



PTFE
Competence
Center



PTFE COMPETENCE FOR YOUR PRODUCTS

 *Individual solutions.*



- ▶ CHEMICAL INDUSTRY
- ▶ VALVE AND FITTINGS INDUSTRY
- ▶ PUMP AND COMPRESSOR INDUSTRY
- ▶ PLANT ENGINEERING AND CONSTRUCTION
- ▶ MECHANICAL ENGINEERING
- ▶ FOOD INDUSTRY
- ▶ ANALYTICAL AND LABORATORY EQUIPMENT TECHNOLOGY
- ▶ PHARMACEUTICAL INDUSTRY
- ▶ MEDICAL TECHNOLOGY INDUSTRY
- ▶ ELECTRICAL ENGINEERING
- ▶ SEMICONDUCTOR INDUSTRY
- ▶ AUTOMOTIVE AND RAIL CAR INDUSTRY
- ▶ BUILDING INDUSTRY

OUR INDUSTRY EXPERIENCE -
GAINED OVER THE YEARS -
FOR YOUR BENEFIT,
TODAY AND TOMORROW.



OUR COMPETENCE AS PARTNER

You design, construct and produce machines, automobiles, plants or technical equipment. You are in the repair and maintenance services industry or the technology sector. You have set high quality standards for your products and naturally pay attention to each and every detail.

That's why you need reliable and experienced partners who think the same way as you do. And companies that work to the highest standards, which are reliable and contribute their own ideas to make your products more efficient and competitive. You want to see results that match your high and specific requirements. We also do. And to achieve this, we undertake a lot.

We invest in cutting-edge technology and in our employees. We have established perfectly synchronized production processes and stand out with consistent high quality through our in-house production. We pay attention to individual wishes. Our experts provide advisory support right from the beginning, from the first design draft up to serial production.

We never cut-back on expectations when quality and reliability are concerned.
That's why we are your right partner and happy to assist you.

Yours sincerely,

Andreas Madaus
CEO





COMPANY

PTFE COMPETENCE FOR YOUR PRODUCTS - WE ARE HERE TO ASSIST YOU

We are a polymer processing company with a main - but not exclusive - focus on PTFE. We use modern machinery to manufacture semi-finished PTFE products as well as structural components made of many different high-performance plastic materials.

High-performance plastics in general and PTFE in particular, are used in an enormous range of applications in modern machine, automobile and plant construction and for medical, electrical and also semiconductor technology. Here, materials selection is of great importance. Each structural component places its own requirements on material, design and fabrication.

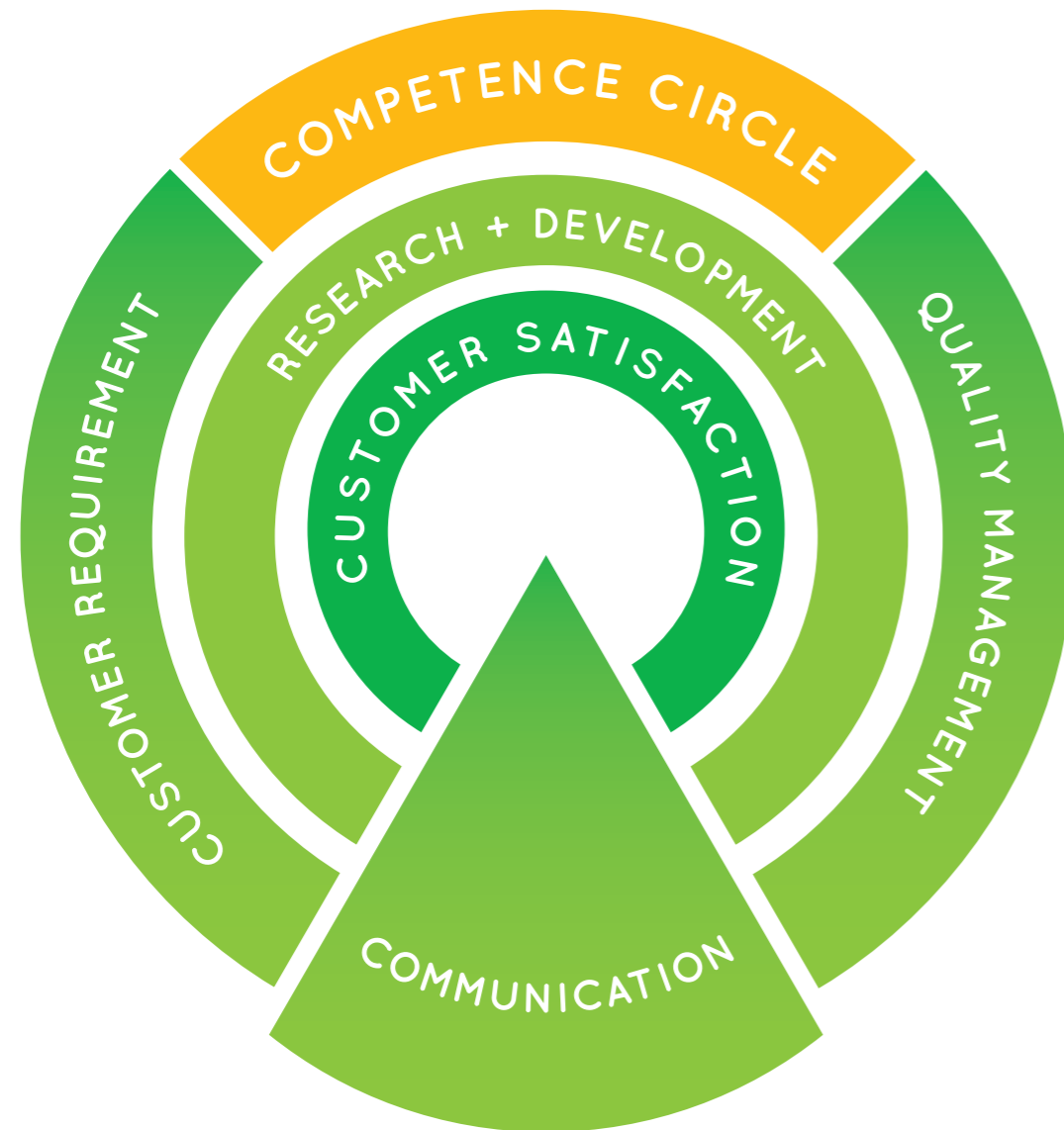
If you wish, we provide our support as early as during your first construction proposals. In close cooperation with you, we develop semi-finished products or finished parts that are designed to optimally comply with your economic and technical requirements. You benefit from our competence as if it were your own.

We respond flexibly to your individual wishes. We even take care of changes at short-notice. Fully established production processes and effective communication throughout the company and with our customers and suppliers ensure rapid and flexible responses and consistent high quality as well as reliable delivery.

We process a wide range of high-performance plastics besides PTFE and are able to deliver products made of PA, PE, PET, PP, POM, PEEK, PCTFE, PVDF and many other such materials.

You have the requirements. We have the necessary knowledge to find the appropriate technical solution.

YOU ARE IMPORTANT TO US. IT'S FOR YOU WE ARE HERE.



**INDIVIDUAL SOLUTIONS
THAT SHAPE THE FUTURE -
FOCUSED AND GOAL-DIRECTED**

CUSTOMER REQUIREMENT - THE STARTING BASIS FOR CUSTOMER SATISFACTION AND QUALITY

The correct identification and definition of customer requirement is of great importance. These are essential prerequisites for providing our customers the product they envisioned. However, defining a customer's requirement is far more than just preparing a product specification; it also includes establishing deadlines, quantities, prices and ensuring compliance with legal and regulatory provisions.

QUALITY MANAGEMENT - SUCCESS WITH ESTABLISHED AND DOCUMENTED PRODUCTION PROCESSES

Our company is certified to the standard DIN EN ISO 9001 – 2008. Modern measurement and test equipment used in materials testing, fabrication and also in novel high-performing production machines provide the technical basis for meeting our high quality standards and achieving consistently high quality products. Our employees are experienced, qualified and obligated to quality. Each one of them is integrated in the production procedures and processes and understands his or her role within the organization. Our suppliers are also included in our comprehensive quality management system. They are an essential part of value creation. Therefore, we select them carefully according to strict criteria.

CUSTOMER SATISFACTION

Customer satisfaction is the most valuable asset we possess and is therefore at the center of all our efforts. Only if you are satisfied, we are too. We therefore take complaints very seriously. They help us to do our work even better. After all, it is with our semi-finished products and machined parts that you ensure the high quality of your products. Naturally, we want your customers to be satisfied as well.

COMPETENCE IN RESEARCH AND DEVELOPMENT

Our competence in PTFE is the core feature of our company. The profound knowledge of our employees enables us to exploit the potential of high performance plastic materials, and especially of PTFE, for novel applications. We are happy to develop together with you new compounds which perfectly match your application and specific requirements. This allows us to expand the range of potential applications for PTFE and to create materials that are put to the test in novel upscale devices, machines and plants.

COMMUNICATION AS THE BASIS FOR CUSTOMER TRUST

We are interested in building lasting relationships with our customers and partners. This will only succeed if all who are involved work together closely. We promote trust through open communication. Your requirements, our knowledge and mutual experience provide the potential to jointly create innovative materials and products.

Research + Development: features of innovation and competence - Examples that speak for themselves

EXAMPLE - INNOVATION I - ABRASION RESISTANCE

- ▶ **Objective:** Lowering maintenance and repair costs by raising the service life of seat rings for valves and fittings in the pharmaceutical and food industry.
- ▶ **Challenge:** Commonly available PTFE seat rings are pressure-stable but not resistant enough against abrasion. They show signs of wear.
- ▶ **Approach:** Analysis of various materials giving consideration to economic and technical aspects as well as to legal and regulatory requirements.
- ▶ **Solution:** A highly abrasion-resistant PTFE compound that conforms to the regulations of the US Food and Drug Administration (FDA).
- ▶ **Product:** PTFE ball valve seat ring that show no signs of wear even after 80,000 switch operations.

EXAMPLE - INNOVATION II - WEIGHTLESSNESS

- ▶ **Objective:** Development of an experimental cell for the International Space Station ISS to investigate the behavior of granular media in a micro-g environment.
- ▶ **Challenge:** The geometry of the cell should adapt flexibly to the volume of the investigated media even under weightlessness.
- ▶ **Approach:** Analysis of the requirements and behavior of plastic materials under microgravity conditions in cooperation with the RWTH Aachen University.
- ▶ **Solution:** A PTFE bellows that can change its volume in a micro-g environment.
- ▶ **Product:** A line of samples to be tested under real conditions.

EXAMPLE - INNOVATION III - COMPATIBILITY

- ▶ **Objective:** Development of a universal connector kit for joining storage containers to titration devices in laboratories.
- ▶ **Challenge:** The connectors provided in the kit should be compatible with all commonly used devices and in colors matching the client's corporate design.
- ▶ **Approach:** Analysis of the adapters from different manufacturers and development of an appropriate production technology for forming and assembling the tubes.
- ▶ **Solution:** A kit containing several screw joints and tubing connectors made of FEP and PU material for establishing the various connections.
- ▶ **Product:** A tube-adapter kit in corporate colors including packaging.

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RESEARCH + DEVELOPMENT



OVERCOMING LIMITATIONS - WITH OUR COMPETENCE IN PTFE

PTFE, polytetrafluoroethylene, is a unique plastic material. It is chemically extremely stable and does not easily react with other materials. Even highly aggressive media are not able to destroy it. It can withstand temperatures up to 250°C without difficulty. And due to its low surface tension almost no substances adhere to PTFE. Its low friction coefficient furthermore makes it an excellent seal and bearing material. These are outstanding properties which we specifically are capable of exploiting.

However, in many cases, it is our customers who inspire us to create innovations for their requirements. They come to us with their ideas. They know what a structural component should be able to perform and how high its resistance against pressure, temperature or certain media needs to be. And they know the limitations of current materials. That's why they turn to us. To overcome limitations and find a material that, owing to its unique properties, can cope even with the most challenging of functions. With our competence in PTFE we can jointly search for the best economical and technological solution and perfectly match material and geometries to the desired function.

We can develop special PTFE compounds that allow you to selectively influence the properties of this excellent material and exploit them for entirely new applications. Already today, our CNC machined parts of outstanding quality are used in valves and fittings, laboratory equipment, machines, installations, vehicles, new technologies and even astronautics.

Our research and development activities are aimed at

- ▶ providing materials with exactly the properties you need
- ▶ giving structural components longer service lives, thus lowering repair and maintenance costs
- ▶ producing semi-finished products and finished parts as economically as possible
- ▶ saving costs while at the same time delivering highest quality products to our customers
- ▶ making our core competency your competitive advantage

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SEMI-FINISHED PRODUCTS

SHEETS

RODS

TUBES

FOILS

TAPES



STATIC SEALS

STATIC SEALS SPLIT

ENVELOPES

STATIC SEALS UNSPLIT

O-RINGS



DYNAMIC SEALS

SEALING COLLARS

TAPES

SEALS AND OTHER COLLARS

FACE SEALS

PRODUCTS

We fabricate for our customers semi-finished products and machined parts made of a variety of high-performance plastics. We process PTFE in its pure form, as a modified material and also as a compound. As a sub or contract manufacturer no product is uncommon to us, whether it is a seal, bellows or other structural component. Almost no challenge is too difficult. Please ask us and we will be glad to create an individual offer.



BELLOWS

BELLOWS WITH ROUND FOLDS

BELLOWS WITH ANGULAR FOLDS

BELLOWS WITH SHARP FOLDS



STRUCTURAL COMPONENTS

OTHER CONSTRUCTION ELEMENTS

BALL SEATS

GROOVE RINGS



The following table provides an overview of our most frequently processed materials. The list is not comprehensive. For information on other plastics materials please contact one of our product advisors.

ENGINEERING PLASTICS

	STANDARD	UNIT	PVC	PP	PE-UHMW	POM-C	PA 6	PA 6.6	PA 6 G			PA 66-30GF	PA 12	PET	PVDF	ECTFE	PCTFE	PTFE	PPS	PEEK	PEEK-mod.	PAI	PI
							dry/ cond.	dry/ cond.	dry/ cond.			dry/ cond.	dry/ cond.										
I General properties																							
1. Density	ISO 1183	g/cm ³	1,36	0,91	0,93	1,39	1,13	1,14	1,15			1,29	1,04	1,39	1,78	1,71	2,10	2,18	1,34	1,3	1,48	1,14	1,43
2. Water absorption	ISO 62	%	0,2	0,01	0,01	0,2	3/9	2,8/8	2,2/6,5			1,7/5,5	0,7/1,5	0,25	0,05	0,1	< 0,01	< 0,01	0,2	0,1	0,1	2,5	1,3
3. Color			gray	gray	natural	natural	natural	natural	natural			black	natural	natural	natural	natural	natural	white	natural	beige	black	yellow ochre	yellow
II Mechanical properties																							
1. Tensile stress at yield (σ_s)	ISO 527	MPa	55	30	17	63	85/60	80/60	80/60			-	40	90	50	30	30	25	-	95	-	150	-
2. Elongation at yield (ϵ_s)	ISO 527	%	3	10	20	10	-	-	-			-	-	4	9	5	-	-	3	-	-	-	-
3. Tensile stress at break (σ_b)	ISO 527	MPa	30	-	40	-	-	-	-			100/75	-	-	-	47	-	-	88	-	130	-	86
4. Elongation at break (ϵ_b)	ISO 527	%	≥ 10	≥ 50	≥ 50	31	≥ 50	40	40/100			5/12	-	15	50	250	-	50	20	25	1,5	20	7,5
5. Ball indentation hardness (H_k)/Rockwell	ISO 2039	MPa	120	67	35	125	160/70	170/100	160/125			165	M80	170	80	R90	65	30	M93	M99	208	200/M120	-
6. Shore-D	DIN 53505	-	82	70	61	-	-	-	-			-	-	-	78	68	75	-	-	90	-	-	-
7. Flexural strength ($\sigma_{B3,5\%$)	ISO 178	MPa	90	-	27	-	-	-	-			-	-	-	80	54	-	-	143	170	210	-	-
8. Modulus of elasticity (E_t)	ISO 527	MPa	3000	1300	680	2600	3000/1800	3100/2000	3100/1800			5900/3200	1300	3500	200	1830	1000	700	4000	3000	9500	4200	3250
III Thermal properties																							
1. Coefficient of linear expansion (α)	DIN 53765	K ⁻¹ x 10 ⁻⁴	0,80	-	1,80	1,20	0,80	0,80	0,80			0,60	1,20	0,80	1,50	0,92	0,50	1,70	0,42	0,50	0,22	0,30	0,54
2. Thermal conductivity	DIN 53752	W/(m x K)	0,14	-	0,41	-	0,23	0,23	0,23			0,3	0,23	0,29	0,13	0,15	0,19	0,25	0,25	0,25	0,24	0,26	0,35
3. Max. service temperature	DIN 52612	°C																					
temporary ⁽¹⁾			70	110	90	140	160	180	170			240	150	160	160	-	-	300	260	310	310	270	360
constant ⁽²⁾			60	90	80	100	70	80	90			110	120	100	150	150	170	260	200	250	250	250	250
4. Min. service temperature ⁽³⁾		°C	-15	-10	-150	-50	-40	-30	-30			-20	-50	-20	-50	-76	-270	-200	-20	-60	-30	-200	-200
IV Electrical properties																							
1. Specific volume resistivity	VDE 0303	$\Omega \times \text{cm}$	10 ¹⁵	10 ¹⁶	10 ¹⁴	10 ¹³	10 ¹³ /10 ¹⁰	10 ¹² /10 ¹⁰	10 ¹⁵ /10 ¹²			10 ¹⁴ /10 ¹³	10 ¹¹	10 ¹⁴	10 ¹⁴	10 ¹⁶	10 ¹³	10 ¹³	10 ¹¹	10 ¹⁶	10 ⁵	10 ¹³	10 ¹³
2. Specific surface resistivity	VDE 0303	Ω	10 ¹³	-	10 ¹²	10 ¹³	-/10 ¹⁰	10 ¹⁰ /10 ¹²	10 ¹³ /10 ¹²			10 ¹³ /10 ¹²	10 ¹²	10 ¹³	10 ¹³	10 ¹²	10 ¹³	10 ¹³	10 ¹⁵	10 ¹⁵	10 ⁶	10 ¹³	10 ¹³
3. Dielectric strength	VDE 0303	kV/mm	20-40	-	45	40	50/20	30/28	50/20			30/20	32	22	18	15	50	48	30	20	-	24	22

(1) Exposure to thermal stress is just a few hours with little or no mechanical load.

(2) The maximum service temperature depends on the period and level of mechanical loading applied during temperature exposure.

(3) Values are based on assumed high impact stress levels. Lower service temperatures are possible with little or no mechanical load.

The data specified are reference values that fall within the normal range of product properties. They only serve for the purposes of a materials pre-selection. We have provided all chemical and physical property data as well as any spoken, written or experiment-based technical advice to the best of our knowledge. This information is given without any legal warranty of properties and does not exempt users from undertaking their own tests and experiments to establish a product's suitability for the desired application. While doing so, the user must observe legal and official regulations as well as possible trademark rights of a third party.



MAINTAINING AND DEVELOPING COMPETENCIES FOR YOU

PTFE Competence Center's corporate culture is characterized by openness. We are open to change. Our aim is to continue to expand our competencies and to accelerate the development of new products. For this purpose we consistently improve our internal procedures, our technologies and our whole infrastructure. We constantly strive to synchronize our processes even better and to work together with our customers and partners even more intensively.

We continually look for ways to react even more flexibly to the wishes of our customers whilst maintaining unvarying high quality. This is because we know that our customers require products that are optimally adapted to their needs.

In the future, we will focus our attention even more on a careful use of natural resources. Although crude oil is not necessary to produce PTFE - unlike most other plastic materials - we attach great importance to material efficiency and to the sustainable use of raw and auxiliary materials. Fluorite (calciumfluoride), which is a natural material that is also not available unlimitedly, is required for the production of PTFE. We are fully aware of our responsibility towards the generations following us.

We want to create products that make us and our customers more competitive. You are at the center of our efforts and the reason why we take all these measures. This is the only thing we wouldn't want to change

 **Join us,**
with you we wish to shape the future.



FOR YOUR NOTES



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