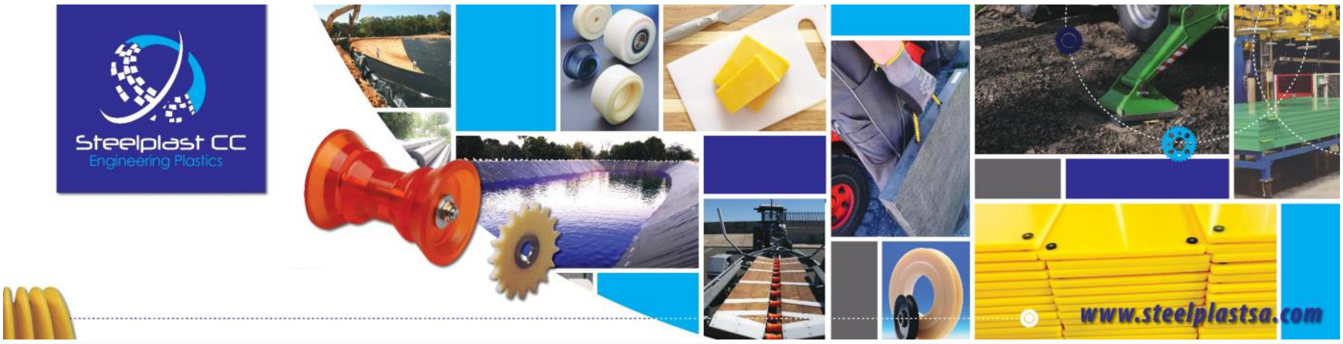

PTFE Polytetrafluoroethylene [Teflon]

Polytetrafluoroethylene is a high crystalline thermoplastic with excellent sliding properties, antiadhesive surfaces, excellent insulation properties, an almost universal chemical resistance and an exceptionally broad temperature deployment spectrum. However, this is offset by low mechanical strength and a high specific weight compared to other plastics. To improve the mechanical properties, polytetrafluoroethylene is compounded with fillers such as glass fibre, carbon or bronze. The polytetrafluoroethylene finished products that we offer consist of high density polytetrafluoroethylene types produced by extrusion or moulding processes.

Standard Colour: White

Mechanical Properties		
Density DIN53 479	g/cm³	2.18
Yield Stress DIN53 455	MPa	25
Elongation at break DIN53 455	%	380
Modules of elasticity resulting from **tensile** test DIN53 457	MPa	750
Modules of elasticity resulting from **bending** test DIN53 457	MPa	540
Flexural strength DIN53 452	MPa	6
Impact strength DIN53 453	KJ/m²	o. B.
Notched-bar impact strength DIN 53 453	KJ/m²	16
Ball indentation Hardness $H_{358/30}$ DIN53 456	MPa	30
Creep rate stress at 1% elongation DIN53 444	MPa	1.5
Sliding friction coefficient against steel (dry running) [3]	-	0.08
Sliding wear against steel (dry running) [3]	µm/km	21.0
Thermal Properties		
Melting temperature DIN53 736	ºC	+327
Thermal conductivity DIN52 612	W//(k m)	0.23
Specific thermal capacity	J/(g K)	1
Coefficient of linear expansion	10^{-5} - K^{-1}	18-20
Operating temperature range (long-term)	ºC	-200 +260
Operating temperature range (short-term)	ºC	+280
Fire behaviour after UL 94 IEC 60695	-	V-0
Electrical Properties		
Dielectric constant DIN53 483	-	2.1
Dielectric loss factor DIN53 483	-	0.0005
Specific volume resistance DIN53 482	Ω-cm	10^{18}
Surface resistance DIN53 482	Ω	10^{17}
Dielectric strength DIN53 481	KV/mm	40
Creep resistance DIN53 480	-	KA 3c KB> 600
Miscellaneous data		
Moisture absorption in natural Rubber until saturated DIN53 715	$W(H_2O)\%$	<0.01
Water absorption until saturated DIN53 495	$W_5\%$	<0.01
Specific properties		high chemical resistance, low strength

Main properties

- Excellent sliding properties
- Highest chemical resistance, also to solvents (limited with PTFE + bronze)
- Resistant to hydrolysis (limited with PTFE + bronze)
- High corrosion resistance (limited with PTFE + bronze)
- Broad temperature deployment spectrum (-200 °C to +260 °C)
- Resistant to weathering, does not absorb moisture
- Physiologically safe not PTFE + carbon/ + bronze)
- Good electrical insulator (not PTFE + carbon/+ bronze)
- Good thermal insulator (not PTFE + carbon/+ bronze)
- Anti-adhesive
- Virtually unwettable with liquids
- Fire resistant

Colours

PTFE pure: white
PTFE + glass: light grey
PTFE + carbon: black
PTFE + bronze: brown

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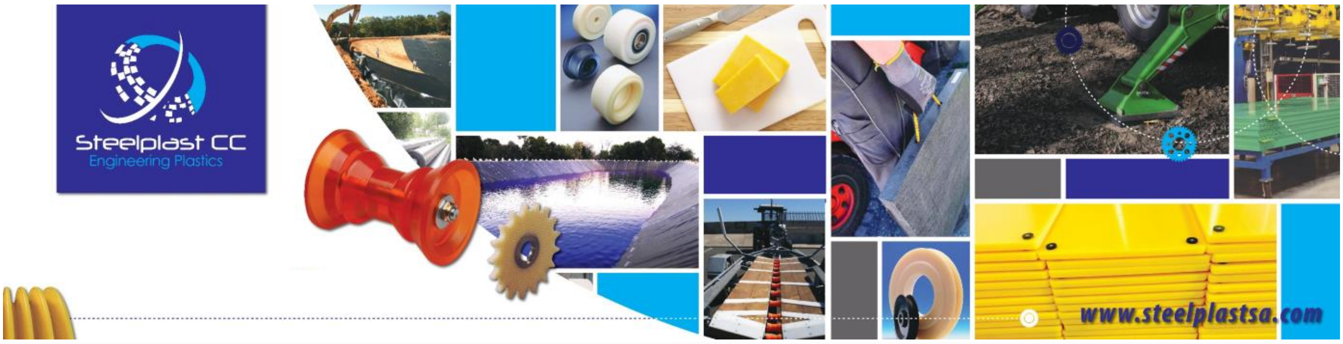

Sliding properties
PTFE has excellent sliding properties and because of its very close static and dynamic abrasion values, it prevents the "stick-slip effect". However, due to its low mechanical strength, PTFE has high sliding abrasion and a tendency to creep (cold flow). Hence, unfilled PTFE is only suitable for sliding applications with low mechanical load. Its load bearing capacity can be constructively improved by equipping the sliding element with several chambers. It must be ensured that the chamber is fully enclosed so that the slip lining cannot escape ("flow out").

PTFE + glass has worse sliding properties than pure PTFE due to the filler, but it can bear much higher loads. Sliding abrasion and the coefficient of elongation are reduced, while creep resistance and dimensional stability increase. The glass particles embedded in the material cause higher wear on the mating part than pure PTFE.

PTFE + carbon has similarly good slip properties as pure PTFE, but because of the addition of a filler, it has much better mechanical stability. As with glass as a filler, sliding abrasion and the coefficient of elongation are reduced, while creep resistance and dimensional stability increase. Sliding elements filled with carbon can be used for applications that are occasionally or constantly surrounded by water.

PTFE + bronze has the best mechanical values of all filled PTFE types and is very suitable for sliding applications. The filler causes the lowest sliding abrasion of all PTFE types. In addition to this, thermal conductivity, and consequently the dissipation of friction heat from the friction bearing, is considerably improved compared to other sliding materials, which leads to a longer life.

Weathering effects - All PTFE types are very resistant to UV rays, even in combination with atmospheric oxygen. No oxidation or discolouration has been observed.

Chemical resistance - Unfilled PTFE is resistant to almost all media apart from elemental fluorine, chlorotrifluoride and molten or dissolved alkali metals. Halogenated hydrocarbons cause minor, reversible swelling. In the case of filled PTFE, due to the filler one can assume a lower chemical resistance, although it is the filler that forms the reaction partner to the medium, not the PTFE. As a rule, it can be said that the types filled with carbon are not much less resistant than pure PTFE. The types filled with glass are resistant to acids and oxidising agents but less resistant to alkalis. The types filled with bronze have a much lower chemical resistance than pure PTFE. Before using filled PTFE types in chemically burdened environments, their resistance to the respective medium should always be tested.

Behaviour in fire - PTFE is rated as fire resistant in the highest category. It does not burn when an ignition source is added. The oxygen index (the oxygen concentration required for combustion), at 95% is one of the highest compared to other plastics.

Areas of use Applications
• Chemical industry
• Friction bearings
• Machine engineering
• Bearing bushes
• Precision mechanics
• Shaft seals
• Electrical industry
• Piston rings
• Textile industry
• Valve seats/seat rings
• Paper industry
• Insulators
• Food industry
• Flat seals
• Aerospace industry
• O-rings
• Building and bridge construction
• Test jacks
• Thread guides
• Anti-adhesive liners

Machining - PTFE is difficult to weld and even then, only by using a special process. It can be machined on machine tools. The semi-finished products can be drilled, milled, sawed, planed and turned on a lathe. It is also possible to cut a thread into the material or insert a threaded element. PTFE can also be bonded when the surface has been suitably treated by etching with special etching fluid. Up to approx. 19 °C, PTFE is subject to a phase transition which is normally accompanied by an increase in volume of up to 1.2%. This means that finished parts that are dimensionally stable at 23 °C can have considerable dimensional deviations at temperatures below 19 °C. This must be considered in the design and dimensioning of PTFE components. When the material is being machined, attention must be paid that good heat dissipation is guaranteed for parts with minimum tolerances, otherwise the good insulation properties can lead to dimensional deviations in finished parts after cooling because of the heat build-up and thermal expansion. Fluoropolymers degrade above approx. 360 °C forming highly aggressive and toxic hydrofluoric acid. As polymer dust can form when the material is being machined, smoking should not be permitted at the workplace.

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