Makrolon® LED2045

Grades / Light guides	MVR (250 °C/2.16 kg) 17 cm³/10 min; light guides; PC with highest transmission; low viscosity; easy release; injection molding - melt temperature 260 - 300 °C; available in color code 000000 only
ISO Shortname	PC

	Property	Test Condition	Unit	Standard	typical Value
Rheological properties					-
C	Melt volume-flow rate	250 °C/ 2.16 kg	cm³/10 min	ISO 1133	17.0
	Melt volume-flow rate	300 °C/ 1.2 kg	cm³/10 min	ISO 1133	61
C	Molding shrinkage, parallel	60x60x2 mm³/ 500 bar	%	ISO 294-4	0.6
C	Molding shrinkage, normal	60x60x2 mm³/ 500 bar	%	ISO 294-4	0.65
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	63
C	Yield strain	50 mm/min	%	ISO 527-1,-2	6.0
C	Nominal strain at break	50 mm/min	%	ISO 527-1,-2	> 50
	Stress at break	50 mm/min	MPa	ISO 527-1,-2	55
	Strain at break	50 mm/min	%	b.o. ISO 527-1,-2	100
	Flexural modulus	2 mm/min	MPa	ISO 178	2350
	Flexural strength	2 mm/min	MPa	ISO 178	97
	Flexural strain at flexural strength	2 mm/min	%	ISO 178	7.3
	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 21305/based on ISO 179/1eA	50P(C)
	Charpy notched impact strength	-30 °C/ 3 mm	kJ/m²	ISO 21305/based on ISO 179/1eA	12C
	Izod notched impact strength	23 °C/ 3 mm	kJ/m²	ISO 21305/based on ISO 180/A	50P
	Izod notched impact strength	-30 °C/ 3 mm	kJ/m²	ISO 21305/based on ISO 180/A	12C
C	Puncture impact properties - maximum force	23 °C	N	ISO 6603-2	4700
C	Puncture impact properties - maximum force	-30 °C	N	ISO 6603-2	5700
C	Puncture energy	23 °C	J	ISO 6603-2	50
C	Puncture energy	-30 °C	J	ISO 6603-2	55
	Ball indentation hardness		N/mm²	ISO 2039-1	115

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	Property	Test Condition	Unit	Standard	typical Value
Thermal properties					
C	Glass transition temperature	10 °C/min	°C	ISO 11357-1,-2	144
C	Temperature of deflection under load	1.80 MPa	°C	ISO 75-1,-2	124
C	Temperature of deflection under load	0.45 MPa	°C	ISO 75-1,-2	137
C	Vicat softening temperature	50 N; 50 °C/h	°C	ISO 306	145
	Vicat softening temperature	50 N; 120 °C/h	°C	ISO 306	146
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 [UL recognition]	0.71 mm	Class	UL 94	V-2 (NC)
C	Oxygen index	Method A	%	ISO 4589-2	27
	Thermal conductivity, through-plane	23 °C; 50 % r. h.	W/(m·K)	ISO 8302	0.20
	Resistance to heat (ball pressure test)		°C	IEC 60695-10-2	136
	Relative temperature index (Tensile strength) [UL recognition]	0.71 mm	°C	UL 746B	125
	Relative temperature index (Tensile impact strength) [UL recognition]	0.71 mm	°C	UL 746B	115
	Relative temperature index (Electric strength) [UL recognition]	0.71 mm	°C	UL 746B	125
	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	5
C	Dissipation factor	1 MHz	10^{-4}	IEC 60250	90
C	Volume resistivity		Ohm·m	IEC 62631-3-1	1E14
C	Surface resistivity		Ohm	IEC 62631-3-2	1E16
C	Electrical strength	1 mm	kV/mm	IEC 60243-1	34
C	Comparative tracking index CTI	Solution A	Rating	IEC 60112	225
	Comparative tracking index CTI M	Solution B	Rating	IEC 60112	125M
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	1190
	Bulk density	Pellets	kg/m³	ISO 60	660
Material specific properties					
	Refractive index	Procedure A	-	ISO 489	1.584
	Haze for transparent materials	3 mm	%	ISO 14782	< 0.5
	Luminous transmittance (clear transparent materials)	1 mm	%	ISO 13468-2	90
C	Luminous transmittance (clear transparent materials)	2 mm	%	ISO 13468-2	90
	Luminous transmittance (clear transparent materials)	3 mm	%	ISO 13468-2	> 89
	Luminous transmittance (clear transparent materials)	4 mm	%	ISO 13468-2	> 89
	Luminous transmittance (clear transparent materials)	400 nm; 4mm	%	ISO 13468-2	> 87.5
Processing conditions for test specimens					
C	Injection molding - Melt temperature		°C	ISO 294	280
C	Injection molding - Mold temperature		°C	ISO 294	80
C	Injection molding - Injection velocity		mm/s	ISO 294	200

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	Property	Test Condition	Unit	Standard	typical Value
Recommended processing and drying conditions					
	Melt temperatures		°C	-	250-300
	Standard Melt temperature		°C	-	270
	Barrel Temperatures - Rear		°C	-	230-240
	Barrel Temperatures - Middle		°C	-	250-260
	Barrel Temperatures - Front		°C	-	260-270
	Barrel Temperatures - Nozzle		°C	-	260-270
	Mold Temperatures		°C	-	80 - 120
	Hold Pressure (% of injection pressure)		%	-	50 - 75
	Plastic Back Pressure (specific)		bar	-	50 - 150
	Peripheral Screw Speed		m/s	-	0.05 - 0.2
	Shot-to-Cylinder Size		%	-	30 - 70
	Dry Air Drying Temperature		°C	-	120
	Dry Air Drying Time		h	-	2-3
	Moisture Content max. (%)		%	-	<= 0,02
	Vent Depth		mm	-	0.025 - 0.075

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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Disclaimer

Typical value

These values are typical values only. Unless explicitly agreed in written form, the do not constitute a binding material specification or warranted values. Values may be affected by the design of the mold/die, the processing conditions and coloring/pigmentation of the product. Unless specified to the contrary, the property values given have been established on standardized test specimens at room temperature.

General

The manner in which you use and the purpose to which you put and utilize our products, technical assistance and information (whether verbal, written or by way of production evaluations), including any suggested formulations and recommendations are beyond our control. Therefore, it is imperative that you test our products, technical assistance, information and recommendations to determine to your own satisfaction whether our products, technical assistance and information are suitable for your intended uses and applications. This application-specific analysis must at least include testing to determine suitability from a technical as well as health, safety, and environmental standpoint. Such testing has not necessarily been done by Covestro. Unless we otherwise agree in writing, all products are sold strictly pursuant to the terms of our standard conditions of sale which are available upon request. All information and technical assistance is given without warranty or guarantee and is subject to change without notice. It is expressly understood and agreed that you assume and hereby expressly release us from all liability, in tort, contract or otherwise, incurred in connection with the use of our products, technical assistance, and information. Any statement or recommendation not contained herein is unauthorized and shall not bind us. Nothing herein shall be construed as a recommendation to use any product in conflict with any claim of any patent relative to any material or its use. No license is implied or in fact granted under the claims of any patent. With respect to health, safety and environment precautions, the relevant Material Safety Data Sheets (MSDS) and product labels must be observed prior to working with our products.

Non Medical and non Food Contact Grade

This product is not designated for the manufacture of a pharmaceutical/medicinal product, medical device or of intermediate products for medical devices1). This product is also not registered for Covestro for the use in other specifically regulated applications, in particular applications requiring regulatory registration, approval or notification (e.g. including cosmetics, plant protection, food processing, food contact and others). If the intended use of the product is for the manufacture of a pharmaceutical, medical device or of intermediate products for medical devices or for other specifically regulated applications which may lead to a regulatory obligation of Covestro, Covestro must be contacted in advance to provide its agreement to sell such product for such purpose. Nonetheless, any determination as to whether a product is appropriate for use in a pharmaceutical, medical device or intermediate products for medical devices or for the use in other specifically regulated applications, must be made solely by the purchaser of the product without relying upon any representations by Covestro, irrespective of the existence of any regulatory obligation for the registration, approval or notification. 1) Please see the "Guidance on Use of Covestro Products in a Medical Application" document.

Recommended Processing and Drying Conditions

Barrel temperatures are valid for a standard 3-zone barrel. Temperature set-up for different barrel types may change according to configuration. Values for hold pressure as percentage of injection pressure may vary depending on, amongst others, part geometry, injection molding machine and injection mold. Drying conditions are for dry air dryers only. Drying times and drying temperatures may differ depending on valid dryer type. Further information is provided by your local Covestro support as well as in the following brochures: Injection Molding of High Quality Molded Parts - Drying; Determining the Dryness of Makrolon by TVI Test; The fundamentals of shrinkage in thermoplastics; Shrinkage and deformation of glass fiber reinforced thermoplastics [...]. https://www.plastics.covestro.com/Library/Overview.aspx

Disclaimer shrinkage data

Shrinkage data is provided as a reference only, and is based on sample plaques molded under specific, controlled processing conditions. Shrinkage rates in production parts can vary and are influenced by several variables such as, but not limited to: part design (e.g. part size, thickness and geometry), mold design (e.g. gate type and location, runner design, mold materials, cooling system), molding conditions (e.g. processing temperature, mold temperature, packing time and pressure, injection speed). We suggest materials be evaluated in existing applicable molds to achieve the most accurate shrinkage estimation for your specific application and processing practices. The final choice of shrinkage is the responsibility of the user of the material, and should be made based on your experience and testing results. We shall not be liable for any damage caused by the use of the shrinkage data as provided by us. If you have any questions, pls consult technical representatives from Covestro.

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