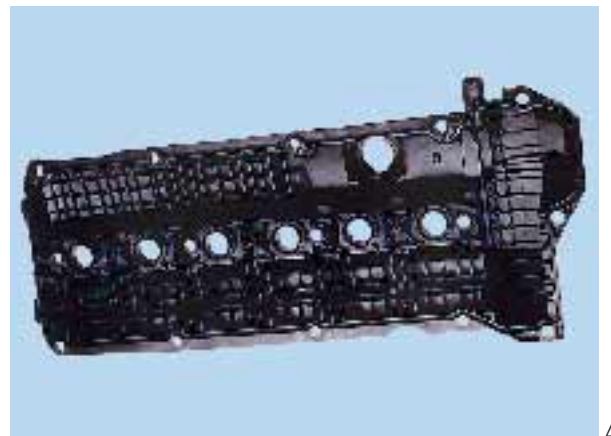


DuPont™ Minlon®

mineral reinforced nylon resin

Product guide and properties



The miracles of science™

DuPont™ Minlon®

mineral reinforced nylon resin

Introduction

MINLON® is DuPont's registered trademark for its range of mineral and mineral/glass reinforced nylon resins. These compositions are reinforced – not filled.

The chemical bond between the nylon and the mineral reinforcement enhances the tensile properties and stiffness of the resins. Due to their excellent balance of properties, components of MINLON® (produced by injection moulding) find extensive use in many applications including: automotive, electrical, electronic, domestic appliances and construction.

Products and properties

MINLON® engineering thermoplastic resins are classified by chemical composition into the following groups:

- Nylon 66.
- Nylon 6.
- Nylon 66/6 blends.

In addition to the inherent features of nylon (e.g. mechanical strength, toughness, high temperature performance, chemical resistance), MINLON® resins offer:

- High stiffness.
- Low warpage.
- Dimensional stability.
- Paintability.

A number of MINLON® grades described in this brochure also incorporate the toughening technology used for ZYTEL® ST in order to give superior impact resistance.

Major “families” of MINLON® engineering thermoplastic resins described in this brochure include:

- Mineral reinforced nylons.
- Mineral/glass reinforced nylons.

Only standard compositions are described in this brochure. Many other grades are available for specific applications.

Unreinforced, glass reinforced and modified nylons are available under the ZYTEL® trademark. Information on these products is given in the brochure “ZYTEL® – Product guide and properties” (H-53823).

Data

All data in this brochure is taken from Campus version 4.0 (measured according to ISO standards), except where otherwise specified. In addition, all data is for natural colour material except where otherwise specified.

Physical description

MINLON® nylon resins are solid granular materials, typically cylinder cut with nominal dimensions of 3 × 2,5 mm. Most compositions are available in colours, either cube blended or fully compounded.

Packaging

MINLON® nylon resins are available in 4 standard packaging types:

- 40 × 25 kg bags.
- 1000 kg octabin.
- 1000 kg octabin (with bottom unloading).
- Bulk shipments.

Full details of these packaging types are given in the brochures: “Introduction to Engineering Polymers Packaging Materials” and “Silo Shipments”.

Processing

MINLON® nylon resins are supplied in moisture proof packaging, so that drying should not normally be necessary. However, nylon resins are hygroscopic and absorb moisture on exposure to the atmosphere.

If excessive moisture absorption has occurred, then the resin must be dried at 80°C to less than 0,2% moisture content before processing.

These products can be processed on conventional injection moulding equipment. Detailed recommendations for processing MINLON® engineering thermoplastic resins can be obtained from DuPont sales and distributor offices listed on the back of this brochure.

Compositions

Designation	Description
Mineral reinforced grades	
MINLON® 10B140	40% mineral reinforced PA66.
MINLON® 11C140	40% mineral reinforced PA66/6 blend. Heat stabilised.
MINLON® 13T2	30% mineral reinforced PA66. Toughened and heat stabilised.
MINLON® EFE6096 GY	15% mineral reinforced PA66. Toughened and heat stabilised.
MINLON® 13MM	16% mineral reinforced PA66. Toughened and heat stabilised.
MINLON® 14D1 BK	26% mineral reinforced PA66. UV stabilised (black).
MINLON® 73M30	30% mineral reinforced PA6.
MINLON® 73M40	40% mineral reinforced PA6.
Mineral/glass reinforced grades	
MINLON® 23B1 BK	37% mineral-glass reinforced PA66 (28% mineral and 9% glass).
MINLON® EFE6053 BK	40% mineral-glass reinforced PA66 (16% mineral and 24% glass).
MINLON® EFE6091 BK	40% mineral-glass reinforced PA66 (25% mineral and 15% glass).
MINLON® 73GM30HSL BK	30% mineral-glass reinforced PA6 (20% mineral and 10% glass).
MINLON® 73GM40	40% mineral-glass reinforced PA6 (25% mineral and 15% glass).

Photographs

- 1 – Outboard motor engine cover – mineral/glass reinforced
- 2 – Street light housing – mineral reinforced
- 3 – Painted wheel covers – toughened mineral reinforced
- 4 – Rocker cover – mineral/glass reinforced

Properties of MINLON® mineral reinforced nylon resin

Mineral reinforced grades										
Property	Test conditions	Standard ISO	Unit	PA66		PA66/6 blend		PA66		
				MINLON® 10B140 DAM	50% RH**	MINLON® 11C140 DAM	50% RH**	MINLON® 13T2 GY282 DAM	50% RH**	
MECHANICAL*	Stress at break	5 mm/min	527-1/2	MPa	82	54	89	60	72	55
	Strain at break	5 mm/min	527-1/2	%	3,5	9	10	24	16	34
	Tensile modulus	1 mm/min	527-1/2	MPa	6600	3900	5800	2500	4300	2200
	Charpy impact strength	23°C	179/1eU	kJ/m ²	36	63	120	NB	NB	NB
		-30°C			26	26	80	80	117	115
	Charpy notched impact strength	23°C	179/1eA	kJ/m ²	3	5	6	7	10	13
		-30°C			3	2	5	4	6	5
Izod notched impact strength	23°C	180/1A	kJ/m ²	3	4	6	9	9	11	
	-30°C			2,5	2,5	4	4	5,5	4	
THERMAL	Melting temperature	10 K/min	3146 C	°C	260		255		260	
	Temperature of deflection under load ¹⁾	0,45 MPa	75-1/2	°C	240		220		225	
		1,8 MPa			210		147		89	
	Vicat softening temperature	50 N		°C	245		235		230	
	Coefficient of linear thermal expansion	Parallel	ASTM E831	E-4 1/K	0,67		0,86		0,94	
Normal		0,88				0,86		0,85		
ELECTRICAL*	Comparative tracking index		IEC 112	–	575	–	550			
	Electric strength		IEC 243-1	kV/mm	40		36	27	37	
	Surface resistivity		IEC 93	ohm	–	>E15		E14		
	Volume resistivity		IEC 93	ohm · cm	–	E12		E11		
	Relative permittivity	100 Hz	IEC 250	–	4,5	9,4	4,3	12,6	4,2	9,3
		1 Mhz			3,9	4,5	3,6	4,5	4,1	4,1
Dissipation factor	100 Hz	IEC 250	E-4	110	2100	120	4400	110	3600	
	1 Mhz			230	550	240	750	200	550	
MISCELLANEOUS	Density		1183	g/cm ³	1,50		1,46		1,36	
	Flammability ²⁾	1,6 mm	UL 94		HB		HB		HB	
	Water absorption	Saturation at 23°C	Similar to ISO 62	%	5		5,7		6	
	Humidity absorption	23°C, 50% RH			1,6		1,8		1,5	
	Rockwell hardness		2039/2							
		Scale M			95		86		80	
		Scale R			121		120		118	
	Ball indentation hardness		2039	MPa	250	169	255	127	200	115
Moulding shrinkage	Parallel	294-4	%	1,0		1,4		1,4		
	Normal			1,0		1,4		1,6		

* Tested at 23°C and 50% RH (ISO 291).

** 23°C and 50% RH.

1) Values are obtained by first annealing test bars for 30 min. in oil at 50°C below melting point of the resin.

2) Numerical flame test ratings are not intended to present behaviour of moulded parts in real life fire conditions; each end-user must determine whether any potential flammability hazards exist with parts moulded from MINLON® engineering thermoplastic resins. UL yellow cards available upon request.

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

Mineral reinforced grades

PA66		PA66		PA66		PA6		PA6	
MINLON® 13MM		MINLON® EFE6096 GY		MINLON® 14D1 BK113		MINLON® 73M30		MINLON® 73M40	
DAM	50% RH**	DAM	50% RH**	DAM	50% RH**	DAM	50% RH**	DAM	50% RH**
76	53	70/76	45/52	80	55	82	56	87	59
19	50	20/21	45/52	6,0	21	14	46	11	29
3800	1800	3500/3800	1600/1800	4800	2400	4900	1800	6000	2300
NB	NB			30	136	115	NB	129	NB
110	35			25	26	97	80	95	96
7,5	13	7		4	5	6	12	6,7	11,8
5	5			3	3	3,5	3,7	4,0	5,2
7	12	6	11	3	7	6	12	6	9
5	4,5			2,5	3	4		4,2	4,5
260		260		260		221		220	
230				230		196		196	
78		75		90		80		172	
244				235		209		210	
0,85				0,77		0,88		0,65	
0,85				0,99		1,02		0,75	
				29					
				5,3	13,5				
				5,0	4,6				
				480	5200				
				370	700				
1,24		1,23		1,35		1,35		1,45	
HB		HB		HB		HB		HB	
7,7		7,7		6,3		6,3		5,4	
2,1		2,1		1,9		2,1		1,8	
				89					
				119					
				210	98				
1,8		1,1		1,3		0,9		0,8	
1,4		1,1		1,4		0,9		0,8	

Properties of MINLON® mineral reinforced nylon resin

Mineral/glass reinforced grades									
Property	Test conditions	Standard ISO	Units	PA66		PA66			
				MINLON® 23B1 BK114 DAM	50% RH**	MINLON® EFE6053 BK413 DAM	50% RH**		
MECHANICAL*	Stress at break	5 mm/min	527-1/2	MPa	90	57	157	95	
	Strain at break	5 mm/min	527-1/2	%	3,5	10	2,3	4,6	
	Tensile modulus	1 mm/min	527-1/2	MPa	6600	4000	10300	6500	
	Charpy impact strength	23°C	179/1eU	kJ/m ²	40	50	45	57	
		-30°C			35	35	42	43	
	Charpy notched impact strength	23°C	179/1eA	kJ/m ²	4	6	4,5	6	
		-30°C			5	3	4	4	
Izod notched impact strength	23°C	180/1A	kJ/m ²	4,2	4,5				
	-30°C			2,5	2,5				
THERMAL	Melting temperature	10 K/min	3146 C	°C	260		260		
	Temperature of deflection under load ¹⁾	0,45 MPa	75-1/2	°C	250		256		
		1,8 MPa			220		240		
	Vicat softening temperature	50 N		°C	249		250		
	Coefficient of linear thermal expansion	Parallel	ASTM	E-4 1/K	0,42		0,28		
Normal		E831	1,01			0,87			
ELECTRICAL*	Comparative tracking index		IEC 112	–					
	Electric strength		IEC 243-1	kV/mm			28		
	Surface resistivity		IEC 93	ohm					
	Volume resistivity		IEC 93	ohm · cm					
	Relative permittivity	100 Hz		IEC 250	–			4,9	13,9
		1 MHz						4,8	5
	Dissipation factor	100 Hz		IEC 250	E-4			140	5400
1 MHz							130	700	
MISCELLANEOUS	Density		1183	g/cm ³	1,46		1,47		
	Flammability ²⁾	1,6 mm	UL 94		HB		HB		
	Water absorption	Saturation at 23°C	Similar to ISO 62	%	5,1		5		
	Humidity absorption	23°C, 50% RH			1,7		1,5		
	Rockwell hardness		2039/2						
		Scale M Scale R							
	Ball indentation hardness		2039	MPa			254	149	
Moulding shrinkage	Parallel	294-4	%	0,8		0,4			
	Normal			1,2		1,1			

* Tested at 23°C and 50% RH (ISO 291).

** 23°C and 50% RH.

1) Values are obtained by first annealing test bars for 30 min. in oil at 50°C below melting point of the resin.

2) Numerical flame test ratings are not intended to present behaviour of moulded parts in real life fire conditions; each end-user must determine whether any potential flammability hazards exist with parts moulded from MINLON® engineering thermoplastic resins. UL yellow cards available upon request.

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