

**Makrolon® AL2447**

 Covestro - Polycarbonates - *Polycarbonate*
**General Information**
**Product Description**

MVR (300°C/1.2 kg) 19 cm<sup>3</sup>/10 min; Automotive lighting; low viscosity; UV stabilized; easy release; injection molding - melt temperature 280 - 320°C; available in clear transparent colors and in various signal colors; headlamp lenses for automotive forward lighting

**General**

|                   |                            |                    |                         |
|-------------------|----------------------------|--------------------|-------------------------|
| Material Status   | • Commercial: Active       |                    |                         |
| Availability      | • Africa & Middle East     | • Europe           | • North America         |
|                   | • Asia Pacific             | • Latin America    |                         |
| Additive          | • UV Stabilizer            |                    |                         |
| Features          | • Good Mold Release        | • Low Viscosity    | • UV Stabilized         |
| Uses              | • Automotive Applications  | • Lenses           | • Lighting Applications |
| RoHS Compliance   | • RoHS Compliant           |                    |                         |
| Appearance        | • Clear/Transparent        | • Colors Available |                         |
| Processing Method | • Injection Molding        |                    |                         |
| ISO Designation   | • ISO 7391-PC,MLR,(,)-18-9 |                    |                         |

**Properties <sup>1</sup>**

| Physical   | Nominal Value | Unit                   | Test Method  |
|--|---------------|------------------------|--------------|
| Density (73°F)   | 1.20          | g/cm <sup>3</sup>      | ISO 1183     |
| Apparent (Bulk) Density <sup>2</sup>                     | 0.66          | g/cm <sup>3</sup>      | ISO 60       |
| Melt Mass-Flow Rate (MFR) (300°C/1.2 kg)                 | 20            | g/10 min               | ISO 1133     |
| Melt Volume-Flow Rate (MVR) (300°C/1.2 kg)               | 19            | cm <sup>3</sup> /10min | ISO 1133     |
| Molding Shrinkage  |               |                        |              |
| Across Flow  | 0.50 to 0.70  | %                      | ISO 2577     |
| Flow   | 0.50 to 0.70  | %                      | ISO 2577     |
| Across Flow : 536°F, 0.0787 in <sup>3</sup>              | 0.70          | %                      | ISO 294-4    |
| Flow : 0.0787 in <sup>3</sup>                            | 0.65          | %                      | ISO 294-4    |
| Water Absorption (Saturation, 73°F)                      | 0.30          | %                      | ISO 62       |
| Water Absorption (Equilibrium, 73°F, 50% RH)             | 0.12          | %                      | ISO 62       |
| Mechanical   | Nominal Value | Unit                   | Test Method  |
| Tensile Modulus (73°F)                                   | 348000        | psi                    | ISO 527-1/1  |
| Tensile Stress (Yield, 73°F)                             | 9570          | psi                    | ISO 527-2/50 |
| Tensile Stress   |               |                        |              |
| Break, 73°F  | 10200         | psi                    | ISO 527-2/5  |
| Break, 73°F  | 9430          | psi                    | ISO 527-2/50 |
| Tensile Strain (Yield, 73°F)                             | 6.0           | %                      | ISO 527-2/50 |
| Tensile Strain   |               |                        |              |
| Break, 73°F  | 130           | %                      | ISO 527-2/5  |
| Break, 73°F  | 120           | %                      | ISO 527-2/50 |
| Nominal Tensile Strain at Break (73°F)                   | > 50          | %                      | ISO 527-2/50 |
| Tensile Creep Modulus (1 hr)                             | 319000        | psi                    | ISO 899-1    |
| Tensile Creep Modulus (1000 hr)                          | 276000        | psi                    | ISO 899-1    |
| Flexural Modulus <sup>4</sup> (73°F)                     | 341000        | psi                    | ISO 178      |
| Flexural Stress <sup>4</sup>                             |               |                        | ISO 178      |
| 73°F   | 14200         | psi                    |              |
| 3.5% Strain, 73°F  | 10700         | psi                    |              |
| Flexural Strain at Flexural Strength <sup>5</sup> (73°F) | 7.0           | %                      | ISO 178      |



| <b>Films</b>  | <b>Nominal Value</b> | <b>Unit</b>                                | <b>Test Method</b> |
|---|----------------------|--|--------------------|
| Water Vapor Transmission Rate (73°F, 85% RH, 3.9 mil)   | 0.97                 | g/100 in <sup>2</sup> /24 hr               | ISO 15106-1        |
| Carbon Dioxide Permeability (73°F, 1.0 mil)             | 18900                | cm <sup>3</sup> /m <sup>2</sup> /bar/24 hr | ISO 2556           |
| Gas Permeation  |                      |  | ISO 2556           |
| Carbon Dioxide : 3.9 mil                                | 4800                 | cm <sup>3</sup> /m <sup>2</sup> /bar/24 hr |                    |
| Nitrogen : 1.0 mil                                      | 630                  | cm <sup>3</sup> /m <sup>2</sup> /bar/24 hr |                    |
| Nitrogen : 3.9 mil                                      | 160                  | cm <sup>3</sup> /m <sup>2</sup> /bar/24 hr |                    |
| Oxygen : 1.0 mil  | 3150                 | cm <sup>3</sup> /m <sup>2</sup> /bar/24 hr |                    |
| Oxygen : 3.9 mil  | 800                  | cm <sup>3</sup> /m <sup>2</sup> /bar/24 hr |                    |
| <b>Impact</b>   | <b>Nominal Value</b> | <b>Unit</b>                                | <b>Test Method</b> |
| Charpy Notched Impact Strength <sup>6</sup>             |                      |  | ISO 179/1eA        |
| -22°F, Complete Break                                   | 6.7                  | ft·lb/in <sup>2</sup>                      |                    |
| 73°F, Partial Break                                     | 31                   | ft·lb/in <sup>2</sup>                      |                    |
| Charpy Unnotched Impact Strength                        |                      |  | ISO 179/1eU        |
| -76°F   | No Break             |  |                    |
| -22°F   | No Break             |  |                    |
| 73°F  | No Break             |  |                    |
| Notched Izod Impact Strength <sup>6</sup>               |                      |  | ISO 180/A          |
| -22°F, Complete Break                                   | 7.1                  | ft·lb/in <sup>2</sup>                      |                    |
| 73°F, Partial Break                                     | 31                   | ft·lb/in <sup>2</sup>                      |                    |
| Multi-Axial Instrumented Impact Energy                  |                      |  | ISO 6603-2         |
| -22°F   | 47.9                 | ft·lb                                      |                    |
| 73°F  | 40.6                 | ft·lb                                      |                    |
| Multi-Axial Instrumented Impact Peak Force              |                      |  | ISO 6603-2         |
| -22°F   | 1350                 | lbf  |                    |
| 73°F  | 1150                 | lbf  |                    |
| <b>Hardness</b>   | <b>Nominal Value</b> | <b>Unit</b>                                | <b>Test Method</b> |
| Ball Indentation Hardness                               | 16700                | psi  | ISO 2039-1         |
| <b>Thermal</b>  | <b>Nominal Value</b> | <b>Unit</b>                                | <b>Test Method</b> |
| Deflection Temperature Under Load (66 psi, Unannealed)  | 280                  | °F   | ISO 75-2/B         |
| Deflection Temperature Under Load (264 psi, Unannealed) | 257                  | °F   | ISO 75-2/A         |
| Glass Transition Temperature <sup>7</sup>               | 293                  | °F   | ISO 11357-2        |
| Vicat Softening Temperature                             |                      |  |                    |
| --  | 293                  | °F   | ISO 306/B120       |
| --  | 291                  | °F   | ISO 306/B50        |
| Ball Pressure Test (275°F)                              | Pass                 |  | IEC 60695-10-2     |
| CLTE - Flow (73 to 131°F)                               | 3.6E-5               | in/in/°F                                   | ISO 11359-2        |
| CLTE - Transverse (73 to 131°F)                         | 3.6E-5               | in/in/°F                                   | ISO 11359-2        |
| Thermal Conductivity <sup>8</sup> (73°F)                | 1.4                  | Btu·in/hr/ft <sup>2</sup> /°F              | ISO 8302           |
| RTI Elec (0.06 in)                                      | 257                  | °F   | UL 746B            |
| RTI Imp (0.06 in)                                       | 239                  | °F   | UL 746B            |
| RTI Str (0.06 in)                                       | 257                  | °F   | UL 746B            |
| <b>Electrical</b>                                       | <b>Nominal Value</b> | <b>Unit</b>                                | <b>Test Method</b> |
| Surface Resistivity                                     | 1.0E+16              | ohms                                       | IEC 60093          |
| Volume Resistivity (73°F)                               | 1.0E+16              | ohms·cm                                    | IEC 60093          |
| Electric Strength (73°F, 0.0394 in)                     | 860                  | V/mil                                      | IEC 60243-1        |
| Relative Permittivity                                   |                      |  | IEC 60250          |
| 73°F, 100 Hz  | 3.10                 |  |                    |
| 73°F, 1 MHz   | 3.00                 |  |                    |
| Dissipation Factor                                      |                      |  | IEC 60250          |
| 73°F, 100 Hz  | 5.0E-4               |  |                    |
| 73°F, 1 MHz   | 9.0E-3               |  |                    |
| Comparative Tracking Index                              |                      |  | IEC 60112          |
| Solution A  | 250                  | V  |                    |
| Solution B  | 125                  | V  |                    |
| Electrolytic Corrosion (73°F)                           | A1                   |  | IEC 60426          |
|   | <b>Nominal Value</b> | <b>Unit</b>                                | <b>Test Method</b> |
|   | HB                   |  | UL 94              |
|   | V-2                  |  | UL 94              |

|                                |                           |                    |
|--------------------------------|---------------------------|--------------------|
| Oxygen Index <sup>9</sup>      | 28 %                      | ISO 4589-2         |
| Flash Ignition Temperature     | 896 °F                    | ASTM D1929         |
| Self Ignition Temperature      | 1022 °F                   | ASTM D1929         |
| <b>Optical</b>                 | <b>Nominal Value Unit</b> | <b>Test Method</b> |
| Refractive Index <sup>10</sup> | 1.586                     | ISO 489            |
| Light Transmittance            |                           | ISO 13468-2        |
| 39.37 mil                      | 89.0 %                    |                    |
| 78.74 mil                      | 89.0 %                    |                    |
| 118.1 mil                      | 88.0 %                    |                    |
| 157.5 mil                      | > 87.0 %                  |                    |
| Haze (118.1 mil)               | < 0.500 %                 | ISO 14782          |

### Processing Information

| Injection                          | Nominal Value Unit  |
|------------------------------------|---------------------|
| Drying Temperature - Dry Air Dryer | 248 °F              |
| Drying Time - Dry Air Dryer        | 2.0 to 3.0 hr       |
| Suggested Max Moisture             | < 0.020 %           |
| Suggested Shot Size                | 30 to 70 %          |
| Rear Temperature                   | 482 to 500 °F       |
| Middle Temperature                 | 518 to 536 °F       |
| Front Temperature                  | 536 to 554 °F       |
| Nozzle Temperature                 | 554 to 572 °F       |
| Processing (Melt) Temp             | 536 to 608 °F       |
| Mold Temperature                   | 176 to 248 °F       |
| Back Pressure                      | 725 to 2180 psi     |
| Vent Depth                         | 9.8E-4 to 3.0E-3 in |

### Injection Notes

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

### 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

<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 A

