

# Makrolon® 2405

Covestro - Polycarbonates - Polycarbonate

Thursday, December 21, 2023

## General Information

### Product Description

MVR (300°C/1.2 kg) 19 cm<sup>3</sup>/10 min; general purpose; low viscosity; easy release; injection molding - melt temperature 280 - 320°C; available in transparent, translucent and opaque colors

### General

Material Status	• Commercial: Active		
Regional Availability	• Africa & Middle East • Asia Pacific	• Europe • Latin America	• North America
Features	• General Purpose	• Good Mold Release	• Low Viscosity
Uses	• General Purpose		
RoHS Compliance	• RoHS Compliant		
Appearance	• Clear/Transparent • Colors Available	• Opaque • Translucent	
Processing Method	• Injection Molding		
ISO Shortname	• ISO 7391-PC,MR,(,,-)18-9		

## ASTM & ISO Properties <sup>1</sup>

Physical	Typical Value (English)	Typical Value (SI)	Test Method
Density (73°F (23°C))	1.20 g/cm <sup>3</sup>	1.20 g/cm <sup>3</sup>	ISO 1183
Apparent (Bulk) Density <sup>2</sup>	0.66 g/cm <sup>3</sup>	0.66 g/cm <sup>3</sup>	ISO 60
Melt Mass-Flow Rate (MFR) (300°C/1.2 kg)	20 g/10 min	20 g/10 min	ISO 1133
Melt Volume-Flow Rate (MVR) (300°C/1.2 kg)	19 cm <sup>3</sup> /10min	19 cm <sup>3</sup> /10min	ISO 1133
<b>Molding Shrinkage</b>			
Across Flow	0.50 to 0.70 %	0.50 to 0.70 %	ISO 2577
Flow	0.50 to 0.70 %	0.50 to 0.70 %	ISO 2577
Across Flow : 536°F (280°C), 0.0787 in (2.00 mm) <sup>3</sup>	0.70 %	0.70 %	ISO 294-4
Flow : 0.0787 in (2.00 mm) <sup>3</sup>	0.65 %	0.65 %	ISO 294-4
<b>Water Absorption</b>			
ISO 62			
Saturation, 73°F (23°C)	0.30 %	0.30 %	
Equilibrium, 73°F (23°C), 50% RH	0.12 %	0.12 %	
Mechanical	Typical Value (English)	Typical Value (SI)	Test Method
Tensile Modulus (73°F (23°C))	348000 psi	2400 MPa	ISO 527-1/1
<b>Tensile Stress</b>			
ISO 527-2/50			
Yield, 73°F (23°C)	9430 psi	65.0 MPa	
Break, 73°F (23°C)	9430 psi	65.0 MPa	

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# Makrolon® 2405

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Mechanical	Typical Value (English)	Typical Value (SI)	Test Method
Tensile Strain			ISO 527-2/50
Yield, 73°F (23°C)	6.0 %	6.0 %	
Break, 73°F (23°C)	130 %	130 %	
Nominal Tensile Strain at Break			ISO 527-2/50
73°F (23°C)	> 50 %	> 50 %	
Tensile Creep Modulus			ISO 899-1
1 hr	319000 psi	2200 MPa	
1000 hr	276000 psi	1900 MPa	
Flexural Modulus <sup>4</sup> (73°F (23°C))	341000 psi	2350 MPa	ISO 178
Flexural Stress <sup>4</sup>			ISO 178
73°F (23°C)	14100 psi	97.0 MPa	
3.5% Strain, 73°F (23°C)	10600 psi	73.0 MPa	
Flexural Strain at Flexural Strength <sup>5</sup>			ISO 178
73°F (23°C)	7.1 %	7.1 %	
Films	Typical Value (English)	Typical Value (SI)	Test Method
Water Vapor Transmission Rate			ISO 15106-1
73°F (23°C), 85% RH, 3.9 mil (100 µm)	0.97 g/100 in <sup>2</sup> /24 hr	15 g/m <sup>2</sup> /24 hr	
Carbon Dioxide Permeability			ISO 2556
73°F (23°C), 1.0 mil (25.4 µm)	18900 cm <sup>3</sup> /m <sup>2</sup> /bar/24 hr	18900 cm <sup>3</sup> /m <sup>2</sup> /bar/24 hr	
Gas Permeation			ISO 2556
Carbon Dioxide : 3.9 mil (100.0 µm)	4000 cm <sup>3</sup> /m <sup>2</sup> /bar/24 hr	4000 cm <sup>3</sup> /m <sup>2</sup> /bar/24 hr	
Nitrogen : 1.0 mil (25.4 µm)	630 cm <sup>3</sup> /m <sup>2</sup> /bar/24 hr	630 cm <sup>3</sup> /m <sup>2</sup> /bar/24 hr	
Nitrogen : 3.9 mil (100.0 µm)	130 cm <sup>3</sup> /m <sup>2</sup> /bar/24 hr	130 cm <sup>3</sup> /m <sup>2</sup> /bar/24 hr	
Oxygen : 1.0 mil (25.4 µm)	3150 cm <sup>3</sup> /m <sup>2</sup> /bar/24 hr	3150 cm <sup>3</sup> /m <sup>2</sup> /bar/24 hr	
Oxygen : 3.9 mil (100.0 µm)	700 cm <sup>3</sup> /m <sup>2</sup> /bar/24 hr	700 cm <sup>3</sup> /m <sup>2</sup> /bar/24 hr	
Impact	Typical Value (English)	Typical Value (SI)	Test Method
Charpy Notched Impact Strength <sup>6</sup>			ISO 179/1eA
-22°F (-30°C), Complete Break	6.7 ft·lb/in <sup>2</sup>	14 kJ/m <sup>2</sup>	
73°F (23°C), Partial Break	31 ft·lb/in <sup>2</sup>	65 kJ/m <sup>2</sup>	
Charpy Unnotched Impact Strength			ISO 179/1eU
-76°F (-60°C)	No Break	No Break	
-22°F (-30°C)	No Break	No Break	
73°F (23°C)	No Break	No Break	
Notched Izod Impact Strength <sup>6</sup>			ISO 180/A
-22°F (-30°C), Complete Break	7.1 ft·lb/in <sup>2</sup>	15 kJ/m <sup>2</sup>	
73°F (23°C), Partial Break	31 ft·lb/in <sup>2</sup>	65 kJ/m <sup>2</sup>	
Multi-Axial Instrumented Impact Energy			ISO 6603-2
-22°F (-30°C)	47.9 ft·lb	65.0 J	
73°F (23°C)	40.6 ft·lb	55.0 J	
Multi-Axial Instrumented Impact Peak Force			ISO 6603-2
-22°F (-30°C)	1350 lbf	6000 N	
73°F (23°C)	1150 lbf	5100 N	

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# Makrolon® 2405

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Hardness	Typical Value (English)	Typical Value (SI)	Test Method
Ball Indentation Hardness	16700 psi	115 MPa	ISO 2039-1
Thermal	Typical Value (English)	Typical Value (SI)	Test Method
Deflection Temperature Under Load			
66 psi (0.45 MPa), Unannealed	279 °F	137 °C	ISO 75-2/B
264 psi (1.8 MPa), Unannealed	255 °F	124 °C	ISO 75-2/A
Glass Transition Temperature <sup>7</sup>	291 °F	144 °C	ISO 11357-2
Vicat Softening Temperature			
--	295 °F	146 °C	ISO 306/B120
--	293 °F	145 °C	ISO 306/B50
Ball Pressure Test (277°F (136°C))	Pass	Pass	IEC 60695-10-2
CLTE			ISO 11359-2
Flow : 73 to 131°F (23 to 55°C)	3.6E-5 in/in/°F	6.5E-5 cm/cm/°C	
Transverse : 73 to 131°F (23 to 55°C)	3.6E-5 in/in/°F	6.5E-5 cm/cm/°C	
Thermal Conductivity <sup>8</sup> (73°F (23°C))	1.4 Btu-in/hr/ft <sup>2</sup> /°F	0.20 W/m/K	ISO 8302
RTI Elec (0.06 in (1.5 mm))	257 °F	125 °C	UL 746B
RTI Imp (0.06 in (1.5 mm))	239 °F	115 °C	UL 746B
RTI Str (0.06 in (1.5 mm))	257 °F	125 °C	UL 746B
Electrical	Typical Value (English)	Typical Value (SI)	Test Method
Surface Resistivity	1.0E+16 ohms	1.0E+16 ohms	IEC 60093
Volume Resistivity (73°F (23°C))	1.0E+16 ohms-cm	1.0E+16 ohms-cm	IEC 60093
Electric Strength			IEC 60243-1
73°F (23°C), 0.0394 in (1.00 mm)	860 V/mil	34 kV/mm	
Relative Permittivity			IEC 60250
73°F (23°C), 100 Hz	3.10	3.10	
73°F (23°C), 1 MHz	3.00	3.00	
Dissipation Factor			IEC 60250
73°F (23°C), 100 Hz	5.0E-4	5.0E-4	
73°F (23°C), 1 MHz	9.0E-3	9.0E-3	
Comparative Tracking Index			IEC 60112
Solution A	250 V	250 V	
Solution B	125 V	125 V	
Flammability	Typical Value (English)	Typical Value (SI)	Test Method
Flame Rating			UL 94
0.11 in (2.7 mm)	HB	HB	
0.014 in (0.36 mm)	V-2	V-2	
0.030 in (0.75 mm)	V-2	V-2	
Glow Wire Flammability Index			IEC 60695-2-12
0.030 in (0.75 mm)	1560 °F	850 °C	
0.06 in (1.5 mm)	1610 °F	875 °C	
0.12 in (3.0 mm)	1710 °F	930 °C	

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# Makrolon® 2405

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Flammability	Typical Value (English)	Typical Value (SI)	Test Method
Glow Wire Ignition Temperature			IEC 60695-2-13
0.030 in (0.75 mm)	1610 °F	875 °C	
0.04 in (1.0 mm)	1610 °F	875 °C	
0.06 in (1.5 mm)	1610 °F	875 °C	
0.12 in (3.0 mm)	1610 °F	875 °C	
Oxygen Index <sup>9</sup>	27 %	27 %	ISO 4589-2
Application of Flame from Small Burner <sup>10</sup>			DIN 53438-1, -3
78.7 mil (2.00 mm)	K1, F1	K1, F1	
Burning Rate <sup>11</sup> (> 39.4 mil (> 1.00 mm))	passed	passed	ISO 3795
Flash Ignition Temperature	896 °F	480 °C	ASTM D1929
Needle Flame Test			IEC 60695-11-5
59.1 mil (1.50 mm) <sup>12</sup>	5.0 sec	5.0 sec	
59.1 mil (1.50 mm) <sup>13</sup>	60.0 sec	60.0 sec	
78.7 mil (2.00 mm) <sup>12</sup>	5.0 sec	5.0 sec	
78.7 mil (2.00 mm) <sup>13</sup>	120.0 sec	120.0 sec	
0.12 in (3.00 mm) <sup>12</sup>	10.0 sec	10.0 sec	
0.12 in (3.00 mm) <sup>13</sup>	120.0 sec	120.0 sec	
Self Ignition Temperature	1022 °F	550 °C	ASTM D1929
Optical	Typical Value (English)	Typical Value (SI)	Test Method
Refractive Index <sup>14</sup>	1.585	1.585	ISO 489
Light Transmittance			ISO 13468-2
39.37 mil (1000 µm)	89.0 %	89.0 %	
78.74 mil (2000 µm)	89.0 %	89.0 %	
118.1 mil (3000 µm)	88.0 %	88.0 %	
157.5 mil (4000 µm)	87.0 %	87.0 %	
Haze (118.1 mil (3000 µm))	< 0.800 %	< 0.800 %	ISO 14782
Additional Information	Typical Value (English)	Typical Value (SI)	Test Method
Electrolytical Corrosion (73°F (23°C))	A1	A1	IEC 60426

### Processing Information

Injection	Typical Value (English)	Typical Value (SI)
Drying Temperature - Dry Air Dryer	248 °F	120 °C
Drying Time - Dry Air Dryer	2.0 to 3.0 hr	2.0 to 3.0 hr
Suggested Max Moisture	< 0.020 %	< 0.020 %
Suggested Shot Size	30 to 70 %	30 to 70 %
Rear Temperature	482 to 500 °F	250 to 260 °C
Middle Temperature	518 to 536 °F	270 to 280 °C
Front Temperature	536 to 554 °F	280 to 290 °C
Nozzle Temperature	554 to 572 °F	290 to 300 °C
Processing (Melt) Temp	536 to 608 °F	280 to 320 °C
Mold Temperature	176 to 248 °F	80 to 120 °C
Back Pressure	725 to 2180 psi	5.00 to 15.0 MPa
Vent Depth	9.8E-4 to 3.0E-3 in	0.025 to 0.075 mm

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### Injection Notes

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Hold Pressure (% of Injection Pressure): 50 - 75%  
Peripheral Screw Speed: 0.05 - 0.2 m/s  
Standard Melt Temperature: 300°C

### Notes

<sup>1</sup> Typical properties: these are not to be construed as specifications.

<sup>2</sup> Pellets

<sup>3</sup> 60x60x2mm, 500 bar

<sup>4</sup> 0.079 in/min (2.0 mm/min)

<sup>5</sup> 2.0 mm/min

<sup>6</sup> 3 mm

<sup>7</sup> 10°C/min

<sup>8</sup> Across Flow

<sup>9</sup> Procedure A

<sup>10</sup> Method K and F

<sup>11</sup> US-FMVSS

<sup>12</sup> Method K

<sup>13</sup> Method F

<sup>14</sup> Method A

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