | + | + | + | o | + | o |
| Pyridine | 100 | + | + | + | o | o | – | + | – | – | – |
| **Q** | | | | | | | | | | | |
| Quinol | 100 | + | + | + | + | + | + | + | – | – | + |
| **R** | | | | | | | | | | | |
| Resorcinol | 50 | + | + | + | + | + | + | + | – | o | o |
| **S** | | | | | | | | | | | |
| Salicylic acid | 100 | + | + | + | + | + | + | + | + | + | + |
| Salmiac | 100 | + | + | + | + | + | + | + | o | o | – |
| Salt, red | 100 | + | + | + | + | + | + | + | o | o | o |
| Selenite | 100 | + | + | + | + | + | + | + | – | – | – |
| Silicic acid | 100 | + | + | + | + | + | + | + | + | o | o |
| Silicone oils | 100 | + | + | + | + | + | + | + | + | + | + |
| Silver acetate | 100 | + | + | + | + | + | + | + | o | o | o |
| Silver cyanide | 50 | + | + | + | + | + | + | + | + | + | o |
| Silver nitrate | 100 | + | + | + | + | + | + | + | o | + | + |

| Substance at +20 °C | Conc. in % | PTFE | PFA | FEP | ETFE | ECTFE | PVDF | PP | PA | PS | PMMA |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Soda ash | 100 | + | + | + | + | + | + | + | o | o | + |
| Soda lye | 85 | + | + | + | + | + | + | + | o | + | – |
| Sodium acetate | 100 | + | + | + | + | + | + | + | o | o | o |
| Sodium benzoate | 100 | + | + | + | + | + | + | + | o | o | o |
| Sodium bicarbonate | 100 | + | + | + | + | + | + | + | + | + | + |
| Sodium bisulfate | 100 | + | + | + | + | + | + | + | + | + | o |
| Sodium bisulfite | 100 | + | + | + | + | + | + | + | o | + | – |
| Sodium bromide | 100 | + | + | + | + | + | + | + | o | o | + |
| Sodium carbonate | 100 | + | + | + | + | + | + | + | o | o | + |
| Sodium chromate | 100 | + | + | + | + | + | + | + | o | + | o |
| Sodium chlorate | 100 | + | + | + | + | + | + | + | – | + | + |
| Sodium chloride | 100 | + | + | + | + | + | + | + | + | + | + |
| Sodium chlorite | 100 | + | + | + | + | + | + | + | – | + | + |
| Sodium cyanide | 50 | + | + | + | + | + | + | + | + | + | o |
| Sodium dithionite | 100 | + | + | + | + | + | + | + | o | + | + |
| Sodium fluoride | 100 | + | + | + | o | o | + | + | o | + | + |
| Sodiu. hydrogen carbonate | 100 | + | + | + | + | + | + | + | + | + | + |
| Sodiu. hydrogen sulfate | 100 | + | + | + | + | + | | + | + | + | o |
| Sodiu. hydrogen sulfite | 100 | + | + | + | + | + | | + | o | + | – |
| Sodium hydroxide | 85 | + | + | + | + | + | + | + | o | + | – |
| Sodium hyposulfite | 100 | + | + | + | + | + | + | + | o | + | + |
| Sodium nitrate | 100 | + | + | + | + | + | + | + | o | + | + |
| Sodium nitrite | 100 | + | + | + | + | + | + | + | o | + | + |
| Sodiu. perborate Tetrahydrate | 100 | + | + | + | + | + | + | + | o | + | – |
| Sodium perchlorate | 25 | + | + | + | + | + | + | + | + | + | + |
| Sodium peroxide | 100 | + | + | + | + | + | + | o | + | + | o |
| Sodium peroxodisulfate | 100 | + | + | + | + | + | + | + | o | + | + |
| Sodium persulfate | 100 | + | + | + | + | + | + | + | o | + | + |
| Sodium phosphate | 100 | + | + | + | + | + | + | + | o | + | + |
| Sodium silicate | 100 | + | + | + | + | + | + | + | o | + | + |
| Sodium sulfate Decahydrate | 100 | + | + | + | + | + | + | + | o | + | + |
| Sodium sulfide | 100 | + | + | + | + | + | + | + | o | + | + |
| Sodium sulfite | 100 | + | + | + | + | + | + | + | o | + | + |
| Sodium superoxide | 100 | + | + | + | + | + | + | o | + | + | o |
| Sodiu. tetraborate Decahydra. | 100 | + | + | + | + | + | + | + | + | + | o |
| Sodium thiosulfate | 100 | + | + | + | + | + | + | + | o | + | + |
| Soft soap | 25 | + | + | + | + | + | + | + | o | + | + |
| Stearic acid | 100 | + | + | + | + | + | + | + | + | + | + |
| Styrene | 100 | + | + | + | + | + | + | o | + | – | – |
| Styrolene | 100 | + | + | + | + | + | + | o | + | – | – |
| Sublimate | 100 | + | + | + | + | + | + | + | + | + | + |
| Succinic acid | 100 | + | + | + | + | + | + | + | + | – | – |
| Sulfuric acid | 98 | + | + | + | + | + | + | o | – | – | – |
| Sulfuric acid fuming | 100 | + | + | + | – | – | – | – | – | – | – |
| Sulfur dioxide | 100 | + | + | + | + | + | + | + | – | o | o |
| **T** | | | | | | | | | | | |
| Table salt | 100 | + | + | + | + | + | + | + | + | + | + |

**Definitions and abbreviations:**

+ **Excellent chemical resistance** – continuous exposure for more than 30 days does not cause any damage or only minor damages.
o **Limited chemical resistance** – depending on the plastic material, a continuous exposure for a longer period of time may cause damages such as cracks, decrease of mechanical strength, discoloration, etc.
– **Poor resistance** – the plastic material can be deformed or destroyed.

# Materials - Chemical Resistance

| Substance at +20 °C | Conc. in % | PTFE | PFA | FEP | ETFE | ECTFE | PVDF | PP | PA | PS | PMMA |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Tallow | 100 | + | + | + | + | + | + | + | + | + | + |
| Tannic acid | 100 | + | + | + | + | + | + | + | + | o | – |
| Tannins | 100 | + | + | + | + | + | + | + | + | o | – |
| Tartaric acid | 100 | + | + | + | + | + | + | + | + | o | o |
| Tensides, non alkaline | 5 | + | + | + | + | + | + | + | + | + | + |
| Tetrachloroethane | 100 | + | + | + | – | – | + | – | + | – | – |
| Tetrachloroethylene | 100 | + | + | + | – | – | + | – | + | – | – |
| Tetrachloromethane | 100 | + | + | + | + | + | + | o | – | – | – |
| Tetraethyl lead | 100 | + | + | + | + | + | + | + | + | o | – |
| Tetrahydrofuran | 100 | + | + | + | o | o | o | o | + | – | – |
| Tetrahydronaphtalene | 100 | + | + | + | + | + | + | o | + | – | o |
| Tetralin | 100 | + | + | + | + | + | + | o | + | – | o |
| Tetramethylene oxide | 100 | + | + | + | o | o | o | o | + | – | – |
| THF | 100 | + | + | + | o | o | o | o | + | – | – |
| Thionyl chloride | 100 | + | + | + | + | + | o | – | – | – | – |
| Thinner (Solvol) | 100 | + | + | + | + | + | + | + | o | – | – |
| Toluol | 100 | + | + | + | + | + | + | o | + | – | – |
| Transformer oil | 100 | + | + | + | + | + | + | + | + | + | + |
| Trichlorobenzene | 100 | + | + | + | + | + | + | – | o | – | – |
| Trichloroacetic acid | 100 | + | + | + | + | + | + | o | – | o | o |
| Trichloroethylene | 100 | + | + | + | + | + | + | – | + | – | – |
| Trichloromethane | 100 | + | + | + | o | o | + | + | o | – | – |
| Triethanolamine | 100 | + | + | + | + | + | + | + | + | + | + |
| Triethylene glycol | 100 | + | + | + | + | + | + | + | + | + | + |
| Trifluorotrichloroethane | 100 | + | + | + | + | + | + | – | o | – | – |
| Triglycerides | 100 | + | + | + | + | + | + | + | + | + | + |
| Triglycol | 100 | + | + | + | + | + | + | + | + | + | + |
| Trimethylpentane-2,2,4 | 100 | + | + | + | + | + | + | + | + | – | o |
| Trinitrophenol-2,4,6 | 100 | + | + | + | o | o | + | + | – | o | – |
| Turpentine | 100 | + | + | + | + | + | + | o | + | – | – |
| Turpentine substitute | 100 | + | + | + | + | + | + | o | + | – | o |
| **U** | | | | | | | | | | | |
| Urea | 100 | + | + | + | + | + | + | + | + | + | + |
| Uric acid | 100 | + | + | + | + | + | + | + | + | + | o |
| Urine | 100 | + | + | + | + | + | + | + | + | + | + |
| **V** | | | | | | | | | | | |
| Vaseline | 100 | + | + | + | + | + | + | + | + | + | + |
| Vinyl acetate | 100 | + | + | + | o | o | + | – | – | – | – |
| Vinegar | 100 | + | + | + | + | + | + | + | o | + | – |
| Vinyl acetate | 100 | + | + | + | o | o | + | – | – | – | – |
| Vinyl chloride | 100 | + | + | + | o | o | + | – | – | – | – |
| Vinylbenzene | 100 | + | + | + | + | + | + | o | + | – | – |
| Vinyl cyanide | 100 | + | + | + | + | + | o | o | + | – | – |
| Vinylidene chloride | 100 | + | + | + | o | o | + | – | – | – | – |
| **W** | | | | | | | | | | | |
| Washing agents | 5 | + | + | + | + | + | + | + | + | + | + |
| Washing-up liquid | 5 | + | + | + | + | + | + | + | + | + | + |

| Substance at +20 °C | Conc. in % | PTFE | PFA | FEP | ETFE | ECTFE | PVDF | PP | PA | PS | PMMA |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Water | 100 | + | + | + | + | + | + | + | + | + | + |
| Water demineralized | 100 | + | + | + | + | + | + | + | + | + | + |
| Water glass | 100 | + | + | + | + | + | + | + | + | + | + |
| Wine spirit | 100 | + | + | + | + | + | + | + | – | o | o |
| Woll fat | 100 | + | + | + | + | + | + | + | + | + | + |
| Woll wax | 100 | + | + | + | + | + | + | + | + | + | + |
| **X** | | | | | | | | | | | |
| Xylol | 100 | + | + | + | + | + | + | o | + | – | – |
| **Y** | | | | | | | | | | | |
| Yeasts | 100 | + | + | + | + | + | + | + | + | + | + |
| **Z** | | | | | | | | | | | |
| Zinc carbonate | 100 | + | + | + | + | + | + | + | o | o | + |
| Zinc chloride | 100 | + | + | + | + | + | + | + | + | + | + |
| Zinc nitrate | 100 | + | + | + | + | + | + | + | o | + | + |

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