Angst+Pfister

APSOplast®

Engineering Plastics

APSOplast® – Innovative Solutions Involving Plastics

Plastics are used in a vast array of areas. Innovations and new product developments are constantly bringing new materials with excellent properties onto the market. Angst + Pfister continually keeps abreast of the dynamic developments in plastics technology and offers a comprehensive range of products and services for practically all applications.

Engineering services

Our specialists have extensive experience and expertise in materials and manufacturing technology. Whether proof-of-concept prototype, finished product or targeted further development – we are there to support you in any phase. We base our consultations on well-grounded expertise and work together with you to devise the best solution for your application.

Plastics assortment

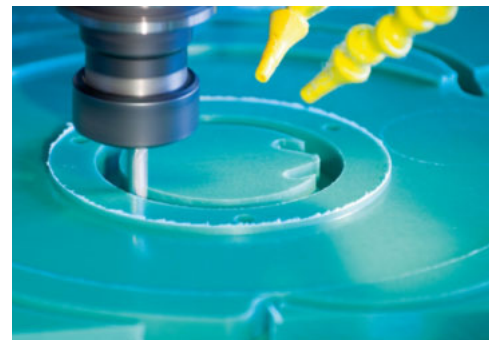
Our European logistics center stocks an extensive assortment of semifinished products in more than 100 different types of plastic – ranging from simple standard plastics to ultra-high-performance plastics. Specially modified plastics are also available to meet application-specific requirements such as ATEX-compliant explosion protection. For uses in the food industry and medical technology, we provide the requisite product conformities and certifications such as ISO 10993, USP and FDA.

Cutting-to-size service and preliminary machining

High-performance computerized cutting equipment guarantees precision cutting to size and angle in accordance with customer specifications. State-of-the-art sawing, planing and molding machines enable customized preliminary machining of the blanks, which can then be efficiently further processed or finished by the customer. This also eliminates costly warehousing for customers and spares them the trouble and expense of having to dispose of offcuts or swarf. With our cut-to-size configurator, you can also easily calculate and order custom-cut plastic plates from our APSOparts® online shop at shop.angst-pfister.com.

Customized finished plastic parts

Ready-to-use finished parts are manufactured on a customer-specific basis, i.e. from drawings, sketches or samples on powerful CNC or conventional machine tools using methods such as turning, milling or drilling – whether as prototypes, in small batches, or all the way up to mass production series. Angst + Pfister also supplies outline-cut finished parts processed by means of stamping, water jet cutting and laser cutting. Hot forming of transparent plastics, casting of polyurethanes, and extrusion and injection molding of thermoplastics round out our offering.



Standard plastics

Our range of standard plastics includes polystyrene, PVC and the polyolefins PE and PP. These inexpensive plastics can be used in many areas. We also carry a selection of transparent plastics such as PMMA, PET (amorphic) and PC with high temperature and impact resistance.

Duroplastics

Duroplastics are offered in the form of laminated materials and pultrusion products (FRP). Duroplastics stand out for their hardness, rigidity and excellent dimensional stability. They retain their dimensional stability to the greatest extent even at high temperatures (highly resistant to heat).

Selection criteria

Material designation (abbreviation)		APSOplast® designation	Density [g/cm³]	Color	Modification, additives and reinforcing materials	Operating temperature / Short-term operating temperature [°C]	Food-grade	Drinking-water tested	Biocompatibility	Hardness/dimensional stability	Impact resistance	Wear resistance	Suitability for sliding functions	Suitability for outdoors
Thermoplastics														
SB		SB	1.05	white						B	B	C	C	–
PVC-U		PVC-U	1.42	gray, red, transparent						B	B	B	C	B
		PVC-U FO	0.55	white, gray	foamed [4]					C	C	C	–	B
PVC-U mod.		PVC-U FO COLOR	0.60	colored	foamed [4]					C	C	C	–	B
		PVC-U FO ED	0.55	white	foamed [4], electrostatic dissipative					C	C	C	–	B
		PVC-U FO UV	0.67	white	foamed [4], weather-stabilized					C	C	C	–	A
PE-LD		PE-LD	0.92	natural			×	(×)		C	B	B	C	B
PE-HD		PE-HD	0.95	black			×	(×)		B	B	B	C	B
PE-HMW		PE-HMW	0.95	natural, red-brown + other			×			B	A	B	B	B
PE-UHMW		PE-UHMW	0.93	natural, black and colored			(×)	(×)		B	A	A	A	B
PE-UHMW mod.		PE-UHMW ED	0.93	black	electrostatic dissipative					B	B	A	A	B
		PE-UHMW ED FDA	0.94	black	electrostatic dissipative		×			B	B	A	A	B
		PE-UHMW FR	1.05	black	flame-retardant					B	B	A	A	A
PP		PP	0.91	gray, colored			×	(×)		B	B	C	C	B
		PP LSG [1]	0.92	natural, black	heat-stabilized		×		×	B	B	C	C	B
PP mod.		PP GM40	1.21	black	glass fiber mat-reinforced					A	B	B	–	B
		PP GF30	1.14	black	30% GF					A	B	B	–	B
ABS		ABS	1.06	gray						A	A	C	–	B
Thermoplastics – transparent														
PMMA		PMMA-XT	1.19	transparent, colored			×			A	C	B	–	A
		PMMA-GS	1.19	transparent, colored			×			A	C	B	–	A
PMMA mod.		PMMA-XT ED	1.19	transparent	electrostatic dissipative [2]					A	C	B	–	A
PET-A		PET-A	1.34	transparent			×			B	B	B	–	B
PET-G		PET-G	1.27	transparent	glycol-modified		×			B	B	B	–	B
PC		PC	1.20	natural, transparent			×			B	B	C	–	B
		PC LSG [1]	1.20	natural (translucent)			×		×	B	B	C	–	B
PC mod.		PC EC	1.20	transparent	electrically conductive [2]					B	B	C	–	B
		PC FR	1.20	transparent	flame-retardant					B	B	C	–	B
Duroplastics – laminated materials														
PF CP	Hp 2061	PF CP 201	1.35	dark brown	paper					A	C	B	B	–
	MKHP	PF CP MF	1.40	gray	paper and melamine					A	C	A	–	A
PF CC	Hgw 2082	PF CC 201	1.35	brown	cotton fabric					A	B	B	B	–
	Hgw 2088	PF CC 42	1.35	brown	cotton fabric					A	B	B	B	–
EP GC	Hgw 2372.1	EP GC 202	1.80	brownish green	glass filament webbing					A	B	B	–	B
	Hgw 2372.4	EP GC 203	1.80	brownish green	glass filament webbing					A	B	B	–	B
EP GM		EP GM 203	1.85	brownish yellow	glass filament mat					A	B	B	–	B
UP GM	Hm 2471	UP GM 203-1	1.80	white	glass filament mat					A	B	B	–	A
	Hm 2472	UP GM 203-2	1.90	white	glass filament mat					A	B	B	–	A
Duroplastics – pultrusion material														
GFK		UP GFK	1.90	white	glass fibers [3]					A	B	B	–	A

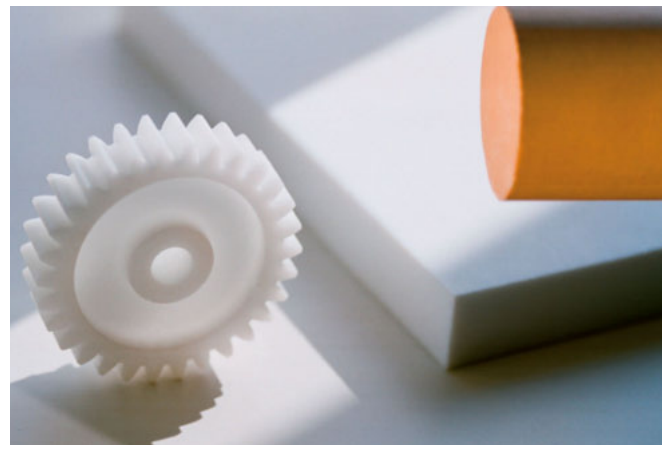
Temperature [°C]: –300, –200, –100, 0, +100, +200, +300, +400, +500

1 LSG: plastics for medical technology and food manufacturing
2 surface coating
3 unidirectional, endless
4 closed-cell

A high
B medium
C low
– no information

Engineering plastics

The plastics most frequently used in mechanical and apparatus engineering are the semicrystalline plastics PA, POM, PET (crystalline) and their modifications. Their good mechanical stability and excellent slide and wear properties make them suitable for a wide variety of uses. A vast number of modified variants enable optimum solutions to be found for the most widely differing requirements.



Selection criteria

Material designation (abbreviation)	APSOplast® designation	Density [g/cm³]	Color	Modification, additives and reinforcing materials	Operating temperature / Short-term operating temperature; Temperature [°C]: –300	–200	–100	0	+100	+200	+300	+400	+500	Food-grade	Drinking-water tested	Biocompatibility	Hardness/dimensional stability	Impact resistance	Wear resistance	Suitability for sliding functions	Suitability for outdoors
PA 6	PA 6	1.14	natural, black											×			B	A	B	A	B
PA 6 mod.	PA 6 MO	1.14	black	MoS_2													B	B	B	A	B
PA 66	PA 66	1.14	natural, black											×			B	B	B	A	B
PA 66 mod.	PA 66 MO	1.15	anthracite	MoS_2													B	B	B	A	B
	PA 66 GF30	1.29	black	30% GF													A	B	B	C	B
	PA 66 CF20	1.23	black	20% CF													A	B	A	A	B
PA 46	PA 46	1.18	reddish brown														B	A	B	A	B
PA 12	PA 12	1.02	natural, black														B	A	B	A	B
PA 6 G	PA 6 G	1.15	natural, black, blue											×			B	B	B	A	B
PA 6 G mod.	PA 6 G MO	1.16	anthracite	MoS_2													B	B	B	A	B
	PA 6 G HS	1.15	black	heat-stabilized													B	B	B	A	A
	PA 6 G LO	1.14	chartreuse	oil													B	B	A	A	B
	PA 6 G LO FDA	1.14	natural, blue	oil										×			B	B	A	A	B
	PA 6 G PLUS	1.15	blue	toughened													B	B	B	A	B
	PA6 G SL	1.14	gray	solid lubricant													B	B	A	A	B
	PA6 G SL PLUS	1.11	dark blue	solid lubricant													B	B	A	A	B
POM-C	POM-C	1.41	natural, black, colored											×			A	B	C	B	C
	POM-C LSG [1]	1.41	natural, black, colored											×		×	A	B	C	B	C
POM-C mod.	POM-C SL	1.35	blue	solid lubricant													B	B	B	B	C
	POM-C EC	1.45	black	electrically conductive													A	B	C	B	B
	POM-C ED	1.33	beige	electrostatic dissipative													A	B	C	B	C
	POM-C GF25	1.58	grayish white	25% GF													A	B	B	C	C
	POM-C ID	1.48	gray, colored	detectable										×			A	B	B	B	C
	POM-C SAN	1.41	white	antimicrobial										×			B	B	B	C	C
POM-H	POM-H	1.43	natural, black											×			A	B	B	B	C
POM-H mod.	POM-H SL	1.50	grayish brown	PTFE													A	B	B	A	C
PET-C	PET-C	1.39	natural, black											×			A	C	A	A	B
PET-C mod.	PET-C SL	1.44	gray	solid lubricant										×			A	C	A	A	B
PET-H	PET-H	1.36	white											×			A	C	A	A	B

1 LSG: plastics for medical technology and food manufacturing

A high
B medium
C low
– no information

High-performance plastics

All high-performance plastics exhibit high to very high temperature resistance as well as high strength and dimensional stability. Differentiation is made between plastics with amorphous structure (partially transparent) for rather static applications and plastics with semi-crystalline structure, high impact resistance and good to excellent sliding and wear properties. Polyimides stand out for their extraordinary application possibilities at extremely high and low temperatures.

Selection criteria

Material designation (abbreviation)	APSOplast® designation	Density [g/cm³]	Color	Modification, additives and reinforcing materials	Operating temperature / Short-term operating temperature; Temperature [°C]: −300	−200	−100	0	+100	+200	+300	+400	+500	Food-grade	Drinking-water tested	Biocompatibility	Hardness/dimensional stability	Impact resistance	Wear resistance	Suitability for sliding functions	Suitability for outdoors
PPE	PPE	1.06	gray, black														B	B	–	–	B
	PPE LSG [1]	1.08	colored													×	B	B	–	–	B
PPE mod.	PPE GF30	1.21	beige, black	30% GF													B	B	–	–	B
	PPE LSG XRO [1]	1.08	colored	x-ray opaque										×		×	B	B	–	–	B
PSU	PSU	1.24	natural											×			B	B	–	–	–
	PSU LSG	1.24	natural, colored											×		×	B	B	–	–	–
PPSU	PPSU	1.29	black											×			B	A	–	–	C
	PPSU LSG	1.29	black											×		×	B	A	–	–	C
PPSU mod.	PPSU LSG XRO [1]	1.30	black, colored	x-ray opaque										×		×	B	A	–	–	C
PEI	PEI	1.27	natural											×			B	B	–	–	C
	PEI LSG [1]	1.27	natural											×		×	B	B	–	–	C
PEI mod.	PEI EC	1.41	black	electrically conductive													B	B	B	B	B
PPS mod.	PPS GF40	1.64	black	40% GF													A	B	B	B	C
	PPS GF SL	1.43	dark blue	GF+solid lubricant										×			B	B	B	A	B
	PPS SL	1.47	black	CF+graphite+PTFE										×			B	B	B	A	B
PEEK	PEEK	1.30	natural											×			A	B	B	B	B
	PEEK LSG	1.30	natural, black, colored											×		×	A	B	B	B	B
	PEEK CLASSIX® LSG [1]	1.38	white											×		×	A	B	B	B	B
PEEK mod.	PEEK SL	1.45	black	CF+graphite+PTFE													A	B	A	A	B
	PEEK SL FDA	1.39	blue	solid lubricant										×			A	B	A	A	B
	PEEK GF30	1.51	natural	30% GF													A	B	B	B	B
	PEEK GF30 LSG [1]	1.51	blue	30% GF												×	A	B	B	B	B
	PEEK CF30	1.41	black	30% CF													A	B	A	A	B
	PEEK CF30 LSG [1]	1.40	black	30% CF												×	A	B	A	A	B
	PEEK EC	1.44	black	CF nanotubes, electr. conductive													A	B	A	A	B
PAI mod.	PAI SL	1.41	yellow ocher	TiO_2+PTFE													A	A	B	B	B
	PAI SL PLUS	1.45	black	graphite+PTFE													A	B	A	A	B
	PAI GF30	1.61	khaki gray	30% GF													A	B	B	B	B
	PAI ED	1.58	khaki gray	electrostatic dissipative													A	B	B	B	B
PI	VESPEL® PI SP1	1.43	brown														B	B	B	B	B
PI mod.	VESPEL® PI SP21	1.51	anthracite	15% graphite													B	B	A	A	B
	VESPEL® PI SP22	1.65	anthracite	40% graphite													B	B	A	A	B
	VESPEL® PI SP211	1.55	anthracite	15% graphite+PTFE													B	B	A	A	B
PBI	PBI	1.30	black														A	B	B	B	B

1 LSG: plastics for medical technology and food manufacturing

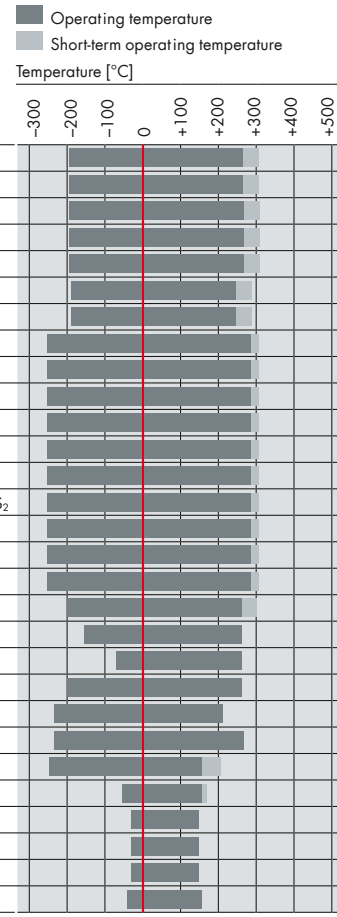
A high
B medium
C low
– no information

Fluoroplastics

Among the main features of PTFE, the most important fluoroplastic, are high chemical and thermal resistance, exceptional dielectric properties and excellent sliding behavior. PTFE is the base plastic for a series of modifications that have been expressly developed with specific properties in mind. These are high-performance special compounds made of PTFE that contain selected fillers and reinforcing materials and enable a material selection finely matched to the application.

Selection criteria

Material designation (abbreviation)	APSOplast® designation	Density [g/cm³]	Color	Modification, additives and reinforcing materials	Food-grade	Drinking-water tested	Biocompatibility	Hardness/dimensional stability	Impact resistance	Wear resistance	Suitability for sliding functions	Suitability for outdoors
PTFE	PTFE	2.18	white		×			–	A	C	B	A
PTFE mod.	PTFE 125	2.25	beige	25% GF	×			B	B	B	–	A
	PTFE 225	2.11	black	25% carbon dust				B	B	B	A	A
	PTFE 660	3.90	bronze	60% bronze powder				B	B	B	B	B
	PTFE 904	2.28	light blue	30% GF+metallic oxide				B	B	B	B	A
	PTFE 207	2.30	beige	mica	×			C	B	B	A	A
	PTFE 500	2.32	beige	mica				B	B	B	A	A
	PTFE HP 107	2.08	black	CF				C	B	B	B	A
	PTFE HP 108	2.25	dark red	GF+metallic oxide				C	B	B	B	A
	PTFE HP 110	2.10	black	carbon dust+graphite				B	B	B	A	A
	PTFE HP 114	3.82	dark brown	bronze+MoS_2				B	B	B	B	B
	PTFE HP 115	1.97	light yellow	polymer				C	B	B	A	A
	PTFE HP 117	2.09	black	CF				B	B	B	A	A
	PTFE HP 118	1.89	dark gray	polymer+carbon dust+graphite+MoS_2				C	B	B	A	A
	PTFE HP 123	2.16	black	graphite				B	B	B	A	A
	PTFE HP 125	2.06	cream	polymer	×			C	B	B	A	A
	PTFE HP 128	2.06	cream	polymer	×			C	B	B	A	A
	PTFE EC	2.14	black	electrically conductive	×			B	B	B	B	A
PTFE mod.	PTFE-coated fabric	–	various	various types				–	–	C	A	A
	PTFE tapes	–	various	various types				–	–	C	A	A
	PTFE films	–	various	various types				–	–	C	A	A
FEP	FEP films	2.15	transparent					B	A	C	C	A
PFA	PFA films	2.15	transparent					B	A	C	C	A
PCTFE	PCTFE	2.12	natural (white)		×			B	B	B	A	A
PVDF	PVDF	1.79	natural (white)		×			A	B	B	B	A
PVDF mod.	PVDF EC	1.78	natural	electrically conductive				A	B	B	B	A
	PVDF PK	1.78	natural	with polyester fabric				A	B	B	B	A
	PVDF GK	1.78	natural	with glass-fiber fabric				A	B	B	B	A
ECTFE	ECTFE	1.68	natural					A	B	B	B	A



A high
B medium
C low
– no information

Elastomers

Elastomers are materials with high elasticity and great extensibility and recovery capability. These properties make elastomers an irreplaceable material in sealing, fluid handling, antivibration and drive technology. Elastomers are based on natural and synthetic rubbers.

Polyurethanes (PUR)

Polyurethanes – unlike elastomers based on rubber – are manufactured using molding methods and do not contain carbon black. In comparison with other elastomers, they also have high mechanical property values and feature exceptional abrasion and tear resistance.

Selection criteria

Material designation (abbreviation)	APSOplast® designation	Chemical designation	Density [g/cm³]	Hardness Shore A	Operating temperature / Short-term operating temperature – Temperature [°C]: –300	–200	–100	0	+100	+200	+300	+400	+500	Low-temperature flexibility	Wear/abrasion resistance	Weathering/ozone resistance	Resistance to: Mineral oil (+100°C)	Acid 25% H_2SO_4 (+50°C)	Alkali 25% NaOH (+50°C)	Water (+100°C)	Deformation resistance [7]
Elastomers																					
NR/SBR	NR	Natural rubber	1.01–1.41	30–90										B	B	–	–	C	B	C	C
SBR	SBR	Styrene butadiene elastomer	1.20	35–95										B	B	–	–	C	B	C	C
IIR	IIR [6]	Butyl elastomer		30–80										B	C	B	–	A	A	B	B
EPDM	EPDM	Ethylene-propylene-diene monomer elastomer	1.02–1.17	30–90										B	B	A	–	B	B	A	B
CR	CR	Chloroprene elastomer	1.31–1.52	40–90										B	B	B	B	B	B	B	C
CSM	CSM	Chlorosulfonated polyethylene elastomer	1.43	50–90										C	B	A	B	A	B	B	C
NBR	NBR	Acrylonitrile-butadiene elastomer	1.18–1.55	30–95										B	B	C	B	B	C	B	B
HNBR	HNBR [6]	Hydrogenated nitrile butadiene rubber		30–95										B	B	B	A	B	C	B	B
PNR	PNR	Polynorbornene elastomer		10–45										C	C	C	–	–	–	C	B
VMQ	VMQ	Silicone elastomer	1.15–1.30	30–85										A	C	A	B	C	–	B	A
FVMQ	FVMQ [6]	Fluorosilicone elastomer		30–75										A	B	A	B	C	–	B	A
ACM	ACM [6]	Polyacrylate elastomer		50–90										C	C	B	A	B	C	–	B
FKM	FKM	Fluorinated elastomer	2.00	65–90										C	B	A	A	B	B	B	A
FEPM	FEPM [6]	Tetrafluoroethylene-propylene elastomer		65–90										C	B	A	A	B	B	A	A
FFKM	FFKM	Perfluoroelastomer	1.90	60–90										C	B	A	A	A	A	A	A
Polyurethanes																					
AU (PUR)	PUR D15	Poly(ester)urethane elastomer	1.26	70–92										B	A	B	B	C	C	C	C
	PUR D44	Poly(ester)urethane elastomer	1.22	70–92										B	A	B	B	C	C	C	C
EU (PUR)	PUR AP	Poly(ester)urethane elastomer	1.20	55–90										A	A	A	A	C	C	B	C

6 Semifinished products are only available on request with with mandatory minimum ordering quantities

7 Resistance against permanent deformation at high temperatures

A high
B medium
C low
– no information

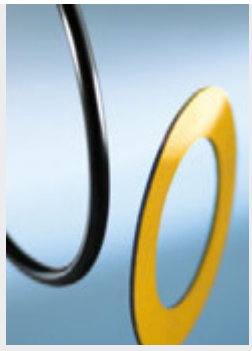
Services from Angst + Pfister Group

Angst + Pfister – Your supply and solutions partner

The Angst + Pfister Group is a leading international technical manufacturer and service provider for high-end industrial components. As a supply and solutions partner for engineering plastics, sealing, fluid handling, drive, and antivibration technology as well as sensors, Angst + Pfister combines efficient logistics concepts with comprehensive product application engineering services. Besides providing customer-specific parts, the Group offers a product range consisting of approximately 100,000 standard items.

Our core product divisions

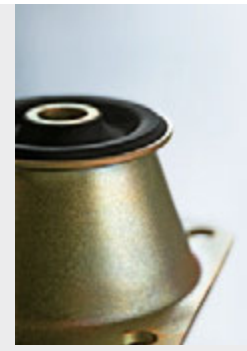
APSOplast®
Engineering Plastics
Technology



APSOseal®
Sealing
Technology

APSOfluid®
Fluid Handling
Technology

APSOdrive®
Drive
Technology



APSOvib®
Antivibration
Technology

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