Ultrason®

Resistance to chemicals

Ultrason® in the web: www.ultrason.de

BASF
We create chemistry

Ultrason® E, S, P

The Ultrason® resins are amorphous thermoplastics derived from polyethersulfone (PESU), polysulfone (PSU) and polyphenylsulfone (PPSU) and offer very high resistance to heat. Their wide spectrum of beneficial properties allows them to be molded into high-quality engineering parts and high-load mass-produced articles. They can be processed by almost all the techniques adopted for thermoplastics. Ultrason® can be successfully used for applications in which other plastics, e. g. polyamide, polycarbonate, polyoxymethylene and polyalkylene terephthalates, fail to meet the requirements. By virtue of their extraordinary versatility, Ultrason® resins can substitute thermosets, metals and ceramics.

Ultrason® – Resistance to chemicals

Resistance of Ultrason® to chemicals

Overview

This brochure contains overview tables and diagrams that give information on the resistance of Ultrason® to chemicals.

With regard to the suitability of Ultrason® for specific applications, the details can only serve as a basic guide, since the behavior of the actual components when in contact with chemicals depends on their design, processing, and potential mechanical loads (internal and external stresses). The polymer's molecular weight also plays an important role. As an amorphous material, Ultrason® is susceptible to stress cracking in the presence of certain media. A higher molecular weight is in this context beneficial. In many cases, statements regarding the suitability of a selected material can only be made after practical testing with actual moldings.

Ultrason® solutions can be produced in a series of solvents that are commonly used in industry. These solutions can be applied in coating processes or when manufacturing filter membranes, for example. The most important solvents are summarized in Table 7.

When comparing the three Ultrason® product types with one another, the following general statements can be made with regard to their suitability:

- Ultrason® E (PESU: polyethersulfone) is especially suitable for applications in contact with non-polar media, such as fats and oils (also at very high temperatures), as well as under oxidative conditions.
- Ultrason® S (PSU: polysulfone) is particularly useful in the presence of polar media, such as hot water.
- Ultrason® P (PPSU: polyphenylsulfone) is most suitable for applications with superheated steam (134 °C), as is common in sterilization, as well as in the presence of aggressive detergents.

Test results

The test results summarized in Table 3 are given to better assess the behavior of Ultrason® in the presence of specific media. On the one hand, information is given concerning stress cracking at room temperature following short-term contact (contact duration of 1 minute or 24 hours). For this purpose, stresses were created in tensile bars by clamping on bending blocks of different radii (Table 1). These specimens, while under stress, were brought in contact with the medium. The extent of the damage (crack formation) was evaluated in 5 categories (from 0 to 4):

0: no cracks
4: test bar is broken

On the other hand, the products were stored long-term (partly at elevated temperatures) in selected media. The changes in mechanical properties were analyzed in comparison to the initial values (Table 2). Five categories (0 to 4) were once again used to characterize the extent of change. In this process, **it was not distinguished whether the change was positive or negative (whether the values improved or worsened)**:

0: properties changed only slightly
4: at least one property could have changed by more than 50%

Radius [mm]	OFS [%] at a thickness of 4 mm	Stresses [MPa]		
		Ultrason® E 3010	Ultrason® S 3010	Ultrason® P 3010
265	0.75	19.5	18.5	17.5
400	0.50	13.5	12.5	12.0
1,000	0.20	5.0	5.0	5.0

Table 1: Outer fiber strain (OFS) and corresponding initial stresses at the respective bending radii

		Unit	Ultrason® E 3010	Ultrason® S 3010	Ultrason® P 3010
Moisture absorption		%	0.80	0.30	0.60
Density	ISO 1183	g/cm³	1.37	1.23	1.29
Tensile mod. of elasticity	ISO 527-2	MPa	2,650	2,550	2,270
Tensile stress at yield	ISO 527-2	MPa	85	75	74
Elongation at yield	ISO 527-2	%	6.9	6.0	7.8
Notched imp. str. (23 °C)	ISO 179/1eA	kJ/m²	8	5.5	75
HDT/A (1.8 MPa)	ISO 75-2	°C	207	177	198
TG (DSC)		°C	228	187	220

Table 2: Overview of the most important properties of Ultrason®

Two scenarios are considered in Table 3. In column F1, only properties from the tensile test are taken into account for assessment. In column F2, the notched impact strength is additionally considered. This results in differences in evaluation, since the toughness of amorphous thermoplastics is particularly sensitive to environmental stresses.

In addition, the level of toughness of the three Ultrason® types is quite different. When processing the data, it must be noted that the potential of change for Ultrason® P is significantly greater than that of the other two polymers, due to the high initial value. **In many cases, therefore, strongly aged Ultrason® P still shows the highest residual toughness level among the three polymers.**

The tables do not cover glass fiber-reinforced products. However, it can be generally said that such glass fiber-reinforced products are significantly less susceptible and react slower to the impact of media.

			Stress Crack Test (at room temperature)					
			Bending Radius [mm]					
	Conc. [wt-%]	Time	265	400	1,000	265	400	1,000
Media			Ultrason® E			Ultrason® S		
Acetic Acid	10	1 min	0	0		0	0	
	10	24 h	0	0		0	0	
	100	1 min	2	2	2	2	2	1
Acetone	100	1 min	4	4	4	4	4	4
AdBlue (Urea solution)								
Air								
Calcium chloride	20	1 min	0			0		
	sat.	24 h	0			0		
Citric acid	10	1 min	0	0		0	0	
	10	24 h	0	0		0	0	
	50	1 min	0	0		0	0	
	50	24 h	0	0		0	0	
Cleaning agent: Deconex HT 1169, HT 1170 (2-Amino-Ethanol, Polyethyleneglycol-5-Cocosamide, nonionic tenside)	100	1 min	0			0	0	
	100	24 h	0			1	1	
Cleaning agent: Deconex HT 1201 (Polyethylenglycole-5-Cocosamide, Triethanolamine, nonionic tenside)	100	1 min	0	0		0	0	
	100	24 h	1	0		1	0	
Cleaning agent: Deconex HT 1511 (Triethanolamine, Fatty Amine, nonionic tenside)	100	1 min	0			0	0	
	100	24 h	0			2	2	
Cleaning agent: Deconex 1401 (5-15 % Potassium hydroxide, <15 % nonionic, amorphous, anionic tenide)	100	1 min	0			0		
	100	24 h	0			0		
Degreaser: Tangit (based on: Acetone, Butanone)	100	1 min	4	4	4	4	4	4
Degreaser: Kempt LO	100	1 min	2	2	0	2	2	0
	100	24 h			2			4
Degreaser: Lusin Clean 51	100	1 min	0			0		

Stress crack testing:
0 = no cracks
4 = bar is broken

Mechanical properties:
F1 = assessment based on tensile test
F2 = assessment based on tensile test and notched impact strength

0 = properties changed only slightly
4 = at least one property could have changed by over 50%

			Mechanical Properties								
265	400	1,000	Conc. [wt-%]	Temp. [°C]	Time [d]	F1	F2	F1	F2	F1	F2
Ultrason® P						Ultrason® E		Ultrason® S		Ultrason® P	
0	0										
0	0										
1	0	0	100	80	42	0	3	0	2	0	3
3	3	3									
			100	60	28	0		0			
			100	80	28	0		0			
				200	42	1	2			0	4
				160	42			1	1		
0											
0											
0	0										
0	0										
0	0										
0	0										
0											
0											
0											
0											
0											
0											
0											
0											
4	4	4									
0	0										
3	3	3									
0											

Media	Conc. [wt-%]	Time	Stress Crack Test (at room temperature) – Bending Radius [mm] – Ultrason® E 265	Ultrason® E 400	Ultrason® E 1,000	Ultrason® S 265	Ultrason® S 400	Ultrason® S 1,000
Demolding agent: Lusin Alro OL 151 (silicone-free)	100	1 min	0			0		
Demolding agent: Lusin Alro OL 153 S (contains silicone)	100	1 min	0			0		
Demolding agent: Lusin Alro OL 401 (silicone-free, high temp.)	100	1 min	0			0		
Demolding agent: Lusin Alro 261 (silicone-free, based on Toluol, Ethylacetate)	100	1 min	4	4	3	4	3	3
	100	24 h						
Diethyl carbonate	100	1 min	3	2	1	4		4
Diisopropanol amine	80	1 min	0	0		0	0	
	80	24 h	0	0		0	0	
Dimethyl carbonate	100	1 min	4		4	4		4
Dioctylphthalate	100	1 min	0	0	0	0	0	0
	100	24 h	0	0	0	4	0	0
Disinfectant: BIB Forte 11% tert. Alkylamine; 9% Trialkyl-ethoxyammoniumpropionate; tensides	4	1 min	0			0		
	4	24 h	0			0		
	4	96 h	0			0		
Disinfectant: Gigasept FF 12% Succindialdehyde; 3% Dimethoxy tetrahydrofurane; tensides	5	1 min	0	0		0	0	
	5	24 h	0	0		1	0	
	5	96 h	0	0		2	0	
Disinfectant: Gigasept PAA 5% Peracetic acid; Hydrogen peroxide; Acetic acid; caustic potash	2	1 min	0	0		0	0	
	2	24 h	0	0		0	0	
	2	96 h	0	0		1	0	
Disinfectant: Korsolex basic 15% Glutaraldehyde; 20% (Ethylenedioxy)dimethanol; tensides	5	1 min	0	0		0	0	
	5	24 h	0	0		0	0	
	5	96 h	0	0		0	0	
Ethanol	100	1 min	0	0		2	0	
	100	24 h	0	0		2	0	
Ethanolamine	100	1 min	0	0	0	0	0	0
	100	24 h	3	2	0	2	0	0
Ethyl acetate	100	1 min	2	2	2	4	4	4
Ethylene glycols: Ethylene glycol	50	1 min	0	0		0	0	
Ethylene glycols: Glysantin G 48 (90% Ethylene glycol, inhibitor)	100	1 min	0	0		0	0	
	100	24 h	0	0		0	0	
Formaldehyde	37	1 min	0			0		
Formic acid	85	1 min	0	0		0	0	
	85	24 h	0	0		0	0	
Fuel: Biodiesel Rapeseed oil methyl ester	100	1 min	0	0		0	0	
	100	24 h	0	0			2	1
Fuel: Diesel RF 06-03	100	1 min	0			0		
	100	24 h	0			0		

			Mechanical Properties								
265	400	1,000	Conc. [wt-%]	Temp. [°C]	Time [d]	F1	F2	F1	F2	F1	F2
Ultrason® P						Ultrason® E		Ultrason® S		Ultrason® P	
0											
0											
0											
4	3	3									
2	2	0									
0	0										
0	0										
3	3	0									
0	0	0									
0	0	0									
0			4	RT	42	0	0	0	0	0	0
0											
0											
0	0		5	RT	42	0	0	0	1	0	0
0	0										
0	0										
0	0		2	RT	42	0	2	0	1	0	0
0	0										
0	0										
0	0		5	RT	42	0	1	0	1	0	1
0	0										
0	0										
0	0										
0	0										
0	0	0									
0	0	0									
3	2	2									
0	0		50	RT	42	0	0	0	0	0	0
			50	120	42	1	3	1	2	0	4
0	0		50	85	42	1	3	1	3	0	4
0	0										
0											
0	0										
0	0										
0	0		100	RT	42	0	0	1	0	0	0
0	0										
0			100	85	42	0	1	0	1	0	0
0											

Media	Conc. [wt-%]	Time	Stress Crack Test (at room temperature) Bending Radius [mm] Ultrason® E 265	Ultrason® E 400	Ultrason® E 1,000	Ultrason® S 265	Ultrason® S 400	Ultrason® S 1,000
Fuel: FAM B (DIN 51604) Testing fuel	100	1 min	0	0		4	3	
	100	24 h	3	0				
Fuel: Kerosine								
Glycerol	100	1 min	0			0		
	100	24 h	0			0		
Heat transfer medium: Glythermin P44 (1,2-Propylene glycole)	100	1 min	0			0		
	100	24 h	2	0		0		
Heat transfer medium: Glythermin P82 (i-Propylene glycole)	100	1 min	0			0		
	100	24 h	2	0		0		
Heat transfer medium: H Galden ZT 130 (Hydrofluoropolyether)	100	1 min	0			0		
	100	24 h	0			0		
Hydraulic Fluid: Brake Fluid DOT 4 (Polyglycolcompounds)	100	1 min	3	3	2	3	2	2
	100	24 h						
Hydraulic Fluid: Pentosin CHF 202	100	1 min	0			0		
	100	24 h	0			0		
Hydraulic Fluid: Skydrol LD 4 (aviation, fire resistant)	100	1 min	0	0	0	3	3	0
	100	24 h	4	4	4	4	4	4
Hydraulic Fluid: Skydrol PE 5 (aviation, fire resistant)	100	1 min	1	0	0	3	3	0
	100	24 h	4	0	0	4	4	4
Hydraulic Fluid: Tributyl phosphate	100	1 min	0	0		4	3	3
	100	24h	4	4				
Hydrochloric acid	10	1 min	0			0		
	10	24 h	0			0		
Hydrogen peroxide								
Isopropanol	100	1 min	1	1	0	1	1	0
	100	24 h	2	1	0	2	2	0
Lubricant: Gear oil Shell Donax TX	100	1 min	0			0		
	100	24 h	0			1		
Lubricant: Gear oil Shell Spirax MA 80								
Lubricant: Motor oil (used oil)								
Lubricant: Motor oil ARAL P375 SAE 10W-40								
Lubricant: Motor oil Castrol RS Rallye 10 W-60								
Lubricant: Motor oil Shell Helix 5W 40	100	1 min	0			0		
	100	24 h	0			0		
Lubricant: Motor oil OS 206 304	100	1 min	0			0		
	100	24 h	0			0		
Lubricant: Motor oil Shell TMO 10W-30								
Lubricant: Motor oil Viva 15 W-40								

			Mechanical Properties								
265	400	1,000	Conc. [wt-%]	Temp. [°C]	Time [d]	F1	F2	F1	F2	F1	F2
Ultrason® P						Ultrason® E		Ultrason® S		Ultrason® P	
0	0		100	RT	42	0	3	3	4	0	0
0	0										
			100	50	28	0		0			
0											
0											
0											
0											
0			100	100	42	0	3	0	2	0	1
0											
0											
0											
1	1	0	100	120		test bars damaged after 100 h					
0			100	125	42	0	1	0	2	0	3
0											
0	0	0									
4	4	0									
0	0	0									
0	0	0									
0	0										
4	4										
0			10	80	42	0	1	0	1	0	4
0											
			10	RT	42	0	1	0	0	0	0
0	0										
0											
0			100	140	42	0	2	1	2	0	3
0											
			100	170	42	0					
			100	170	42	0					
			100	150	42	0					
			100	150	125	1					
			100	170	42	0					
0											
0											
0			100	140	42	0	2	1	2	0	3
0											
			100	170	42	0					
			100	170	42	0					

Media	Conc. [wt-%]	Time	Stress Crack Test (at room temperature) – Bending Radius [mm] – Ultrason® E 265	400	1,000	Ultrason® S 265	400	1,000
Methanol	100	1 min	0			0		
	100	24 h	0			0		
Methyl ethyl ketone	100	1 min	4	4	4	4	4	4
Mold cleaner: Lusin Clean L 21	100	1 min	3	2	2	4	4	4
Nitric acid								
n-Octane	97	1 min	0	0		0	0	
	97	24 h	0	0		2	0	
Olive oil	100	1 min	0			0		
	100	24 h	0			0		
Peracetic acid								
Petroleum ether	100	1 min	0			0		
	100	24 h	0			0		
Phosphoric acid	85	1 min	0			0		
	85	24 h	0			0		
Potassium sulfate								
Sodium carbonate	2	24 h	0	0		0	0	
	20	24 h	0	0		0	0	
Sodium chloride	10	24 h	0	0		0	0	
Sodium hydrogen sulfite								
Sodium hydroxide	1	1 min	0			0		
	1	24 h	0			0		
	35	1 min	0			0		
	35	24 h	0			0		
Sodium hypochlorite	10	1 min	0			0		
	10	24 h	0			0		
Sulfuric acid	20	1 min	0	0		0	0	
	20	24 h	0	0		0	0	
	98	> 48 h	soluble			partially soluble		
Tenside: Lutensol A7N (fatty alcohol ethoxylate)	20	24 h	0					
Tenside: Sodium dodecylbenzene sulphonate	12,5	24 h	0					
tert. Butylethylether	100	1 min	0	0		2	0	
	100	24 h						
Tetrahydrofurane	100	1 min	4	4	4	3	2	2
	100	24 h	unsoluble			soluble		
Toluene	100	1 min	2	1	0	4	4	4

			Mechanical Properties								
265	400	1,000	Conc. [wt-%]	Temp. [°C]	Time [d]	F1	F2	F1	F2	F1	F2
Ultrason® P						Ultrason® E		Ultrason® S		Ultrason® P	
0											
0											
4	4	4									
4	3	3									
			10	RT	7	0		0			
			10	80	7	0		0			
0	0										
0	0										
0											
0											
			8	RT	2	0	1	0	0		
0											
0											
0			50	RT	42	0	1	0	0	0	0
0			85	RT	42	0	1	0	0	0	0
			4	96	30	0		1			
0	0										
0	0										
0	0		4	96	30	0		0			
			5	96	30	1		0			
0			10	RT	7	0		0			
0			10	80	3	0		0			
0			35	RT	42	0	0	0	1	0	0
0			10	40	42	0	0	0	3	0	0
0			10	RT	42	0	0	0	0	0	0
0			1,500 ppm	40	42	0	0	0	0	0	0
0	0		20	65	42	0	1	0	0	0	0
0	0										
partially soluble											
0											
0											
0	0										
3	3	3									
partially soluble											
3	3	0									

Media	Conc. [wt-%]	Time	Stress Crack Test (at room temperature) Bending Radius [mm]					
			Ultrason® E 265	Ultrason® E 400	Ultrason® E 1,000	Ultrason® S 265	Ultrason® S 400	Ultrason® S 1,000
Triacetine	100	1 min	0	0		0	0	
Tributyl phosphate	100	1 min	0	0		4	3	3
	100	24 h	4	4				
Trichloro ethylene	100	1 min	2	2	2		4	4
	100	> 24 h		unsoluble			partially soluble	
Triethanolamine	100	1 min	0	0	0	0	0	0
	100	24 h	1	0	0	0	0	0
Water (demineralized)	100	1 min	0	0		0	0	
	100	24 h	0	0		0	0	
Xylene	100	1 min	1	0	0	4	4	4
	100	24 h	3	2				
UV (ISO 4892-2, 320 nm – visible range)								

Table 3: Evaluation of resistance to chemicals

Media	Conc. [wt-%]	Time	Stress Crack Test (at room temperature) Bending Radius [mm]					
			Ultrason® E 265	Ultrason® E 400	Ultrason® E 1,000	Ultrason® S 265	Ultrason® S 400	Ultrason® S 1,000
Single-component adhesive: Loctite 431 (ethyl cyanoacrylate)	100	1 min	3	3	2	3	3	3
	100	24 h						
Single-component adhesive: Loctite 572 (dimethacrylate ester)	100	1 min	0	0	0	0	0	0
	100	24 h	4	4	0	4	4	4
Single-component adhesive: Loctite 3211 (acrylated urethane)	100	1 min	0	0	0	0	0	0
	100	24 h	0	0	0	4	4	4
Single-component adhesive: Araldit AV 170 (epoxy resin-based)	100	1 min	0	0	0			
	100	24 h	0	0	0			
Two-component adhesive: Araldit AV 138 with hardening agent HV 998 (epoxy resin-based)	100	1 min				0	0	0
	100	24 h						
Contact adhesive: Armaflex adhesive 520 (polychloroprene-based)	100	1 min	3	2	0	3	3	2
	100	24 h						
Thread sealant: Loctite 5331 (acetoxy silicone)	100	1 min	0			0		
	100	24 h	0			0		
Pipe thread sealant: Loctite 55 (polyamide fiber with chemically inert paste)	100	1 min	0	0	0	0	0	0
	100	24 h	0	0	0	0	0	0

Table 4: Evaluation of resistance against adhesives and sealants

			Mechanical Properties								
265	400	1,000	Conc. [wt-%]	Temp. [°C]	Time [d]	F1	F2	F1	F2	F1	F2
Ultrason® P						Ultrason® E		Ultrason® S		Ultrason® P	
0	0										
0	0										
4	4										
	4	4									
	unsoluble										
0	0	0									
0	0	0									
0	0		100	100	42	0	2	0	1	0	0
0	0										
1	0	0									
3	3										
				RT	42	4	4	2	4	0	4

265	400	1,000	
Ultrason® P			Hardening
2	2	0	Moisture
0	0	0	Anaerobic
3	0	0	
0	0	0	UV/visible light
0	0	0	
			140 °C -180 °C
			5 °C or higher
2	0	0	At 20 °C 36 h bonding time
	0	0	
0			Moisture
0			
0	0	0	
0	0	0	

Resistance of Ultrason® to water

Water absorption and dimensional stability

Ultrason® moldings absorb moisture in both water and air (Fig. 1). The extent of moisture absorption depends on the relative humidity, time period, temperature, and wall thickness of the molding. The time course of water absorption follows the law of diffusion.

Moisture absorption affects the mechanical properties. Especially with unfilled Ultrason® E products, moisture absorption increases the elongation at break and, above all, the impact strength. Strength and tensile modulus of elasticity are only slightly affected.

The dimensional change due to water absorption is limited for all Ultrason® products (Table 5). Water permeability is, by contrast, fairly high (Table 6).

Resistance to thermal aging in water at 100 °C

Immersion in cold water has practically no aging effect. Ultrason® is highly resistant to hydrolysis, even in boiling water or superheated steam, although a certain effect on its toughness is discernible.

	Water absorption [%]	Change in cross section [%]	Change in length [%]
Ultrason® E	2.2	+0.3	+0.3
Ultrason® E G6	1.6	+0.3	+0.1
Ultrason® S	0.8	+0.1	+0.1
Ultrason® S G6	0.6	+0.1	+0.1
Ultrason® P	1.2	+0.1	+0.1

Table 5: Water absorption and dimensional change in injection-molded tensile bars after immersion in water at 23 °C up to saturation

		Ultrason® E	Ultrason® S	Ultrason® P
Transmission rate 23 °C / 85 % r. h.	$\frac{g}{m^2 \cdot d}$	179	114	70
Permeability 23 °C	$\frac{g \cdot \mu m}{m^2 \cdot d}$	4,630	2,580	3,420

Table 6: Water vapor permeability at 23 °C according to ASTM F-1249

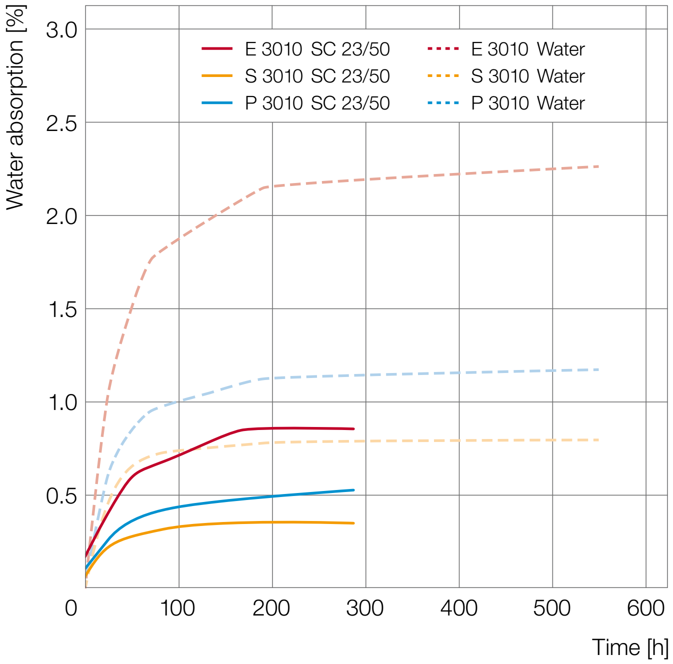

Fig. 1: Water absorption of Ultrason® as a function of storage time (under standard climatic conditions or immersed at RT); 2 mm specimen thickness; ISO 62

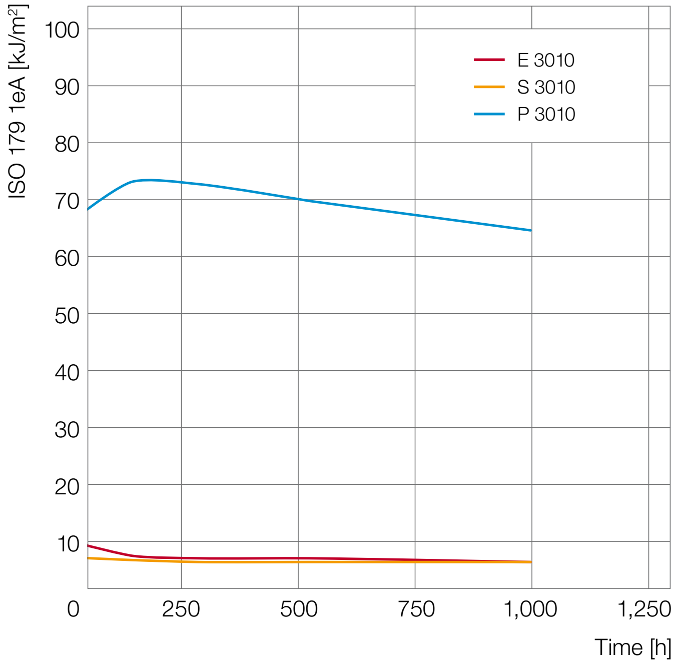

Fig. 3: Water immersion of Ultrason® at 100 °C, notched impact strength ISO 179 1eA

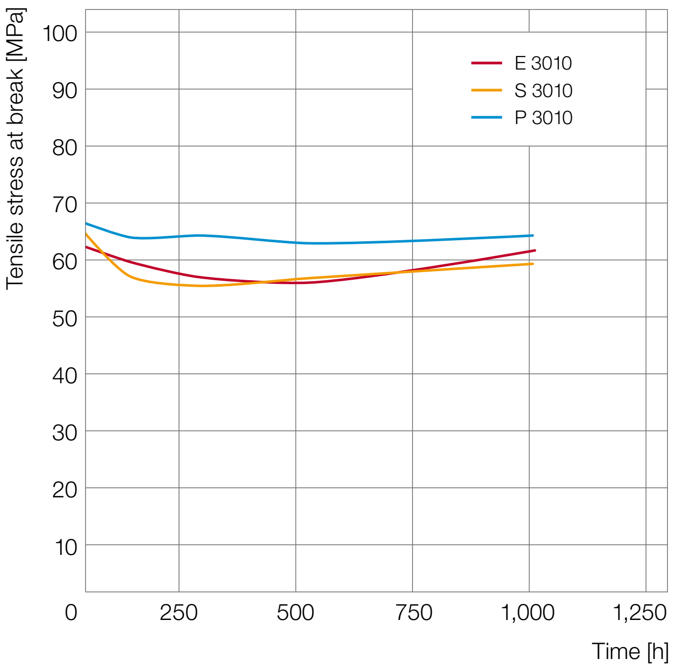

Fig. 2: Water immersion of Ultrason® at 100 °C, tensile test ISO 527

Superheated-steam sterilization

Components made of Ultrason® can be repeatedly sterilized in superheated steam and largely keep both their transparency and their high level of mechanical properties (Fig. 4). Ultrason® P performs extremely well in this case, since its toughness and elongation at break changes very little over many sterilization cycles (Fig. 5). The suitability for superheated-steam sterilization increases in the following order: Ultrason® E < Ultrason® S < Ultrason® P.

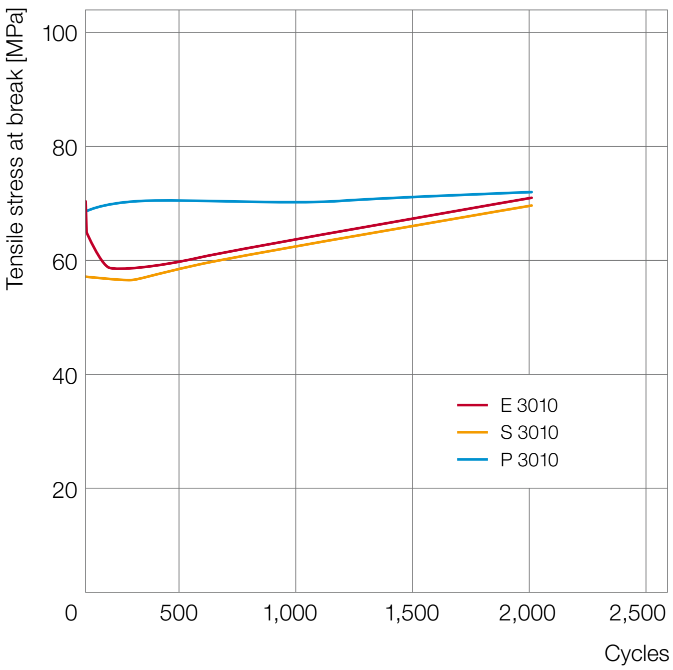

Fig. 4: Superheated-steam sterilization of Ultrason® at 134 °C, tensile test ISO 527

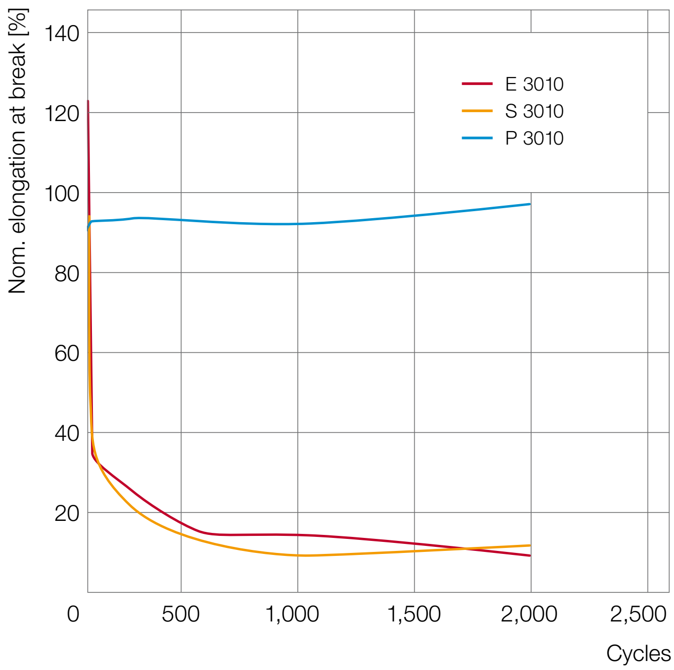

Fig. 5: Superheated-steam sterilization of Ultrason® at 134 °C, tensile test ISO 527

Creep strength

The behavior of Ultrason® under static load in water at 95°C is shown in Fig. 6 and Fig. 7. It is to be noted, however, that such measurements on standardized specimens can only indicate the behavior of an actual molding under comparable conditions. Therefore, for applications in the presence of media, tests should be conducted on moldings that are subjected to similar conditions as during the use of the component.

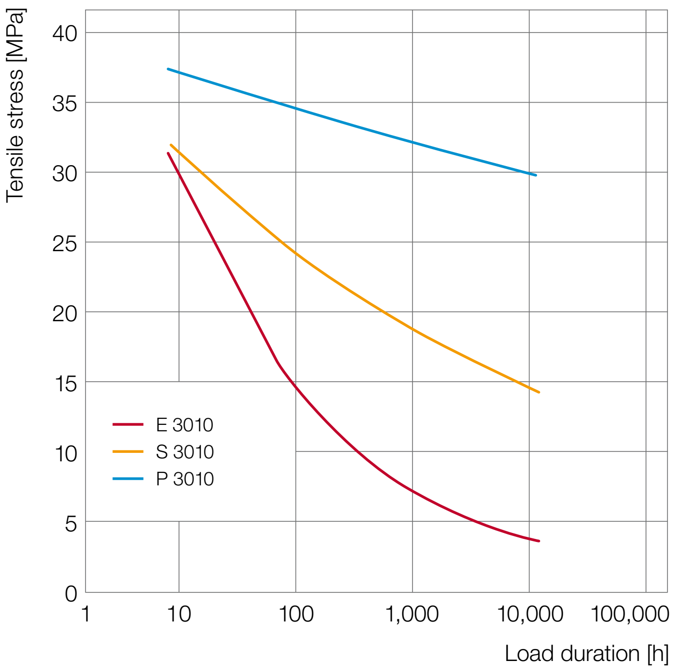

Fig. 6: Creep strength of unreinforced Ultrason® in water at 95 °C

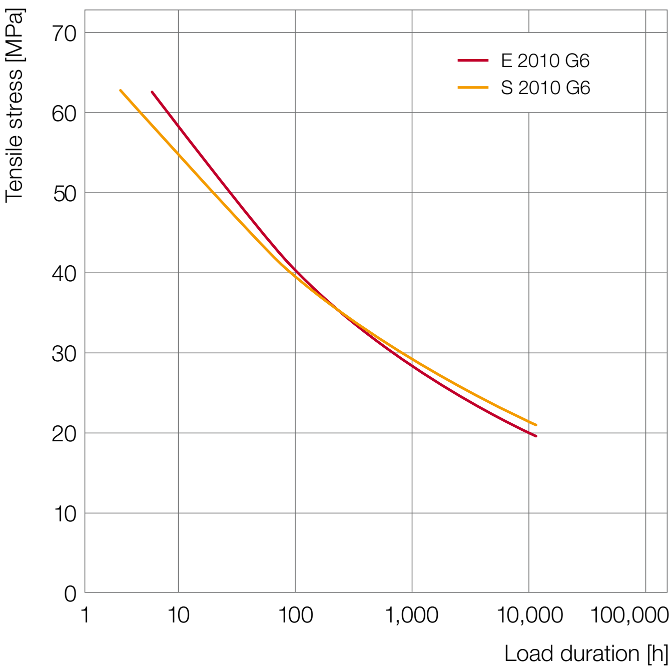

Fig. 7: Creep strength of glass-fiber reinforced Ultrason® in water at 95 °C

Solvents for Ultrason®

Overview

The preparation of polymer solutions as well as their handling is an important process step for certain applications. Among these are, for example, coatings or the manufacture of filter membranes for water and food processing. Solvents commonly used in industry and their dissolving capacity for Ultrason® are shown in Table 7.

Ultrason® may form physical bonds in certain solvents over time. This leads to an increase in viscosity and often to solution opacity. The formulation can even become paste-like in consistency. Therefore, the solvents that are generally capable of giving stable solutions, even after 24 hours, are marked in the table.

	Ultrason® E 3010		Ultrason® S 3010		Ultrason® P 3010	
Polymer concentration	10 %	25 %	10 %	25 %	10 %	25 %
Dichloro methane						
Dimethylacetamide	√	√	√	√	√	
Dimethylformamide	√		√	√	√	
Dimethyl sulfoxide	√	√	80 °C		80 °C	
Cresol	√		√			
N-Methylpyrrolidone	√	√	√	√	√	√
o-Dichloro benzene	180 °C		√	√	180 °C	
Sulfuric acid 96 %	√					
Sulfolane	40 °C	80 °C	120 °C	140 °C	120 °C	140 °C
Tetrahydrofuran			√	√		
Trichlorethylene						

Dissolving time:

< 4 h	4 - 12 h	> 24 h	partial	not soluble

√ = stability of the solution > 24 h

Table 7: Solvents for Ultrason®, at room temperature or as stated

	disperse	polar	total
Ultrason® E 2010	44.1	0.8	44.9
Ultrason® S 2010	37.1	3.1	40.2
Ultrason® P 3010	42.1	0.6	42.7

Table 8: Surface energy acc. to Owens, Wendt [mN/m]

Resistance to high-energy radiation

Ultrason® is very resistant to beta-, gamma-, and X-rays over the entire range of working temperatures. Only at high radiation doses (over 2 MGy) do Ultrason® E products suffer a noticeable decline in yield stress and a significant decrease in elongation at break. There is very little outgassing. The transmissibility for gamma- and X-rays is very high. Ultrason® is also characterized by a very low microwave absorption rate.

Resistance to gases

Ultrason® cannot be used as a barrier material since its permeability is too high. In this regard, Ultrason® E tends to be distinguished by the lowest permeability coefficients.

	Ultrason® E 3010	Ultrason® S 3010	Ultrason® P 3010
Carbon dioxide	$6.30 \cdot 10^4$	$15.00 \cdot 10^4$	$8.70 \cdot 10^4$
Methane	$4.31 \cdot 10^4$	$0.85 \cdot 10^4$	$0.75 \cdot 10^4$
Oxygen	$3.17 \cdot 10^4$	$6.13 \cdot 10^4$	$5.50 \cdot 10^4$
Nitrogen	$0.52 \cdot 10^4$	$1.08 \cdot 10^4$	$9.25 \cdot 10^4$
Hydrogen	$42.50 \cdot 10^4$	$79.50 \cdot 10^4$	$63.80 \cdot 10^4$

Table 9: Permeability coefficient [$cm^3 \cdot 1\,\mu m/m^2/d/bar$] dry, ISO 15 105 1

	Ultrason® E 3010	Ultrason® S 3010	Ultrason® P 3010
Carbon dioxide	$24.50 \cdot 10^2$	$66.30 \cdot 10^2$	$17.90 \cdot 10^2$
Methane	$17.80 \cdot 10^2$	$1.82 \cdot 10^2$	$1.42 \cdot 10^2$
Oxygen	$12.10 \cdot 10^2$	$26.80 \cdot 10^2$	$11.20 \cdot 10^2$
Nitrogen	$2.01 \cdot 10^2$	$4.74 \cdot 10^2$	$1.89 \cdot 10^2$
Hydrogen	$158.00 \cdot 10^2$	$343.00 \cdot 10^2$	$120.00 \cdot 10^2$

Table 10: Transmission rate [$cm^3/m^2/d$] dry, ISO 15 105 1

Nomenclature

Structure

The nomenclature adopted for the products consists of an alphanumeric code, the key to which is given below. An appended "P" signifies that the product concerned is a specialty intended for the preparation of solutions.

1st digit (letter):
type of polymer
E = Polyethersulfone (PESU)
S = Polysulfone (PSU)
P = Polyphenylensulfone (PPSU)

2nd digit (number):
viscosity class
1 … = low viscosity
6 … = high viscosity

6th digit (letter):
reinforcements
G = glass fibers
C = carbon fibers

7th digit (number):
proportion of additives
2 = mass fraction of 10%
4 = mass fraction of 20%
6 = mass fraction of 30%

Example

E	2	0	1	0	G	6
1st digit	2nd digit	3rd digit	4th digit	5th digit	6th digit	7th digit

e. g. Ultrason® E 2010 G6

E = Polyethersulfon (PESU)
2 = of medium viscosity (standard injection-molding grade)
G6 = 30% by weight of glass fibers

Selected Product Literature for Ultrason®:

- Ultrason® E, S, P – Product Brochure
- Ultrason® E, S, P – Product Range
- Ultrason® – Products for the Automotive Industry
- Ultrason® – Injection Molding
- Ultrason® – Special Products
- Ultrason® – A Versatile Material for the Production of Tailor-made Membranes

Note

The data contained in this publication are based on our current knowledge and experience. In view of the many factors that may affect processing and application of our product, these data do not relieve processors from carrying out own investigations and tests; neither do these data imply any guarantee of certain properties, nor the suitability of the product for a specific purpose. Any descriptions, drawings, photographs, data, proportions, weights etc. given herein may change without prior information and do not constitute the agreed contractual quality of the product. It is the responsibility of the recipient of our products to ensure that any proprietary rights and existing laws and legislation are observed. (June 2016)

Please visit our websites:
www.plasticsportal.com (World)
www.plasticsportal.eu (Europe)

Additional information on specific products:
www.plasticsportal.eu/name of product
e.g. www.plasticsportal.eu/ultrason

Request of brochures:
PM/K, F204
Fax: +49 621 60-49497

If you have technical questions on the products, please contact the Ultra-Infopoint:

Ultra Infopoint
+49 621 60-78780
ultraplaste.infopoint@basf.com

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