



POLY TETRA FLUORO ETHYLENE

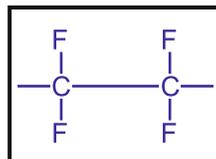
PTFE - SEMIFINISHED & FINISHED PRODUCTS

PTFE is a high performance engineering speciality polymer invented by Dr. Roy J. Plunkett at Du Pont's Jackson Laboratory, New Jersey, US, on 6th April 1938. As the polymer was found to have exceptional properties with regards to chemical inertness, heat resistance & frictional properties; developmental manufacturing began in 1943 with joint efforts of Kinetic Engineering Inc., USA & E.I. Du Pont de Nemours & Co. Inc., USA. The commercial production went operational by E.I. Du Pont de Nemours & Co. Inc., USA in 1948. The world wide consumption of PTFE is around 1,40,000 Tonnes per annum and is expected to grow at 10% per annum.



POLYMER SCIENCE

TFE Monomer is generally manufactured by synthesis of Calcium Fluoride (Fluorospar), Sulphuric Acid & Chloroform. The polymerisation of TFE is carried out in carefully controlled conditions to form PTFE. The chemical structure of PTFE is due to presence of stable & strong C-F bonds, PTFE molecule possess outstanding chemical inertness, high heat resistance & remarkable electrical insulation characteristics, in addition to excellent frictional properties.



GENERAL PROPERTIES

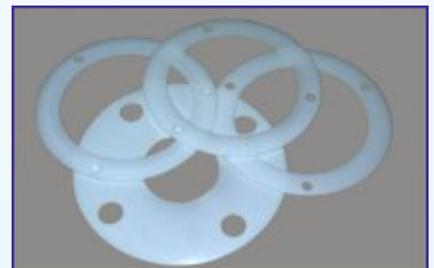
PTFE is a polymer which is extensively used in Chemical, Mechanical, Electronic & Electrical industries due to its unique characteristics:

- Chemical inertness to all known chemicals however attacked by molten alkali metals, chlorine, trifluorides, fluorine & related fluorine complexes at elevated temperatures & pressures
- Resistance to solvents, insoluble in all solvents up to 260°C. Certain high fluorinated oils swell & dissolve PTFE at temperature close to crystalline melting point.
- Wide operating temperature range -250°C to +260°C, at atmospheric pressure
- Lowest coefficient of friction among all known metals & non metals
- Nontoxic & antistick properties / Negligible water absorption / Nonflammable
- Resistance to radiation : electrical properties remain practically unchanged during & after irradiation, both in air & vacuum
- Excellent weathering resistance
- Outstanding electrical / insulating properties over wide frequency range

PTFE FILLED COMPOSITIONS

PTFE is available in virgin & filled compounds to improve the basic characteristics to match very diverse application & optimization for specific and uses

Grades	Filler Content by weight	Properties
Virgin PTFE	-----	<ul style="list-style-type: none"> ✓ Excellent Chemical Resistance ✓ Outstanding electrical properties ✓ Excellent flexural properties
Glass Filled PTFE	15 - 25	<ul style="list-style-type: none"> ✓ High compressive strength ✓ Better wear resistance ✓ Excellent chemical resistance
Carbon / Coke Filled	25 - 35	<ul style="list-style-type: none"> ✓ High compressive strength ✓ Better wear resistance ✓ Better thermal conductivity
Graphite Filled PTFE	15	<ul style="list-style-type: none"> ✓ Excellent chemical resistance ✓ Outstanding electrical properties ✓ Excellent flexural properties
Bronze Filled PTFE	40 - 60	<ul style="list-style-type: none"> ✓ High compressive strength ✓ Excellent wear resistance ✓ Very low cold flow ✓ Good thermal conductivity
Bronze + Molybdenum Disulphide filled PTFE	55 + 5	<ul style="list-style-type: none"> ✓ Improved frictional properties ✓ High compressive strength ✓ Excellent wear resistance ✓ Very low cold flow ✓ Good thermal conductivity
Glass + Molybdenum Disulphide filled PTFE	5/15 + 5	<ul style="list-style-type: none"> ✓ High compressive strength ✓ Better wear resistance ✓ Excellent chemical resistance
Pigmented PTFE	-----	<ul style="list-style-type: none"> ✓ Color coding ✓ Inferior chemical resistance



CAUTION : The presence of filler generally causes following negative features in compounds :

- Reduction in tensile strength & break elongation.
- Reduction in volume & surface resistivity.
- Difficulty in processing & fabrication.
- Lower chemical resistance depending upon type of filler.
- Reduction in coefficient of linear thermal expansion.

PTFE APPLICATIONS

Chemical Process Industries

1. Rods, Bushes, Sheets & Tubes
2. Expansion joints – Line Bellows, Valve bellows, PTFE+GFT Composite bellows, Custom bellows
3. Gaskets – Envelope, Ready cut Gaskets, Universal Rope Gaskets, Fused joint – circular – elliptical equipment envelope gaskets
4. Mechanical Packing – Chevron packings, O/V/D/U Rings, Cup Seals
5. Valve & Pump Components – Ball Seats, Stem Seals, Body Seals, Plug Sleeves, Diaphragms, Balls
6. Laboratory Ware – Beakers, Plug cocks, Tubes
7. Thread Seal Tapes



Mechanical Industries

1. Liners for machine tools guideways & slideways
2. Piston Rings / Sodium Itched Sheet
3. Low load high speed bush bearings
4. Guidebands & piston seals for hydraulic & machines Pneumatic actuators / seals
5. Thin walled tubings
6. Hysteresis – Friction washers for clutches

Electrical & Electronic Industries

1. PTFE Sintered insulation tape for insulation
2. PTFE films for capacitor
3. Chemically treated – Insulator bushes for traction
4. PTFE Brush Holder

Glass Lined Vessels Spares

1. Mainhole electrical gaskets, Body flange gaskets, flush bottom valve seat, 'T' Bushes, Sight glass Bush Ring

SPECIFICATION - PTFE

The Specification applicable and followed to process & manufacture PTFE Products are as under :

SHAPES	ASTM	BS
1. RAW POLYMER	D-1457	5184
2. RODS	D-1710	4271/5130
3. THICK WALLED TUBES	D-1710	4271/5130
4. THIN WALLED TUBES	D-3295	4976
5. MOULDED SHEET	D-3293	3784
6. SKIVED SHEET / TAPE	—	4893
7. MOULDED BASIC SHAPE	D-3294	3873
8. UNSINTERED TAPE	—	4375





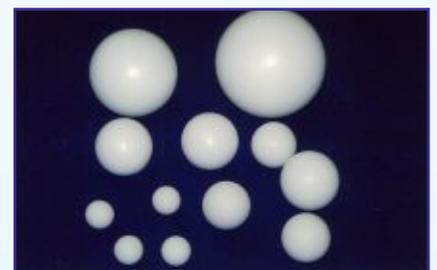
PTFE PRODUCT RANGE

PRODUCTS	STANDARD DIMENSIONS
PTFE MOULDED ROD / ROUND BAR	Dia 25mm – 500mm Dia Length upto 500mm
PTFE MOULDED BUSH, SLEEVE & HOLLOW BAR	Custom made Outer & Inner Dia. Length 100, 300, 500mm long
PTFE MOULDED SHEET	Thickness 2.5mm to 100mm Length & Width - 300mm ² to 1200mm ²
PTFE RAMEXTRUDED ROD / ROUND BAR	5mm DIA upto 100mm DIA, 900mm DIA, 1000mm DIA, 2000mm DIA
PTFE RAMEXTRUDED PIPE, SLEEVE, TUBE	25mm OD x 12.5mm ID to 100mm OD x 75mm ID Length upto 3300mm
PTFE SKIVED SHEET, THIN SHEET	50mm Width to 1200mm Width Thickness 0.1mm to 3mm
PTFE FLEXIBLE TUBING	0.8mm, 1mm, 1.5mm wall thickness in coil forms.
PTFE CUT GASKET, RING GASKET	To Suit Flange Standard Table E/F, ANSI-B-16.5-150#, 300#, 600# DIN Std., Size ½" NB to 28" NB (15NB - 700NB) Available in Raise Face & Full Face
PTFE ENVELOPE GASKET 15 NB TO 750 NB <small>Note : Envelope Gasket available with Asbestos, Non Asbestos, Steel and Rubber Filled Insert.</small>	Slitted Type / V Type with Flap Thickness 0.5 + 0.5mm Milled / U- Type with Gap 1.5, 2, 3, 4mm Flape (0.5 + 0.5)mm
PTFE VALVE COMPONENTS & PUMP COMPONENTS	Seat Ring, Stem Ring, Body Ring, Plug / Sleeve Ring





PRODUCTS	STANDARD DIMENSIONS
PTFE MACHINED COMPONENTS	O/V/U Chevron Ring 'T' Bushes, Bearing Bush in Two Half, Pully, Sparger, Beeker, Nut, Bolt & Washer
PTFE BELLOWS	Valve Bellow, Lined Bellow as per Customer Specification
PTFE BALL / SPHERE	6mm DIA to 100 mm DIA
PTFE PISTON RING	
PTFE GLAND PACKING Non Asbestos Packing	100% Pure PTFE Gland Packing 3mm Square & above Graphited/Carbon Blended PTFE Gland Packing.
PTFE UNIVERSAL ROPE	Size 3mm Round & Square onward
STANDARD GRADES OF MATERIAL OF COMPOSITION	
1) Virgin PTFE	5) 25% - 35% Carbon Filled PTFE
2) Chemically Modified Virgin PTFE	6) 15% Graphite Filled PTFE
3) 15%-25% Glass Filled PTFE	7) 40%-60% Bronze Filled PTFE
4) 5%/15% Glass + 5% MOS2 Filled PTFE	8) 55% Bronze + 5% MOS2 Filled PTFE



POLY ETHER ETHER KETONE (PEEK) PRODUCTS & MACHINED COMPONENTS

PEEK is a semi crystalline thermoplastic with a very stable chemical structure that offers critical advantages when compared to other materials.

Properties:

- ◆ High temperature resistance ◆ Extended lifetime
- ◆ Hydrolysis resistance ◆ Excellent chemical resistance





PHYSICAL PROPERTIES

	PROPERTY	UNIT	TEST METHOD	VIRGIN PTFE	25% GLASS FILLED PTFE	25% CARBON FILLED PTFE	15% GRAPHITE FILLED PTFE	40% BRONZE FILLED PTFE	60% BRONZE FILLED PTFE
MECHANICAL	1. Density	gm/cc	ASTM D-792	2.1-2.2	2.25	2.14	2.10-2.16	3.0-3.2	3.8
	2. Tensile strength	kgf/cm ²	ASTM D-638	210-350	125-200	120-155	150-200	125-300	105-140
	3. Elongation at Break	%	ASTM D-638	250-400	200-300	100-150	150-250	225-325	80-160
	4. Compressive strength	kgf/cm ²	ASTM D-695	40-50	75-85	75-85	65-75	85-100	115-125
	5. Compressive modulus	kgf/cm ²		4000	7000	8400	7500-8000	8000-8500	8800
	6. Deformation A. 2 Hrs. 23°C, 140 kg/cm ² B. 24 Hrs. 23°C, 140 kg/cm ² C. Permanent D. 2 Hrs. 150°C, 200 kg/cm ²	%	ASTM D-621	12 15 8 50	9 11 7 50	4 5 2.5 33	6 8 4.5 43	5 6 3 42	4 5 2.5 40
	7. Flexural strength	kgf/cm ²	ASTM D-790	57	42	96	55-60	80-85	80
	8. Flexural Modulus	kgf/cm ²	ASTM D-790	3500-6300	16700	11900	11000	14000	13800
	9. Impact Strength A. -20°C B. +20°C	cm kg/cm ²	ASTM D-256	9 15	9.5 11	7.5 10	10 14	11 9	11 10
	10. Hardness	Scale D	Shore	60-65	70-75	70-75	58-63	63-68	70-75
	11. Coefficient of friction A. Dynamic P-7 kg/cm ² V-0.5 m/sec B. Static P-35 kg/cm ²			0.06 0.05-0.08	0.5-0.54 1-0.13	0.31-0.37 0.09-0.11	0.11-0.16 0.08-0.10	0.11-0.15 0.08-0.10	0.12-0.17 0.08-0.1
	12. Water Absorption	%	ASTM D-570	0	0.013	0	0	0	0
THERMAL	13. Heat Resistant	°C		-250 to +260	-250 to +260	-250 to +260	-250 to +260	-250 to +260	-250 to +260
	14. Thermal Conductivity	10 ⁻⁴ CAL / CMS ² C	GENCO FITCH	6	9	13	14	17	19
	15. Linear Thermal Expansion A. 30-150°C B. 30-200°C C. 30-250°C	%	ASTM D-696	Axial-Radial 1.5 1.5 2.4 2.3 3.4 3.6	Axial-Radial 1.5 0.7 2.2 1.0 3.2 1.4	Axial-Radial 1.2 1 1.9 1.5 2.7 2.4	Axial-Radial 1.3 1 2 1.7 3 2.5	Axial-Radial 1.15 0.95 1.85 1.55 2.55 2.25	Axial-Radial 1.1 0.9 1.8 1.5 2.5 2.2
ELECTRICAL	16. Dielectric strength	Kv / mm	ASTM D-149	24	12	2	1-2	Conductive	Conductive
	17. Volume Resistivity	Ohm cm	ASTM D-257	10 ¹⁸	10 ¹⁵	10 ⁴	10 ³	10 ⁷	10 ⁷
	18. Surface Resistivity	Ohm	ASTM D-258	10 ¹⁵	10 ¹⁵	10 ⁷	10 ⁶	10 ⁹	10 ⁹
CHEMICAL	19. Chemical Resistance	PTFE is chemically inert & unaffected by all known chemicals except molten or dissolved alkali metals - Sodium, Potassium, Rubidium, Cesium, Francium & Fluorine Gas. Certain flourine compounds & complexes at elevated temperatures. Filled PTFE has inferior chemical resistance because of the presence of the particular filler.							

Note : Data quoted are average values only and should not be used as specifications for designing specific applications.



Shashi Fluoroplastiks

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