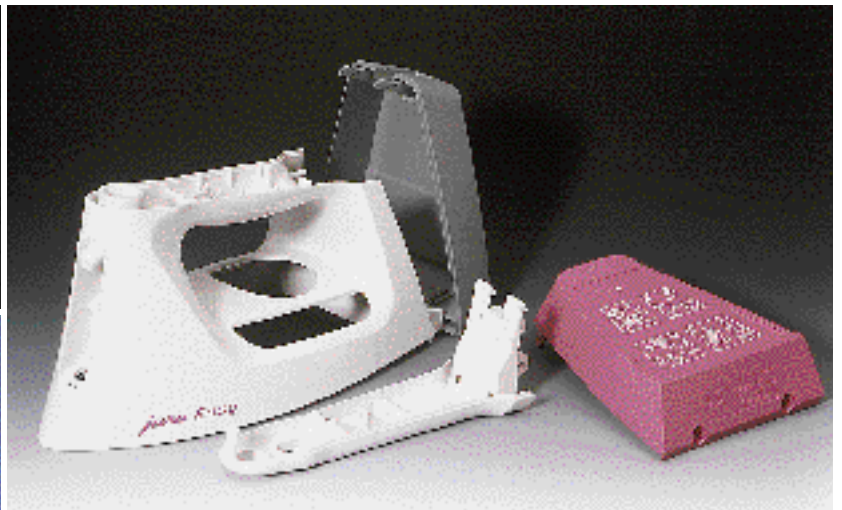
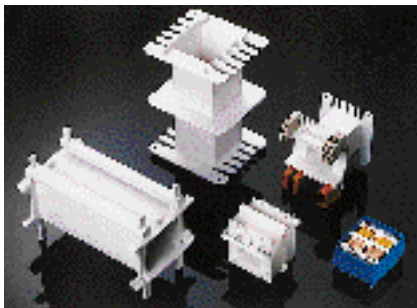




Crastin® PBT
Thermoplastic polyester resins



Product guide and properties



Start
with DuPont
Engineering Polymers

Crastin® PBT

Thermoplastic polyester resins

Introduction

CRASTIN® is the DuPont trade name for thermoplastic polyesters based on polybutylene terephthalate (PBT). By physical and technical modification, it is possible to create a wide range of products to fulfill the demands of various applications; e.g. electronics, electrical, automotive, mechanical engineering, chemical, domestic appliances and sporting goods.

Characteristic properties of CRASTIN®

The CRASTIN® product range offers grades with different property profiles.

Key properties are:

Mechanical properties

- Excellent stiffness and hardness
- Good toughness
- Good static and dynamic long term behaviour

Physical properties

- Dimensional stability, even at high temperatures
- High heat deflection temperature
- Good heat ageing resistance
- Flame retardant grades (V-0, according to UL 94)
- Good friction and wear properties

Electrical properties

- Excellent electrical insulating properties
- Special grades with a high arc resistance and a high comparative tracking index

Effect of environmental exposure

- High chemical resistance
- Low risk of stress cracking
- Low influence of humidity on mechanical and electrical properties

Other properties

- Good surface finish
- Fully compounded colours available

Processing

- Standard injection moulding machines
- Good flow properties
- Short cycle times
- Pre-drying required (110-130 °C, 2 to 4 hours, preferably in desiccant dryers)

Post moulding operations

- Assembly
 - Welding (Ultrasonic-, Vibration-, Spin-)
 - Snap fits
 - Screwing
 - Glueing
- Decorating
 - Painting
 - Printing
 - Hot stamping
 - Laser marking

Supply form

Cylindrical pellets supplied in 25 kg recyclable bags, in 1000 kg loads on CP-7 pallets and 1000 kg Octabins on CP-9 pallets.

Environment

- can be incinerated with energy recovery
- represents no known risk to human health or the environment when land filled
- is not restricted for inter European transport of waste destined for recovery

CRASTIN® PBT Product Line

		Non-flame retardant	Flame retardant	
Unreinforced	Multi purpose	S600	S650 FR	
	Easy flow	CE6125 L	CE1064, S680 FR	
	Fast cycling	S620		
	Extrusion	6129, 6130		
	High impact	ST820	T850 FR	
Reinforced	Glass reinforced	Multi purpose	SK601, SK602, SK603, SK605, SK608, SK609	SK641 FR, SK642 FR, SK643 FR, SK645 FR, CE7931, SK673 GW
		Easy flow		SK645 FRC
		Surface gloss	SK9215, SK9220, SK9230, LW9236	
		Low warpage	LW9020, LW9030, LW9236, LW9130	LW9020 FR, LW9030 FR
		High impact	T801, T803, T805	T841 FR, T843 FR, T845 FR
	Glass/mineral reinforced	High tracking	HTI619	HTI668 FR, HTI688 FR
	Glass beads or mineral filled	Low warpage	S0653, S0655	HTI681 FR
		High tracking		HTI681 FR

Compositions

Designation	Description
Non-flame retardant polybutylene terephthalate (PBT)	
CRASTIN® S600	Basic, unreinforced, high viscosity
CRASTIN® CE6125 L	Basic, unreinforced, medium viscosity
CRASTIN® S620	Basic, unreinforced, medium viscosity, fast cycling
CRASTIN® 6129	Basic, unreinforced, non lubricated (suitable for extrusion)
CRASTIN® 6130	Basic, unreinforced, non lubricated (suitable for extrusion)
CRASTIN® ST820	Toughened, unreinforced grade
CRASTIN® SK601	Basic, 10% glass reinforced grade
CRASTIN® SK602	Basic, 15% glass reinforced grade
CRASTIN® SK603	Basic, 20% glass reinforced grade
CRASTIN® SK605	Basic, 30% glass reinforced grade
CRASTIN® SK608	Basic, 45% glass reinforced grade
CRASTIN® SK609	Basic, 50% glass reinforced grade
CRASTIN® SK9215	High gloss, 15% glass reinforced blend
CRASTIN® SK9220	High gloss, 20% glass reinforced blend
CRASTIN® SK9230	High gloss, 30% glass reinforced blend
CRASTIN® LW9130	Low warpage, 30% glass reinforced grade
CRASTIN® LW9020	Low warpage, 20% glass reinforced blend
CRASTIN® LW9030	Low warpage, 30% glass reinforced blend
CRASTIN® LW9236	Low warpage, high gloss, 36% glass flakes/fibres reinforced blend
CRASTIN® T801	Toughened, 10% glass reinforced grade
CRASTIN® T803	Toughened, 20% glass reinforced grade
CRASTIN® T805	Toughened, 30% glass reinforced grade
CRASTIN® HTI619	Track resistant, 50% mineral filled and glass reinforced grade
CRASTIN® SO653	Basic, 20% glass bead filled grade
CRASTIN® SO655	Basic, 30% glass bead filled grade
Flame retardant polybutylene terephthalate (PBT)	
CRASTIN® S650 FR	Basic, unreinforced grade
CRASTIN® CE1064	Basic, unreinforced, easy flow grade
CRASTIN® S680 FR	Basic, unreinforced, very easy flow grade
CRASTIN® T850 FR	Toughened, unreinforced grade
CRASTIN® SK641 FR	Basic, 10% glass reinforced grade
CRASTIN® SK642 FR	Basic, 15% glass reinforced grade
CRASTIN® SK643 FR	Basic, 20% glass reinforced grade
CRASTIN® SK645 FR	Basic, 30% glass reinforced grade
CRASTIN® CE7931	Basic, 30% glass reinforced grade
CRASTIN® SK673 GW	Glow wire resistant 960 °C, 20% glass reinforced grade
CRASTIN® SK645 FRC	Basic, 30% glass reinforced grade, easy flow grade
CRASTIN® LW9020 FR	Low warpage, 20% glass reinforced blend
CRASTIN® LW9030 FR	Low warpage, 30% glass reinforced blend
CRASTIN® T841 FR	Toughened, 10% glass reinforced grade
CRASTIN® T843 FR	Toughened, 20% glass reinforced grade
CRASTIN® T845 FR	Toughened, 30% glass reinforced grade
CRASTIN® HTI681 FR	Track resistant, 10% mineral filled grade
CRASTIN® HTI668 FR	Track resistant, 45% mineral filled and glass reinforced grade
CRASTIN® HTI688 FR	Track resistant, 45% glass reinforced and mineral filled grade

Properties of non-flame retardant CRASTIN® PBT grades



Property	Test conditions	Method ISO	Units	Unreinforced				
				Multipurpose S600	Easy flow CE6125 L	Fast cycling S620	Extrusion 6129	
Yield stress ¹⁾	23°C	527-1/2	MPa	58	58	58	58	
Yield strain ¹⁾	23°C	527-1/2	%	3,6	3,8	3,6	3,6	
Stress at break ¹⁾	23°C	527-1/2	MPa	*	*	*	*	
Strain at break ¹⁾	50 mm/min	527-1/2	%	>50	>50	36	>50	
	5 mm/min	527-1/2	%	*	*	*	*	
Tensile modulus ¹⁾	1 mm/min	527-1/2	MPa	2700	2500	2700	2500	
Tensile creep modulus ¹⁾	1 h	899	MPa	2600	2600	2600	2600	
	1000 h			1800	1800	1800	1800	
Flexural strength ²⁾		178	MPa	85	85	85	85	
Ball indentation hardness ²⁾	H 358/30	2039-1	MPa	139	139	139	139	
	H 961/30			–	–	–	–	
Izod notched impact strength ²⁾	23°C	180/1A	kJ/m ²	6,5	4	6	6,5	
	–30°C			6	3,5	5	6	
Izod impact strength	23°C	180/1U	kJ/m ²	NB	–	142	NB	
	–30°C			130	–	70	130	
Charpy notched impact strength ²⁾	23°C	179/1eA	kJ/m ²	4,2	5,6	5,7	5,5	
	–30°C			4	5,2	3,4	4	
Charpy Impact strength	23°C	179/1eU	kJ/m ²	NB	NB	NB	NB	
	–30°C			NB	NB	45	NB	
Melting temperature	10 K/min	DSC	°C	225	225	225	225	
Temperature of deflection under load ⁴⁾	0,45 MPa	75	°C	160	155	160	160	
	1,8 MPa			60	50	60	60	
	5,0 MPa			*	*	*	*	
Coefficient of linear thermal expansion	parallel	ASTM E 831	10 ⁻⁴ /K	1,3	1,3	1,3	1,3	
	normal			1,3	1,3	1,3	1,3	
Thermal conductivity		DIN 51046	W/(mK)	0,25	0,25	0,25	0,25	
Vicat softening temperature ³⁾	50 K/h; 10 N	306	°C	216	–	216	–	
	50 K/h; 50 N			175	180	181	–	
Hot ball pressure test	Plate 3 mm	VDE 0470	°C	180	180	180	180	
Temperature index	3,2 mm	UL 746B	°C	electrical	130	130	130	75
				mechanical with impact	115	115	115	75
				mechanical without impact	120	120	120	75
				Stress at break	130	–	130	–
	20000 h	IEC 216	°C	120	–	120	–	

* Properties are not applicable for this material.
 1) Tensile test bar 4 mm (ISO 3167).
 2) Test bar of 80 × 10 × 4 mm.
 3) Test bar of 80 × 10 × 4 mm.
 4) Test bar of 110 × 10 × 4 mm.
 5) Specimen of ≥10 × 10 × 4 mm.

Property	Unreinforced		Glass reinforced								
	Extrusion 6130	High impact ST820	Multi-purpose				Surface gloss				
			SK601	SK602	SK603	SK605	SK608	SK609	SK9215	SK9220	SK9230
Yield stress ¹⁾	58	35	*	*	*	*	*	*	*	*	*
Yield strain ¹⁾	3,6	9	*	*	*	*	*	*	*	*	*
Stress at break ¹⁾	*	*	91	100	115	140	155	160	110	125	145
Strain at break ¹⁾	>50	>50	*	*	*	*	*	*	*	*	*
	*	*	3,7	3,6	3,3	2,6	1,8	1,7	3,5	3	2,5
Tensile modulus ¹⁾	2600	1600	4500	6000	7500	10000	15000	16000	6700	8000	11000
Tensile creep modulus ¹⁾	2600	–	4000	5300	7200	9000	–	15000	–	–	–
	1800	–	2500	4300	5600	6600	–	11600	–	–	–
Flexural strength ²⁾	85	67	130	160	180	210	255	270	–	190	220
Ball indentation hardness ²⁾	139	78	155	–	–	–	–	–	–	–	–
	–	–	–	175	180	200	222	230	–	190	210
Izod notched impact strength ²⁾	–	58	5,5	7	8	11	11	11	6	7,5	10
	–	10	5	6	7	9	10	10	–	–	–
Izod impact strength	–	NB	27	35	44	56	44	43	–	–	–
	–	215	26	34	41	55	44	43	–	–	–
Charpy notched impact strength ²⁾	5	87	7	8	10	12,4	–	11,5	7,5	9,5	11
	–	12,8	6	8	9,8	11,1	–	12,2	–	–	–
Charpy Impact strength	–	NB	45	50	65	69	63	52	40	40	45
	–	NB	42	46	54	82	70	68	–	–	–
Melting temperature	225	225	225	225	225	225	225	225	225-250	225-250	225-250
Temperature of deflection under load ⁴⁾	160	105	215	220	220	220	222	222	–	–	–
	60	48	185	195	204	205	212	215	200	205	205
	*	*	112	150	164	179	190	196	–	–	–
Coefficient of linear thermal expansion	1,3	1,9	0,6	0,5	0,4	0,3	0,2	0,2	–	–	–
	1,3	1,9	1,2	1,1	1,0	0,9	0,8	0,8	–	–	–
Thermal conductivity	0,25		0,25	0,26	0,27	0,28	0,32	0,33	–	–	–
Vicat softening temperature ³⁾	–	216	217	221	221	221	221	221	–	–	–
	–	123	204	205	208	213	214	215	–	–	–
Hot ball pressure test	180	–	–	210	210	210	210	220	–	–	–
Temperature index	–	–	130	130	130	130	–	130	–	–	–
	–	–	115	115	130	130	–	125	–	–	–
	–	–	120	120	130	130	–	130	–	–	–
	–	–	–	145	155	165	–	165	–	–	–
	–	–	–	135	140	145	–	145	–	–	–

These values are for these specific compositions only. Additives of any kind may alter some or all of these properties. The data listed here fall within the normal range of product properties but they should not be used to establish specification limits nor used alone as the basis of design.

Properties of non-flame retardant CRASTIN® PBT grades (continued)



	Unreinforced							
	Property	Test conditions	Method ISO	Units	Multipurpose S600	Easy flow CE6125 L	Fast cycling S620	Extrusion 6129
ELECTRICAL	Volume resistivity ⁴⁾		IEC 93	ohm cm	>10 ¹⁶	>10 ¹⁶	>10 ¹⁶	>10 ¹⁶
	Surface resistivity ⁴⁾		IEC 93	ohm	>10 ¹⁴	>10 ¹⁴	>10 ¹⁴	>10 ¹⁴
	Relative permittivity ⁷⁾	50 Hz	IEC 250		3.8	3.8	3.8	3.8
		10 ⁶ Hz			3.2	3.2	3.2	3.2
	Dissipation factor ⁷⁾	50 Hz	IEC 250	× 10 ⁻⁴	20	20	20	20
		10 ⁶ Hz		200	200	200	200	200
	Electric strength, 1 mm plate 2 mm plate	P25/P75	IEC 243-1	kV/mm	26	26	26	26
		20 s			15	15	15	15
	Electrolytical corrosion ⁸⁾		IEC 426	rating	A1	A1	A1	A1
Arc resistance 4 mm plate	ASTM D495	s	160	–	160	–	–	
Comparative tracking index ⁹⁾	CTI	IEC 112	V	>600	>600	>600	>600	
	CTI-M			350 M	–	350 M	–	
FLAMMABILITY	Flammability	0,8 mm	UL 94	rating	HB	–	HB	HB
		1,6 mm	UL 94	rating	HB	HB	HB	HB
		1,6 mm	ASTM D635	cm/min	2,6	2,6	2,6	2,6
		1,6 mm	ASTM D635	s	*	*	*	*
		1,6 mm	ASTM D635	mm	*	*	*	*
Oxygen Index		ASTM D2863	%	22	22	22	22	
Glow wire test	Plate 3 mm	IEC 695-2-1	°C	750	750	750	750	
MISC.	Density ¹⁰⁾		1183	g/cm ³	1,31	1,31	1,31	1,31
	Humidity absorption	23 °C, 50% RH	62	%	0,20	0,20	0,20	0,20
	Water absorption	23 °C, saturation	62	%	0,50	0,50	0,50	0,50
PROCESSING	Melt temperature		°C	240-260	240-260	240-260	240-260	
	Mould temperature		°C	ca. 80	ca. 80	ca. 80	ca. 80	
	Moulding shrinkage	Specimen of 100 × 100 × 2 mm parallel normal	DIN 16901	%	1,6	1,6	1,6	1,6
					1,6	1,6	1,6	1,6
Flow length (spiral flow) at 100 MPa injection pressure	7 × 2 mm	–	mm	380	450	425	380	

4) Specimen of 80 × 80 × 1 mm. According to Campus, version 1.2 (measured without sticking electrode).
 7) Specimen of 80 × 80 × 1 mm, measured with silver paint.
 8) Specimen of 30 × 10 × 4 mm.
 9) Specimen of >15 × >15 × 4 mm.
 10) Specimen of >10 × 10 × 4 mm.

	Unreinforced		Glass reinforced								
	Extrusion 6130	High impact ST820	Multi-purpose SK601	SK602	SK603	SK605	SK608	SK609	Surface gloss SK9215 SK9220 SK9230		
ELECTRICAL	>10 ¹⁶	>10 ¹⁶	>10 ¹⁶	>10 ¹⁶	>10 ¹⁶	>10 ¹⁶	>10 ¹⁶	>10 ¹⁶	–	–	–
	>10 ¹⁴	>10 ¹⁴	>10 ¹⁴	>10 ¹⁴	>10 ¹⁴	>10 ¹⁴	>10 ¹⁴	>10 ¹⁴	–	–	–
	3.8	–	3.9	4,1	4,2	4,4	4,1	4,1	–	–	–
	3,2	–	3,5	3,5	3,6	3,8	3,9	3,9	–	–	–
	20	–	20	20	21	25	38	38	–	–	–
	200	–	200	200	190	180	130	130	–	–	–
	26	–	30	27	29	31	32	33	–	–	–
	15	–	17	17	17	17	15	14	–	–	–
	A1	–	A1	A1	A1	A1	A1	A1	–	–	–
–	–	103	103	103	124	124	134	–	–	–	
>600	>600	300	350	400	450	475	500	–	–	–	
–	>600 M	200 M	200 M	200 M	200 M	200 M	200 M	–	–	–	
HB	–	HB	HB	HB	HB	HB	HB	HB	HB	HB	
HB	HB	HB	HB	HB	HB	HB	HB	HB	HB	HB	
2,6	4,6	3,7	3,7	3,7	3,0	2,5	2,4	–	–	–	
*	*	*	*	*	*	*	*	–	–	–	
*	*	*	*	*	*	*	*	–	–	–	
22	–	20	19	19	19	20	20	–	–	–	
750	700	–	750	750	750	750	750	–	–	–	
1,31	1,21	1,37	1,41	1,45	1,53	1,67	1,71	1,43	1,47	1,55	
0,20	–	0,18	0,17	0,15	0,13	0,11	0,10	–	–	–	
0,50	–	0,45	0,42	0,40	0,37	0,27	0,25	–	–	–	
240-260	240-260	240-260	240-260	240-260	240-260	250-270	250-270	265-275	260-280	260-280	
ca. 80	ca. 80	ca. 80	ca. 80	ca. 80	ca. 80	ca. 80	ca. 80	ca. 80	ca. 80	ca. 80	
1,6	2,2	0,6	0,6	0,4	0,3	0,25	0,25	–	–	–	
1,6	2,2	1,2	1,2	1,1	1,0	0,85	0,8	–	–	–	
440	300	500	500	445	375	270	235	520	480	480	

These values are for these specific compositions only. Additives of any kind may alter some or all of these properties. The data listed here fall within the normal range of product properties but they should not be used to establish specification limits nor used alone as the basis of design.

Properties of non-flame retardant CRASTIN® PBT grades

Property	Test conditions	Method ISO	Units	Glass reinforced			
				Low warpage			
				LW9130	LW9020	LW9030	LW9236
Yield stress ¹⁾	23°C	527-1/2	MPa	*	*	*	*
Yield strain ¹⁾	23°C	527-1/2	%	*	*	*	*
Stress at break ¹⁾	23°C	527-1/2	MPa	130	120	135	95
Strain at break ¹⁾	50 mm/min	527-1/2	%	*	*	*	*
	5 mm/min	527-1/2	%	2,6	3,2	2,8	3
Tensile modulus	1 mm/min	527-1/2	MPa	9500	7000	9500	9700
Tensile creep modulus	1 h	899	MPa	9000	6500	9000	–
	1000 h			8000	4800	7300	–
Flexural strength ²⁾		178	MPa	200	170	190	–
Ball indentation hardness ²⁾	H 358/30	2039-1	MPa	–	–	–	–
	H 961/30			188	162	175	–
Izod notched Impact strength ²⁾	23°C	180/1A	kJ/m ²	11	9	10	4,7
	–30°C			10	7	8	–
Izod Impact strength	23°C	180/1U	kJ/m ²	50	49	50	–
	–30°C			50	49	50	–
Charpy notched Impact strength ³⁾	23°C	179/1eA	kJ/m ²	13,8	9,8	10,4	4,7
	–30°C			11,7	7,6	9,3	–
Charpy Impact strength	23°C	179/1eU	kJ/m ²	71	60	63	42
	–30°C			83	43	66	–
Melting temperature	10 K/min	DSC	°C	213	225	225	225-250
Temperature of deflection under load ⁴⁾	0,45 MPa	75	°C	202	215	215	–
	1,8 MPa			180	172	182	179
	5,0 MPa			132	*	*	–
Coefficient of linear thermal expansion	parallel	ASTM E 831	10 ⁻⁴ /K	0,3	0,3	0,25	–
	normal			1,0	1,0	1,0	–
Thermal conductivity		DIN 51046	W/(mK)	0,28	0,25	0,26	–
Vicat softening temperature ⁵⁾	50 K/h; 10 N	306	°C	204	214	214	–
	50 K/h; 50 N			192	147	150	–
Hot ball pressure test	Plate 3 mm	VDE 0470	°C	200	180	180	–
Temperature index	3,2 mm	UL 746B	°C				
			electrical	140	130	130	–
			mechanical with impact	140	130	130	–
			mechanical without impact	140	130	130	–
Stress at break	5000 h	IEC 216	°C	165	160	160	–
	20000 h			150	145	145	–

* Properties are not applicable for this material.
 1) Tensile test bar 4 mm (ISO 3167).
 2) Test bar of 80 × 10 × 4 mm.
 3) Test bar of 80 × 10 × 4 mm.
 4) Test bar of 110 × 10 × 4 mm.
 5) Specimen of ≥10 × 10 × 4 mm.

Property	Glass reinforced			Glass/ mineral reinforced	Glass beads filled	
	High impact			High tracking	Low warpage	
	T801	T803	T805	HT1619	SO653	SO655
Yield stress ¹⁾	*	*	*	*	*	*
Yield strain ¹⁾	*	*	*	*	*	*
Stress at break ¹⁾	65	95	100	100	54	57
Strain at break ¹⁾	*	*	*	*	*	*
	8	5	4,2	1,5	10,5	5,8
Tensile modulus	3000	5000	7000	12500	3800	4000
Tensile creep modulus	–	–	6200	10500	3500	3600
	–	–	4000	6500	2400	2500
Flexural strength ²⁾	–	–	160	165	90	95
Ball indentation hardness ²⁾	–	–	150	–	144	170
	–	–	–	226	–	–
Izod notched Impact strength ²⁾	4,5	–	12	5	4	4
	–	–	10	5	4	3
Izod Impact strength	–	–	50	24	37	26
	–	–	50	23	34	25
Charpy notched Impact strength ³⁾	6	10	14,5	5,8	4,1	4,2
	–	8	12,6	5,2	3,7	3,5
Charpy Impact strength	55	64	77	11,7	47	49
	–	53	89	10,4	44	50
Melting temperature	213	213	213	225	225	225
Temperature of deflection under load ⁴⁾	200	202	205	220	185	212
	180	185	190	200	70	99
	–	*	152	175	*	*
Coefficient of linear thermal expansion	–	0,35	0,3	0,3	1,1	1,0
	–	1,6	1,2	0,7	1,1	1,0
Thermal conductivity	–	–	0,28	0,48	0,27	0,28
Vicat softening temperature ⁵⁾	–	–	205	218	208	210
	–	–	191	205	196	198
Hot ball pressure test	–	–	200	210	190	190
Temperature index	–	–	140	130	120	120
	–	–	130	125	115	120
	–	–	140	130	120	120
	–	–	155	155	–	150
Stress at break	–	–	140	140	–	135

These values are for these specific compositions only. Additives of any kind may alter some or all of these properties. The data listed here fall within the normal range of product properties but they should not be used to establish specification limits nor used alone as the basis of design.

Properties of non-flame retardant CRASTIN® PBT grades (continued)

Property	Test conditions	Method ISO	Units	Glass reinforced				
				Low warpage LW9130	LW9020	LW9030	LW9236	
Volume resistivity ⁶⁾		IEC 93	ohm cm	>10 ¹⁶	>10 ¹⁵	>10 ¹⁵	–	
Surface resistivity ⁶⁾		IEC 93	ohm	>10 ¹⁴	>10 ¹³	>10 ¹³	–	
Relative permittivity ⁷⁾	50 Hz	IEC 250		4,0	3,6	3,8	–	
	10 ⁶ Hz			3,5	3,4	3,6	–	
Dissipation factor ⁷⁾	50 Hz	IEC 250	× 10 ⁻⁴	23	30	30	–	
	10 ⁶ Hz			172	180	170	–	
Electric strength, 1 mm plate	P25/P75	IEC 243-1	kV/mm	31	35	36	–	
	2 mm plate			20 s	17	20	21	–
Electrolytical corrosion ⁸⁾		IEC 426	rating	A1	A1	A1	–	
Arc resistance	4 mm plate	ASTM D495	s	122	106	121	–	
Comparative tracking index ⁹⁾	CTI CTI-M	IEC 112	V	400	550	550	–	
				200 M	175 M	175 M	–	
FLAMMABILITY	0,8 mm	UL 94	rating	HB	–	–	HB	
	1,6 mm	UL 94	rating	HB	HB	HB	HB	
	1,6 mm	ASTM D635	cm/min	4,0	5,0	5,0	–	
	1,6 mm	ASTM D635	s	*	*	*	*	
	1,6 mm	ASTM D635	mm	*	*	*	*	
Oxygen Index		ASTM D2863	%	19	19	19	–	
Glow wire test	Plate 3 mm	IEC 695-2-1	°C	750	650	650	–	
Density ¹⁰⁾		1183	g/cm ³	1,51	1,35	1,43	1,56	
Humidity absorption	23 °C, 50% RH	62	%	0,14	0,26	0,24	–	
Water absorption	23 °C, saturation	62	%	0,35	0,78	0,72	–	
Melt temperature			°C	240-260	240-260	240-260	265-275	
Mould temperature			°C	>80	ca. 80	ca. 80	ca. 80	
Moulding shrinkage	Specimen of 100 × 100 × 2 mm	DIN 16901	%	parallel	0,2	0,3	0,2	–
				normal	0,5	0,6	0,5	–
Flow length (spiral flow) at 100 MPa injection pressure	7 × 2 mm	–	mm	400	425	400	440	

6) Specimen of 80 × 80 × 1 mm. According to Campus, version 1.2 (measured without sticking electrode).
 7) Specimen of 80 × 80 × 1 mm, measured with silver paint.
 8) Specimen of 30 × 10 × 4 mm.
 9) Specimen of >15 × >15 × 4 mm.
 10) Specimen of >10 × 10 × 4 mm.

Glass reinforced	Glass/ mineral reinforced		Glass beads filled			
	High impact T801	T803	T805	High tracking HT1619	Low warpage SO653	SO655
>10 ¹⁶	>10 ¹⁶	>10 ¹⁶	>10 ¹⁶	>10 ¹⁵	>10 ¹⁵	
>10 ¹⁴	>10 ¹⁴	>10 ¹⁴	>10 ¹⁴	>10 ¹⁴	>10 ¹⁴	
–	3,8	4,4	4,4	4,0	4,6	
–	3,6	4,0	3,8	3,7	3,9	
–	100	95	136	90	136	
–	200	218	228	160	190	
–	26	29	35	25	25	
–	–	17	17	17	17	
–	–	A1	A1	A1	A1	
–	–	116	130	101	110	
–	500	500	>600	300	250	
–	–	200 M	200 M	200 M	200 M	
HB	HB	HB	HB	HB	HB	
HB	HB	HB	HB	HB	HB	
–	–	3,5	4,9	2,7	2,7	
–	*	*	*	*	*	
–	*	*	*	*	*	
19	19	19	21	22	22	
750	750	750	750	750	750	
1,35	1,42	1,50	1,71	1,45	1,53	
0,14	0,14	0,14	0,20	0,15	0,12	
0,45	0,40	0,35	0,50	0,40	0,35	
230-260	230-260	230-260	240-260	230-260	230-260	
ca. 80	ca. 80	ca. 80	ca. 80	ca. 80	ca. 80	
–	0,2	0,25	0,4	1,5	1,4	
–	0,9	0,7	0,9	1,5	1,4	
530	490	425	250	350	255	

These values are for these specific compositions only. Additives of any kind may alter some or all of these properties. The data listed here fall within the normal range of product properties but they should not be used to establish specification limits nor used alone as the basis of design.

Properties of flame retardant CRASTIN® PBT grades

Property	Test conditions	Method ISO	Units	Unreinforced				Glass reinforced	
				Multi-purpose S650 FR	Easy flow CE1064	S680 FR	High impact T850 FR	Multi-purpose SK641 FR	
Yield stress ¹⁾	23°C	527-1/2	MPa	65	59	*	47	*	
Yield strain ¹⁾	23°C	527-1/2	%	3,7	3,7	*	3,4	*	
Stress at break ¹⁾	23°C	527-1/2	MPa	58	54	51	45	85	
Strain at break ¹⁾	50 mm/min	527-1/2	%	9	5,3	*	20	*	
	5 mm/min	527-1/2	%	13,0	7,2	5,5	25	3,1	
Tensile modulus	1 mm/min	527-1/2	MPa	2900	3200	3100	2400	5000	
Tensile creep modulus	1 h	899	MPa	2500	2800	–	–	4600	
	1000 h			1800	1800	–	–	3500	
Flexural strength ²⁾		178	MPa	100	95	90	78	140	
Ball indentation hardness ²⁾	H 358/30	2039-1	MPa	150	168	160	100	–	
	H 961/30			–	–	–	–	170	
Izod notched Impact strength ²⁾	23°C	180/1A	kJ/m ²	4	5	3	11	5	
	–30°C			4	4	3	7	5	
Izod Impact strength	23°C	180/1U	kJ/m ²	45	36	31	125	30	
	–30°C			42	35	30	70	27	
Charpy notched Impact strength ³⁾	23°C	179/1eA	kJ/m ²	4,0	4,0	4,1	12,6	5,2	
	–30°C			3,3	3,0	3,7	5,1	4,7	
Charpy Impact strength	23°C	179/1eU	kJ/m ²	88	42	36	NB	47	
	–30°C			67	36	44	NB	37	
Melting temperature	10 K/min	DSC	°C	225	225	225	225	225	
Temperature of deflection under load ⁴⁾	0,45 MPa	75	°C	160	190	175	167	215	
	1,8 MPa			65	75	64	60	200	
	5,0 MPa			*	*	*	*	152	
Coefficient of linear thermal expansion	parallel	ASTM E 831	10 ⁻⁴ /K	1,2	1,1	1,3	1,4	0,6	
	normal			1,2	1,1	1,3	1,4	1,1	
Thermal conductivity		DIN 51046	W/(mK)	0,26	0,26	–	–	0,26	
Vicat softening temperature ⁵⁾	50 K/h; 10 N	306	°C	215	218	218	214	217	
	50 K/h; 50 N			177	194	184	162	205	
Hot ball pressure test	Plate 3 mm	VDE 0470	°C	190	190	190	180	210	
Temperature index	3,2 mm	UL 746B	°C	electrical	130	120	–	75	140
				mechanical with impact	130	120	–	75	140
				mechanical without impact	130	120	–	75	140
	Stress at break	5000 h	IEC 216	°C	145	145	–	–	160
	20000 h			130	130	–	–	145	

MECHANICAL

THERMAL

* Properties are not applicable for this material.
 1) Tensile test bar 4 mm (ISO 3167).
 2) Test bar of 80 × 10 × 4 mm.
 3) Test bar of 80 × 10 × 4 mm.
 4) Test bar of 110 × 10 × 4 mm.
 5) Specimen of ≥10 × 10 × 4 mm.

Property	Glass reinforced											Glass/mineral reinforced		
	Multipurpose			Easy flow		Low warpage		High impact			High tracking			
	SK642 FR	SK643 FR	SK645 FR	CE7931	SK673 GW	SK645 FRC	LW9020 FR	LW9030 FR	T841 FR	T843 FR	T845 FR	HTI681 FR	HTI668 FR	HTI688 FR
Yield stress ¹⁾	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Yield strain ¹⁾	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Stress at break ¹⁾	95	105	140	135	119	140	110	125	70	90	110	54	70	100
Strain at break ¹⁾	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	3,0	2,8	2,5	2,2	2,9	2,1	2,5	2,2	5,2	4,5	3,7	2,2	2,0	1,7
Tensile modulus	6500	8000	12000	11200	7500	12000	8000	10500	3900	6200	8500	3600	6500	9000
Tensile creep modulus	6000	7200	11000	–	–	–	7500	9500	3000	5400	7800	3400	5500	7600
	4800	5500	8000	–	–	–	6000	7400	2000	3500	5200	2500	4100	5800
Flexural strength ²⁾	155	170	215	–	–	220	155	185	100	140	170	95	105	150
Ball indentation hardness ²⁾	–	–	–	–	–	–	–	–	120	140	153	165	–	–
	180	190	214	246	185	–	160	170	–	–	–	–	189	170
Izod notched Impact strength ²⁾	7	8	9	10	8	8,6	7	8	7	9	11	3	4	6
	6	7	8	8	7	–	6	7	5	7	9	3	4	5
Izod Impact strength	33	36	40	40	44	–	33	35	28	39	44	20	18	25
	32	35	40	40	44	–	33	35	26	39	44	19	17	24
Charpy notched Impact strength ³⁾	7,8	8,5	9,5	10,9	11,3	9,5	7,6	8,7	7,8	11,6	10,9	3,6	4,8	8,2
	7,1	7,8	9,4	11,4	9,8	–	6,8	8,1	5	8,5	10	3,7	3,9	7,3
Charpy Impact strength	53	56	56	66	64	54	42	48	45	55	56	29	28	42
	44	53	57	77	66	–	39	40	41	62	65	28	22	38
Melting temperature	225	225	225	225	225	225	225	225	210	210	210	225	210	210
Temperature of deflection under load ⁴⁾	218	220	220	221	220	–	215	220	200	204	205	194	200	205
	203	205	210	210	205	210	175	190	183	188	192	88	185	190
	168	178	186	–	173	–	105	130	119	147	165	*	140	171
Coefficient of linear thermal expansion	0,5	0,4	0,3	0,27	0,43	–	0,3	0,25	0,7	0,4	0,3	1,1	0,4	0,3
	1,1	1,0	0,9	1,4	1,5	–	1,0	0,8	1,4	1,3	1,2	1,1	1,0	0,9
Thermal conductivity	0,27	0,28	0,29	–	–	–	0,25	0,26	0,26	0,28	0,29	0,27	0,51	0,43
Vicat softening temperature ⁵⁾	217	218	218	–	–	–	215	215	201	201	203	218	199	205
	207	210	212	212	210	–	145	150	179	187	190	197	172	188
Hot ball pressure test	210	210	210	210	210	–	180	180	180	180	180	190	200	200
Temperature index	140	140	140	130	–	140	140	140	130	130	140	140	125	125
	130	130	130	130	–	130	120	130	130	130	140	140	125	125
	140	140	140	140	–	140	130	140	130	130	140	140	125	130
	160	165	165	–	–	–	160	160	155	155	160	160	150	–
	145	145	145	–	–	–	145	145	140	140	145	145	135	–

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Properties of flame retardant CRASTIN® PBT grades (continued)

Property	Test conditions	Method ISO	Units	Unreinforced				Glass reinforced	
				Multi-purpose S650 FR	Easy flow CE1064	S680 FR	High impact T850 FR	Multi-purpose SK641 FR	
Volume resistivity ⁶⁾		IEC 93	ohm cm	>10 ¹⁶	>10 ¹⁶	>10 ¹⁶	>10 ¹⁶	>10 ¹⁶	
Surface resistivity ⁶⁾		IEC 93	ohm	>10 ¹⁴	>10 ¹⁴	>10 ¹⁴	>10 ¹⁴	>10 ¹⁴	
Relative permittivity ⁷⁾	50 Hz 10 ⁶ Hz	IEC 250		3,5 3,5	3,6 3,5	3,5 3,5	3,4 3,2	3,6 3,4	
Dissipation factor ⁷⁾	50 Hz 10 ⁶ Hz	IEC 250	× 10 ⁻⁴	17 180	22 168	13 181	10 180	30 170	
Electric strength, 1 mm plate 2 mm plate	P25/P75 20 s	IEC 243-1	kV/mm	25 15	25 18	25 15	27 17	26 17	
Electrolytical corrosion ⁸⁾		IEC 426	rating	A1	A1,2	–	A1,2	A1	
Arc resistance	4 mm plate	ASTM D495	s	54	93	–	65	103	
Comparative tracking index ⁹⁾	CTI CTI-M	IEC 112	V	225 175 M	250 175 M	250 175 M	>600 275 M	250 175 M	
FLAMMABILITY	Flammability	0,8 mm 1,6 mm 1,6 mm 1,6 mm 1,6 mm	UL 94 UL 94 ASTM D635 ASTM D635 ASTM D635	rating rating cm/min s mm	V-0 V-0 * <5 <5	V-0 V-0 * <5 <5	V-0 V-0 * <5 <5	– V-0 * <5 <5	– V-0 * <5 <5
	Oxygen Index		ASTM D2863	%	30	29	30	29	31
	Glow wire test	Plate 3 mm	IEC 695-2-1	°C	960	960	960	960	960
	Density ¹⁰⁾		1183	g/cm ³	1,47	1,48	1,49	1,40	1,52
	Humidity absorption	23 °C, 50% RH	62	%	0,15	0,16	0,16	0,22	0,15
Water absorption	23 °C, saturation	62	%	0,39	0,40	0,40	0,55	0,35	
PROCESSING	Melt temperature		°C	240-260	240-260	240-260	240-260	240-260	
	Mould temperature		°C	ca. 80	ca. 80	ca. 80	ca. 80	ca. 80	
	Moulding shrinkage	Specimen of 100 × 100 × 2 mm parallel normal	DIN 16901	%	1,7 1,7	2,1 2,1	1,9 1,9	1,9 1,9	0,6 1,3
	Flow length (spiral flow) at 100 MPa injection pressure	7 × 2 mm	–	mm	360	450	580	370	480

6) Specimen of 80 × 80 × 1 mm. According to Campus, version 1.2 (measured without sticking electrode).
 7) Specimen of 80 × 80 × 1 mm, measured with silver paint.
 8) Specimen of 30 × 10 × 4 mm.
 9) Specimen of >15 × >15 × 4 mm.
 10) Specimen of >10 × 10 × 4 mm.

Property	Glass reinforced											Glass/mineral reinforced			
	Multipurpose			Easy flow	Low warpage		High impact			High tracking					
	SK642 FR	SK643 FR	SK645 FR	CE7931	SK673 GW	SK645 FRC	LW9020 FR	LW9030 FR	T841 FR	T843 FR	T845 FR	HTI681 FR	HTI668 FR	HTI688 FR	
Volume resistivity ⁶⁾	>10 ¹⁶	>10 ¹⁶	>10 ¹⁶	>10 ¹⁶	>10 ¹⁶	>10 ¹⁶	>10 ¹⁵	>10 ¹⁵	>10 ¹⁶	>10 ¹⁶	>10 ¹⁶	>10 ¹⁶	>10 ¹⁶	>10 ¹⁶	
Surface resistivity ⁶⁾	>10 ¹⁴	>10 ¹⁴	>10 ¹⁴	>10 ¹⁴	>10 ¹⁴	>10 ¹⁶	>10 ¹³	>10 ¹³	>10 ¹⁴	>10 ¹⁴	>10 ¹⁴	>10 ¹⁴	>10 ¹⁴	>10 ¹⁴	
Relative permittivity ⁷⁾	3,7 3,5	3,8 3,7	4,5 3,8	4,2 4,1	4,0 3,6	– –	3,7 3,5	3,8 3,6	4,0 3,8	4,1 3,9	4,2 4,0	3,5 3,5	5,3 4,1	4,9 4,3	
Dissipation factor ⁷⁾	30 170	30 160	30 160	30 150	50 170	– –	30 150	30 150	100 180	110 170	130 170	30 164	236 307	216 214	
Electric strength, 1 mm plate 2 mm plate	28 17	28 17	28 17	33 –	26 16	– –	29 20	29 20	27 16	27 16	27 16	25 15	25 18	25 17	
Electrolytical corrosion ⁸⁾	A1	A1,2	A1,2	–	–	–	A1,2	A1, 2	A1	A1	A1	A1	A1,2	A1	
Arc resistance	73	73	122	65	–	–	95	105	77	77	82	84	181	124	
Comparative tracking index ⁹⁾	250 175M	250 175 M	250 175 M	250 150 M	250 175 M	– –	350 175 M	375 175 M	250 175 M	275 175 M	325 175 M	>600 450 M	>600 200 M	475 200 M	
FLAMMABILITY	Flammability	V-0 V-0 * <5 <5	V-0 V-0 * <5 <5	V-0 V-0 * <5 <5	V-0 V-2 * – –	V-0 V-0 * – –	– V-0 * <5 <5	– V-0 * <5 <5	– V-0 * <5 <5	– V-0 * <5 <5	– V-0 * <5 <5	– V-0 * <5 <5	V-0 V-0 * <5 <5	– V-0 * <5 <5	– V-0 * <5 <5
	Oxygen Index	31	31	31	33	–	27	27	30	30	30	29	29	30	
	Glow wire test	960	960	960	960	960	960	960	960	960	960	960	960	960	960
	Density ¹⁰⁾	1,55	1,59	1,69	1,68	1,56	1,69	1,51	1,56	1,53	1,59	1,69	1,51	1,75	1,77
	Humidity absorption	0,14	0,13	0,10	0,10	0,12	–	0,23	0,21	0,15	0,13	0,10	0,15	0,20	0,20
Water absorption	0,33	0,32	0,30	0,30	0,35	–	0,78	0,72	0,36	0,31	0,27	0,37	0,50	0,50	
PROCESSING	Melt temperature	240-260	240-260	240-260	240-260	240-260	240-260	240-260	230-250	230-250	230-250	240-260	240-260	240-260	
	Mould temperature	ca. 80	ca. 80	ca. 80	ca. 80	ca. 80	ca. 80	ca. 80	ca. 80	ca. 80	ca. 80	ca. 80	ca. 80	ca. 80	
	Moulding shrinkage	0,6 1,2	0,4 1,1	0,35 1,0	0,35 1,1	0,45 1,2	– –	0,35 0,6	0,25 0,55	0,7 1,1	0,3 1,0	0,25 0,9	1,9 1,9	0,4 0,8	0,3 0,9
	Flow length (spiral flow) at 100 MPa injection pressure	465	445	425	445	520	460	420	380	440	400	330	340	400	370

These values are for these specific compositions only. Additives of any kind may alter some or all of these properties. The data listed here fall within the normal range of product properties but they should not be used to establish specification limits nor used alone as the basis of design.