Bayer MaterialScience

MAKROLON® 6485

Product Information

Polycarbonate Resin

Flame-Retardant Grade

Description

Makrolon 6485 polycarbonate resin is a linear, low-viscosity, high-performance thermoplastic. This flame-retardant grade exhibits a UL94 flammability rating* of V-0 at a thickness of 1.5 mm (0.059 in) and V-0/5VA at a thickness of 3.0 mm (0.118 in). Makrolon 6485 resin contains an internal mold release additive. The resin is produced in pellet form for processing by injection molding and is available in opaque colors and with special visual effects.

Applications

Makrolon 6485 polycarbonate resin is used for applications in the electrical/electronic and business machine industries where a good balance of properties and stringent flame retardance are required. Typical applications include business machine housings, connectors, and connector blocks. As with any product, use of Makrolon 6485 resin in a given application must be tested (including but not limited to field testing) in advance by the user to determine suitability.

Drying

All polycarbonate resins are hygroscopic and must be thoroughly dried prior to processing. A desiccant dehumidifying hopper dryer is recommended. To achieve a moisture content of less than 0.02%, hopper inlet air temperature should be 250°F (121°C) and inlet air dew point should be -20°F (-29°C) or lower. The hopper capacity should be sufficient to provide a minimum residence time of 4 hours. Additional information on drying procedures is available in the Bayer brochure *General Drying Guide.*

Processing

Makrolon 6485 resin may be easily processed on commercially available equipment suitable for injection molding of polycarbonate. Melt temperature should not exceed 605°F (320°C); otherwise, flame retardance may be impaired.

Typical processing parameters are noted below. Actual processing conditions will depend on machine size, mold design, material residence time, shot size, etc.

Typical Injection Molding Conditions

Barrel Temperatures:	
Rear	480°–520°F (249°–271°C)
Middle	520°–560°F (271°–293°C)
Front	545°–585°F (285°–307°C)
Nozzle	515°–585°F (268°–307°C)
Melt Temperature	550°–580°F (288°–304°C)
Mold Temperature	150°–220°F (66°–104°C)
Injection Pressure	10,000–20,000 psi
Hold Pressure	50–70% of Injection Pressure
Back Pressure	50–100 psi
Screw Speed	50–75 rpm
Injection Speed	Moderate to Fast
Cushion	1/8–1/4 in
Clamp	3–5 ton/in^2

Additional information on processing may be obtained by consulting the Bayer publication *Makrolon Polycarbonate — A Processing Guide for Injection Molding* and by contacting a Bayer Corporation technical service representative.

** Flammability results are based on small-scale laboratory tests for purposes of relative comparison and are not intended to reflect the hazards presented by this or any other material under actual fire conditions.*

Regrind Information

Where end-use requirements permit, up to 20% Makrolon resin regrind may be used with virgin material, provided that the material is kept free of contamination and is properly dried (see section on Drying). Any regrind used must be generated from properly molded parts, sprues, and/or runners. All regrind used must be clean, uncontaminated, and thoroughly blended with virgin resin prior to drying and processing. Under no circumstances should degraded, discolored, or contaminated material be used for regrind. Materials of this type should be properly discarded.

Improperly mixed and/or dried regrind may diminish the desired properties of Makrolon resin. It is critical that you test finished parts produced with any amount of regrind to ensure that your end-use performance requirements are fully met. Regulatory or testing organizations (e.g., UL) may have specific requirements limiting the allowable amount of regrind. Because third party regrind generally does not have a traceable heat history or offer any assurance that proper temperatures, conditions, and/or materials were used in processing, extreme caution must be exercised in buying and using regrind from third parties.

The use of regrind material should be avoided entirely in those applications where resin properties equivalent to virgin material are required, including but not limited to color quality, impact strength, resin purity, and/or load-bearing performance.

General Characteristics of Polycarbonate

Hydrolytic Stability. Parts molded from polycarbonate absorb only 0.15 to 0.19% water at room temperature and 50% relative humidity. Dimensional stability and mechanical properties remain virtually unaffected. Even with immersion in water, dimensional changes measure only about 0.5%. Although frequent, intermittent contact with hot water does not harm polycarbonate, continuous exposure to humidity or water at high temperatures (>140°F/60°C) is not recommended due to hydrolytic degradation, which reduces impact strength and tensile properties.

Gas Permeability. Steam permeability, measured on 100-µm thick film, is 15 g/m^2·24 h (0.97 g/100 in^2·24 h). Significant permeability also exists for other gases, such as hydrogen, carbon dioxide, sulfur dioxide, helium, ethylene oxide, and oxygen.

Chemical Resistance. Polycarbonate is resistant to mineral acids (even in high concentrations), a large number of organic acids, many oxidizing and reducing agents, neutral and acidic saline solutions, some greases and oils, saturated aliphatic and cycloaliphatic hydrocarbons, and most alcohols. It is important to note that polycarbonate is degraded by alkaline solutions, ammonia gas and its solutions, and amines. Polycarbonate dissolves in a number of organic solvents, such as halogenated hydrocarbons and some aromatic hydrocarbons. Other organic compounds cause polycarbonate to swell or stress-crack, e.g., acetone and methyl ethyl ketone. Since chemical resistance to various media is dependent on variables, such as concentration, time, temperature, part design, and residual stresses, the above information should serve only as a guideline. It is imperative that production parts be evaluated under actual application conditions prior to commercial use.

Health and Safety Information

Appropriate literature has been assembled which provides information concerning the health and safety precautions that must be observed when handling Makrolon 6485 resin. Before working with this product, you must read and become familiar with the available information on its hazards, proper use, and handling. This cannot be overemphasized. Information is available in several forms, e.g., material safety data sheets and product labels. Consult your Bayer MaterialScience representative or contact Bayer's Product Safety and Regulatory Affairs Department in Pittsburgh, Pa.

Typical Properties* for Natural Resin	ASTM Test Method (Other)	Makrolon® 6485 Resin U.S. Conventional	Makrolon® 6485 Resin SI Metric
General			
Specific Gravity	D 792	1.20	
Density	D 792	0.043 lb/in³	1.20 g/cm³
Specific Volume	D 792	23.1 in³/lb	0.83 cm³/g
Mold Shrinkage	D 955	0.006–0.008 in/in	0.006–0.008 mm/mm
Water Absorption, Immersion at 73°F (23°C):	D 570		
24 Hours		0.12%	
Equilibrium		0.30%	
Melt Flow Rate[a] at 300°C/1.2-kg Load	D 1238	11 g/10 min	
Mechanical			
Tensile Stress at Yield	D 638	9,400 lb/in²	65 MPa
Tensile Stress at Break	D 638	8,700 lb/in²	60 MPa
Tensile Elongation at Yield	D 638	6%	
Tensile Elongation at Break	D 638	95%	
Tensile Modulus (1 mm/min)	D 638	350,000 lb/in²	2.4 GPa
Flexural Stress at 5% Strain	D 790	13,200 lb/in²	91 MPa
Flexural Modulus	D 790	340,000 lb/in²	2.4 GPa
Compressive Stress at Yield	D 695	11,000 lb/in²	76 MPa
Impact Strength, Notched Izod:	D 256		
73°F (23°C)			
0.125-in (3.2-mm) Thickness		2 ft·lb/in	107 J/m
Rockwell Hardness, M Scale	D 785	70	
Thermal			
Deflection Temperature, Unannealed:	D 648		
0.250-in (6.4-mm) Thickness			
264-psi (1.82-MPa) Load		262°F	128°C
66-psi (0.46-MPa) Load		277°F	136°C
Coefficient of Linear Thermal Expansion	D 696	3.34 E-05 in/in/°F	6.0 E-05 mm/mm/°C
Thermal Conductivity	C 177	1.39 Btu·in/(h·ft²·°F)	0.20 W/(m·K)
Specific Heat	D 2766	0.28 Btu/(lb·°F)	1,172 J/(kg·K)
Relative Temperature Index:	(UL746B)		
0.059-in (1.5-mm) Thickness			
Electrical		125°C	
Mechanical with Impact		115°C	
Mechanical without Impact		125°C	
Vicat Softening Temperature, 50N; 50K/h	D 1525	291°F	144°C
Flammability**			
Oxygen Index	D 2863	37%	
UL94 Flame Class:	(UL94)		
1.5-mm (0.059-in) Thickness		V-0 Rating	
3.0-mm (0.118-in) Thickness		V-0/5VA Rating	
6.0-mm (0.236-in) Thickness		V-0 Rating	
Electrical			
Volume Resistivity (Tinfoil Electrodes)	D 257	1.0 E+16 ohm·cm	
Surface Resistivity	D 257	1.0 E+16 ohm	
Dielectric Strength (Short Time Under Oil at 0.062-in [1.6-mm] Thickness and 73°F [23°C])	D 149	810 V/mil	32 kV/mm
Dielectric Constant (Tinfoil Electrodes): 60 Hz	D 150	3.0	
1 MHz		3.0	
Dissipation Factor (Tinfoil Electrodes): 60 Hz	D 150	0.0009	
1 MHz		0.01	
Arc Resistance (Tungsten Electrodes)	D 495	107s	
IEC Tracking (CTI)	D 3638	180V	
Hot Wire Ignition (HWI)[b]	(UL746A)	31s	
High-Ampere Arc Ignition (HAI)[b]	(UL746A)	40 no. of arcs	
High-Voltage Arc Tracking Rate (HVTR)	(UL746A)	4.9 in/min	124.5 mm/min

** These items are provided as general information only. They are approximate values and are not part of the product specifications. Type and quantity of pigments or additives used to obtain certain colors and special effects can affect material properties.*

*** Flammability results are based on small-scale laboratory tests for purposes of relative comparison and are not intended to reflect the hazards presented by this or any other material under actual fire conditions.*

[a] *For information on using melt flow as a quality control procedure, see the Bayer publication* Makrolon Polycarbonate — A Processing Guide for Injection Molding.

[b] *Measured at 0.058-in (1.47-mm) thickness.*

Note: The information contained in this bulletin is current as of December 2002. Please contact Bayer MaterialScience to determine whether this publication has been revised.

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