DuPont™ Rynite® PET

thermoplastic polyester resin

Product guide and properties

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Product guide and properties for RYNITE® PET

General description

RYNITE® is DuPont's registered trademark for its thermoplastic polyester resins based on polyethylene terephthalate (PET). They are specially formulated for rapid crystallisation during the injection moulding process and are reinforced with glass fibres or combinations of glass fibres with glass flake or mica. RYNITE® PET grades offer excellent dimensional stability, creep resistance, heat resistance, outstanding colour stability, high surface gloss and have inheren good electrical properties.

The properties of the standard grades are summarised in the following tables. Many more grades are available which are customised for special requirements (e.g. UL Encapsulation Systems) or technologies (e.g. gas injection, cold riveting etc.). RYNITE® PET is also available in colours as well as UV stabilized grades for exterior applications.

Applications

RYNITE® PET resins are used in numerous industry segments such as automotive, electrical and electronics, appliances, mechanical engineering etc. where they successfully replace metals and thermosets as well as other thermoplastic polymers. Some typical applications are windshield wiper arms, brake systems, motor end frames, microswitches, coil forms, lamp sockets, oven handles and iron skirts.

Processing

RYNITE® PET resins can be processed on standard injection moulding machines. They should be processed at melt temperatures of 280° to 290° C. Surface temperature of the mould should be at least 95° C. Some grades like 5211 S and 5213 S require a mould temperature of 120° C or above. Lower mould temperatures can lead to ejection problems, poor surface appearance and increased cycle times.

All grades of RYNITE® PET have to be dried to a moisture level below 0,02 % (4 hours at 120° C). The use of dehumidified driers is the only practical way to assure this. Too high a level of moisture during processing results in significant loss of toughness and strength. Unlike other polymers too high moisture levels in RYNITE® PET do not result in any visible surface defect. The "Moulding Manual for RYNITE®" (TR R 30) contains all relevant processing information and should be consulted before using the material.

Packaging

RYNITE® PET resins are suplied on pallets with 40 bags of 25 kg or in 1000 kg Octabin. Bulk shipment is also possible.

Safety information

DuPont supplies Material Safety Data Sheets (MSDS) information to its customers with the initial order and on the next order after an MSDS is revised. An MSDS includes such information as hazardous components, health hazards, emergency and first aid procedures, disposal procedures and storage information.

Environment

The good melt stability of RYNITE® PET normally enables the recycling of properly handled production waste. If recycling is not possible, DuPont recommends, as the preferred option, incineration with energy recovery. The incinerator has to be equipped with a state of the art scrubber in order to clean the flue gases before release.

RYNITE® PET is not soluble in water and has practically no additives which can be extracted by water. Therefore RYNITE® PET represents no known risk to human health or the environment when land filled. For disposal, local regulations have to be observed which can vary significantly from locality to locality.

Polyethylene terephthalate is mentioned on the 'green list' of the European Regulation EEC 259/93, Annex II. Thus, RYNITE® PET is not restricted for inter European transport of waste destined for recovery.

Cover pictures
1 – Connector
2 – Lamp socket
3 – Oven door frame and integrated control panel
4 – Rear windshield wipers

Compositions

Grade	Short description	Key properties	Major applications
Standard glass reinforced grades			
520	20 % glass fibre reinforced	Excellent melt flow characteristics. Offers a balance of strength, stiffness and toughness.	Housings
530	30 % glass fibre reinforced	Excellent melt flow characteristics. Outstanding balance of strength, stiffness and toughness, good electrical properties and excellent surface appearance. Close moulding tolerances, outstanding chemical and heat resistance.	Ignition components, coil caps, relay bases, sprockets, carburettor components, various pump housings, vacuum cleaner parts, window cranks, motor end frames.
536	36 % glass fibre reinforced	Outstanding mechanical properties. High colour stability.	Body valves for servo break booster.
545	45 % glass fibre reinforced	Excellent melt flow characteristics. Superior strength and stiffness, with excellent dimensional stability and creep resistance, good electrical properties and surface appearance. Close moulding tolerances, outstanding chemical and heat resistance.	Motor end frame, compressor housings, fuel, air and temperature sensor housings, frames, coil bobbins, transmission components.
555	55 % glass fibre reinforced	Excellent melt flow characteristics. Excellent strength, dimensional stability, heat resistance and outstanding resistance to creep. Good electrical properties and surface appearance, excellent chemical resistance.	Clamps, structural housings and covers, transmission components, fixing parts for bumpers, coil encapsulations.
Flame retardant grades			
FR515	15 % glass fibre reinforced, flame retardant	Excellent balance of electrical and mechanical properties, good toughness and surface appearance. Very good high temperature resistance and high flow.	Electronic connectors, coil forms, switches, relays, lamp sockets, handles or frames.
FR530L	30 % glass fibre reinforced, flame retardant	Outstanding balance of strength, stiffness and toughness, good electrical properties and surface appearance. Close moulding tolerances, outstanding chemical and heat resistance.	Electrical/electronic connectors and high temperature bobbins used in applications employing vapour phase and wave soldering techniques.
FR543	43 % glass fibre reinforced, flame retardant	Outstanding balance of strength, stiffness and toughness, good electrical properties and surface appearance. Close moulding tolerances, outstanding chemical and heat resistance.	Electrical and electronic components such as connectors and coil forms.
FR943	43 % glass flake and glass fibre reinforced, flame retardant	Combination of very low warpage with outstanding balance of stiffness, strength, toughness, good surface appearance and electrical properties.	Electrical/electronic components such as connector bodies and terminal blocks requiring low warp characteristics.
Colour stable grades			
530CS	30 % glass fibre reinforced	Outstanding colour stability at high temperatures compared to RYNITE® 530.	Housings and handles for domestic appliances.
936CS	36 % glass flake and glass fibre reinforced	Combination of very low warpage with outstanding colour stability at high temperature.	Housings for domestic appliances and large parts, frames and handles.
Toughened			
415HP	15 % glass fibre reinforced, toughened	As a toughened resin provides excellent surface appearance in combination with increased elongation.	Electrical/electronic components, automotive and appliance housings.
408	30 % glass fibre reinforced, toughened	Improved impact resistance, excellent balance of strength, stiffness and temperature resistance.	Water pump housings, structural housings and brackets, handles.
Mineral and glass reinforced			
935	35 % mica/glass fibre reinforced	Low warpage and excellent dimensional stability over a wide temperature range. Good electrical properties.	Structural housings under the hood, electrical components.
940	40 % glass fibre reinforced/mica	High strength and low warpage. Dimensional stability over a wide temperature range. Good electricals. Excellent adhesion to Epoxy potting resins.	Automotive ignition housings.

Properties of RYNITE® PET thermoplastic polyester resins

	Property		Test method ISO	Units	Standard 520	530	545	555
MECHANICAL	Stress at break [1]		527-1/2	MPa				
		−40° C			148	218	242	221
		23° C			120	158	182	196
		93° C			58	83	92	96
		150° C			41	55	67	71
	Strain at break [1]		527-1/2	%				
		−40° C			2,1	2,5	2	1
		23° C			2,7	2,5	2	2
		93° C			6	6	5	4
		150° C			7	7	6	5
	Tensile Modulus		527-1/2	MPa	7200	11000	15500	19500
	Flexural Modulus		178	MPa				
		−40° C			7900	10300	15200	20700
		23° C			6000	9000	13800	17900
		93° C			2700	3600	5500	9200
		150° C			1800	2700	4000	5700
	Tensile Creep Modulus (1000 h)	23° C	899	MPa	5700	8800	13300	15300
	Charpy impact strength			kJ/m^2				
	– notched	23° C	179/1eA		9	11	11	11
		−30° C			8	11	11	12
	– unnotched	23° C	179/1eU		33	60	60	60
		−30° C			27	45	40	45
	Izod impact strength		180	kJ/m^2				
	– notched	−30° C			7,7	10		16
		23° C			9	10	11	15
THERMAL	Melting temperature[2]		3146C	°C	252	252	252	252
	Temperature of deflection under load [3]		75	°C				
		1,8 MPa			220	225	225	230
	Vicat softening temperature	B/50	306	°C	228	228	230	230
	Coefficient of linear thermal expansion		11359-2	$10^{-4} \cdot K^{-1}$				
		parallel 23 to 55° C			0,25	0,1	0,13	0,08
		normal			0,93	0,81	0,71	0,75
	Temperature index:	(0,8 mm)	UL 746B	°C				
	Electrical				140	140	140	140
	Mechanical w. impact				140	140	140	140
	Mechanical w/o impact				140	140	140	140

1) Testing speed 5 mm/min.

2) Melting temperature determined by differential thermal analysis.

3) Deflection temperature under flexural load, annealed 30 minutes in oil at 50° C below melting point.

4) Flame-retarded resins are subject to specific UL processing and handling regulations for applications where an official UL rating is required. For more detailed information, please contact your Du Pont representative.

5) Numerical flame test ratings are not intended to represent behaviour of moulded parts in real life fire conditions; each enduser must determine whether any potential flammability hazards exist with parts moulded from RYNITE®. UL yellow card available upon request.

Flame retardant				Colour stable			Toughened		Mineral reinforced	
FR515	**FR530L**	**FR543**	**FR943**	**536**	**530CS**	**936CS**	**415HP**	**408**	**935**	**940**
138	193	217	156				145	206	121	
107	135	172	124	205	180	122	79	126	85	110
55	72	86	65				45	70	44	
38	45	52	43				36	55	30	
2,5	1,9	1,7	1,3				3	3	2	
2,6	2	1,8	1,5	2,5	2,5	2	5	3,3	2	2
4,7	3,5	4,3	4				14	7,0	5	
6,7	4	6,3	5,3				14,2	7,5	5	
6800	11500	17000	14000	14000	11000	11200	4700	9300	10200	12000
6500	11000	15100	14500				5900	8900	11800	
5900	9900	14500	13100				3600	8300	9600	
2400	4600	6900	5900				1300	3000	3400	
1500	2600	3100	3400				1100	2300	2200	
	9700								7700	
8	8,5	10	7	12	10,5	5,2	11	14	6	7
7	8,5	10	5				8	12	4	
40	40	43	30	65	50	25	55	70	25	35
35	33	30	25				25		20	
6	9,5						7,7		4	
6,7	8,0			11	9,5	3,8	12,5	12	5	6
252	252	252	250	250	245	247	252	250	252	250
200	220	225	220	225	225	210	205	220	200	225
210	218						206		204	
0,18	0,19	0,11				0,2	0,2		0,16	0,2
0,88	0,92	0,79				0,65	1,17		0,81	0,7
140	150	155	155				140	140	140	
140	150	155	155				120	140	140	
140	150	155	155				140	140	140	

Properties of RYNITE® PET thermoplastic polyester resins

				Standard			
	Property	Test method ISO	Units	520	530	545	555
ELECTRICAL	Relative permittivity						
	10^2 Hz	IEC 60250	–	4,2	4,2	4,5	4,8
	10^6 Hz			4,0	3,9	4,4	4,7
	Dissipation factor	IEC 60250	10^{-4}				
	10^2 Hz			300	130	70	70
	10^6 Hz			200	70	110	70
	Surface resistivity	IEC 60093	Ohm		10^{14}	10^{14}	
	Volume resistivity	IEC 60093	Ohm · m		10^{13}	10^{13}	
	Electric strength		kV/mm				
	1,0 mm disk 23° C	IEC 60243-1		33,5	35	32	35
	Comparative tracking	UL 746A	PLC level	3	2	2	3
	Index (CTI)	IEC 60112	V	250	250	250	200
	Arc resistance	UL 746A	s		125	126	126
FLAMMABILITY	Flammability [4), 5)]	UL-94	–				
	0,8 mm			HB	HB	HB	HB
	Glow wire 2 mm	IEC 60695-2-1	°C	650	750	750	
	3 mm			750	750	850	
	Oxygen index	4589	%		20	20	22
OTHERS	Density	1183	g/cm³	1,46	1,56	1,69	1,80
	Humidity absorption, 50 % RH, 23° C	62	%	0,2	0,2	0,14	0,11
	Water absorption, saturation, 23° C			1,0	0,78	0,62	0,59
	Hardness Rockwell	2039/2	–				
	scale M			90	100	100	100
	scale R			120	120	120	120
	Coefficient of friction	ASTM D 1894	–				
	against self				0,18	0,17	0,27
	against steel				0,17	0,20	0,18
	Taber abrasion	ASTM D 1044	mg/1000				
	CS-17 wheel, 1000 g		cycles		30	44	
PROCESSING	Mould shrinkage, plates 60 × 60 × 2 mm	294-4	%				
	parallel			0,25	0,20	0,25	0,25
	normal			0,85	0,80	0,85	0,80

1) Testing speed 5 mm/min.

2) Melting temperature determined by differential thermal analysis.

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All the above information is subject to the disclaimer printed on the back page of this document.

Flame retardant				Colour stable			Toughened		Mineral reinforced	
FR515	**FR530L**	**FR543**	**FR943**	**536**	**530CS**	**936CS**	**415HP**	**408**	**935**	**940**
3,7 3,7	4,8 4,7	4,1	4,1					3,3	4,5 4,1	3,8 3,7
90 150	70 100	170	150					150	300 250	70 150
10^{13}	10^{14}	10^{15}	10^{15}				10^{13}	10^{14}	10^{14}	10^{14}
10^{13}	10^{13}	10^{13}	10^{15}				10^{11}	10^{15}	10^{13}	10^{15}
34	33								39	
3 225	2 250	3 250	2 225		250	250	2	2	2 300	
67	117	124	102				95		131	
V-0	V-0 at 0,35 mm	V-0 at 0,35 mm	V-0				HB	HB	HB	HB
	960 (at 1,2 mm) 960									
32	33	35	31		22		19	22		
1,53	1,67	1,79	1,78	1,64	1,59	1,63	1,39	1,49	1,58	1,64
	0,17 0,77	0,11 0,62	0,1 1,0		0,16 0,6		0,25 2,5		0,13 0,83	
88 120	100 120	102 122	91 116				58 111	70 115	75 115	75 115
0,21 0,18	0,18 0,19	0,18 0,16	0,29 0,18				0,42 0,27		0,21 0,19	
88	38	69	82				35			81
0,35 0,85	0,25 0,90	0,20 0,75	0,25 0,65	0,25 0,80	0,15 0,60	0,20 0,40	0,35 0,85	0,25 0,85	0,30 0,70	0,20 0,70

* PLC level CTI

0		TI ≥	600
1	600 ≥	TI≥	400
2	400 ≥	TI≥	250
3	250 ≥	TI ≥	175
4	175 ≥	TI ≥	100
5	100 ≥	TI ≥	0

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