Teflon™ PFA 451HP

Molding and Extrusion Resin

Product Information

For inventory control purposes, product name may be followed by an X.

Products labeled PFA 451HP and PFA 451HP X are equivalent, and all information in this document is applicable to both.

Typical Applications

Applications for Teflon™ PFA 451HP include tubing, unsupported pipe linings for the production of ultra-pure chemicals, semiconductor fluid handling components, and high-performance chemical delivery systems where purity in the parts-per-billion range is needed. Teflon™ PFA 451HP is preferred in applications where surface smoothness and the highest levels of chemical permeation resistance are required.

Description

Teflon™ PFA 451HP is a special purpose fluoroplastic resin available in pellet form. This resin is a chemically modified form of Teflon™ PFA 350 that combines many of the advantages of the parent resin with several additional benefits. Teflon™ PFA 451HP exhibits improved surface smoothness achieved through minimization of spherulite size, enhanced chemical permeation resistance achieved by increasing its crystallinity from Teflon™ PFA 450HP, enhanced purity, and improved thermal stability while processing.

Teflon™ PFA 451HP is a relatively low melt flow rate (typical MFR of 2), premium resin with the lowest level of extractables designed to meet ultra-high purity requirements. An enhanced resistance to environmental stress-cracking and chemical permeation make Teflon™ PFA 451HP a preferred resin when extended service is required in hostile environments involving chemical, thermal, and mechanical stress. Additionally, the enhanced purity of Teflon™ PFA 451HP makes it suitable for applications that require improved color, lower extractable fluorides, and freedom from other foreign materials. This product contains no additives and is designed for hostile chemical environments where purity in the parts-per-billion range is needed. Examples are in semiconductor manufacture, fluid handling systems for industry or life sciences, and instrumentation for precise measurements of fluid systems. Compared to other thermoplastics, the high melt strength and thermal stability of Teflon™ PFA 451HP can be used to improve processing rates, combining the processing ease of conventional thermoplastics with many properties similar to those of polytetrafluoroethylene.

Properly processed products made from neat Teflon™ PFA 451HP resin provide the superior properties characteristic of fluoroplastic resins: chemical inertness, exceptional dielectric properties, heat resistance, toughness and flexibility, low coefficient of friction, non-stick characteristics, negligible moisture absorption, low flammability, performance at temperature extremes, and excellent weather resistance.

In a flame situation, products of Teflon™ PFA 451HP resist ignition and do not promote flame spread. When ignited by flame from other sources, their contribution of heat is very small and added at a slow rate with very little smoke.

Processing

Teflon™ PFA 451HP can be processed by conventional melt extrusion, and by injection, compression, transfer, and blow-molding processes. High melt strength and heat stability permit the use of relatively large die openings and high temperature draw-down techniques that increase production rates. Reciprocating screw injection molding machines are preferred. 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 to approximately 390 °C (730 °F). For more detailed processing information, including recommended draw-down ratios, consult your Chemours representative.

Safety Precautions

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

Before using Teflon™ PFA 451HP 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 Teflon™ PFA 451HP should be exhausted completely from the work area. Contamination of tobacco with these polymers must be avoided. Vapors and fumes liberated during hot processing that are not properly exhausted, or from smoking tobacco or cigarettes contaminated with Teflon™ PFA 451HP, 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 hours. Mixtures with some finely divided metals, such as magnesium or aluminum, can be flammable or explosive under some conditions.

Food Contact Compliance

Properly processed products made from Teflon™ PFA 451HP resin can qualify for use in contact with food in compliance with FDA 21 CFR 177.1550 and European Regulation (EU) No. 10/2011. For details and information, please contact your Chemours representative.

Storage and Handling

Special product isolation and packaging procedures are used by Chemours to eliminate external contamination of Teflon™ PFA 451HP resin. Processors also must avoid contamination for successful production of high purity products. The properties of Teflon™ PFA 451HP 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 Classifications

Teflon™ PFA 451HP resin is classified as "Plastics, Materials, Pellets."

Packaging

Teflon™ PFA 451HP is supplied as pellets and is available in 25-kg multilayer bags with an integral polyethylene liner.

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Table 1: Typical Property Data for Teflon™ PFA 451HP

Property	Test Method		Unit	Typical Value
GENERAL				
Melt Flow Rate	ISO 12086	ASTM D3307	g/10 min	2
Melting Point	—	ASTM D4591	°C (°F)	305 (581)
Specific Gravity	—	ASTM D792	—	2.15
Critical Shear Rate, 372 °C (702 °F)	—	—	1/s	12
MECHANICAL				
Tensile Strength	ISO 12086	ASTM D3307	MPa (psi)	
23 °C (73 °F)				33 (4,800)
200 °C (392 °F)				18 (2,600)
Ultimate Elongation	ISO 12086	ASTM D3307	%	
23 °C (73 °F)				360
200 °C (392 °F)				500
Flexural Modulus	ISO 178	ASTM D790	MPa (psi)	
23 °C (73 °F)				410 (60,000)
200 °C (392 °F)				54 (7,800)
MIT Folding Endurance (0.20 mm, 8 mil film)	—	ASTM D2176‡	Cycles	300,000*
Hardness Durometer	ISO 868	ASTM D2240	—	D55
ELECTRICAL				
Dielectric Strength, Short Time, 0.25 mm (0.010 in)	IEC 243	ASTM D149	kV/mm (V/mil)	80 (2,000)
Dielectric Constant, 1 MHz (106 Hz)	IEC 250	ASTM D150	—	2.03
Dissipation Factor, 1 MHz (106 Hz)	IEC 250	ASTM D150	—	<0.0002
Volume Resistivity	ISO 1325	ASTM D257	ohm·cm	1018
OTHER				
Water Absorption, 24 hr	—	ASTM D570	%	<0.03
Weather and Chemical Resistance	—	—	—	Outstanding
Limiting Oxygen Index	ISO 4589	ASTM D2863	%	>95
Continuous Service Temperatureg	—	—	°C (°F)	260 (500)
Flammability Classification†	—	UL 94	—	V-0

* Depending on fabrication conditions

‡ Historical standard

ᵍ Definition of continuous service temperature: The continuous service temperature is based on accelerated heat-aging tests, and represents the temperature at which tensile strength and ultimate elongation retain 50% of the original values after 20,000 hr thermal aging. Continuous service temperature above 260 °C (500 °F) may be feasible, depending on such factors as chemical exposure, support from the substrate, etc. When considering uses of Teflon™ PFA 451HP above 260 °C (500 °F), preliminary testing should be done to verify suitability.

† 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.

Note: Teflon™ PFA 451HP meets the requirements of ASTM D3307, Type II

Typical properties are not suitable for specification purposes.

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.

HOW TO USE THE TEFLON™ BRAND NAME WITH YOUR PRODUCT

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