Product Name: IC3D Standard PETG

Revision Date: 01/16/2020



Applications

- Flexible medical device packaging
- Pharmaceutical packaging
- Rigid medical packaging

Key Attributes

- Easy primary & secondary operations
- Excellent clarity
- Excellent toughness
- Gamma, ebeam, ETO sterilization stable

Product Description

Meets ISO 10993 and/or USP Class VI biocompatibility requirement: Food Contact Status compliant. IC3D Standard PETG is a clear, amorphous material that can be molded and extruded with ease. Its excellent performance properties include clarity, toughness, good melt strength, no dusting, no stress whitening, good heat sealability, easy cutting and thermoforming. IC3D Standard PETG may be colored using color concentrates, dry colors, or liquid colorants. It can be safely sterilized with proper ethylene oxide, radiation, or electron beam methods without property loss or color shift. It is well suited for a variety of applications including, medical packaging, cosmetics and personal care packaging, food and beverage packaging, and display & signs.

In medical applications, IC3D Standard PETG provides:

- Superior, long-term clarity provides easy identification of instruments
- Excellent puncture resistance and impact toughness ensure package integrity
- Excellent ability to be subjected to several methods of sterilization, providing flexibility and security to the device manufacturer
- Excellent optical and physical property stability post sterilization
- Good melt strength offers wide processing latitude and ease in thermoforming

The production and trimming of rigid medical trays made from sheet of IC3D results in little or no dust or particulates. After the thermoformed trays are made, they are put in polybags. The polybags of trays are then placed in protective boxes for storage or shipment. If the polybags in the protective boxes are intact and no outside contamination is evident, the medical device manufacturer should not need to clean the tray prior to packaging a device and sealing the package. If contamination is found on the medical trays and cleaning is required, use a lint-free towel. Blowing the tray out with filtered, deionized, non-lubricated air is also acceptable, assuming this does not stir up dust from the surrounding area. Using alcohol, which could cause crazing, or water, which would not evaporate, is not recommended.

This product has been Cradle to Cradle Certified™ Bronze, with Material Health Certificate, Platinum. The Cradle to Cradle Certified mark is a registered certification mark used under license through the Cradle to Cradle Products Innovation Institute, a nonprofit organization that administers the publicly available Cradle to Cradle Certified™ Product Standard which provides designers and manufacturers with criteria and requirements for continually improving product materials and manufacturing processes. This standard guides designers and manufacturers through a continual improvement process that looks at a product through five quality categories—material health, material reutilization, renewable energy and carbon management, water stewardship, and social fairness. A product receives an achievement level in each category—Basic, Bronze, Silver, Gold, or Platinum—with the lowest achievement level representing the product's overall mark. The Material Health Certificate provides manufacturers with a trusted way to communicate their efforts to identify and replace chemicals of concern in their products.

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Typical Properties

| | turi ropercies | |
|--|--------------------------|---|
| Property ^a | Test Method ^b | Typical Value, Units ^c |
| Electrical Properties | | |
| Dielectric Constant 1kHz | D 150 | 2.6 |
| 1MHz | D 150 | 2.4 |
| Dissipation Factor | | |
| 1kHz 1MHz | D 150 D 150 | 0.005 0.02 |
| Arc Resistance | D 495 | 158 sec |
| Volume Resistivity | D 257 | 10 ¹⁵ ohm.cm |
| Surface Resistivity | D 257 | 10 ¹⁶ ohms/square |
| Dielectric Strength, Short Time, 500 V/sec rate-of-rise | D 149 | 16 kV/mm (410 V/mil) |
| Film Properties | | |
| Thickness of Film Tested | D 374 | 250 Microns (10 mils) |
| Density | D 1505 | 1.27 g/cm³ |
| Haze | D 1003 | 0.8 % |
| Gloss @ 45° | D 2457 | 108 |
| Transparency | D 1746 | 85 % |
| Regular Transmittance | D 1003 Modified | 89 % |
| Total Transmittance | D 1003 Modified | 91 % |
| Water Vapor Transmission Rate | F 1249 | 7 g/m²-24h (0.5 g/100in.²-24h) |
| Gas Permeability, CO ₂ | D 1434 | 49 cm³-mm/m²-24h-atm (125 cm³-mil/100in.²-24h-atm) |
| Gas Permeability, O ₂ | D 3985 | 10 cm³-mm/m²-24h-atm (25 cm³-mil/100in.²-24h-atm) |
| Elmendorf Tear Resistance M.D. | D 1922 | 13.7 N (1400 gf) |
| T.D. | D 1922 | 16.7 N (1700 gf) |
| PPT Tear Resistance M.D. T.D. | D 2582 D 2582 | 93 N (21 lbf) 93 N (21 lbf) |
| Tear Propagation Resistance, Split Tear Method M.D. @ 254 mm/min (10 in./min) T.D. @ 254 mm/min (10 in./min) | D 1938 D 1938 | 36 N/mm (205 lbf/in.) 36 N/mm (205 lbf/in.) |
| Tear Resistance, Trouser @ 200 mm/min M.D. T.D. | ISO 6383-1 ISO 6383-1 | 36 N/mm (205 lbf/in.) 36 N/mm (205 lbf/in.) |
| Tensile Strength @ Yield M.D. T.D. | D 882 D 882 | 52 MPa (7500 psi) 52 MPa (7500 psi) |
| Tensile Strength @ Break M.D. T.D. | D 882 D 882 | 59 MPa (8600 psi) 55 MPa (8000 psi) |
| Elongation @ Yield M.D. T.D. | D 882 D 882 | 4 96 4 96 |

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| Elongation @ Break | | |
|--|--------------------------------------|--|
| M.D. T.D. | D 882 D 882 | 400 % 400 % |
| Tensile Modulus M.D. T.D. | D 882 D 882 | 1900 MPa (2.8 x 10 ⁵ psi) 1900 MPa (2.8 x 10 ⁵ psi) |
| Dart Impact ¹ @ -18°C (0°F) @ 23°C (73°F) | D 1709A Modified D 1709A Modified | 500 g 400 g |
| Mechanical Properties (Injection Molded), ASTM Meth | od | |
| Specific Gravity | D 792 | 1.27 |
| Water Absorption, 24 h Immersion | D 570 | 0.13 % |
| Tensile Stress @ Break | D 638 | 28 MPa (4100 psi) |
| Tensile Stress @ Yield | D 638 | 50 MPa (7300 psi) |
| Elongation @ Break | D 638 | 130 % |
| Tensile Modulus | D 638 | 2100 MPa (3.0 x 10 ⁵ psi) |
| Flexural Modulus | D 790 | 2100 MPa (3.0 x 10 ⁵ psi) |
| Flexural Yield Strength | D 790 | 70 MPa (10200 psi) |
| Rockwell Hardness, R-Scale | D 785 | 106 |
| Izod Impact Strength, Notched @ 23°C (73°F) @ -40°C (-40°F) | D 256 D 256 | 101 J/m (1.9 ft-lbf/in.) 37 J/m (0.7 ft-lbf/in.) |
| Impact Strength, Unnotcheds @ -20°C (-4°F) @ 23°C (73°F) @ -30°C (-22°F) @ -40°C (-40°F) | D 4812 D 4812 D 4812 D 4812 | NB NB NB NB |
| Impact Resistance (Puncture), Energy @ Max. Load 2.5-mm (0.100-in.) Thick Plaques, @ 23°C (73°F) 2.5-mm (0.100-in.) Thick | D 3763 D 3763 | 28 J (21 ft-lbf) 41 J (30 ft-lbf) |
| Plaques, @ -40°C (-40°F) 3.2-mm (0.125-in.) Thick | D 3763 | 33 J (24 ft-lbf) |
| Plaques, @ 23°C (73°F) 3.2-mm (0.125-in.) Thick Plaques, @ -40°C (-40°F) | D 3763 | 50 J (37 ft-lbf) |
| Mechanical Properties (Injection Molded), ISO Method | | |
| Density | ISO 1183, Method D | 1.27 g/cm ³ |
| Water Absorption, 24 h Immersion | ISO 62 | 0.13 % |
| Tensile Stress @ Break | ISO 527 | 28 MPa |
| Tensile Stress @ Yield | ISO 527 | 50 MPa |
| Elongation @ Break | ISO 527 | 100 % |
| Tensile Modulus | ISO 527 | 2100 MPa |
| Flexural Modulus | ISO 178 | 2000 MPa |
| Flexural Yield Strength | ISO 178 | 68 MPa |
| Rockwell Hardness, R-Scale | ISO 2039-2 | 109 |
| | | |

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| Processing Melt Temperature Drying Time | | 249-271°C (480-520°F) 4-6 hrs |
|---|--|---|
| Mold Temperature | | 16-38°C (60-100°F) |
| Typical Processing Conditions | | |
| Coefficient of Linear Thermal Expansion ^d | D 696 | 5.1 x 10 ⁻⁵ /°C (mm/mm-°C) (2.8 x 10 ⁻⁵ /°F (in./in°F) |
| Specific Heat @ 100°C (212°F) @ 150°C (302°F) @ 200°C (392°F) @ 250°C (482°F) @ 60°C (140°F) | DSC DSC DSC DSC DSC | 1.76 kJ/kg-K (0.42 Btu/lb-°F) 1.88 kJ/kg-K (0.45 Btu/lb-°F) 1.97 kJ/kg-K (0.47 Btu/lb-°F) 2.05 kJ/kg=K (0.49 Btu/lb-°F) 1.30 kJ/kg-K (0.31 Btu/lb-°F) |
| Glass Transition Temperature (T9) | DSC | 80°C (176°F) |
| Thermal Conductivity | C 177 | 0.21 W/m-K (1.5 Btu-in./h-ft²-°F) |
| Vicat Softening Temperature | D 1525 | 85°C (185°F) |
| Deflection Temperature @ 0.455 MPa (66 psi) @ 1.82 MPa (264 psi) | D 648 D 648 | 70°C (158°F) 64°C (147°F) |
| Thermal Properties | | |
| Impact Resistance (Puncture), Energy @ Max. Load ^h 2.5 -mm Thick Plaques @ 23°C 2.5 -mm Thick Plaques @ -40°C 3.2 -mm Thick Plaques @ 23°C 3.2 -mm Thick Plaques @ -40°C | ISO 6603-2 ISO 6603-2 ISO 6603-2 ISO 6603-2 | 40 J 35 J 44 J 36 J |
| Impact Strength, Unnotched, Type 1 Specimen ^f @ -20°C @ 23°C @ -30°C @ -40°C | ISO 180 ISO 180 ISO 180 ISO 180 | NB kJ/m² NB kJ/m² NB kJ/m² NB kJ/m² |
| Izod Impact Strength, Notched, Type 1 Specimen, Type A Notch @ 23°C @-40°C | ISO 180 ISO 180 | 6.2 kJ/m² 4.2 kJ/m² |

Notes

Disclaimer: The technical data contained on this data sheet is furnished without charge or obligation and accepted at the recipient's sole risk. This data should not be used to establish specifications limits or used alone as the basis of design. The data provided is not intended to substitute any testing that may be required to determine fitness for any specific use.

^{*}Unless noted otherwise, all tests are run at 23°C (73°F) and 50% relative humidity.

⁶Unless noted otherwise, the test method is ASTM.

^eUnits are in SI or US customary units.

d-30°C to 40°C (-22°F to 104°F)

eTest conducted at 38°C (100°F) and 100% relative humidity.

^fNonbreak as defined by ISO 180 with 4-mm specimens.

⁵Nonbreak as defined by ASTM D 4812 with 3.2-mm specimens.

^hTesting based on ISO 6603-2 using a striker diameter of 20 mm, a support and clamp diameter of 40 mm, and a velocity of 4.1 m/s

²12.7 mm (0.5 in.) dia. head, 127 mm (5 in.) dia. clamp, 660 mm (26 in.) drop