DuPont Fluoroproducts

DuPont™ Teflon® PFA 440 HP

fluoropolymer resin

Extrusion and Molding Resin

Brand

Teflon® is a registered trademark of DuPont for its brand of fluoropolymer resins, which can only be licensed by DuPont for use in approved applications. Customers who wish to use the *Teflon*® trademark in connection with DuPont PFA products under license from DuPont should contact (800) 262-2745. Without a license, customers may not identify their product as containing *Teflon*®, but may refer to the resin as PFA 440 HP.

Description

DuPont™ *Teflon*® PFA 440 HP fluoropolymer is a special purpose resin available in clear, 2.5-mm (0.1-in.) pellets. This resin is a chemically modified form of *Teflon*® PFA 340 that combines many of the benefits of the parent resin with several new ones. The additional benefits may include enhanced purity, improved thermal stability while processing, and chemical inertness, for example, to ozonated fluids.

The enhanced purity of *Teflon*® PFA 440 HP 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. **Table 1** shows the typical property data for *Teflon*® PFA 440 HP.

The improved thermal stability of *Teflon*® PFA 440 HP results in reduced amounts of bubbles in final parts and decreased corrosion of processing equipment. *Teflon*® PFA 440 HP combines the processing ease of conventional thermoplastics with properties similar to those of polytetrafluoroethylene.

Properly processed products made from neat *Teflon*® PFA 440 HP resin provide the superior properties typical of fluoropolymer resins: retention of properties after service at 260°C (500°F), useful properties at –196°C (–320°F), and chemical inertness to nearly all industrial chemicals and solvents. Dielectric properties are excellent. Molded products have moderate stiffness and high ultimate elongation.

Three categories (A, B, and D) of *Teflon*® PFA 440 HP resin covering a broad range of melt flow rates (MFR) are available. The low MFR resin provides a higher degree of stress crack resistance while the high MFR resin is easier to process.

In a flame situation, products of *Teflon*® PFA 440 HP resist ignition and do not themselves 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.

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.

The miracles of science®

Typical End Products

Applications for *Teflon*® PFA 440 HP include tubing; unsupported pipe or pipe linings for production of ultrapure chemicals; semiconductor component and fluid handling systems for high-performance chemical filters.

Processing

Teflon® PFA 440 HP can be processed by conventional melt extrusion and by injection, compression, and 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 resin. Extruder barrel should be long, relative to diameter, to provide residence time for heating the resin to approximately 390°C (730°F).

Safety Precautions

WARNING!

VAPORS CAN BE LIBERATED WHICH MAY BE HAZARDOUS IF INHALED.

Before using *Teflon*® PFA 440 HP, read the Material Safety Data Sheet and the detailed information in the "Guide to the Safe Handling of Fluoropolymer Resins," latest edition, published by the Fluoropolymers Division of The Society of the Plastics Industry—available from DuPont.

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 *Teflon*® PFA 440 HP, may cause flu-like symptoms (chills, fever, sore throat) that may not occur until several hours after exposure and typically pass within about 24 hours. 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.

Storage and Handling

Special product isolation and packaging procedures are used by DuPont to eliminate external contamination of *Teflon*® PFA 440 HP resin. Processors also must avoid contamination for successful production of high-purity products.

The properties of *Teflon*® PFA 440 HP resins 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

Teflon® PFA 440 HP, when shipped by rail or express, is classified "Plastics, Synthetic, O.T.L., NOIBN." Resin shipped by truck is classified "Plastics, Materials O.T.F.C.E. or S. Granules."

Packaging

Teflon® PFA 440 HP resin is packaged in 45.4-kg (100-lb) quantities in drums, each containing two 22.7-kg (50-lb) polyethylene bags. Bulk containers of 726 kg (1,600 lb) will be considered on special request. Special packages containing 2.3 kg (5 lb) and 11.3 kg (25 lb) are also available.

Table 1
Typical Property Data for DuPont™ *Teflon*® PFA Fluoropolymer Resin Grade 440 HP

Property	ASTM Test Method	Unit	Nominal Value
Thermal			
Nominal Melting Point	D3418	°C (°F)	302–310 (575–590)
Coefficient of Linear Thermal Expansion, 21–100°C (70–212°F) 100–149°C (212–300°F) 149–208°C (300–408°F)	D696	mm/mm/°C (in./in./°F) mm/mm/°C (in./in./°F) mm/mm/°C (in./in./°F)	14×10^{-5} (7.6×10^{-5}) 17×10^{-5} (9.2×10^{-5}) 21×10^{-5} (11.5×10^{-5})
Upper Service Temperature	—	°C (°F)	260 (500)
Flow Rate	D3307	g/10 min	12–15 (B) 14–19 (A) 18–21 (D)
Mechanical			
Tensile Strength, 23°C (73°F) 250°C (482°F)	D3307	MPa (psi) MPa (psi)	25 (3,600) 14 (1,800)
Tensile Yield Strength, 23°C (73°F)	D3307	MPa (psi)	13.8 (2,000)
Ultimate Elongation, 23°C (73°F) 250°C (482°F)	D3307	% %	300 480
Flexural Modulus, 23°C (73°F) 250°C (482°F)	D790	MPa (psi) MPa (psi)	590 (85,000) 55 (8,000)
Specific Gravity	D792	—	2.12–2.17
Hardness Durometer	D2240	—	D55
MIT Folding Endurance 0.18–0.20 mm (0.007–0.008 in.) 0.50 mm (0.020 in.)	D2176	cycles	 15,000* 10,000*
Electrical			
Dielectric Strength Short Time, 0.25 mm (0.010 in.)	D149	kV/mm (V/mil)	80 (2,000)
Dielectric Constant, 60–10^6 Hz	D150	—	2.03
Dissipation Factor, 60–10^6 Hz	D150	—	0.0001
Volume Resistivity	D257	ohm.cm	10^{18}
General			
Water Absorption, 24 hr	D570	%	<0.03
Weather and Chemical Resistance	—	—	Outstanding
Limiting Oxygen Index	D2863	%	>95

Note: Typical properties are not suitable for specification purposes.

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* Depending on equipment and conditions used.

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