

Moldflon™

The New Dimension in PTFE Processing



elringklinger
Kunststofftechnik

Moldflon™ – The PTFE for Thermoplastic Processing: Properties and Applications

Pages 4–17

Pages 18–19

Pages 20–23



Basic properties
Special properties
DMTA data,
Positioning Moldflon™

Processing technologies
Injection molding, extrusion,
fiber spinning, calendering,
thermoforming, transfer
molding

Applications
Automotive industry,
medical technology,
electrical engineering,
chemical engineering



Innovations from Plastics

With its seals and engineering design elements ElringKlinger Kunststoff-technik has been one of the technology leaders in its field for over 40 years. We develop tailored solutions from PTFE, PTFE compounds and other high-performance plastics as well as composite parts combining PTFE with other plastics or metals for customers around the world. Our solutions meet the toughest demands to be found in the field – with economy and reliability guaranteed.

Moldflon™ – The Tailor-made Thermoplastic Material for Cost-effective Processing

Moldflon™ is a new type of thermoplastic material. Its composition largely corresponds to conventional modified polytetrafluoroethylene (PTFE). However, unlike PTFE, this thermoplastic material can be processed from the melt – a major advantage in terms of economy and processability for PTFE high-volume production.

Moldflon® is a registered trademark in following countries:
Germany | Austria | Bulgaria | Belarus | China | Cyprus | Czech Republic | Denmark | Estonia | Spain | Finland | France | Great Britain | Greece | Hungary | Ireland | India | Italy | Japan | Lithuania | Latvia | Malta | Poland | Portugal | Romania | Russia | Sweden | Slovenia | Slovakia | USA

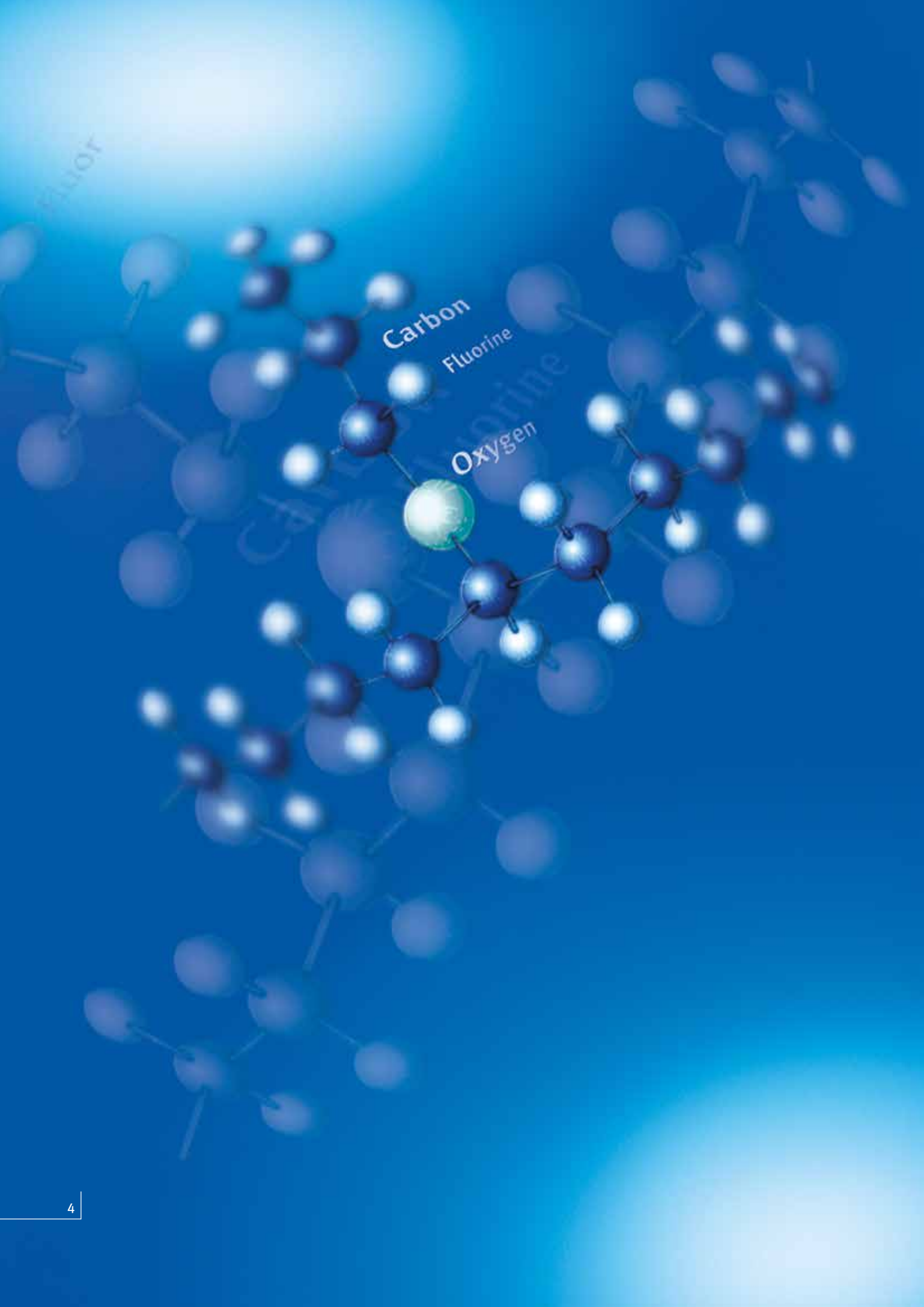


*Technical
Consulting Support*

We will be pleased to support you in selecting the material that best meets your application requirements. Trust us to supply you with the optimum solution in terms of functionality and cost effectiveness.

*Quality and Environmental
Policy*

Top quality and an active commitment to environmental protection are key to ElringKlinger Kunststofftechnik's sustained success in the marketplace. That is why we are certified according to ISO/TS 16949 and DIN EN ISO 14001.



Fluor

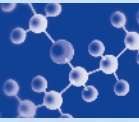
Carbon

Fluorine

Oxygen

Carbon
Fluorine

Moldflon™ – The Innovative Thermoplastic Material



Thanks to its thermoplastic processability Moldflon™ opens up new application potential for PTFE, such as complex geometries which used to be difficult – or impossible – to achieve by cutting. The innovation with Moldflon™ consists of the fact that, unlike PTFE, it can be

processed from the melt – a new dimension in terms of economy and processing technology in high-volume manufacturing of PTFE products.

Other options include the extrusion of continuous profiles, fibers and sheets as well as the fabrication of components by means of transfer-molding. Moldflon™ enables cost-effective system solutions, not least due its avoidance – by and large – of waste which is inevitably generated when cutting PTFE.



Thermoplastic processing

Highly cost-effective due to:

- Customized molding/shaping
- High-volume manufacturing
- Short cycle times
- Sprue recycling
- Low resource consumption
- Low operator requirements
- High process reliability/stability

Outstanding properties of PTFE:

- High temperature resistance
- Nearly universal chemical resistance
- Light and weather resistance
- Very good sliding properties
- Anti adhesive
- Non-flammable
- Electrically insulating
- Physiologically harmless

Basic Properties

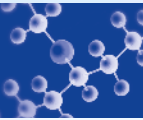
Comparison of physical characteristic values:

PTFE, modified PTFE, Moldflon™, PFA, MFA, FEP

Moldflon™ is characterized by a well-balanced properties profile. In the area of fully fluorinated PTFE and thermoplastic products it is positioned between modified PTFE and PFA. With a melting point between 324°C and 315°C, it immediately follows modified PTFE.

Physical properties of fully fluorinated plastics

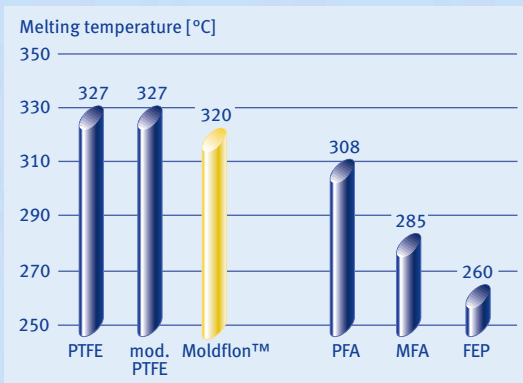
Property	Unit	PTFE	Mod. PTFE	Moldflon™	PFA	MFA	FEP
General							
Permanent service temperature	°C	260	260	260	250	250	205
Specific gravity	g/cm ³	2.13–2.20	2.13–2.19	2.14–2.18	2.12–2.17	2.12–2.17	2.12–2.17
Flammability	UL flammability standard	V-0	V-0	V-0	V-0	V-0	V-0
Oxygen index	%	>95	>95	>95	>95	>95	>95
Water absorption	%	<0.01	<0.01	0.01	0.03	<0.03	<0.01
Thermal							
Melting point	°C	327	327	315–324	300–310	280–290	253–282
Thermal conductivity	W/K x m	0.22–0.23	0.22–0.23	0.22–0.23	0.22	0.22	0.2
Coefficient of thermal expansion	1/K x 10 ⁻⁵	12–17	12–17	12–16	10–16	12–20	8–14
Specific heat at 23°C	KJ/kg x m	1.01	1.01	1.03	1.09	1.09	1.17
Mechanical							
Tensile strength at 23°C	MPa	29–39	29–39	23–32	27–32	22–36	19–25
Elongation at break	%	200–500	300–600	150–450	300	300–360	250–350
Modulus of elasticity in tension at 23°C	MPa	400–800	650	400–630	650	440–550	350–700
Shore hardness D		55–72	59	55–65	60–65	59	55–60
Friction coefficient Dyn. steel, dry		0.05–0.2	0.05–0.2	0.05–0.2	0.2–0.3	0.2–0.3	0.2–0.35
Electrical							
Spec. volume resistivity	Ohm x cm	10 ¹⁸	10 ¹⁸	10 ¹⁸	10 ¹⁸	10 ¹⁸	10 ¹⁸
Dielectric constant at 10 ⁶ Hz		2.0–2.1	2.0–2.1	2.0–2.1	2.1	2.0	2.1
Dielectric loss factor at 10 ⁶ Hz	X10 ⁻⁴	0.7	0.7	0.7–1.1	<5		<9
Surface resistivity	Ohm	10 ¹⁷	10 ¹⁷	10 ¹⁷	10 ¹⁷	10 ¹⁷	10 ¹⁶
Dielectric strength	KV/mm	40–100	50–110	50–100	50–80	34–38	50–80



Comparison of temperature resistance: PTFE, modified PTFE, Moldflon™, PFA, MFA, FEP

The significantly reduced thermal stability compared to PTFE and modified PTFE, which previously had to be accepted in conjunction with thermoplastic processability is practically no issue any more. Depending on the particular requirements profile, a melting temperature in the range between 324–320°C or 320–315°C

can be set. Further physical and mechanical parameters, such as the electrical properties or fatigue strength are linked to the melting range that has been set and will change accordingly. This means that Moldflon™ can be adjusted very precisely to specific applications and optimized regarding their requirements.



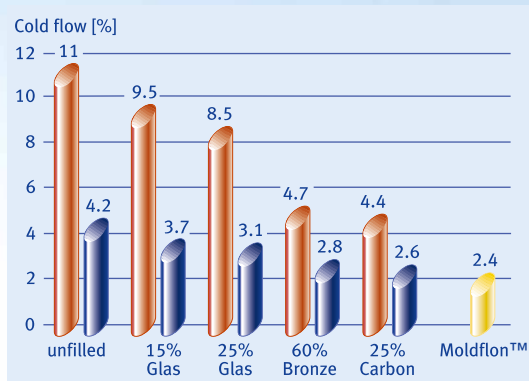
Chemical resistance

The chemical resistance of plastics is typically indicated in listings. Since Moldflon™, as a new representative of the PTFE product class, is resistant to nearly all chemicals or solvents,

there is no need to establish a listing of resistances. Only a few exceptions need to be considered, They are summarized in the table below:

<i>Chemical</i>	<i>Impact</i>
Fluorinated hydrocarbons	Swelling, reversible in case of short-term exposure, irreversible in case of longer-term-contact
Alkali metals, dissolved or molten	Fluorine elimination and polymer destruction
Halogens, elementary fluorine, chlorotrifluoride	In case of higher temperatures may trigger chemical reaction, material destruction and possibly severe reaction
Nitrating acid: mixture of conc. sulfuric acid and nitric acid	Above 100°C slow material decomposition, carbonization
Monomers: styrene, butadiene, acrylonitrile and others	May migrate into the material In case of spontaneous polymerization: swelling or polymer destruction, popcorn effect
Physical impact: ionizing radiation	Gamma and beta radiation: dose of 10 kGy may reduce the mechanical properties by more than 50%

Special Properties



■ PTFE ■ mod. PTFE ■ Moldflon™

In addition to its high melting point, another significant advantage of Moldflon™ is its very low cold flow. With unfilled Moldflon™, cold flow is much lower than that of all standard PTFE compounds and comparable to the value of highly filled compounds based on modified PTFE. This is achieved without having to accept the disadvantages of PTFE compounds that result from fillers, such as limitations in chemical resistance and approval restrictions in areas like food, oxygen or other critical applications. In terms of other typical properties of PTFE, such as good anti-adhesive properties, resistance against light or aging resistance, Moldflon™ is on a par with PTFE.

Electric parameters

Electric parameters, measured at 25 GHz, comparison between PTFE, Moldflon™, PFA.

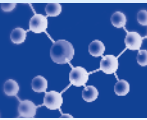
The dielectric constant $\epsilon_r = 2.1$ of Moldflon™ has the same favorable value as all fully fluorinated materials, thus confirming the excellent dielectric properties of this material.

The damping coefficient $\tan \delta$ (dielectric loss factor) is another indicator that illustrates the positioning of Moldflon™ in immediate proximity to PTFE and modified PTFE:

Property	PTFE	Moldflon™	PFA
Relative dielectric constant ϵ_r	2.1	2.1	2.1
Damping coefficient $\tan \delta$ (dielectric loss factor)	0.2×10^{-3}	0.25×10^{-3}	$0.6-1.0 \times 10^{-3}$

Whereas the damping properties of Moldflon™ at 25 GHz compared to PTFE are only slightly higher, the respective value for PFA compared to PTFE is 3 to 5 times higher.

This makes Moldflon™ the ideal material for insulation applications in the high frequency range. Additional benefits are economical and ecological manufacturing, preferably using melt extrusion or injection molding technology.



Wear

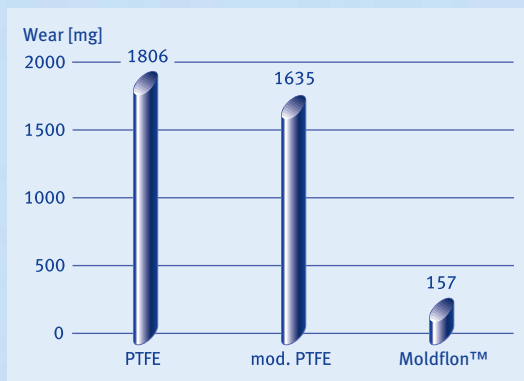
Unfilled: PTFE, modified PTFE, Moldflon™

In the short-term wear test Moldflon™, particularly in the unfilled state, significantly differs from PTFE and modified PTFE. As shown in the graph, wear in this test amounts to only about 10% of the value compared to PTFE and modified PTFE. This quality leap is the result of the special molecular structure of Moldflon™.

Short-term wear test of PTFE, modified PTFE and Moldflon™

Test conditions:

Mating material:	X210Cr12
Rz:	≤ 1.91 μm
Test atmosphere:	air
Spec. load:	0.21 N/mm ²
Temperature:	100°C
Sliding speed:	4 m/s
Test duration:	1h



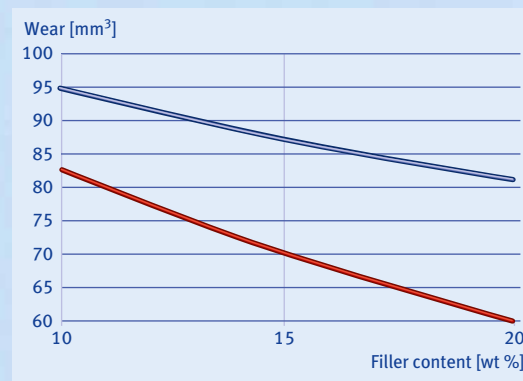
Filled: carbon fiber compound

In the long-term wear test compounds based on Moldflon™ – with the same filler content – show lower wear than compounds based on PTFE. The following figure illustrates this, using the example of carbon fiber compounds with a filler content in the range between 10 and 20%.

Long-term wear test of carbon fiber compounds based on PTFE and on Moldflon™

Test conditions:

Mating material:	X210Cr12
Test atmosphere:	air
T =	100°C
p =	0.52 N/mm ²
v =	4 m/s



■ Moldflon™ + carbon fiber
■ PTFE + carbon fiber

In addition, it is obvious that, as the filler content increases, the wear-reducing effect of Moldflon™ compounds is higher than that of PTFE-based compounds. The reason is the better setting of the filler particles within the polymer matrix. The better the setting of the fillers in the polymer matrix, the longer the duration of the wear-reducing effect.

Permeation

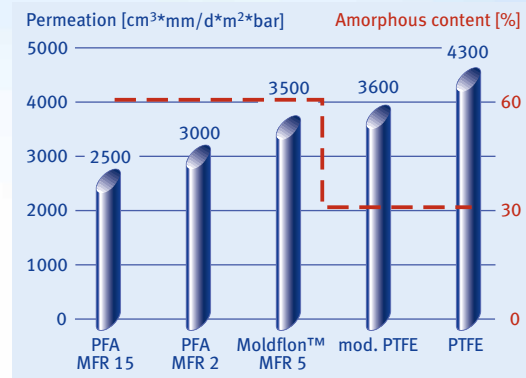
Measured with helium

With respect to permeation, measured with helium gas, Moldflon™ is positioned between PFA and modified PTFE. Compared to PTFE, it is a material with a clearly higher barrier effect.

As a thermoplastic material that can be processed from the melt, Moldflon™, like PFA, has almost no more pore content, and – merely looking at the pore volume – one would expect a bigger difference between the two product classes, thermoplastics and PTFE, in terms of the barrier effect. However, the amorphous polymer content that is responsible for permeation is clearly higher with the thermoplastics PFA and Moldflon™ compared with conventional PTFE and modified PTFE: Whereas sintered PTFE has an amorphous content of about 30%, this content is about 60%, and thus twice as high, with PFA and Moldflon™, which are suitable for thermoplastic processing. The overlapping of both effects results in the relatively low barrier differences between PFA and Moldflon™ on the one hand and PTFE and modified PTFE on the other.

Permeation, measured with helium on PFA, Moldflon™, mod. PTFE and PTFE under the influence of various amorphous contents.

Measuring gas: Helium

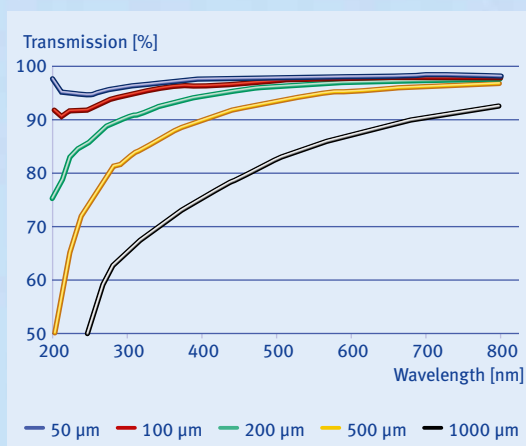


Transmission

Due to its high amorphous content and its crystalline phase with an extremely fine dispersion, Moldflon™ is highly transparent, particularly when used in thin sheets and coatings. The following figure shows the transmittance of films with varying thicknesses for the UV range of 200–400 nm and the wavelength range of visible light of 400–800 nm. Moldflon™ films with a thickness of $\leq 100 \mu\text{m}$ exhibit a very high transparency, in particular at a wavelength of 254 nm—which is of technical interest for many applications—where its transparency is $> 94\%$.

In direct comparison with PFA, modified PTFE and conventional PTFE Moldflon™ is found to be the material with the highest degree of transmission. This property, for example, can be used advantageously in hose applications for sterilization processes using light: A high yield of light, particularly in the UV range, is the application-engineering benefit of this material property.

Transmittance in the range of visible light and in the UV range of Moldflon™ films



Approvals

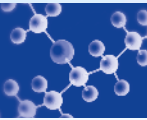
Moldflon™ has received numerous approvals and is thus used successfully as a material in many applications. The following certificates are available for nature types, and in special cases also for compounds.

- FDA, EU, BgVV: application in contact with food
- In-vitro cytotoxicity: no extractable cytotoxic fractions
- USP Class VI: pharmaceuticals and biotechnology
- W270: protection of drinking water from microorganisms

Since Moldflon™ is positioned between modified PTFE and PFA, we assume that we will receive the following approvals:

- BAM: use in the presence of oxygen
- 3 A Sanitary: production, processing, and conveyance of milk and whey products
- KTW: finished article testing for contact with drinking water

With these available approvals, the user can immediately start development and thereby reduce own product testing costs and gain time in the development process.



DMTA Data

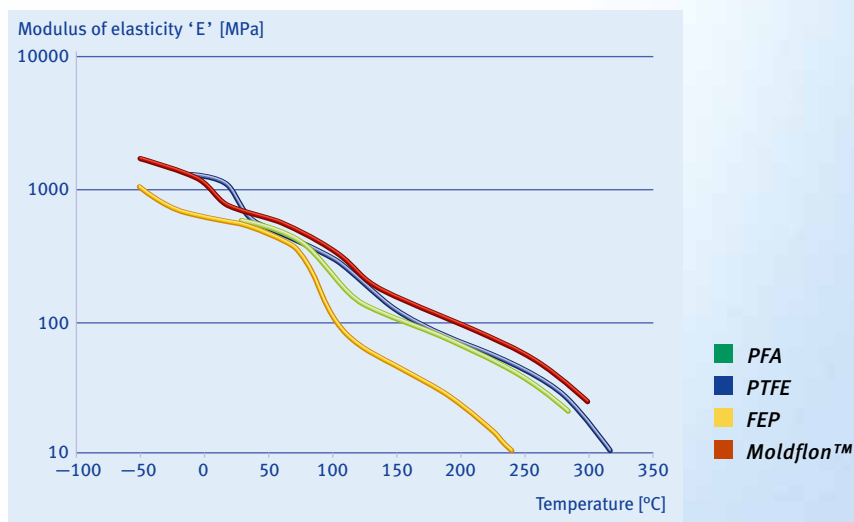
Product comparison: PTFE , Moldflon™, PFA, FEP

Using DMTA (dynamic-mechanical thermal analysis), the viscous (flowing) and elastic (resilient) properties of a material can be determined. The test piece is subjected to a periodically acting force, with both the temperature and the loading frequency being variable. The energy content that is recoverable during deformation, i.e. the elastic content, is described by the dimension of the modulus of elasticity 'E'. It is a measure for the mechanical loadability of the

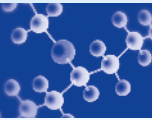
material. The graph shows the modulus of Moldflon™, determined at a measuring frequency of 10 Hz, compared to the conventional, fully fluorinated polymers PFA, FEP and PTFE.

It is obvious that among these materials Moldflon™ offers the highest loadability of over 300°C.

The modulus of elasticity 'E' as a measure for mechanical loadability, measured in the temperature sweep



Positioning Moldflon™

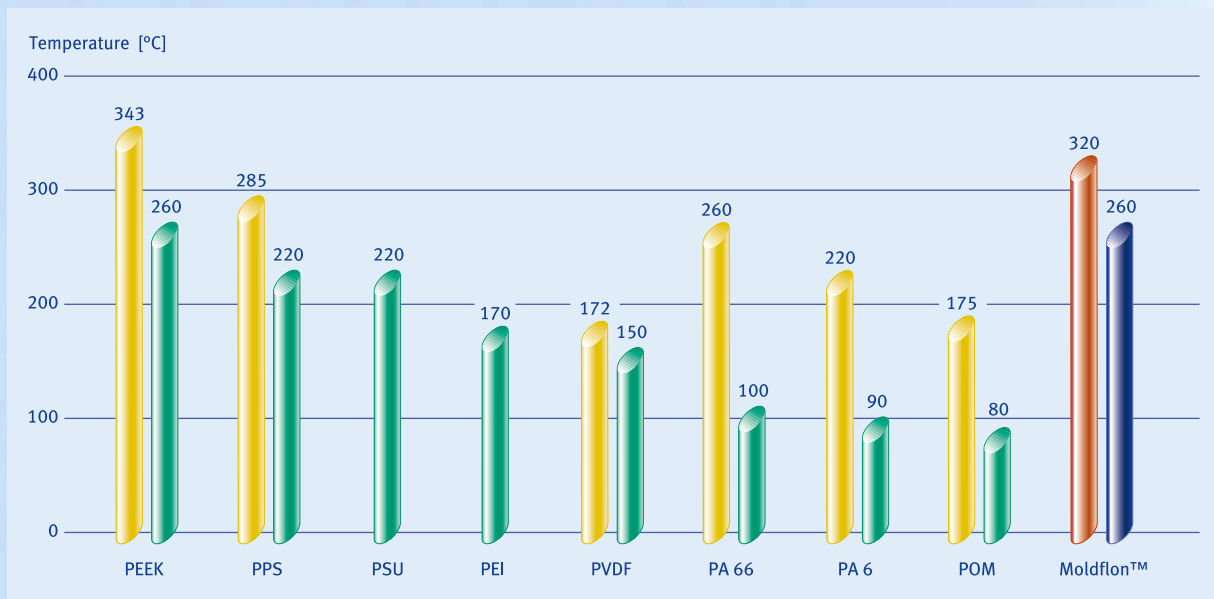


The key markets for Moldflon™ are automotive, electronics, semiconductors, medical applications, aerospace and general industrials. The use of Moldflon™ enables new system solutions in these markets. In addition, this new type of PTFE that is suitable for thermoplastic processing competes with existing materials, particularly with high-performance thermoplastics, as well as with metals and ceramic materials. Considering this, the special properties and advantages of Moldflon™ vis-à-vis existing plastics are described in the following chapters.

Thermal resistance and high permanent service temperatures

Moldflon™ excels in terms of its high permanent service temperature. As the diagram below demonstrates, in the area of partially crystalline thermoplastics the thermal resistance of Moldflon™ is only achieved by PEEK. With a melting temperature of about 320°C and a permanent service temperature of around 260°C, the service temperatures are clearly above those of the traditional high-temperature thermoplastics such as polyphenylene sulfides (PPS), polysulfones (PSU), polyamides (PA) and their derivatives.

Thermal resistance of various plastics



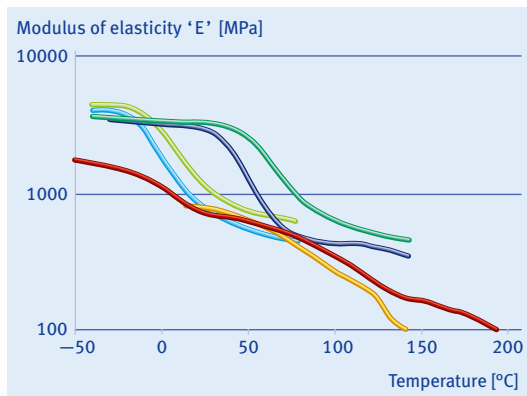
■ Melting temperature ■ Permanent service temperature
■ Melting temperature ■ Permanent service temperature

Another major advantage of Moldflon™ compared to high-performance thermoplastics is the retention of its mechanical properties almost up to the melting point. Among other things, this is also illustrated by the close proximity of the permanent service temperature and the melting temperature. Compared to polyamides (PA 6, PA 66) and polyacetale (POM) Moldflon™ continues to exhibit good mechanical properties (see diagram below) even under extremely high temperatures. It is the material of choice for any application where other thermoplastics fail already due to their low melting points and/or low permanent service temperatures.

The modulus of elasticity 'E' is a measure for mechanical loadability, as a function of the temperature of various plastics

dr = dry

h = humid



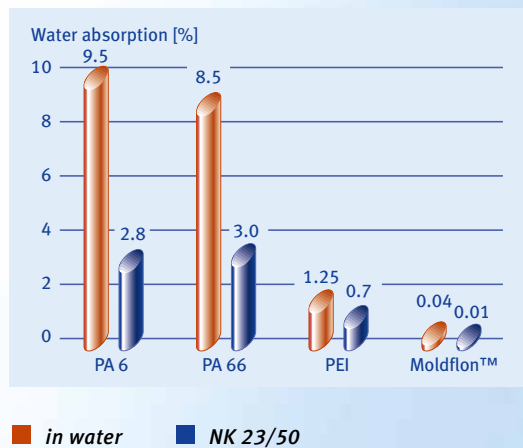
- Moldflon™
- PA 6 (dr)
- PA 6 (h)
- PA 66 (dr)
- PA 66 (h)
- POM

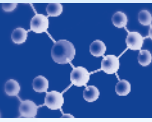
The properties of Moldflon™ remain constant in humid environments as well

Polyamides have a strong tendency toward absorbing water; in direct contact with water, absorption may be up to 9%. The decrease of mechanical loadability is a direct consequence of this absorption of water (see diagram below).

Water absorption of various plastics

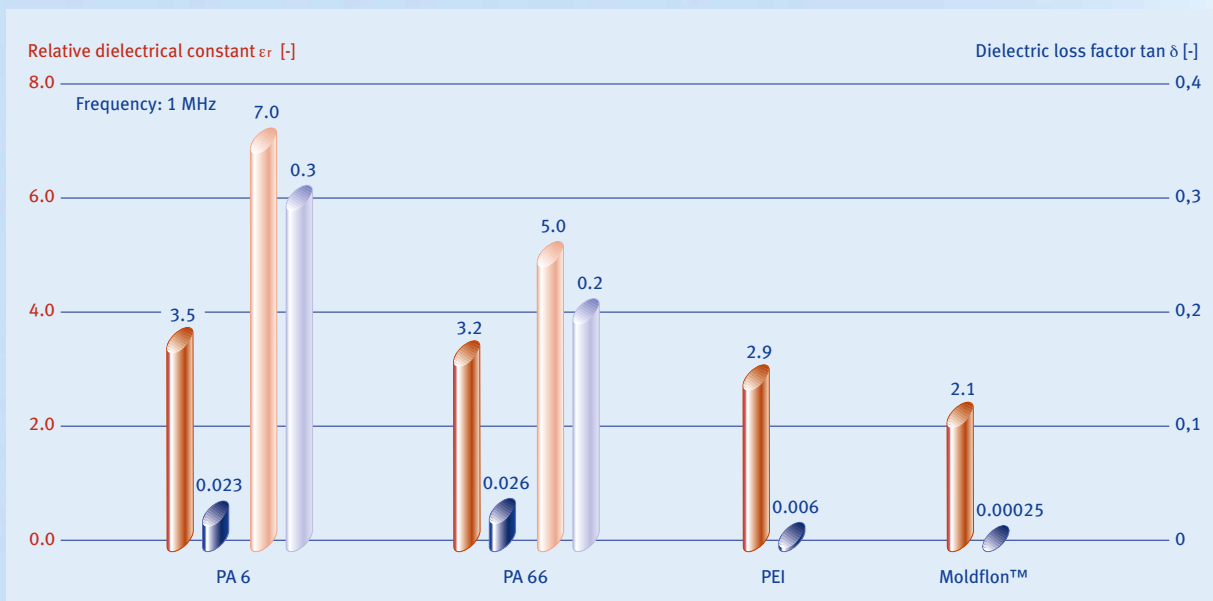
NK 23/50 = standard climate: 23°C and 50% rel. humidity





Another adverse effect of the water absorption of polyamides is the restrictions impacting on engineering design with respect to dimensional stability. This means that components with small tolerances can hardly be fabricated from polyamides. Moldflon™ on the other hand, whose water absorption is negligible, can be used to create precision components whose dimensions remain stable even in humid environments. New polyamides excel in terms of good electric properties. However, the extreme absorption of moisture causes a drastic deterioration of the dielectric parameters (see diagram below).

Electric properties of polyamides, polyetherimides and Moldflon™



■ dry
■ humid

Compared to polyamide (PA) and polyetherimide (PEI), Moldflon™ offers unsurpassed dielectric properties. On account of its special polymer structure Moldflon™ exhibits the lowest values in both the dielectric constant ϵ_r and the dielectric loss factor $\tan \delta$ (damping coefficient), which translates into an enormous performance advantage for applications in electronics and semi-conductor engineering. Analogously, this statement is also valid for the product comparison between polyimide (PI) and Moldflon™.

A considerable additional advantage is the material's outstanding chemical and temperature resistance, which makes Moldflon™ suitable for lead-free soldering, including applications in the high-frequency range.

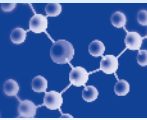
Low wear and low coefficient of friction

Compared to POM, Moldflon™ exhibits excellent sliding friction behavior with good wear resistance, particularly at high temperatures. With a friction coefficient of 3.4, POM already ranges clearly above the friction coefficient of PTFE. With a friction coefficient of 0.2, even unfilled Moldflon™ shows lower abrasion than PTFE. This directly results in a clearly longer service life of components subjected to tribological loads (see short-term wear diagram, page 9). In addition, fillers enable the tribological properties to be adapted to the respective requirements (see diagram on long-term wear of carbon fiber compounds, page 9). Tailor-made Moldflon™ compounds offer excellent filler homogeneity thanks to the thermoplastic compounding process.

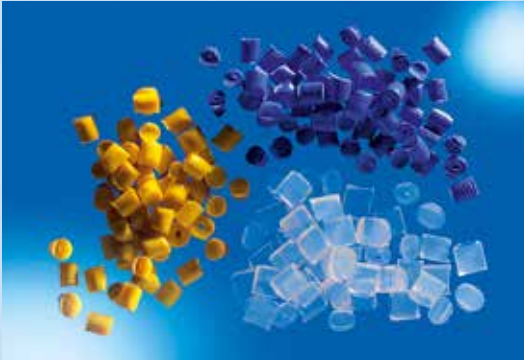
Comparison of the material characteristics of various plastics

Characteristic	Unit	Moldflon™	PVDF	POM	PA6 (tr)	PA66 (tr)	PEI	PSU	PPS	PEEK
Specific gravity	g/cm ³	2.16	1.78	1.42	1.13	1.14	1.27	1.24	1.35	1.32
Elastic modulus in tension	N/mm ²	460	2500	3000	3000	3100	2600	2600	3700	3500
Tensile strength	N/mm ²	25	38-50	70	90	80	105	80	75	95
Elongation at break	%	380	20	45	15	4	6	6	4	25
Melting point (10°C/min)	°C	320	172	175	220	260	–	–	285	343
Dimensional stab temperature (1.8 MPa)	°C	–	115	95	65	80	170	215	110	150
Permanent service temp.	°C	260	150	80	90	100	160	200	220	260
Rel. dielectr. constant (1 MHz)	–	2.1	6.4	3.7	3.5	3.6	3	3.1	4.1	3.2
Dielectr. loss – factor (1 MHz)	–	0.00025	0.17	0.004	0.023	0.026	0.003	0.005	0.001	0.003
Moisture absorption (23°C/50% rel. humidity)	%	<0.01	≤0.01	0.25	3.4	2.8	0.7	0.2	0.01	0.1
Water absorption (23°C)	%	<0.01	≤0.04	1	9	8.5	1.25	0.8	0.02	0.5

Compounds



Since the introduction of Moldflon™ to the market in 2006, a number of compounds have been developed in order to meet the constantly increasing demands of customers in respect of the material property profile.



Colored Moldflon™ beads

By compounding fillers with Moldflon™, many properties can be adapted to the desired applications.

- Decrease the cold flow, meaning the creep tendency is reduced and the compressive strength is increased
- Reduce wear (e.g., increase service life)
- Achieve electrical or thermal conductivity
- Increase mechanical strength and stiffness (e.g., of engineering parts subject to continuous loads)
- Decimate thermal linear expansion and increase thermal stability
- Reduce density for use in lightweight designs

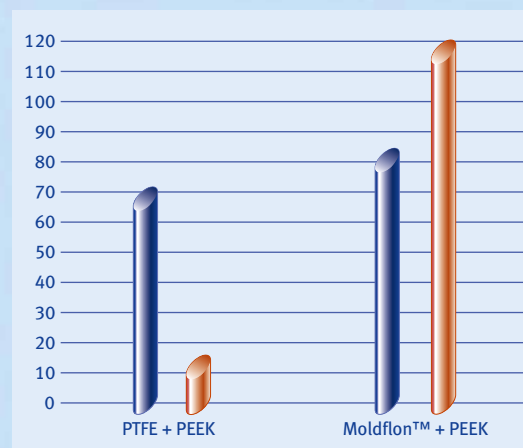
Moldflon™ compounds are characterized, in particular, by their excellent filler homogeneity. Due to the thermoplastic processability of Moldflon™, the filler particles mix into the melt to a uniform compound and as a result has a homogenous morphological structure. For this reason compounds based on Moldflon™ show lower wear with the same proportion of filler material as compounds based on PTFE (see long-

term wear test of carbon fiber compounds on page 9). In addition, Moldflon™ PEEK compounds exhibit excellent mechanical properties. Its elongation at break, for example, is 10 times higher than that of PTFE/PEEK compounds.

Due to their poor incorporation into the PEEK matrix, the PTFE particles act as disruptive elements and negatively influence the mechanical properties. Hence, the stress at break is reduced with PTFE-filled PEEK, while the Moldflon™ PEEK compound can fully exploit the high stress at break of PEEK. In this manner, a high-performance material is made available which combines the best properties of both basic polymers and eradicates unfavorable properties. As a consequence, the previously existing limits to the range of applications for fluoropolymers and PEEK are expanded.

We are happy to assist you with the selection of your ideal material so that you will receive the most functional and economical solution for your specific field of application.

Stress at break and elongation at break of compounds with PEEK



■ Stress at break [MPa] ■ Elongation at break [%]

Processing technologies

Moldflon™ unites the excellent material properties of PTFE with the operating efficiency of thermoplastic processing. For classic PTFE, at least three steps are required to create a component—pressing, sintering, and machining. Thermoplastic processing of Moldflon™ makes it possible to implement complex component geometry in one step, which was previously not achievable with machining. With customized molding and substantial waste prevention, something that is inevitable when machine processing PTFE, Moldflon™ provides an economical system solution.

Injection molding

For large-volume production, in particular, injection molding offers the opportunity to economically produce complex components. This allows our customers to develop new high-tech products without losing sight of the cost factor.

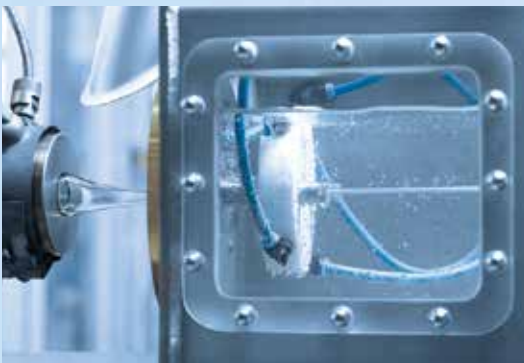


An additional economic advantage is offered through insert molding and spraying of Moldflon™ around the smallest components. Additional costly assembly processes or post-processing steps are thereby eliminated. The required parting lines and sprue points can be designed with optimal placement so that the component is not visually or functionally marred. The manufacture of sample parts with the Moldflon™ high-performance material using prototype tools can be realized at a reasonable cost and low time and labor investment. These tools can also be used for small-volume production.



Extrusion

By using extrusion, seamless films, tubes, pipes, and profiles can be made of Moldflon™ and Moldflon™ compounds with a consistent cross section over the entire length. Continuous processing enables the manufacture of Moldflon™ products in theoretically any length, which is particularly advantageous in the automated packaging of component assemblies.



Moldflon™ is especially characterized by the thermal weldability of its end products.

As a result, for the first time PTFE components can be joined to other parts without the disadvantages associated with common adhesive material.

With its melt processability, Moldflon™ can be used for all classic thermoplastic processing technologies.

- Transfer molding for the lining of fittings
- Blow molding and thermoforming of containers, bottles, bowls, etc.
- Coating for rollers, containers, tools, etc.
- Calendering for the manufacture of laminates with fiberglass cloth, metal foils, etc.
- Surface modification by means of chemical or plasma etching

High process reliability and process stability are the result of the always uniform process conditions for thermoplastic extrusion of Moldflon™. As a result, even complex forms can be produced with low manufacturing tolerances.

High-purity profiles and tubes with almost universal chemical stability and high temperature resistance can be produced continuously in a variety of geometries and dimensions. Colored pigmentation and markings are ideal for easy differentiation and additional functionalization in medical technology for the precise guidance of surgical instruments.



**Injection molding
(one-step process)**
Cost-effective manufacturing through injection molding with minimal waste.

Cutting process
Labor- and cost-intensive manufacturing process; Ex.: material waste exceeds 90%.

Applications

Automotive Industry

Higher pressures, constantly increasing temperatures—these typical operating conditions in the automotive industry place the highest demands on the components. But not only the mechanical properties but also the chemical resistance of a material are crucial factors. Often, sealing must be provided for different media such as oils, hydrocarbonic additives or acids and alkaline solutions.

Moldflon™ meets the requirements profile of such applications not only due to its outstanding material properties. Thanks to new production technologies in PTFE processing, such as injection molding, high-volume items can be manufactured more economically. For applications in the high-pressure range, new Moldflon™ compounds were developed in order to further increase the required wear resistance.

By using Moldflon™ gaskets with the lowest friction and displacement forces, the drive systems can be minimized and weight can subsequently be reduced. This has a positive effect on CO₂ reductions.

Friction bearings

ElringKlinger offers a standard palette of friction bearings made of various Moldflon™ compounds that are essentially different from the other products on the market in terms of the maximum circumferential speed, the maximum static surface pressure, and the maximum $p \times v$ value.

See our brochure “PTFE and Moldflon™ Friction Bearings” for more information.



Piston ring for the switchable pump in the cooling water circuit



Spring-energized seal for sealing the controller in the bypass turbocharger



Friction bearings made of Moldflon™ and Moldflon™ compounds

Medical Technology

Highly diverse processing operations enable the economical production of complete systems that are based on one material.

In medical engineering, the multifunctional components made of Moldflon™, such as gaskets with integrated friction bearings, housing components, very small bearing shells, and overmolded isolation coatings have been used successfully for many years.

Additional Moldflon™ products that offer new, interesting possibilities for the manufacture of medical instruments include:

- Thin-walled, highly transparent tubes that can be refined, for example, with additional reducing and expansion of the ends, or attaching extremely wear-resistant colored rings and labels.
- Thin films with a film thickness of $> 30 \mu\text{m}$
- Moldflon™ fibers or cloth
- Moldflon™ laminate
- Moldflon™ profiles

Components from Moldflon™ are characterized by high levels of anti-adhesiveness as well as a very smooth surface structure. Due to the high chemical resistance of Moldflon™ sterile processes can often be performed on the product without changing their properties.



Tapered tubes



Sterilizable tube connection



Profil with constant diameter



Electrical Engineering

Moldflon™ is used in electrical engineering not only for its excellent dielectric properties, but also because of its high temperature resistance and low cold flow tendency.

An additional advantage is derived from manufacturing parts by injection molding: complicated component geometries can be produced economically.

Due to the excellent dielectric properties and practically nonexistent water absorption, Moldflon™ films are well-suited for electrical components such as condensers or as a base material for flexible circuit boards.

The very low dielectric loss tangent $\tan \delta$ of 0.3×10^{-3} (25 GHz) makes for low energy losses, particularly at high frequencies. With the low dielectric constant ϵ_r of 2.1, low component distances can be realized.



Protective cap for high-voltage switch



Electrode holder



Flexible circuit board

Chemical Engineering

Moldflon™ components have a smooth surface structure and are thus SIP- and CIP-capable (SIP = sterilization in place; CIP = cleaning in place). Fittings or systems no longer need to be disassembled for cleaning, which significantly increases equipment availability.

For products used in the beverage and brewing, foodstuffs, cosmetics and pharmaceutical industries, the hygienic requirements are particularly high. Short cycle and throughput times with constantly increasing production volumes are in demand, particularly with respect to the cleaning cycles of tanks, bottling/filling/packaging lines, etc. Specifically with regard to nozzle technology, the use of Moldflon™ offers a key advantage. As Moldflon™ exhibits high temperature and chemical resistance and, in addition, is CIP- and SIP-capable, in-process cycle, throughput and down times can be minimized further.



Tangential full-cone nozzle

For cleaning small tanks or storage tanks.



Plugs can be in-molded with Moldflon™

Benefits

- Very good sliding properties
- Low break-away force
- Smooth surface structure
- Anti-adhesive behavior



Take our plastics know-how to the test.

The information provided in this brochure, based upon many years' experience and knowledge, does not claim completeness. No liability is assumed for damage claims on the basis of this information. All parts must be installed by trained and specialized staff. Product range and technical specifications subject to modification. No liability assumed for errata.

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