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ISMAT SEALS & HYDRAULICS INC.

PRODUCT CATALOGUE

PERFECTION IN PLASTICS

ISMAT SEALS & HYDRAULICS INC. was established in 2002, as a specialized Engineering Plastic, semi-finished products & components manufacturer, located in one of UA.E's premier free trade zones, Sharjah Airport International Free Zone. The company specializes in manufacturing of machined & injection molded Engineering Plastic components, Rubber molded & extruded components, and Polyurethane components.

Ismat Seals & Hydraulics Inc. can be rightfully claim to be only Company in U.AE to produce PTFE semi-finished and finished products. Besides PTFE the company specializes in general & advanced Engineering Plastics like Polyamide (PA), Polyacetal (POM), Polyethylene (PE), Polypropylene (PP), Polyvinyl Chloride (PVC), PET & PEEK machined parts catering to some of the major industries like Oil & Gas, Petrochemical, Cement, Dewatering, Powder coating, Valves, Shipping, Construction, Bottling, Packaging, Tiles & blocks, Gaskets & Seals manufacturing etc. Besides its extensive product portfolio, the company's greatest strength is its capability to custom design and produce components to meet individual customer specification.

In order to make it easier for design engineers and users to determine which plastic is best for their specific applications, we have summarised our experience in form of material descriptions in our website.

Engineering plastics are becoming increasingly popular in machine and plant construction as design engineers recognize their advantages and economic significance.

The use and development of materials is subject to continuous change. This also applies to plastics, many machined parts that were manufactured exclusively from conventional metals just ten years back and now being made from modern engineered plastics.

The main advantage of engineered plastics when compared to conventional metals are, weight reduction, noise reduction, resistance to wear, good vibration absorption and the fact that plastic are easier to machine. Additionally their level of chemical resistance, increasing thermal stability of several types of plastic and improved recycling possibilities are further positive arguments for choosing engineering plastics.

INDEX

Polyamide (PA)-Nylon

These are divided into three basic types PA6, PA66 and PA12

The main benefits of using PA are

1. High mechanical strength, hardness, rigidity & toughness
2. High mechanical damping properties
3. Good fatigue resistance
4. Very high wear resistance
5. Good sliding and emergency running properties
6. Good machining properties
7. Good Electrical Insulating properties
8. Good resistance to high energy radiation (Gamma & X-rays)

The standard stock shapes are manufactured by two methods.

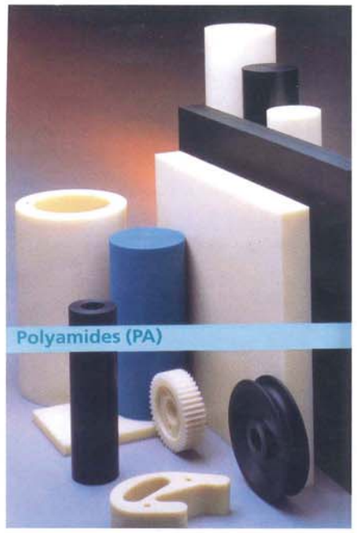
Casting & Extrusion

Casting grades:-
These grades are denoted by the suffix 'G' and these grades exhibit high mechanical strength, stiffness, heat, impact strength, creep resistance and wear resistance

The commonly used casting grades are:-

PA6G
Standard cast Polyamides for components, and equipment that are subject to above conditions.
Colors: natural, black.

PA6 is also available in an oil filled grade called Oilamid which offers superior self-lubricating properties and MoS2 filled grade which has a higher degree of crystallinity.



Applications: Gears, wear pads, bushings, bearings, conveyor plates, pump impellors etc.

PA12G

This is a special purpose grade used when higher impact and shock resistance, less water absorption and improved creep resistance is required.

Extrusion Grades

Extrusion grades are denoted by the suffix 'E', these are produced in smaller thicknesses and diameters and offer superior damping properties to casting grades.

The commonly available grades are:

PA6E This is a standard multipurpose grade and offer a good combination of mechanical stability, impact resistance and damping but much lower wear resistance to casting grades.

Applications: hammer heads, gear wheel etc.

PA66E This is harder than PA6 and is more resistant to wear but has lesser impact resistance.

PA12E Has very low water absorption proportion hence has very good impact behavior and is tough, but is much more costlier than PA6.

Colors: natural and black.

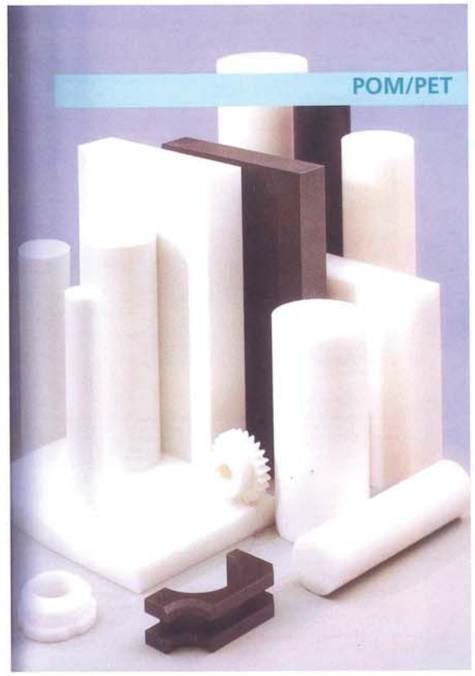
Polyacetal (POM) - Delrin

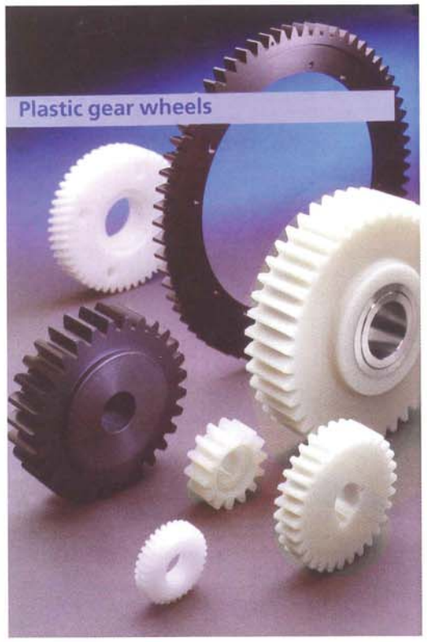
POM also known as Polyacetal and Delrin

This is highly crystalline thermoplastic with a high level of stability and rigidity as well as exhibits good sliding properties.

The main benefits of POM are

1. High stability, rigidity and hardness.
2. Good impact resistance even at low temperature
3. Low moisture absorption
4. Good creep resistance
5. High dimension stability
6. Good resistance to hydrolysis
7. Excellent Machineability
8. Good electric and dielectric properties
9. Suitable for food industries (physiologically safe)





POM-C has excellent sliding properties and good wear resistance, together with its other outstanding properties, POM-C is well suited for sliding applications with medium to high loads. This also applies to applications where high levels of humidity or wetness are to be expected.

POM-C is not resistant to UV rays, UV rays, in combination with atmospheric oxygen, oxidize the surface, and discoloration occurs or the surface become matt. If the material is subject to the effects UV rays for a long time, it tends to become brittle.

Applications: Spring elements, bushes, gear wheels. Sliding elements, insulators, pump components, casing parts, valve and valve bodies, counter parts, precision parts etc etc,

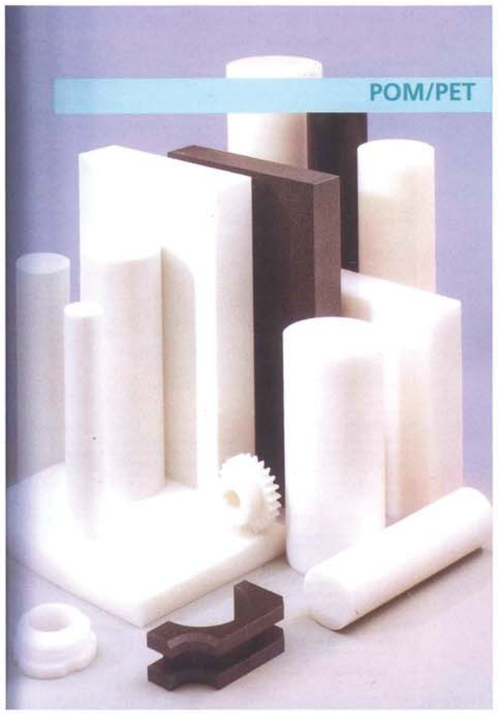
Polyethyleneterephthlate （PET）

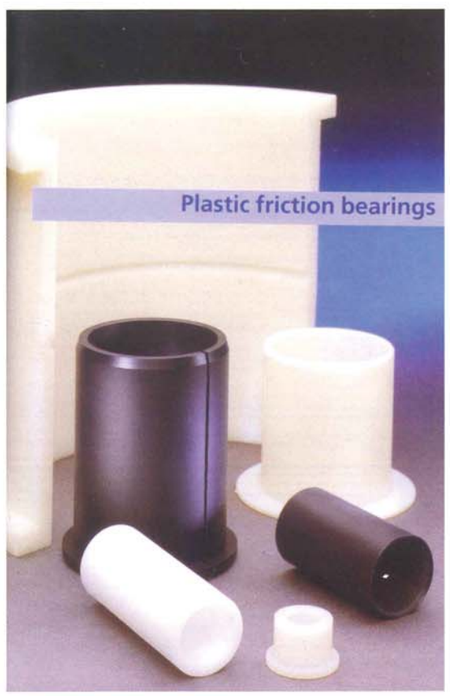
PET stock shapes are of the semi crystalline type and have a high level of hardness, rigidity and stability with excellent sliding properties and low sliding abrasion. Because of its good creep resistance, low level of moisture absorption and excellent dimensional stability, the material is ideally suited for complex parts with the highest demands on dimension stability and surface finish. For the reasons mentioned above, only the semi crystalline type is suitable for sliding applications.

The wear resistance and sliding properties of PET-GL have been improved compared to pure PET by adding a special, homogeneously distributed solid lubricating agent.

The main benefits of PET are

1. High stability, rigidity and hardness.
2. Very good creep resistance and dimension stability.
3. Very less sliding friction and sliding abrasion.
4. Resistance to hydrolysis





5. Physiologically safe
6. Excellent stain resistance
7. Better resistance to acids than PA & POM
8. Good electrical insulating properties
9. Resistant to high energy radiation （Gamma & X-rays）

Colors: PET （natural, black）, PET-GL light grey

PET has excellent sliding properties, very good wear resistance and, in combination with its other properties, is an excellent material for highly loaded sliding applications, This also applies to applications where high levels of humidity or wetness are expected.

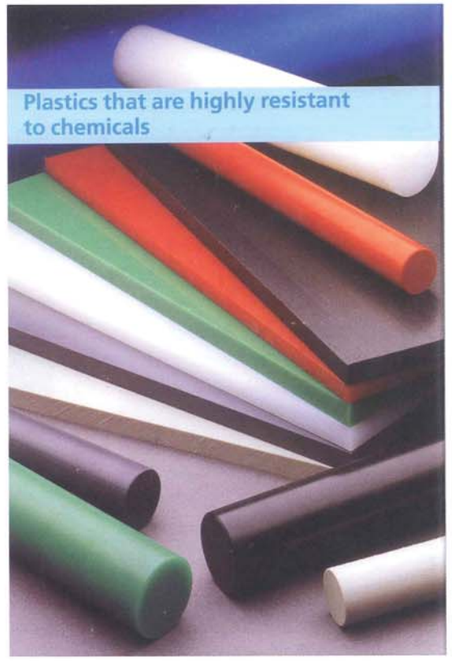
Applications: ratchet wheels, bushes, gears, sliding elements, insulators, casing parts, counter components, precision bearings, cam disks etc etc,

Polyethylene (PE)

Polyethylene is a semi crystalline thermoplastic with toughness and chemical resistance but has lower mechanical strength and lower high temperature resistance compared to other plastics.

The main benefits of PE are

1. Low density compared to other materials （0.94g/cm2）
2. High impact resistance even at low temperatures.
3. Minimum water absorption
4. Excellent chemical resistance
5. High corrosion resistance
6. Anti Adhesive
7. Very good electrical insulator
8. High vibration absorption
9. Physiologically safe
10. Good wear and abrasion resistance （Particularly UHMW-PE）
11. Excellent release properties
12. Good resistance to high energy radiation （Gamma & X-rays）



Colors: Natural （White）, Black & Green

PE Stock shapes are commonly available in 3 grades.

PE-HD:- （PE 300-molar mass approx 200,000g/mol）

or commonly known as HDPE （High density Polyethylene）. This grade is suitable for welding due to its relatively low molar mass

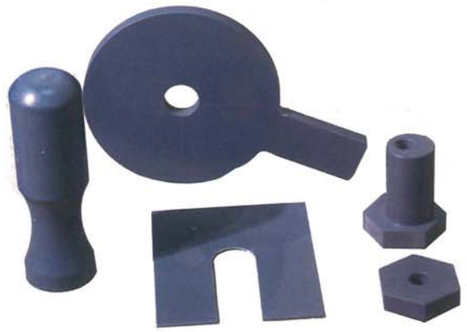
PE-HMW:- （PE 500 – molar mass approx 500,000g/mol） or commonly known as HMW-PE （High molecular weight Polyethylene）. This material has better sliding properties because of it's high molar mass and is also more abrasion resistant than HDPE, it is suitable for low stress components that are not subject to any high degree of abrasion.

PE-UHMW:- （PE 1000- molar mass approx 4,500,000g/mol） commonly known as UHMW-PE（Ultra high molecular weight

Polyethylene）. This material has very good wear resistance and good noise absorption.

Polyvinyl chloride (PVC)

PVC-U (Hard PVC) is an amorphous thermoplastic with no added plasticizer. It has high hardness and rigidity. According to DIN 16 927 the material is classified as normal shock resistant, however its toughness values border on being rated as highly shock resistant, which gives it a high degree of safety in regards to the design of components. PVC-U is a flame retardant material with an exceptional chemical resistance and also lower stress cracking. It shows high mechanical strength, tensile strength and works with a continues operating temperature of -15°C to +60°C. It can be easily glued and welded



The main benefits of PVC are:-

1. Good insulation properties for electronics
2. High mechanical strength, tensile strength and hardness
3. Low water absorption
4. Excellent chemical resistance
5. Fire resistant
6. Easily thermoformed
7. Can be bonded
8. Good cutting properties

Colors: Grey (RAL 7011)

PVC-U is not subject to any major sliding abrasion and is thus not suitable for use in sliding applications.

PVC-U is resistant to acids, alkaline solutions, alcohols, oils, fats, aliphatic hydrocarbons and petrol.

PVC-U is not resistant to benzole, chlorinated hydrocarbons, ketones or esters. In combination with strong oxidizing materials (e.g. nitric acid or chromic acid), there is a danger of stress corrosion cracking.

Applications: Pump parts, fittings, valve bodies, component parts in chemical plant construction, feed tables, machine and equipment coverings, gaskets, bearing cages, pipe lines, lamp boxes, parts in dental medicine etc etc,

Polypropylene (PP)

Polypropylene is a semi crystalline thermoplastic with high rigidity and very good chemical resistance. A distinction is also made between homopolymers and copolymers, copolymers are tougher but have less mechanical and chemical stability. The stock shapes offered by us are PP homopolymers as they are a superior type of PP.

The main benefits of PP are:-

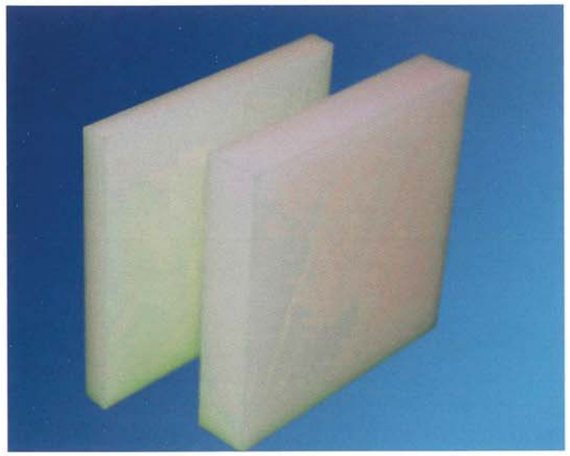
1. Low density compared to other materials
2. Minimum water absorption
3. Excellent chemical resistance even solvents
4. High corrosion resistance
5. Very good electrical insulator
6. Physiologically safe

Colors: Natural (White)

Applications: pump parts, component parts in chemical apparatus construction, fittings, valve bodies, product holders for electroplating processes, punching pads.

PP-H is subject to strong sliding abrasion and is thus not suitable for use in sliding applications.

PP-H is resistant to acids, alkaline solutions, salts and salt solutions, alcohols, oils, fats, waxes and many solvents. Aromatics and halogenated hydrocarbons cause swelling. PP-H is not resistant to strong oxidizing materials (e.g. nitric acid, chromic acid or halogens) and there is a danger of stress corrosion cracking.



PP-C with high impact strength and superior strength and its lower susceptibility to tension cracks are widely used for chemical, mechanical and electronic industry, e.g. tanks, lab equipments, etching equipments, semiconductor processing equipments, plating barrels, machined parts in industrial doors, swimming pools and so on.

PP-S with excellent low flammability property are used for special areas, such as in ventilation systems and electrical engineering.

PP-FG reinforced with fiber glass has higher strength than common PP sheets and are ideal for structural tanks and linings, Ducts and fume hoods, plating barrels and so on.

PTFE Coated Glass Fabric Cloth & Tapes

PTFE Glass Fabric Cloth can truly be described by that much used work "unique", as no other plastics material can match its combination of properties. Its typically composed of woven glass fibers coated with PTFE. As a result of which PTFE coated fabrics have the following general properties.

The main Properties of PTFE Coated Glass Fabic are

- Outstanding temperature resistance (from -170°C to +260°C)
- Excellent chemical resistance
- Superior non-stick surface, easy to clean
- High dielectric strength
- Dimensional stability
- Resistance to UV, IR and HF
- Non-toxic

High quality glass fabrics combined with specially formulated high level of PTFE content produces a smooth, high gloss surface coating, it has a good abrasion resistance and tensile strength. These fabrics comes in two forms, adhesive and non adhesive.

Adhesive fabrics are produced with either a silicone or acrylic pressure sensitive adhesive system. The silicone adhesive coated has a continues operating temperature range between -70°C and +260°C, while the acrylic adhesive coated provides high initial tack, enhanced solvent resistant and a continues operating temperature range between -40°C and +170°C

PTFE Glass self wound adhesive tapes has excellent characteristics of PTFE for e.g excellent electrical properties, high resistance to heat, weathering, chemicals and water repellency, nonteckiness, etc.

PTFE Film self wound adhesive tapes are used for laminating, winding, bundling and sealing purposes as well as electric insulation purpose.

Applications: packaging food stuff, rice bags, chemicals, heat sealing of plastic films, covering of friction areas of chutes, hoppers and guide rails, plastic bag sealing machines, mold releasing purposes etc etc,

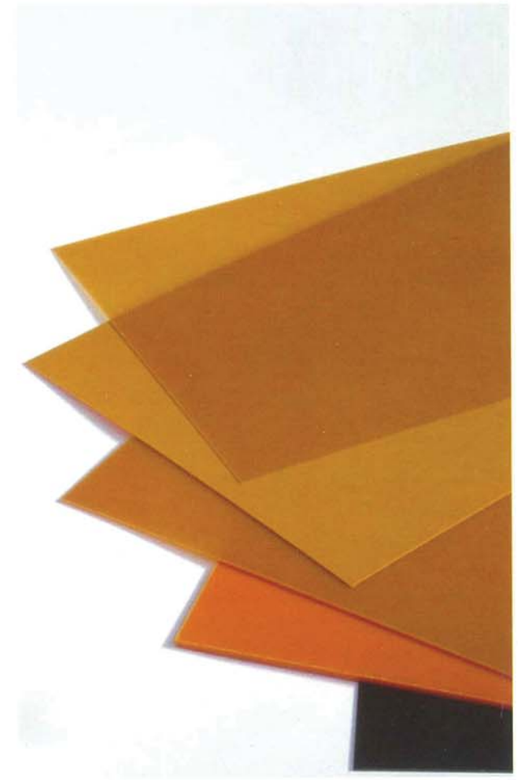
Phenolic Laminates (Bakelite)-Hylam

Laminate manufactured from extra fine and super extra fine cotton mesh impregnated with a Phenolic resin binder. It is characterized by its very great mechanical strength and low specific gravity. Resilient against a wide variety of chemical agents, it is highly resistant to wear and due to its finer surface, has better Machineability than paper grades. Phenolic laminates are mainly used in industrial applications in the electronics, power generation and aero-space industries.

Mechanical grades of fabric reinforced Phenolics rod and sheets are available ready stock.

Fabric Based Industrial Laminates

F1 grade material is manufactured from fine weave scoured cotton fabric, this has got good electrical and mechanical properties and can be machined to fine finish. This grade is suitable for small components such as instrument gears as well as intricate machined parts.



F2 grade material is manufactured from medium weave cotton fabric, the material of this grade has superior machining and punching properties and better resistance to chemicals, Recommended for small parts.

F3 grade material is manufactured from coarse weave, grey cotton fabric, the material of this grade is strong and tough with good machining properties, it is suitable for heave duty gears and applications requiring high impact strength.

F4 grade material is manufactured from medium weave fabric with very good die electrical properties and medium mechanical strength, some of the applications of the material is armature wedges, generators slot wedges insulation and bus bar support etc.

Polyetheretherketone (PEEK)

PEEK is a semi-crystalline thermoplastic with excellent sliding properties, very good mechanical properties, even under thermal load and an excellent resistance to chemicals.

The PEEK semi-finished products that we offer come in sheets, rods and tubes form, from these we can also manufacture finished parts made to specific requirements.

The main properties of PEEK are:-

1.High continuous working temperature (+250 C in air)
2. High mechanical strength
3. High rigidity
4. High creep resistance, also at high temperatures
5. Good sliding properties
6. High wear resistance
7. High dimensional stability
8. Excellent chemical resistance
9. Resistant to hydrolysis
10. Good electrical insulator
11. Radiation resistant
12. Physiologically safe
13. Fire resistant (UL 94 VO)

Color: Natural, black

PEEK ideally combines good sliding properties with high mechanical strength and thermal stability as well as excellent chemical resistance. Because of this, it is suitable for sliding applications. PEEK can be modified with carbon fiber, PTFE and graphite-with highest wear resistance, a low coefficient of friction and high pv limiting value – are available for component parts that are subject to especially high abrasion and wear.

Because of its unique properties, PEEK finds application in the chemical, pharma, food, nuclear, petrochemical, aerospace, and defence technologies.

Applications: gear wheels, friction bearings, bobbins, fitting or hot water meters, valves, piston rings, parts for car engines like bearing cages etc etc,

Polyurethane (P.U)

Polyurethane is an extremely versatile elastomer used in countless applications world wide. Polyurethanes mechanical properties can be isolated through creative chemistry which creates a number of unique opportunities with performance characteristics unequaled in any other material. It is our understanding of how to seize these opportunities which allow us to provide "Flexible Solutions Through Polymeric Innovation."

Advantages of Polyurethane?

Wide range of hardness: This classification of hardness of polyurethane relies on the prepolymers molecular structure, can be manufactured from 20 Shore A to 85 Shore D.

High load bearing capacity: It has a high load capacity in both tension and compression. It may undergo a little change in shape under a heavy load, but will return to its original shape once the load is removed with little compression set in the material when designed properly for a given application.

Color Ranges: Varying color pigments can be added to it in the manufacturing process. Ultraviolet shielding can be incorporated into the pigment to provide better color stability in outdoor applications.

Short Production Lead Times: Compared to conventional thermoplastic materials polyurethane has a relatively short lead time with significantly more economical tooling costs.

Flexibility: It performs very well when used in high flex fatigue applications. Flexural properties can be isolated allowing for vary good elongation and recovery properties.

Abrasion & Impact Resistance: for applications where severe wear prove challenging, polyurethanes are an ideal solution even at low temperatures.

Tear Resistance: It possesses high tear resistance along with high tensile properties.

Resistance to Water, Oil & Grease: Its properties will remain stable (with minimal swelling) in water / oil / grease. Its compounds will last many years in subsea applications.
Strong Bonding Properties: It bonds to a wide range of materials during the manufacturing process. These materials include other plastics, metals and wood. This properties make polyurethane an ideal material for wheels, rollers and inserts.
Applications: Engine mounts, bearings, flexible couplings, insulation, cable joining, gears, sprockets, wire guides, scraper blades, impellers, fenders, board rollers, nip rollers, seals, diaphragms, fork lift tyres, escalator wheels, roller skate wheels etc etc...

PHYSICAL MATERIAL GUIDING VALUES OF PLASTICS

			MECHANICAL VALUES								THERMAL VALUES					ELECTRICAL VALUES				
MATERIAL	ABB.	COLOURS (STANDARD)	DENSITY DIN EN ISO 1183	ELONGATION AT BREAK DIN EN ISO 527	E-MODULE(BENDING) DIN EN ISO 527	FLEXUAL STRENGTH DIN EN ISO 178	IMPACT STRENGTH DIN EN ISO 179	BALL INDENTATION HARDNESS H DIN EN ISO 2039-1	SLIDING FRICTION COEFFCIENT AGAINST STEEL (DRY RUNNING)	SLIDING FRICTION COEFFCIENT AGAINST STEEL (DRY RUNNING)	MELTING TEMPERATURE DIN EN ISO 3146	THERMAL CONDUCTIVITY DIN 52612	COEFFICIENT OF LINEAR EXPANSION	OPERATION TEMPERATURE RANGE (LONG TERM)	OPERATION TEMPERATURE RANGE (SHORT TERM)	DIELECTRIC CONSTANT IEC 250	DILECTRIC LOSS FACTOR IEC 250	SURFACE RESISTANCE IEC 93	DIELECTRIC STRENGTH IEC 93	WATER ABSORPTION UNTIL SATURATED DIN EN ISO 62
			1 ρ g/cm³	2 €zR %	3 Et MPa	4 σbB	5 acu kJ/m²	6 Hk MPa	7 -	8 V m/km	9 Tm °C	10 λ W/(K.m)	11 α $10^{-5}\cdot K^{-1}$	12 - °C	13 - °C	14 €R -	15 tanδ	16 R° Ω	17 Ed kV/mm	18 Ws %
Polyamide 6	PA 6	Natural /Black	1.14	50/180	2700/1800	130/40	o.B.	160/70	0.38/0.42	0.23	+218	0.23	8-9	-30 bis +100	+140	3.7	0.031	10 /10	50.20	10.0
Polyamide 6 Cast	PA 6 G	Natural /Black /Blue	1.15	40/100	3100/1800	140/60	o.B.	160/125	0.36/0.42	0.15	+220	0.23	7-8	-40bis +105	+170	3.7	0.03	10 /10	50/20	6.5
Polyamide 1200	PA 12 G	Natural	1.03	56	2200	90	o.B.	100	0.4	-	+190	0.23	10-11	-60bis +110	+150	3.7	0.003	10	50/20	1.4
Polyacetal Copolymer	POM - C	Natural /Black	1.41	40	3000	115	o.B.	150	0.32	8.9	+168	0.31	9-10	-30 bis +100	+140	3.9	0.008	10	40	0.8
Polyethyleneterephthlate	PET	Natural /Black	1.38	20	3200	125	80	140	0.25	0.35	+255	0.24	7-8	-20 bis +100	+160	3.6	0.008	10	-	0.5
Polyethyleneterephthlate solid lubricant	PET-GL	Light Grey	1.43	5	2200	-	30	-	0.2	0.1	+255	0.23	7-8	-20 bis +100	+160	3.6	0.008	10	-	0.4
Polyethylene 500	PE- HMW	Natural /Black /Green	0.95	300	850	40	o.B.	45	0.29	1.0	+133	0.38	18	-100 bis +50	+80	2.9	0.0002	10	44	<0.01
Polyethylene 1000	PE-UHMW	Natural /Black /Green	0.94	350	800	27	o.B.	40	0.29	0.45	+133	0.38	18	-260 bis +50	+80	3.0	0.0004	10	44	<0.01
Polypropylene Homopolymer	PP-H	Natural /Grey	0.91	70	1400	45	o.B.	70	0.35	11.0	+162	0.22	16	-0bis +80	+100	2.25	0.00033	10	52	<0.01
Polyvinylehloride	PVC-U	Grey/ Black/Red/White	1.42	15	3000	82	o.B.	130	0.6	56.0	-	0.156	8	-0bis +50	+70	3.3	0.025	10	39	<0.01
Polyetherketone	PEEK	Natural /Black	1.32	45	3600	160	o.B.	230	0.34	-	+340	0.25	4-5	-40 bis +250	+310	3.2	0.002	10	24	0.45

All above stated data results from random tests which were taken from the on going production. All data was established on standard test-productsaccording to ISO, DIN and ASTM standards and can basically not be carried over to the complete seal

Polytetrafluoroethylene (PTFE)

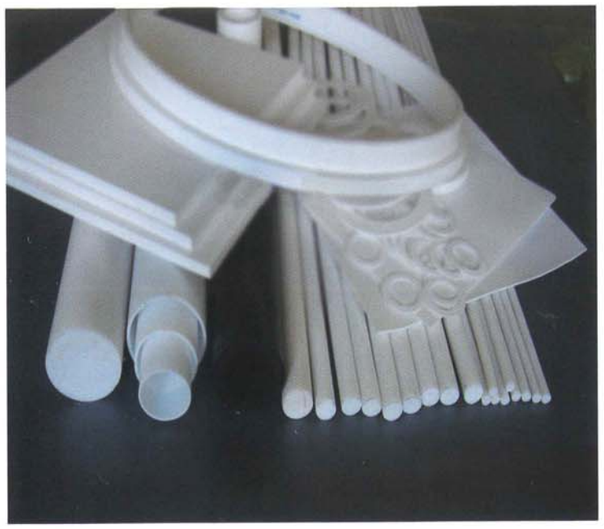
Also known as Teflon (Du Pont brand name), PTFE is a highly crystalline thermoplastic with excellent sliding properties, anti-adhesive surfaces, excellent insulation properties, an almost universal chemical resistance and an exceptionally broad temperature deployment spectrum. However, this is offset by low mechanical strength and high specific weight compared to other plastics. To improve the mechanical properties, PTFE is compounded with fillers such as glass fiber, bronze, carbon, graphite etc etc.

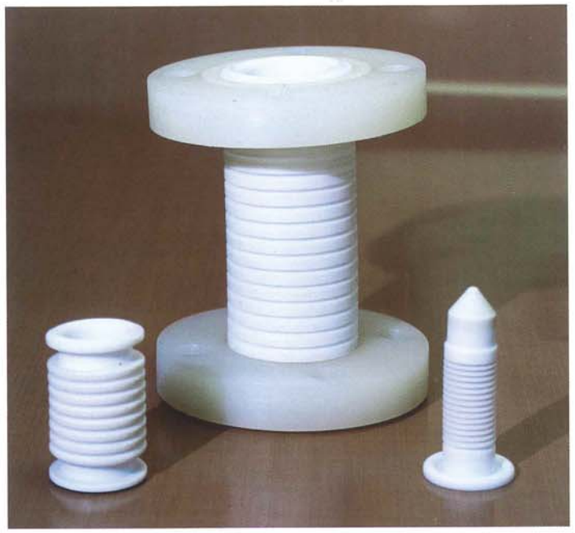
The main properties of PTFE are:-

1. Excellent sliding properties
2. Highest chemical resistance, also to solvents (limited with PTFE+bronze)
3. Resistant to hydrolysis (limited with PTFE+bronze)
4. High corrosion resistance (limited with PTFE+bronze)
5. Broad temperature deployment spectrum (-200°C to + 260°C)
6. Resistant to weathering
7. Does not absorb moisture
8. Physiologically safe (not PTFE+coal/+bronze)
9. Good electrical insulator (not PTFE+coal/+bronze)
10. Good thermal insulator (not PTFE+coal/+bronze)
11. Anti-adhesive
12. Virtually unwettable with liquids
13. Fire resistant

Colors: Virgin PTFE (White), PTFE + Bronze (Brown), PTFE + Glass (Off white), PTFE + Carbon (Black), PTFE + Graphite (Dark grey)

PTFE is available sheets, rods and tubes form as well as custom molded part can be manufactured against drawing and specification.





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 chambers is fully enclosed so that the slip lining cannot escape (flow out).

To suit customized applications, the following filled grades are available readily.

1. 25% carbon filled PTFE
2. 35% carbon filled PTFE
3. 40% bronze filled PTFE
4. 70% bronze filled PTFE
5. 25% glass filled PTFE
6. 15% glass filled PTFE
7. 15% glass + 5% MoS2 filled PTFE

For Every specific requirement, PTFE can be specifically compounded with various fillers to meet your unique requirements.

Applications: Friction bearings, Bearing bushes, Shaft seals, Piston rings, Valve seats / seat rings, Insulators, Flat seals, O rings, Hydraulic seals, Test jacks, Thread guides, Anti- adhesive liners etc etc,

Physical Properties of PTFE

Properties	Condition	Standard	Unit	Virgin	Graphite	Glass + Molly	Glass	Carbon	Bronze
				100%V	15%G+85%V	15%G+5%MoS_2+80%V	25%G+75%V	25%C+75%V	40%B+60V
Colour				White	Black	Grey	Off White	Black	Brown
Densiy/Specific Gravity	23 °C	DIN 53 479	Kg/m^3	2.160	2.200	2.244	2.220	2.100	3.150
Hardness	23 °C	ISO 868	Shore D	55±3	65±3	58±3	60±3	67 ± 3	60±3
Ball indentaton hardness	23 °C	DN 53456 H135 / 30	MPa	≥26	≥29	≥26	≥27	≥34	≥39
Tensile strength	23 °C	ASTM D 4745 - 79	MPa	≥27	≥15	≥16	≥16	≥18	≥22
Elongation at break	23 °C	ASTM D 4745 - 79	%	≥350	≥140	≥185	≥219	≥80	≥216
Compressive strength	23 °C	DIN 53 455	MPa	≥4	-	≥8	≥8	-	≥10
Thermal conductivity	23 °C	DIN 53 612	$\frac{J \times 10^3}{m \times h \times K}$	0.08	4	0.13	1.3	3.5	4
Coefficient of thermal expansion	25 °C - 200 °C		$K^{-1} \times 10^{-5}$	19	11.2	11	10.7	10.9	8.5
Coefficient of friction	*		u	0.08	0.14	0.13	0.16	0.17	0.13
Minimum Service tempreaure			°C	-200	-200	-200	-200	-200	-200
Maximum service tempreature			°C	260	260	260	260	260	260
Young's module		DIN 53 457	MPa	540	-	1320	1320	-	1375

All above stated data results from random tests which were taken from the on going production. All data was established on standard test-products according to ISO, DIN and ASTM standards and can basically not be carried over to the complete seal

Modified Polytetrafluoroethylene (TFM)

TFM is a chemically modified version of PTFE that has improved capabilities over Virgin PTFE. Some of the advantages include reduced cold flow, much lesser deformation under load, smoother surface and much better flexibility.

In addition to the properties of PTFE, Modified PTFE has the folowing properties...
- Part surfaces are smoother, and less porous - components stay clean since they are less likely to trap contaminants
- Low micro-void content yields improved permeation resistance
- Longer flex life than PTFE
- Increased stiffness & improved creep resistance
- Higher dielectric strength yields superior high-voltage insulation

Application Limitations:

- Higher Cost
- Not recomended for very high preassure applications.

Usage:

- Gaskets, Seals, Ball Valve Seats etc.

Physical properties		*VIRGIN PEEK*	*LUBRICATED PEEK*	*PCTFE*
Colour		*Tan*	*Black*	*White translucent*
Specific Gravity	*D792*	*1.34*	*1.46*	*2.11*
Hardness Shore D	*D2240*	*18300 (126)*	*87*	*80*
Compressive Strength, psi (Mpa)	*D695*	*88*	*24,350 (168)*	*5800 (40)*
Elongation at Break %	*D638*	*27.00*	*1.95*	*150*
Tensile Strength (Mpa)	*D638*	*13,500 (93)*	*20,300 (140)*	*5800 (40)*
Service Temperature °C		*-40 to +260*	*-40 to +260*	*-240 to +204*

Polychlorotrifluoroethylene (PCTFE)

PCTFE is a white translucent material which is very rigid, it has excellent resistance to cold flow, exhibits dimensional stability at a wide temperature range, has very low gas permeability and low moisture absorption properties, PCTFE is also FDA approved.

Application Advantages:

- Stress-crack resistance, High mechanical strength and low shrinkage rate at low temperatures provide excellent stability for valve seats.
- Excellent chemical resistance to all inorganic corrosive liquids
- Practically zero moisture absorption
- Excellent electrical properties maintained in high humidity

Application Limitations:

- PCTFE swells slightly in halocarbon compounds, ethers, esters and aromatic solvents.
- Although PCTFE has excellent chemical resistance, it is still less than that of PTFE

Usage:

- Cryogenic valve seats
- High pressure gas seats and seals
- Semi-conductor process components such as wafer boats.
- Sight Glasses and windows
- Electrical components
- Parts for high vacuum applications

Perfluoroelastomer (FFKM)

Perfluoroelastomers show ultimate performance among all elastomers. They are resistant to nearly every chemical class with some grades offering heat resistance over 300°C, this makes FFKM the material of choice for high demanding sealing applications.

Application advantages:

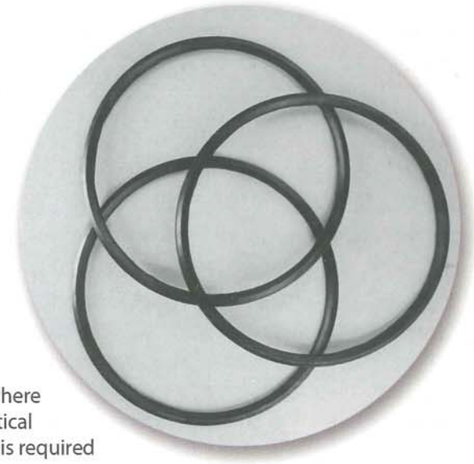
- Excellent heat resistance
- Resistant to almost every chemical class
- Excellent outgassing performance in vacuum environments.
- Wide temperature range -30° C to +300° C

Application limitations:

- Avoid low-molecular-weight, fully halogenated fluids and molten alkali metals. Strong oxidizing acids may causesome swelling
- Helium permeability is slightly higher than fluoroelastomer compounds
- Extreme high cost.

Usage:

- All areas where extreme critical application is required



Physical properties	*ASTM Method*	*FFKM-HS*	*FFKM-HS (I)*	*FFKM-CS*	*FFKM-PS*	*FKM-7512*	*FKM-LT*	*FKM-AED*	*FKM-90*	*HNBR 7513*	*HNBR 9012*	*HNBR-AED*	*HNBR-LT*	*FVMQ*
Colour	*BLACK*	*BLACK*	*BLACK*	*WHITE*	*WHITE*	*BLACK*	*BLACK*	*BLACK*	*BLACK*	*BLACK*	*BLACK*	*BLACK*	*BLACK*	*BLUE*
Specific Gravity		*2.02*	*2*	*2*	*2*	*1.83*	*1.88*		*2.2*					
Hardness Shore A	*D2240*	*81*	*78*	*76*	*74*	*75*	*72*	*94*	*8.6*	*72*	*88*	*88*	*89*	*71*
Elongation at Break %	*D638*	*153*	*152*	*129*	*230*	*150*	*163*	*65*	*100*	*206*	*163*	*185*	*108*	*150*
Tensile Strength Mpa	*D638*	*17*	*11*	*16*	*11*	*12*	*15*	*17*	*11*	*13*	*10*	*20*	*13*	*7*
Compression set 70 Hrs@ 200°C	*D395*	*14*	*14*	*15*	*18*	*20*	*20*	*16*	*25*	*22*	*22*	*18*	*20*	*14*
Max. Service Temperature		*316*	*316*	*275*	*316*	*204*	*204*	*204*	*204*	*150*	*150*	*150*	*150*	*150*
Min. Service Temperature °C						*-19*	*-40*	*-26*	*-19*	*-32*	*-32*	*-35*	*-46*	*-72*

Fluorosilicone (FVMQ)

Fluorosilicone combines most of the attributes of silicone with resistance to petroleum oils and hydrocarbon fuels.
Low physical strength and abrasion resistance combined with high friction limit fluorosilicone to static seals.

Application advantages:

- Excellent heat resistance
- Excellent resistance to ozone, sunlight, oxidation and possesses excelent felxibility at low tempratures
- Excellent electrical and flame resistivity
- Excellent resistance to water, ammonia, dilute acids, alkalis, lubricating oils, fuel oils and aliphatic hydrocarbons such as kerosene
- Temperature range of -59° C to 232° C

Application limitations:

- Poor mechanical properties rating
- Low tensile strength
- Fair compression set resistance
- Poor resistance to ketones and oxygenated solvents

Usage:

- Aeronautical seals, highly specialized and extreme low temperature seals.