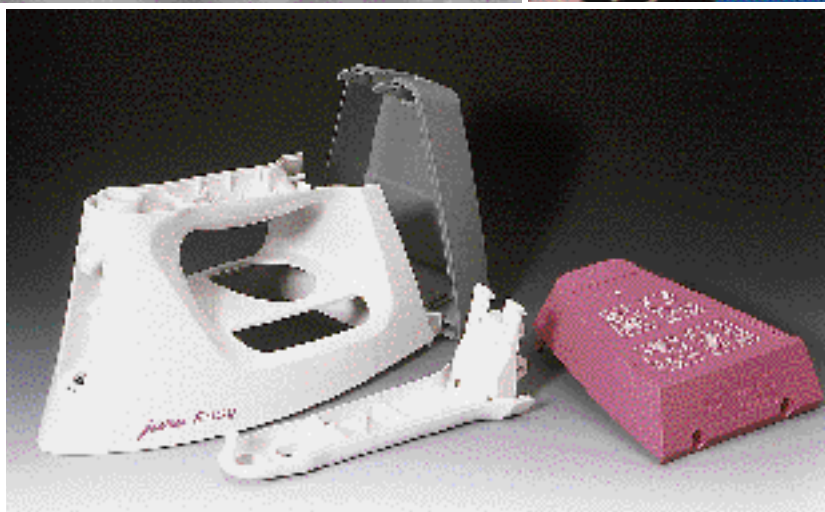




Crastin® PBT

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 dessicant 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
		High impact	T801, T803, T805
	Glass/mineral reinforced	High tracking	HTI619
			HTI668 FR, HTI688 FR
	Glass beads or mineral filled	Low warpage	SO653, SO655
		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

MECHANICAL	Unreinforced							
	Property	Test conditions	Method ISO	Units	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
THERMAL	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/m²	6,5	4	6	6,5
		–30 °C			6	3,5	5	6
	Izod Impact strength	23 °C	180/1U	kJ/m²	NB	–	142	NB
		–30 °C			130	–	70	130
	Charpy notched impact strength ³⁾	23 °C	179/1eA	kJ/m²	4,2	5,6	5,7	5,5
		–30 °C			4	5,2	3,4	4
	Charpy Impact strength	23 °C	179/1eU	kJ/m²	NB	NB	NB	NB
		–30 °C			NB	NB	45	NB
THERMAL	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 ⁵⁾	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
THERMAL	Temperature index	3,2 mm	UL 746B	°C				
					130	130	130	75
					115	115	115	75
					120	120	120	75
	Stress at break	5 000 h	IEC 216	°C	130	–	130	–
		20 000 h			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.

Unreinforced		Glass reinforced								
Extrusion 6130	High impact ST820	Multi-purpose						Surface gloss		
		SK601	SK602	SK603	SK605	SK608	SK609	SK9215	SK9220	SK9230
58	35	*	*	*	*	*	*	*	*	*
3,6	9	*	*	*	*	*	*	*	*	*
*	*	91	100	115	140	155	160	110	125	145
>50	>50	*	*	*	*	*	*	*	*	*
*	*	3,7	3,6	3,3	2,6	1,8	1,7	3,5	3	2,5
2600	1600	4500	6000	7500	10000	15000	16000	6700	8000	11000
2600	—	4000	5300	7200	9000	—	15000	—	—	—
1800	—	2500	4300	5600	6600	—	11600	—	—	—
85	67	130	160	180	210	255	270	—	190	220
139	78	155	—	—	—	—	—	—	—	—
—	—	—	175	180	200	222	230	—	190	210
—	58	5,5	7	8	11	11	11	6	7,5	10
—	10	5	6	7	9	10	10	—	—	—
—	NB	27	35	44	56	44	43	—	—	—
—	215	26	34	41	55	44	43	—	—	—
5	87	7	8	10	12,4	—	11,5	7,5	9,5	11
—	12,8	6	8	9,8	11,1	—	12,2	—	—	—
—	NB	45	50	65	69	63	52	40	40	45
—	NB	42	46	54	82	70	68	—	—	—
225	225	225	225	225	225	225	225	225-250	225-250	225-250
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	—	—	—
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	—	—	—
0,25		0,25	0,26	0,27	0,28	0,32	0,33	—	—	—
—	216	217	221	221	221	221	221	—	—	—
—	123	204	205	208	213	214	215	—	—	—
180	—	—	210	210	210	210	220	—	—	—
—	—	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 CRAFTIN® PBT grades (continued)

					Unreinforced			
	Property	Test conditions	Method ISO	Units	Multipurpose S600	Easy flow CE6125 L	Fast cycling S620	Extrusion 6129
ELECTRICAL	Volume resistivity ⁶⁾		IEC 93	ohm cm	>10 ¹⁶	>10 ¹⁶	>10 ¹⁶	>10 ¹⁶
	Surface resistivity ⁶⁾		IEC 93	ohm	>10 ¹⁴	>10 ¹⁴	>10 ¹⁴	>10 ¹⁴
	Relative permittivity ⁷⁾	50 Hz 10 ⁶ Hz	IEC 250		3.8 3,2	3.8 3,2	3.8 3,2	3.8 3,2
	Dissipation factor ⁷⁾	50 Hz 10 ⁶ Hz	IEC 250	× 10 ^{−4} 200	20 200	20 200	20 200	20 200
	Electric strength, 1 mm plate 2 mm plate	P25/P75 20 s	IEC 243-1	kV/mm	26 15	26 15	26 15	26 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 CTI-M	IEC 112	V	>600 350 M	>600 —	>600 350 M	>600 —
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	HB HB 2,6 * *	— HB 2,6 * *	HB HB 2,6 * *	HB HB 2,6 * *
	Oxygen Index		ASTM D2863	%	22	22	22	22
	Glow wire test	Plate 3 mm	IEC 695-2-1	°C	750	750	750	750
	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
MISC.	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	%				
				1,6 1,6	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

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.

	Unreinforced		Glass reinforced							
	Extrusion 6130	High impact ST820	Multi-purpose				Surface gloss			
	SK601	SK602	SK603	SK605	SK608	SK609	SK9215	SK9220	SK9230	
>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	–	–	–	
3.8	–	–	3.9	4,1	4,2	4,4	4,1	–	–	–
3,2	–	–	3.5	3,5	3,6	3,8	3,9	–	–	–
20	–	–	20	20	21	25	38	–	–	–
200	–	–	200	200	190	180	130	–	–	–
26	–	–	30	27	29	31	32	–	–	–
15	–	–	17	17	17	17	15	–	–	–
A1	–	–	A1	A1	A1	A1	A1	–	–	–
–	–	–	103	103	103	124	124	–	–	–
>600	>600	>600	300	350	400	450	475	–	–	–
–	>600 M	>600 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
2,6	4,6	4,6	3,7	3,7	3,7	3,0	2,5	2,4	–	–
*	*	*	*	*	*	*	*	*	–	–
*	*	*	*	*	*	*	*	*	–	–
22	–	–	20	19	19	19	20	20	–	–
750	700	700	–	750	750	750	750	750	–	–
1,31	1,21	1,21	1,37	1,41	1,45	1,53	1,67	1,71	1,43	1,47
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	2,2	0,6	0,6	0,4	0,3	0,25	0,25	–	–
1,6	2,2	2,2	1,2	1,2	1,1	1,0	0,85	0,8	–	–
440	300	300	500	500	445	375	270	235	520	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
MECHANICAL	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 ³⁾	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	–
THERMAL	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				
					140	130	130	–
					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.

Glass reinforced			Glass/ mineral reinforced	Glass beads filled	
High impact T801	T803	T805	High tracking HT1619	Low warpage SO653	SO655
*	*	*	*	*	*
*	*	*	*	*	*
65	95	100	100	54	57
*	*	*	*	*	*
8	5	4,2	1,5	10,5	5,8
3000	5000	7000	12500	3800	4000
–	–	6200	10500	3500	3600
–	–	4000	6500	2400	2500
–	–	160	165	90	95
–	–	150	–	144	170
–	–	–	226	–	–
4,5	–	12	5	4	4
–	–	10	5	4	3
–	–	50	24	37	26
–	–	50	23	34	25
6	10	14,5	5,8	4,1	4,2
–	8	12,6	5,2	3,7	3,5
55	64	77	11,7	47	49
–	53	89	10,4	44	50
213	213	213	225	225	225
200	202	205	220	185	212
180	185	190	200	70	99
–	*	152	175	*	*
–	0,35	0,3	0,3	1,1	1,0
–	1,6	1,2	0,7	1,1	1,0
–	–	0,28	0,48	0,27	0,28
–	–	205	218	208	210
–	–	191	205	196	198
–	–	200	210	190	190
–	–	140	130	120	120
–	–	130	125	115	120
–	–	140	130	120	120
–	–	155	155	–	150
–	–	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
ELECTRICAL	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	IEC 243-1	kV/mm	31	35	36	–
		2 mm plate			17	20	21	–
FLAMMABILITY	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	IEC 112	V	400	550	550	–
		CTI-M			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	–
MISC.	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	–
PROCESSING	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 parallel normal	DIN 16901	%	0,2	0,3	0,2	–
					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			High tracking	Low warpage	
T801	T803	T805	HT1619	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

					Unreinforced				Glass reinforced
	Property	Test conditions	Method ISO	Units	Multi-purpose S650 FR	Easy flow CE1064	S680 FR	High impact T850 FR	Multi-purpose SK641 FR
MECHANICAL	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	
THERMAL	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						
					130	120	—	75	140
					130	120	—	75	140
	Stress at break	5000 h	IEC 216	°C	145	145	—	—	160
		20000 h			130	130	—	—	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.

Glass reinforced											Glass/mineral reinforced		
Multipurpose SK642 FR					Easy flow SK645 FRC	Low warpage LW9020 FR	LW9030 FR	High impact T841 FR			High tracking HTI681 FR		
SK643 FR	SK645 FR	CE7931	SK673 GW					T843 FR	T845 FR		HTI668 FR	HTI688 FR	
*	*	*	*	*	*	*	*	*	*	*	*	*	*
*	*	*	*	*	*	*	*	*	*	*	*	*	*
95	105	140	135	119	140	110	125	70	90	110	54	70	100
*	*	*	*	*	*	*	*	*	*	*	*	*	*
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
6500	8000	12000	11200	7500	12000	8000	10500	3900	6200	8500	3600	6500	9000
6000	7200	11000	–	–	–	7500	9500	3000	5400	7800	3400	5500	7600
4800	5500	8000	–	–	–	6000	7400	2000	3500	5200	2500	4100	5800
155	170	215	–	–	220	155	185	100	140	170	95	105	150
–	–	–	–	–	–	–	–	120	140	153	165	–	–
180	190	214	246	185	–	160	170	–	–	–	–	189	170
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
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
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
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
225	225	225	225	225	225	225	225	210	210	210	225	210	210
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
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
0,27	0,28	0,29	–	–	–	0,25	0,26	0,26	0,28	0,29	0,27	0,51	0,43
217	218	218	–	–	–	215	215	201	201	203	218	199	205
207	210	212	212	210	–	145	150	179	187	190	197	172	188
210	210	210	210	210	–	180	180	180	180	180	190	200	200
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	–

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** (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
ELECTRICAL	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	IEC 250		3,5	3,6	3,5	3,4	3,6
		10 ⁶ Hz			3,5	3,5	3,5	3,2	3,4
	Dissipation factor ⁷⁾	50 Hz	IEC 250	× 10 ⁻⁴	17	22	13	10	30
		10 ⁶ Hz			180	168	181	180	170
	Electric strength,	1 mm plate	IEC 243-1	kV/mm	25	25	25	27	26
		2 mm plate			15	18	15	17	17
FLAMMABILITY	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	IEC 112	V	225	250	250	>600	250
		CTI-M			175 M	175 M	175 M	275 M	175 M
	Flammability	0,8 mm	UL 94	rating	V-0	V-0	V-0	–	–
		1,6 mm	UL 94	rating	V-0	V-0	V-0	V-0	V-0
		1,6 mm	ASTM D635	cm/min	*	*	*	*	*
		1,6 mm	ASTM D635	s	<5	<5	<5	<5	<5
		1,6 mm	ASTM D635	mm	<5	<5	<5	<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
MISC.	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	2,1	1,9	1,9	0,6
					1,7	2,1	1,9	1,9	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.

Glass reinforced												Glass/mineral reinforced		
Multipurpose SK642 FR			Easy flow SK645 FRC			Low warpage LW9020 FR			High impact T841 FR			High tracking HTI681 FR		
SK643 FR	SK645 FR	CE7931	SK673 GW	SK645 FRC	LW9030 FR	T841 FR	T843 FR	T845 FR	HTI668 FR	HTI688 FR	HTI688 FR	HTI681 FR	HTI668 FR	HTI688 FR
>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	>10 ¹⁶
>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	>10 ¹⁴	>10 ¹⁴
3,7	3,8	4,5	4,2	4,0	–	3,7	3,8	4,0	4,1	4,2	3,5	5,3	4,9	4,9
3,5	3,7	3,8	4,1	3,6	–	3,5	3,6	3,8	3,9	4,0	3,5	4,1	4,3	4,3
30	30	30	30	50	–	30	30	100	110	130	30	236	216	216
170	160	160	150	170	–	150	150	180	170	170	164	307	214	214
28	28	28	33	26	–	29	29	27	27	27	25	25	25	25
17	17	17	–	16	–	20	20	16	16	16	15	18	17	17
A1	A1,2	A1,2	–	–	–	A1,2	A1, 2	A1	A1	A1	A1	A1,2	A1	A1
73	73	122	65	–	–	95	105	77	77	82	84	181	124	124
250	250	250	250	250	–	350	375	250	275	325	>600	>600	475	475
175M	175 M	175 M	150 M	175 M	–	175 M	175 M	175 M	175 M	175 M	450 M	200 M	200 M	200 M
–	V-0	V-0	–	–	V-0	–	–	–	–	–	V-0	–	–	–
V-0	V-0	V-0	V-0	V-2	V-0	V-0	V-0	V-0	V-0	V-0	V-0	V-0	V-0	V-0
*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
<5	<5	<5	<5	–	–	<5	<5	<5	<5	<5	<5	<5	<5	<5
<5	<5	<5	<5	–	–	<5	<5	<5	<5	<5	<5	<5	<5	<5
31	31	31	33	–	–	27	27	30	30	30	29	29	30	30
960	960	960	960	960	960	960	960	960	960	960	960	960	960	960
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	1,77
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	0,20
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	0,50
240-260	240-260	240-260	240-260	240-260	240-260	240-260	240-260	240-260	230-250	230-250	240-260	240-260	240-260	240-260
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	ca. 80	ca. 80
0,6	0,4	0,35	0,35	0,45	–	0,35	0,25	0,7	0,3	0,25	1,9	0,4	0,3	0,3
1,2	1,1	1,0	1,1	1,2	–	0,6	0,55	1,1	1,0	0,9	1,9	0,8	0,9	0,9
465	445	425	445	520	460	420	380	440	400	330	340	400	370	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.

For further information on Engineering Polymers contact :

Belgique/België

Du Pont de Nemours (Belgium)
Antoon Spinoystraat 6
B-2800 Mechelen
Tel. (15) 44 14 11
Telex 22 554
Telefax (15) 44 14 09

Bulgaria

Du Pont Bulgaria
18, Tchermi Vrah Blvd.
Bldg. 2, Floor 5
BG-1407 Sofia
Tel. (2) 66 59 13/66 57 36
Telex 24 261 DUPONT BG
Telefax (2) 65 63 29/66 56 11

Česká Republika a Slovenská Republika

Du Pont - Conoco CS Spol. S.R.O.
Palác Kultury
5, Kvetna 65
CZ-14009 Praha 4
Tel. (02) 422 641 to 422 646
Telex 121 834 DUPO C
Telefax (02) 61 21 50 51

Danmark

Du Pont JET Danmark A/S
Roskildevej 163
DK-2620 Albertslund
Tel. 436 236 00
Telex 33 263 DENDUPONT
Telefax 436 236 17

Deutschland

Du Pont de Nemours
(Deutschland) GmbH
DuPont Straße 1
D-61343 Bad Homburg
Tel. (06172) 87 0
Telex 410 676 DPD D
Telefax (06172) 87 27 01

Egypt

Medgenco International Trade Co.
13, El Bostan Street
ET-Cairo
Tel. (02) 392 78 66
Telex 93 742 MK UN
Telefax (02) 392 84 87

España

Du Pont Ibérica S. A.
Edificio L'Illa
Avda. Diagonal 561
E-08029 Barcelona
Tel. (3) 227 60 00
Telefax (3) 227 62 00

France

Du Pont de Nemours (France) S.A.
137, rue de l'Université
F-75334 Paris Cedex 07
Tel. 01 45 50 65 50
Telex 206 772 dupon
Telefax 01 47 53 09 67

Hellas

Du Pont Agro Hellas S.A.
12, Solomou & Vas. Georgiou Street
GR-152 32 Halandri, Athina
Tel. (01) 680 16 14
Telefax (01) 680 16 11

Israël

Gadot
Chemical Terminals (1985) Ltd.
22, Shalom Aleichem Street
IL-633 43 Tel Aviv
Tel. (3) 528 62 62
Telex 33 744 GADOT IL
Telefax (3) 282 717

Italia

Du Pont de Nemours Italiana S.p.A.
Via Aosta 8
I-20063 Cernusco sul Naviglio (Mi)
Tel. (02) 25 302 1
Telefax (02) 92 107 845

Magyarország

Serviced by Interowa.
See under Österreich.

Maroc

Deborel Maroc S. A.
40, boulevard d'Anfa - 10°
MA-Casablanca
Tel. (2) 27 48 75
Telex 23 719 BOUKBEN
Telefax (2) 26 54 34

Norge

Nordic Polymers A/S
Niels Leuchsvei 99
N-1343 Eiksmarka
Tel. 67 14 28 70
Telefax 67 14 30 44

Österreich

Interowa
Führer-Haimendorf KG
Bräuhäusgasse 3-5
A-1050 Wien
Tel. (01) 512 35 71
Telex 112 993 IROWA A
Telefax (01) 512 35 71 12/
512 35 71 31

Polska

Du Pont Conoco Poland Sp.z o.o.
ul. Prosta 69
PL-00-838 Warszawa
Tel. (22) 635 04 01
Telefax (22) 691 09 00

Portugal

ACENYL
Rua do Campo Alegre, 672 - 1°
P-4100 Porto
Tel. (2) 69 24 25/69 26 64
Telex 23 136 MACOL
Telefax (2) 600 02 07

Romania

Serviced by Interowa.
See under Österreich.

Russia

E. I. du Pont de Nemours & Co. Inc.
Representative Office
B. Palashevsky Pereulok 13/2
SU-103 104 Moskva
Tel. (095) 956 38 50
Telex 413 778 DUMOS SU
Telefax (095) 956 38 53

Schweiz/Suisse/Svizzera

Dolder AG
Immengasse 9
Postfach 14695
CH-4004 Basel
Tel. (061) 326 66 00
Telex 962 306 DOL CH
Telefax (061) 326 62 04

Slovenija

Serviced by Interowa.
See under Österreich.

Suomi/Finland

Du Pont JET Oy
Piispankalliotie 17
P.O. Box 136
FIN-02201 Espoo
Tel. +358-9-75111 211
Telefax +358-9-75111 250

Sverige

Du Pont Conoco Nordic AB
Torshamnsgatan 35
S-164 86 Kista (Stockholm)
Tel. (08) 750 37 00
Telex 12 410 DUPONO S
Telefax (08) 750 90 41

Türkiye

Du Pont Products S.A.
Turkish Branch Office
Sakir Kesebir cad. Plaza 4
No 36/7, Balmumcu
TR-80700 Istanbul
Tel. (212) 275 33 83
Telex 26541 DPIS TR
Telefax (212) 211 66 38

Ukraine

Du Pont de Nemours
International S.A.
Representative Office
3, Glazunova Street
Kyiv 252042
Tel. (044) 294 9633/269 1302
Telefax (044) 269 1181

United Kingdom

Du Pont (U.K.) Limited
Maylands Avenue
GB-Hemel Hempstead
Herts. HP2 7DP
Tel. (01442) 34 65 00
Telefax (01442) 24 94 63

Argentina

Du Pont Argentina S.A.
Avda. Mitre y Calle 5
(1884) Berazategui-Bs.As.
Tel. (541) 319-4484/85/86
Telefax (541) 319-4417

Brasil

Du Pont do Brasil S.A.
Al. Itapecuru, 506 Alphaville
06454-080 Barueri-São Paulo
Tel. (5511) 421-8468/8556

Asia Pacific

Du Pont Kabushiki Kaisha
Arco Tower, 14th Fl.
8-1, Shimomeguro 1-chome
Meguro-ku, Tokyo 153
Tel. (03) 5424 6100

South Africa

Plastamid
P.O. Box 59
Elsies River 59
Cape Town
Tel. 27 (21) 592 12 00
Telefax 27 (21) 592 14 09

USA

DuPont Engineering Polymers
Barley Mill Plaza, Building #22
P.O. Box 80022
Wilmington, Delaware 19880
Tel. (302) 892 0541
Telefax (302) 892 0737

Requests for further information
from countries not listed above
should be sent to:

Du Pont de Nemours International S.A.

2, chemin du Pavillon
CH-1218 Le Grand-Saconnex
Geneva
Tel. (022) 717 51 11
Telex 415 777 DUP CH
Telefax (022) 717 52 00

Internet location :

<http://www.dupont.com/>

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