Tefzel™ ETFE HT-2195

Fluoroplastic Resin

Product Information

Description

Tefzel™ ETFE HT-2195 is a premium-grade fluoroplastic resin designed for use in rotational molding. To be effective as a rotational molding resin, Tefzel™ ETFE HT-2195 is a free-flowing powder with controlled particle size, shape, and size distribution.

The properties of Tefzel™ ETFE HT- 2195 in molded form are similar to other grades of Tefzel™ fluoroplastic resin. Table 1 shows typical property data for Tefzel™ ETFE HT-2195.

Rotational molding is a favored process for making hollow parts (particularly large parts) or for parts with complex geometries. Depending on part design and processing conditions, Tefzel™ ETFE HT-2195 can also be used to rotoline items; whereby, the Tefzel™ binds to the inner surface of the part to form a lining.

Properly processed rotational moldings made from Tefzel™ ETFE HT-2195 provide the superior properties typical of the fluoroplastic resins: retention of properties after service at 150 °C (302 °F), useful properties at –100 °C (–148 °F), and chemical inertness to most industrial chemicals and solvents. Molded products have excellent stiffness and high ultimate elongation.

Statements, or data, regarding behavior in a flame situation are not intended to reflect hazards presented by this or any other material when under actual fire conditions.

Typical End Products

Tefzel™ ETFE HT-2195 is ideal for many end products for fluid handling in chemical processing industries, including pump housings, vessels, columns, elbows, tees, and pipe sections with unusual shapes. In addition, any hollow structure with internal contours that permits uniform coating by powder flow is a candidate for lining, provided it can withstand high temperatures.

Processing

For rotational molding, Tefzel™ ETFE HT-2195 powder is placed inside a hollow metal structure that is slowly rotated biaxially and heated above the melting point of the powder (253 °C [487 °F]).

Frequently, the mold or part containing the resin is preheated (with rotation) to a temperature just below the melting point of the resin. Then, the temperature is raised to above the melting point of the resin to allow for formation of the lining. As the powder melts, it is deposited on the inner surface of the structure. Powder flow and distribution are critical, because the high melt viscosity of Tefzel™ limits the lateral flow of melted resin. A cooling step then causes the molten resin to solidify and densify in place, creating an integral lining or a removable, hollow plastic part. A typical thickness is about 2.3 mm (0.090 in). A thickness as high as 6.4 mm (0.250 in) has been molded.

Good moldings and linings require close attention to many details, such as choice of metals for the mold, preparation of the metal surface, rate of rotation, venting, and heating/cooling cycles. The equipment must operate at high temperature and resist thermal shock.

The times and temperatures of the preheat, fusion, and cooling cycles will vary according to the part, oven, and choice of cooling method, etc. For a wall/lining thickness of 2.3 mm (0.090 in), the following times and temperatures are typical.

Preheat	5 min at 250 °C (482 °F)
Fusion	60 min at 288 °C (550 °F)
Cooling	(ambient air)

Within certain limits, the fusion temperature can be increased to permit shorter cycle times. The minimum time/temperature conditions can be defined as those times, at a specified temperature, that just allow for formation of bubble-free parts and linings. A typical minimum time/temperature relationship for Tefzel™ ETFE HT-2195 is:

Temperature		
°C	°F	Time, min
282	540	100
288	550	60
293	560	50

Tefzel™ is relatively dense, compared to other resins. As a guide, to form a 2.3-mm (0.090-in) lining on a part with an interior surface of 0.093 m^2 (1 ft^2), use 360 g (0.80 lb) of Tefzel™ ETFE HT-2195.

Rotations for major and minor axes that are conventionally used for rotocasting other polymer resins have been applied without modification to Tefzel™ ETFE HT-2195. For example, 8 rpm major, 9 rpm minor for boxes, cylindrical pipe sections, tees, spool pieces, etc.; 8 rpm major, 10 rpm minor for spheres and ellipsoids. These conventional rotations have given acceptable fluoroplastic resin distribution and casting thicknesses.

Molds must be vented during the rotational molding/rotolining cycle. For best results, use an appropriate tube as a vent with glass wool in the tube to restrict contaminants from entering the part.

Safety Precautions

Before using Tefzel™ ETFE HT-2195, 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, or from smoking tobacco or cigarettes contaminated with Tefzel™ ETFE HT-2195, may cause flu-like symptoms (chills, fever, sore throat) that may not occur until several hours after exposure and typically pass within about 24 hr. Vapors and fumes liberated during hot processing should be exhausted completely from the work area. Contamination of tobacco with polymers should be avoided.

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

Substrate Considerations

Because the molding/lining process involves molten resin against the interior part wall, any surface structure on this part wall will tend to be translated to the part. Therefore, it is recommended to make the mold surface as uniform as possible by removing scratches, burrs, etc. Grit blasting with a coarse grit (e.g., 24-grit aluminum oxide for mild steel) will enhance surface uniformity.

Storage and Handling

Ambient storage conditions should be designed to avoid airborne contamination and the formation of water condensation on the resin when it is removed from containers.

Packaging

Tefzel™ ETFE HT-2195 is packaged in 25-kg (55-lb) drums net weight.

Table 1. Typical Property Data for Tefzel™ ETFE HT-2195 Fluoroplastic Resin

Property	Test Method*	Unit	Value
Thermal			
Nominal Melting Point	D3418	°C (°F)	253 (487)
Flow Rate	D3159	g/10 min	20
Upper Service Temperature**		°C (°F)	150 (302)
Mechanical			
Linear Coefficient of Expansion, 0–100 °C (32–212 °F)	D696	mm/mm/°C (in/in/°F)	9×10^{-5} (5×10^{-5})
Specific Gravity	D792	%	1.72
General			
Water Absorption, 24 hr	D570	%	<0.03
Weather and Chemical Resistance	—	—	Outstanding
Average Particle Size	—	µm	270
Bulk Density	—	g/L	750

*ASTM method, unless otherwise specified

**The upper service temperature is based on heat-aging tests and represents the temperature at which tensile strength and elongation would be expected to be diminished 50% after 10,000 hr thermal aging. Upper service temperatures above 150 °C (302 °F) may be feasible, depending on such factors as chemical exposure and support from the substrate. Particularly when considering uses of Tefzel™ ETFE HT-2195 above 150 °C (302 °F), perform preliminary testing to verify the acceptability.

Typical properties are not suitable for specification purposes.

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