

# Makrolon® ET3113

Polycarbonate

Covestro - Polycarbonates

## Message:

MVR (300 °C/1.2 kg) 6.0 cm<sup>3</sup>/10 min; Extrusion; high viscosity; UV stabilized; available in transparent colors only; solid sheet; corrugated sheet

| General Information                        |                                       |                        |              |
|--------------------------------------------|---------------------------------------|------------------------|--------------|
| UL YellowCard                              | E41613-233143                         |                        |              |
| Additive                                   | UV Stabilizer                         |                        |              |
| Features                                   | High Viscosity                        |                        |              |
| Uses                                       | Corrugated Sheet<br>Sheet             |                        |              |
| RoHS Compliance                            | RoHS Compliant                        |                        |              |
| Appearance                                 | Clear/Transparent<br>Colors Available |                        |              |
| Processing Method                          | Extrusion                             |                        |              |
| Physical                                   | Nominal Value                         | Unit                   | Test Method  |
| Density (23°C)                             | 1.20                                  | g/cm <sup>3</sup>      | ISO 1183     |
| Apparent Density <sup>1</sup>              | 0.66                                  | g/cm <sup>3</sup>      | ISO 60       |
| Melt Mass-Flow Rate (MFR) (300°C/1.2 kg)   | 6.5                                   | g/10 min               | ISO 1133     |
| Melt Volume-Flow Rate (MVR) (300°C/1.2 kg) | 6.00                                  | cm <sup>3</sup> /10min | ISO 1133     |
| Molding Shrinkage                          |                                       |                        |              |
| Across Flow                                | 0.60 to 0.80                          | %                      | ISO 2577     |
| Flow                                       | 0.60 to 0.80                          | %                      | ISO 2577     |
| Across Flow : 2.00 mm <sup>2</sup>         | 0.75                                  | %                      | ISO 294-4    |
| Flow : 2.00 mm <sup>3</sup>                | 0.70                                  | %                      | ISO 294-4    |
| Water Absorption                           |                                       |                        |              |
| Saturation, 23°C                           | 0.30                                  | %                      | ISO 62       |
| Equilibrium, 23°C, 50% RH                  | 0.12                                  | %                      |              |
| Hardness                                   | Nominal Value                         | Unit                   | Test Method  |
| Ball Indentation Hardness                  | 113                                   | MPa                    | ISO 2039-1   |
| Mechanical                                 | Nominal Value                         | Unit                   | Test Method  |
| Tensile Modulus (23°C)                     | 2350                                  | MPa                    | ISO 527-2/1  |
| Tensile Stress                             |                                       |                        | ISO 527-2/50 |
| Yield, 23°C                                | 65.0                                  | MPa                    |              |
| Break, 23°C                                | 70.0                                  | MPa                    |              |
| Tensile Strain                             |                                       |                        | ISO 527-2/50 |

| Yield, 23°C                                                       | 6.3                      | %                                          |                 |
|-------------------------------------------------------------------|--------------------------|--------------------------------------------|-----------------|
| Break, 23°C                                                       | 130                      | %                                          |                 |
| Nominal Tensile Strain at Break (23°C)                            | > 50                     | %                                          | ISO 527-2/50    |
| Tensile Creep Modulus                                             |                          |                                            | ISO 899-1       |
| 1 hr                                                              | 2200                     | MPa                                        |                 |
| 1000 hr                                                           | 1900                     | MPa                                        |                 |
| Flexural Modulus <sup>4</sup> (23°C)                              | 2350                     | MPa                                        | ISO 178         |
| Flexural Stress <sup>5</sup>                                      |                          |                                            | ISO 178         |
| 3.5% Strain, 23°C                                                 | 72.0                     | MPa                                        |                 |
| 23°C                                                              | 96.0                     | MPa                                        |                 |
| Flexural Strain at Flexural Strength (23°C) <sup>6</sup>          | 7.2                      | %                                          | ISO 178         |
| Gas Permeation                                                    |                          |                                            | ISO 2556        |
| Carbon Dioxide : 23°C, 25.4 µm                                    | 16900                    | cm <sup>3</sup> /m <sup>2</sup> /bar/24 hr |                 |
| Carbon Dioxide : 23°C, 100.0 µm                                   | 3800                     | cm <sup>3</sup> /m <sup>2</sup> /bar/24 hr |                 |
| Nitrogen : 23°C, 25.4 µm                                          | 510                      | cm <sup>3</sup> /m <sup>2</sup> /bar/24 hr |                 |
| Nitrogen : 23°C, 100.0 µm                                         | 120                      | cm <sup>3</sup> /m <sup>2</sup> /bar/24 hr |                 |
| Oxygen : 23°C, 25.4 µm                                            | 2760                     | cm <sup>3</sup> /m <sup>2</sup> /bar/24 hr |                 |
| Oxygen : 23°C, 100.0 µm                                           | 650                      | cm <sup>3</sup> /m <sup>2</sup> /bar/24 hr |                 |
| Application of Flame from Small Burner - Method K and F (2.00 mm) | K1, F1                   |                                            | DIN 53438-1, -3 |
| Burning Rate - US-FMVSS (> 1.00 mm)                               | passed                   |                                            | ISO 3795        |
| Flash Ignition Temperature                                        | 480                      | °C                                         | ASTM D1929      |
| Needle Flame Test                                                 |                          |                                            | IEC 60695-11-5  |
| Method F : 1.50 mm                                                | 1.0                      | min                                        |                 |
| Method F : 2.00 mm                                                | 2.0                      | min                                        |                 |
| Method F : 3.00 mm                                                | 2.0                      | min                                        |                 |
| Method K : 2.00 mm                                                | 0.1                      | min                                        |                 |
| Method K : 3.00 mm                                                | 0.2                      | min                                        |                 |
| Self Ignition Temperature                                         | 550                      | °C                                         | ASTM D1929      |
| Electrolytical Corrosion (23°C)                                   | A1                       |                                            | IEC 60426       |
| ISO Shortname                                                     | ISO 7391-PC,EL,(,,)-09-9 |                                            |                 |
| Films                                                             | Nominal Value            | Unit                                       | Test Method     |
| Water Vapor Transmission Rate (23°C, 85% RH, 100 µm)              | 15                       | g/m <sup>2</sup> /24 hr                    | ISO 15106-1     |
| Impact                                                            | Nominal Value            | Unit                                       | Test Method     |
| Charpy Notched Impact Strength <sup>7</sup>                       |                          |                                            | ISO 7391        |
| -30°C, Complete Break                                             | 18                       | kJ/m <sup>2</sup>                          |                 |
| 23°C, Partial Break                                               | 80                       | kJ/m <sup>2</sup>                          |                 |
| Charpy Unnotched Impact Strength                                  |                          |                                            | ISO 179/1eU     |
| -60°C                                                             | No Break                 |                                            |                 |
| -30°C                                                             | No Break                 |                                            |                 |
| 23°C                                                              | No Break                 |                                            |                 |
| Notched Izod Impact Strength <sup>8</sup>                         |                          |                                            | ISO 7391        |

| -30°C, Complete Break                      | 20            | kJ/m <sup>2</sup> |                |
|--------------------------------------------|---------------|-------------------|----------------|
| 23°C, Partial Break                        | 70            | kJ/m <sup>2</sup> |                |
| Multi-Axial Instrumented Impact Energy     |               |                   | ISO 6603-2     |
| -30°C                                      | 70.0          | J                 |                |
| 23°C                                       | 60.0          | J                 |                |
| Multi-Axial Instrumented Impact Peak Force |               |                   | ISO 6603-2     |
| -30°C                                      | 6500          | N                 |                |
| 23°C                                       | 5600          | N                 |                |
| Thermal                                    | Nominal Value | Unit              | Test Method    |
| Heat Deflection Temperature                |               |                   |                |
| 0.45 MPa, Unannealed                       | 141           | °C                | ISO 75-2/B     |
| 1.8 MPa, Unannealed                        | 128           | °C                | ISO 75-2/A     |
| Glass Transition Temperature <sup>9</sup>  | 148           | °C                | ISO 11357-2    |
| Vicat Softening Temperature                |               |                   |                |
| --                                         | 148           | °C                | ISO 306/B50    |
| --                                         | 149           | °C                | ISO 306/B120   |
| Ball Pressure Test (140°C)                 | Pass          |                   | IEC 60695-10-2 |
| CLTE                                       |               |                   | ISO 11359-2    |
| Flow : 23 to 55°C                          | 6.5E-5        | cm/cm/°C          |                |
| Transverse : 23 to 55°C                    | 6.5E-5        | cm/cm/°C          |                |
| Thermal Conductivity <sup>10</sup> (23°C)  | 0.20          | W/m/K             | ISO 8302       |
| RTI Elec (1.50 mm)                         | 125           | °C                | UL 746         |
| RTI Imp (1.50 mm)                          | 115           | °C                | UL 746         |
| RTI Str (1.50 mm)                          | 125           | °C                | UL 746         |
| Electrical                                 | Nominal Value | Unit              | Test Method    |
| Surface Resistivity                        | 1.0E+16       | ohms              | IEC 60093      |
| Volume Resistivity (23°C)                  | 1.0E+16       | ohms·cm           | IEC 60093      |
| Electric Strength (23°C, 1.00 mm)          | 34            | kV/mm             | IEC 60243-1    |
| Relative Permittivity                      |               |                   | IEC 60250      |
| 23°C, 100 Hz                               | 3.10          |                   |                |
| 23°C, 1 MHz                                | 3.00          |                   |                |
| Dissipation Factor                         |               |                   | IEC 60250      |
| 23°C, 100 Hz                               | 8.0E-4        |                   |                |
| 23°C, 1 MHz                                | 0.010         |                   |                |
| Comparative Tracking Index                 |               |                   | IEC 60112      |
| Solution A                                 | 250           | V                 |                |
| Solution B                                 | 125           | V                 |                |
| Flammability                               | Nominal Value | Unit              | Test Method    |
| Flame Rating                               |               |                   | UL 94          |
| 1.50 mm                                    | HB            |                   |                |
| 0.750 mm                                   | V-2           |                   |                |

|                                |                            |      |                |
|--------------------------------|----------------------------|------|----------------|
| Glow Wire Flammability Index   |                            |      | IEC 60695-2-12 |
| 0.750 mm                       | 875                        | °C   |                |
| 1.50 mm                        | 875                        | °C   |                |
| 3.00 mm                        | 960                        | °C   |                |
| Glow Wire Ignition Temperature |                            |      | IEC 60695-2-13 |
| 0.750 mm                       | 875                        | °C   |                |
| 1.50 mm                        | 875                        | °C   |                |
| 3.00 mm                        | 900                        | °C   |                |
| Oxygen Index <sup>11</sup>     | 28                         | %    | ISO 4589-2     |
| Optical                        | Nominal Value              | Unit | Test Method    |
| Refractive Index <sup>12</sup> | 1.587                      |      | ISO 489        |
| Transmittance                  |                            |      | ISO 13468-2    |
| 1000 μm                        | 89.0                       | %    |                |
| 2000 μm                        | 89.0                       | %    |                |
| 3000 μm                        | 88.0                       | %    |                |
| 4000 μm                        | 87.0                       | %    |                |
| Haze (3000 μm)                 | < 0.80                     | %    | ISO 14782      |
| NOTE                           |                            |      |                |
| 1.                             | Pellets                    |      |                |
| 2.                             | 60x60x2 mm, 500 bar        |      |                |
| 3.                             | 60x60x2 mm, 500 bar        |      |                |
| 4.                             | 2.0 mm/min                 |      |                |
| 5.                             | 2.0 mm/min                 |      |                |
| 6.                             | 2 mm/min                   |      |                |
| 7.                             | Based on ISO 179-1eA, 3 mm |      |                |
| 8.                             | Based on ISO 180-A, 3 mm   |      |                |
| 9.                             | 10°C/min                   |      |                |
| 10.                            | Cross-flow                 |      |                |
| 11.                            | Procedure A                |      |                |
| 12.                            | Method A                   |      |                |

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