ECCtreme™ ECA 3000

Fluoroplastic Resin

Product Information

Description

ECCtreme™ ECA[1] 3000 fluoroplastic resin is a class of perfluoroplastic specifically designed for use in extreme applications requiring an operating temperature of up to 300 °C (572 °F)[2] in combination with excellent electrical properties and/or chemical resistance. ECCtreme™ ECA 3000 fluoroplastic resin was developed in response to industry demand for a melt-extrudable, high-temperature fluoroplastic resin for wire and cable applications. ECCtreme™ ECA 3000 fluoroplastic resin has been recognized as a 300 °C (572 °F) rated material per UL 746B[2] by UL. Compared with ECCtreme™ ECA 4000 fluoroplastic resin, ECCtreme™ ECA 3000 fluoroplastic resin has a lower melt-flow rate (MFR), making it ideal for constructions needing >10 mil (0.254 mm) of insulation. ECCtreme™ ECA 3000 fluoroplastic resin can also be extruded into rods or tubing, as well as into compression, injection, and transfer molded parts.

ECCtreme™ ECA 3000 fluoroplastic resin can be melt-processed using standard high-temperature fluoroplastic equipment, at standard operating speeds, and possesses physical, electrical, and chemical properties characteristic of polytetrafluoroethylene (PTFE). Its features include:

- UL rated for 300 °C (572 °F)[2]
- High melting point of 320 °C (608 °F)
- Excellent dielectric properties
- Excellent chemical and permeation resistance
- Broad wire processing window of operation

[1] Epitaxial Co-Crystallized Alloy

[2] UL Yellow Card (E54681) for 300 °C (572 °F) rating is based on UL 746B testing; for wire and cable applications, 300 °C (572 °F) rating is referenced in UL 1581 and UL 758. Not a guarantee of performance; see section "Important Notice" on p. 3

In addition, ECCtreme™ ECA 3000 fluoroplastic resin demonstrates enhanced properties (e.g., higher melting point, increased melt viscosity, improved stress crack resistance) when subjected to post-processing heat treatment as shown in the table on p. 3. This effect, known as epitaxial co-crystallization (ECC), occurs when the resin is heated between 280–300 °C (536–572 °F) for a prolonged period.

Safety Precautions

WARNING! VAPORS CAN BE LIBERATED THAT MAY BE HAZARDOUS IF INHALED.

Before using ECCtreme™ ECA 3000 fluoroplastic resin, refer to the Safety Data Sheet and the latest edition of "The Guide to the Safe Handling of Fluoropolymer Resins," published by The Society of the Plastics Industry, Inc. (www.fluoropolymers.org) or by PlasticsEurope (www.plasticseurope.org).

Open and use containers only in well-ventilated areas using local exhaust ventilation (LEV). Vapors and fumes liberated during hot processing of ECCtreme™ ECA 3000 fluoroplastic resin should be exhausted completely from the work area. Contamination of tobacco with these fluoroplastics must be avoided. Vapors and fumes liberated during hot processing that are not properly exhausted, or from smoking tobacco or cigarettes contaminated with ECCtreme™ ECA 3000 fluoroplastic resin, may cause flu-like symptoms, such as chills, fever and sore throat. This may not occur until several hours after exposure and will typically pass within about 24 hr.

Mixtures with some finely divided metals, such as magnesium or aluminum, can be flammable or explosive under some conditions.

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Storage and Handling

The properties of ECCtreme™ ECA 3000 fluoroplastic resin are not affected by storage time. Ambient storage conditions should be designed to avoid airborne contamination and water condensation on the resin when it is removed from containers.

Freight Classification

ECCtreme™ ECA 3000 fluoroplastic resin is classified as "Plastics, Materials, Pellets."

Packaging

ECCtreme™ ECA 3000 fluoroplastic resin is supplied in 25 kg, single layer, plastic bags.

Processing Guidelines

ECCtreme™ ECA 3000 fluoroplastic resin can be processed by conventional fluoroplastic melt extrusion and injection, compression, and transfer molding processes. For wire and cable applications, the processing window is large; wire constructions from AWG 30 gauge to AWG 4 gauge with 10–75 mil of insulation have been produced. ECCtreme™ ECA 3000 fluoroplastic resin processes best in a typical tubing draw-down extrusion using the same temperature profile as other fluoroplastics. Corrosion-resistant metals should be used in contact with molten fluoroplastic resin. Extruder barrel should be long, relative to diameter, to provide residence time for heating the resin.

For more detailed processing information, including recommended draw-down ratios (DDR) and molding parameters, consult your Chemours representative. For recommendations specific to transfer molding, consult the ECCtreme™ ECA addendum ("Application Processing Profile for Transfer Molding of ECA ECCtreme™ Fluoroplastics") to the "Teflon™/Tefzel™ Transfer Molding Guide."

Extrusion Equipment

ECCtreme™ ECA 3000 fluoroplastic resin is fabricated using the same melt-processing techniques as other thermoplastics. A brief description of the extrusion equipment used with ECCtreme™ ECA 3000 fluoroplastic resin is given here; for more detailed processing information, consult the Chemours bulletin "Teflon™/Tefzel™ Melt Extrusion Guide," which can be obtained from your Chemours representative. Molten fluoroplastic resins are corrosive to many metals; therefore, special corrosion-resistant materials must be used for all parts of extrusion equipment that come into contact with the melt. Corrosion is likely to occur if dead spots exist in the equipment, processing temperatures are too high, or hold-up time is too long. In addition, resin degradation will accelerate corrosion. Nickel-based alloys, such as Hastelloy[3], Inconel[4], Monel[4], and Xaloy[5], are the materials of choice. Hardened nickel plate can be used, but even small holes, chips, or cracks in the plating can compromise its performance. Chrome-plated materials are not recommended. Additional information on materials of construction can be obtained from your Chemours representative. Extruder barrels should be long, relative to diameter, to provide residence time for heating the resin to approximately 390 °C (730 °F). A 1.5- to 2.5-in extruder with a barrel length to diameter ratio of 24:1 or higher is recommended for larger diameter extruders and 30:1 for smaller diameter extruders extruding ECCtreme™ ECA 3000 fluoroplastic resin. Extruder barrels should have four to five independently controlled heater zones with temperature controllers capable of accurate operation (±0.6 °C [±1 °F]) in the temperature range of 316–425 °C (600–800 °F). Heaters should be made of cast bronze or aluminum. Controllers with proportional-integral-derivative (PID) action or equivalent are recommended. A melt thermocouple and melt pressure probe should be installed in the adapter section of the extruder. To obtain an accurate measurement, the thermocouple should protrude into the melt flow sufficient to measure its temperature, not the metal surrounding it.

Degradation of the resin during processing greatly reduces the performance of ECCtreme™ ECA 3000 fluoroplastic resin in stringent applications. Degradation is caused by excessively high melt temperatures, long residence time in the extruder, and/or excessive shear from the screw. In general, increases in the MFR greater than 10% during extrusion should be avoided. Other processing conditions that can reduce the resin's performance include melt fracture, very low or uneven melt temperatures, and the presence of hydrocarbon or silicone oils, which act as stress-crack promoters. It is strongly recommended that an ECCtreme™ ECA 3000 fluoroplastic resin-based color concentrate be selected for custom-colored applications. Use of alternative materials in the color concentrate could result in a reduction in the physical properties of ECCtreme™ ECA 3000 fluoroplastic resin, as well as decreased processibility.

[3] Hastelloy is a registered trademark of Cabot Corporation, Kokomo, IN.

[4] Inconel and Monel are registered trademarks of International Nickel Company, Huntington, WV.

[5] Xaloy is a registered trademark of Xaloy Inc., New Brunswick, NJ.

High-Speed Wire Coating Techniques

Considerable experimentation has gone into the development of ECCtreme™ ECA 3000 fluoroplastic resin. This work has resulted in a resin that when processed within the recommended processing parameters will give a reliable, consistent manufacturing process for insulating wire. ECCtreme™ ECA 3000 fluoroplastic resin is applied as a wire insulation using tubing extrusion techniques. It can be extruded using a wide range of DDRs; however, high draw-downs generally offer more favorable processing conditions. The draw ratio balance (DRB) should be in the range of 1.04–1.08. There is a complete discussion of DDR and DRB, including how they can be calculated, in the Chemours bulletin, "Teflon™/ Tefzel™ Melt Extrusion Guide." The melt temperature of the extrudate is critically important to the wire coating

Table 1: Typical Property Data for ECCtreme™ ECA 3000 Fluoroplastic Resin

Property	Test Method		Unit	Typical Value	
Upper Continuous Use Temperature[1]	UL 746B		°C (°F)	300 (572)	
				ECCtreme™ ECA 3000 Neat (As sold)	ECCtreme™ ECA 3000 After Heat Treatment[2]
Thermal					
Melt-Flow Rate	ISO 12086	ASTM D1238	g/10 min	7	1–2
Melting Point		ASTM D4591	°C (°F)	317 (603)	322 (612)
Thermal Conductivity 50 °C (122 °F) 100 °C (212 °F)		ASTM C518	W/mK	 0.188 0.198	 0.180 0.193
Mechanical					
Tensile Strength 23 °C (73 °F) 200 °C (392 °F) 300 °C (572 °F)	ISO 12086	ASTM D1708	MPa (psi)	 20 (2,870) 8 (1,220) 2 (342)	 16 (2,350) 9 (1,300) 3 (388)
Ultimate Elongation 23 °C (73 °F) 200 °C (392 °F) 300 °C (572 °F)	ISO 12086	ASTM D1708	%	 335 430 585	 290 505 660
Tensile Modulus 23 °C (73 °F) 200 °C (392 °F) 300 °C (572 °F)	ISO 12086	ASTM D1708	MPa (psi)	 447 (64,800) 50 (7,300) 10 (1,450)	 567 (82,300) 62 (8,900) 17 (2,470)
MIT Folding Endurance[3]	—	ASTM D2176[4]	Cycles	15,000	140,000
Hardness Durometer	ISO 868	ASTM D2240	Shore D	D55	D55
Impact Strength, Notched Izod, –41 °C (–42 °F)	ISO 180	ASTM D256	ft·lb/in	No Break	No Break
Impact Strength, Unnotched Izod, 100 °C (212 °F)	ISO 180	ASTM D4812	ft·lb/in	No Break	No Break
Electrical					
Dielectric Constant, 23 °C (73 °F) 100 Hz 1 MHz	IEC 250	ASTM D150	—	 2.05 2.05	 2.05 2.05
Dissipation Factor, 23 °C (73 °F) 100 Hz 1 MHz	IEC 250	ASTM D150	—	 <0.00005 <0.00015	 <0.00005 <0.00009
Other					
Flammability Classification[5]	—	UL 94		V-0	V-0

Note: Typical properties are not suitable for specification purposes.

[1] Upper continuous use temperature is based on UL 746B testing; see UL E54681.

[2] Typical heat treatment indicates 7 days at 300 °C (572 °F).

[3] Depending on fabrication conditions.

[4] Historical standard.

[5] These results are based on laboratory tests under controlled conditions and do not reflect performance under actual fire conditions; current rating is a typical theoretical value.

process. Melt temperature cannot be reliably predicted by temperature profiles, as it will also vary with throughput. Melt temperature should be independently measured by an in-stream probe at the adapter or some other proven reliable means. An electronic wire preheater (or in-line wire draw annealer), located as close to the crosshead as possible, is recommended for preheating the wire to 105–176 °C (220–350 °F). A controlled vacuum is required at the rear of the crosshead to adjust the melt cone to the desired length. Experiments have shown cone lengths from 38–57 mm (1.5–2.25 in) yield satisfactory results with 80–100 DDR. Stationary pulleys should be located on both sides of the crosshead to reduce wire flutter. The wire should pass through the crosshead without touching the inside of the head or the extrusion tooling. Consideration should be given to the use of a short, hot water bath at the extruder end of the trough. Processing conditions will depend on the equipment used, the product being made, and the production rates needed. Further guidance is available from your Chemours representative.

IMPORTANT NOTICE

ECCtreme™ ECA 3000 fluoroplastic resin targets extreme applications that require properties beyond the operating limits of typical perfluoroplastics. As a result, the performance characteristics and other properties of this product are not guaranteed, and the User is responsible for evaluating and determining whether this Chemours product is suitable and appropriate for a particular use and intended application. The conditions of evaluation, selection, and use of the Chemours product can vary widely and affect the use and intended application of the Chemours product. Because many of these conditions are uniquely within the User's knowledge and control, User must evaluate and determine whether the Chemours product is suitable and appropriate for a particular use and intended application.

For more information, visit ecctreme.chemours.com

For sales and technical support contacts, visit ecctreme.chemours.com/globalsupport

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