Makrolon® ET3113

Grades / Extrusion	MVR (300 °C/1.2 kg) 6.0 cm³/10 min; Extrusion; high viscosity; UV stabilized; available in transparent colors only; solid sheet; corrugated sheet
ISO Shortname	ISO 7391-PC,EL,(,,)-09-9

	Property	Test Condition	Unit	Standard	typical Value
Rheological properties					
C	Melt volume-flow rate	300 °C/ 1.2 kg	cm³/10 min	ISO 1133	6.0
C	Molding shrinkage, parallel	60x60x2 mm/ 500 bar	%	ISO 294-4	0.7
C	Molding shrinkage, normal	60x60x2 mm/ 500 bar	%	ISO 294-4	0.75
	Molding shrinkage, parallel/normal	Value range based on general practical experience	%	b.o. ISO 2577	0.6 - 0.8
	Melt mass-flow rate	300 °C/ 1.2 kg	g/10 min	ISO 1133	6.5
Mechanical properties (23 °C/50 % r. h.)					
C	Tensile modulus	1 mm/min	MPa	ISO 527-1,-2	2350
C	Yield stress	50 mm/min	MPa	ISO 527-1,-2	65
C	Yield strain	50 mm/min	%	ISO 527-1,-2	6.3
C	Nominal strain at break	50 mm/min	%	ISO 527-1,-2	> 50
	Stress at break	50 mm/min	MPa	ISO 527-1,-2	70
	Strain at break	50 mm/min	%	b.o. ISO 527-1,-2	130
C	Tensile creep modulus	1 h	MPa	ISO 899-1	2200
C	Tensile creep modulus	1000 h	MPa	ISO 899-1	1900
	Flexural modulus	2 mm/min	MPa	ISO 178	2350
	Flexural strength	2 mm/min	MPa	ISO 178	96
	Flexural strain at flexural strength	2 mm/min	%	ISO 178	7.2
	Flexural stress at 3.5 % strain	2 mm/min	MPa	ISO 178	72
C	Charpy impact strength	23 °C	kJ/m²	ISO 179/1eU	N
C	Charpy impact strength	-30 °C	kJ/m²	ISO 179/1eU	N
	Charpy impact strength	-60 °C	kJ/m²	ISO 179/1eU	N
	Charpy notched impact strength	23 °C/ 3 mm	kJ/m²	ISO 7391/b.o. ISO 179/1eA	80P
	Charpy notched impact strength	-30 °C/ 3 mm	kJ/m²	ISO 7391/b.o. ISO 179/1eA	18C(P)
	Izod notched impact strength	23 °C/ 3 mm	kJ/m²	ISO 7391/b.o. ISO 180/A	70P
	Izod notched impact strength	-30 °C/ 3 mm	kJ/m²	ISO 7391/b.o. ISO 180/A	20C(P)
C	Puncture impact properties - maximum force	23 °C	N	ISO 6603-2	5600
C	Puncture impact properties - maximum force	-30 °C	N	ISO 6603-2	6500
C	Puncture energy	23 °C	J	ISO 6603-2	60
C	Puncture energy	-30 °C	J	ISO 6603-2	70
	Ball indentation hardness		N/mm²	ISO 2039-1	113

Makrolon® ET3113

	Property	Test Condition	Unit	Standard	typical Value
Thermal properties					
C	Glass transition temperature	10 °C/min	°C	ISO 11357-1,-2	148
C	Temperature of deflection under load	1.80 MPa	°C	ISO 75-1,-2	128
C	Temperature of deflection under load	0.45 MPa	°C	ISO 75-1,-2	141
C	Vicat softening temperature	50 N; 50 °C/h	°C	ISO 306	148
	Vicat softening temperature	50 N; 120 °C/h	°C	ISO 306	149
C	Coefficient of linear thermal expansion, parallel	23 to 55 °C	10^{-4}/K	ISO 11359-1,-2	0.65
C	Coefficient of linear thermal expansion, normal	23 to 55 °C	10^{-4}/K	ISO 11359-1,-2	0.65
C	Burning behavior UL 94 (1.5 mm) [UL recognition]	1.5 mm	Class	UL 94	HB
C	Burning behavior UL 94 [UL recognition]	0.75 mm	Class	UL 94	V-2
C	Oxygen index	Method A	%	ISO 4589-2	28
	Thermal conductivity, normal	23 °C; 50 % r. h.	W/(m·K)	ISO 8302	0.20
	Resistance to heat (ball pressure test)		°C	IEC 60695-10-2	140
	Relative temperature index (Tensile strength) [UL recognition]	1.5 mm	°C	UL 746B	125
	Relative temperature index (Tensile impact strength) [UL recognition]	1.5 mm	°C	UL 746B	115
	Relative temperature index (Electric strength) [UL recognition]	1.5 mm	°C	UL 746B	125
	Glow wire test (GWFI)	0.75 mm	°C	IEC 60695-2-12	875
	Glow wire test (GWFI)	1.5 mm	°C	IEC 60695-2-12	875
	Glow wire test (GWFI)	3.0 mm	°C	IEC 60695-2-12	960
	Glow wire test (GWIT)	0.75 mm	°C	IEC 60695-2-13	875
	Glow wire test (GWIT)	1.5 mm	°C	IEC 60695-2-13	875
	Glow wire test (GWIT)	3.0 mm	°C	IEC 60695-2-13	900
	Application of flame from small burner	Method K and F/ 2.0 mm	Class	DIN 53438-1,-3	K1, F1
	Needle flame test	Method K/ 2.0 mm	s	IEC 60695-11-5	5
	Needle flame test	Method K/ 3.0 mm	s	IEC 60695-11-5	10
	Needle flame test	Method F/ 1.5 mm	s	IEC 60695-11-5	60
	Needle flame test	Method F/ 2.0 mm	s	IEC 60695-11-5	120
	Needle flame test	Method F/ 3.0 mm	s	IEC 60695-11-5	120
	Burning rate (US-FMVSS)	>=1.0 mm	mm/min	ISO 3795	passed
	Flash ignition temperature		°C	ASTM D1929	480
	Self ignition temperature		°C	ASTM D1929	550
Electrical properties (23 °C/50 % r. h.)					
C	Relative permittivity	100 Hz	-	IEC 60250	3.1
C	Relative permittivity	1 MHz	-	IEC 60250	3.0
C	Dissipation factor	100 Hz	10^{-4}	IEC 60250	8
C	Dissipation factor	1 MHz	10^{-4}	IEC 60250	100
C	Volume resistivity		Ohm·m	IEC 60093	1E14
C	Surface resistivity		Ohm	IEC 60093	1E16
C	Electrical strength	1 mm	kV/mm	IEC 60243-1	34
C	Comparative tracking index CTI	Solution A	Rating	IEC 60112	250
	Comparative tracking index CTI M	Solution B	Rating	IEC 60112	125M
	Electrolytic corrosion		Rating	IEC 60426	A1

Makrolon® ET3113

	Property	Test Condition	Unit	Standard	typical Value
Other properties (23 °C)					
C	Water absorption (saturation value)	Water at 23 °C	%	ISO 62	0.30
C	Water absorption (equilibrium value)	23 °C; 50 % r. h.	%	ISO 62	0.12
C	Density		kg/m³	ISO 1183-1	1200
	Water vapor permeability	23 °C; 85 % RH/ 100 µm film	g/(m²·24 h)	ISO 15106-1	15
	Gas permeation	Oxygen/ 100 µm film	cm³/(m²·24 h·bar)	b.o. ISO 2556	650
	Gas permeation	Oxygen/ 25.4 µm (1 mil) film	cm³/(m²·24 h·bar)	b.o. ISO 2556	2760
	Gas permeation	Nitrogen/ 100 µm film	cm³/(m²·24 h·bar)	b.o. ISO 2556	120
	Gas permeation	Nitrogen/ 25.4 µm (1 mil) film	cm³/(m²·24 h·bar)	b.o. ISO 2556	510
	Gas permeation	Carbon dioxide/ 100 µm film	cm³/(m²·24 h·bar)	b.o. ISO 2556	3800
	Gas permeation	Carbon dioxide/ 25.4 µm (1 mil) film	cm³/(m²·24 h·bar)	b.o. ISO 2556	16900
	Bulk density	Pellets	kg/m³	ISO 60	660
Material specific properties					
	Refractive index	Procedure A	-	ISO 489	1.587
	Haze for transparent materials	3 mm	%	ISO 14782	< 0.8
	Luminous transmittance (clear transparent materials)	1 mm	%	ISO 13468-2	89
C	Luminous transmittance (clear transparent materials)	2 mm	%	ISO 13468-2	89
	Luminous transmittance (clear transparent materials)	3 mm	%	ISO 13468-2	88
	Luminous transmittance (clear transparent materials)	4 mm	%	ISO 13468-2	87
Processing conditions for test specimens					
C	Injection molding - Melt temperature		°C	ISO 294	300
C	Injection molding - Mold temperature		°C	ISO 294	80
C	Injection molding - Injection velocity		mm/s	ISO 294	200

C These property characteristics are taken from the CAMPUS plastics data bank and are based on the international catalogue of basic data for plastics according to ISO 10350.

Impact properties: N = non-break, P = partial break, C = complete break

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