



# Teflon®

Fluoropolymer

## Teflon® PFA 450 HP Moulding and extrusion resin

### Typical applications

Applications for Teflon® PFA 450 HP include extruded tubing; unsupported pipe or pipe linings used in the production of ultra pure chemicals; component for the semiconductor industry and fluid handling systems.

### Description

Teflon® PFA 450 HP is a special purpose resin available in clear 2,5 mm pellets. This resin is a chemically modified form of Teflon® PFA 350 that combines many of the benefits of the parent resin with several new ones. The additional benefits are enhanced purity and improved thermal stability while processing. Similar to Teflon® PFA 350, this resin has a relatively low melt flow rate, high flex life and enhanced resistance to environmental stress cracking compared to most other grades of Teflon® PFA.

The enhanced purity of Teflon® PFA 450 HP makes it suitable for applications that require improved colour, 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. Grade 450 HP is preferred when extended service is required in hostile environments involving chemical, thermal and mechanical stress.

The improved thermal stability of Teflon® PFA 450 HP results in reduced amounts of bubbles in final parts and lower amounts of corrosion from processing equipment. Teflon® PFA 450 HP combines the processing ease of conventional thermoplastics with properties similar to those of polytetrafluoroethylene.

Properly processed products made from virgin Teflon® PFA 450 HP resin provide the superior properties typical of the fluoropolymer resins: retention of physical properties after service at 260°C, useful properties at -196°C and chemical inertness to nearly all industrial chemicals and solvents. Dielectric properties are excellent. Moulded products have moderate stiffness and high ultimate elongation.

In a flame situation, products made of Teflon® PFA 450 HP resist ignition and do not themselves promote flame spread. When ignited by flame from other sources, the contribution of heat is very small and added at a slow rate with very little smoke. Teflon® PFA 450 HP meets the requirements of ASTM D3307, type II.

### Processing

Teflon® PFA 450 HP may be converted by conventional melt extrusion and by injection, compression, transfer and blow moulding processes. High melt strength and heat stability permit the use of relatively large die openings and high temperature draw-down techniques which increase production rates. Reciprocating screw injection moulding machines are preferred. Corrosion resistant metals should be used in contact with molten resin. Extruder barrel should be long, L/D ratio 20:1 to 25:1, to provide residence time for heating the resin to approximately 390°C.

### Safety precautions

Industrial experience has proven that adequate ventilation, in properly maintained processing and handling areas, will eliminate known hazards to personnel. Resin containers should be opened and used in well-ventilated areas.

Equipment used to process at melt temperatures should be provided with local exhaust ventilation to completely remove all fumes and vapours from the processing area. In addition, care should be exercised to avoid the contamination of cigarettes and other forms of smoking tobacco when using fluoropolymer resins. Before using fluoropolymer resins, read the Material Safety Data Sheet (MSDS) and the detailed information in "Guide for the safe handling of Fluoropolymer Resins" published by APME. Copies can be obtained through your local DuPont representative.

Finished devices made of Teflon® PFA 450 HP can be used at temperatures up to 260°C although for temperatures of 200°C or higher, adequate ventilation or containment in a closed system is recommended.

### Storage and handling

In addition to the chemical modifications, which establishes high purity, special product isolation and packaging procedures are used by DuPont to prevent external contamination of Teflon® PFA 450 HP resin. Processors also must avoid contamination for successful production of high purity products.

The properties of Teflon® PFA 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.

### Packaging

Teflon® PFA 450 HP resin is packaged in drums of 45,4 kg, each containing two 22,7 kg bags. Material should be ordered in multiples of 45,4 kg.

## Typical Property Data for Teflon® PFA 450 HP

Property	Test method <sup>1)</sup>		Unit	Typical value	
<b>General</b>					
Melt flow rate (MFR 372/5,0)	ISO 12086	D 3307	g/10 min	2,0	
Specific gravity	ISO 1183	D 792	–	2,12-2,17	
<b>Mechanical</b>					
Tensile strength	23°C	ISO 12086	D 638	MPa	28
	250°C			MPa	12
Tensile strength at yield	23°C	ISO 12086	D 638	MPa	13,9
Ultimate elongation	23°C	ISO 12086	D 638	%	300
	250°C			%	500
Flexural modulus	23°C	ISO 178	D 790	MPa	625
	250°C			MPa	69
Hardness, Shore durometer		ISO 868	D 2240	–	D 55
MIT folding endurance (0,18-0,20 mm film)			D 2176	cycles	200000*
<b>Electrical</b>					
Relative permittivity (60 Hz to 1 MHz)	IEC 250	D 150	–	2,05	
Dissipation factor, tg δ (60 Hz to 1 MHz)	IEC 250	D 150	–	0,0001	
Dielectric strength, short time (0,25 mm film)	IEC 243	D 149	kV/mm	>80	
Volume resistivity	IEC 93	D 257	Ω · m	>10 <sup>16</sup>	
<b>Thermal</b>					
Melting point		D 4591/D 3418	°C	302-310	
Continuous service temperature <sup>2)</sup>		–	°C	260	
Flammability classification <sup>3)</sup>		UL 94	–	94 V-0	
Limiting Oxygen Index	ISO 4589	D 2863	%	>95	
Coefficient of linear thermal expansion	21-100°C	D 696	K <sup>-1</sup>	140 · 10 <sup>-6</sup>	
	100-150°C		K <sup>-1</sup>	180 · 10 <sup>-6</sup>	
	150-200°C		K <sup>-1</sup>	220 · 10 <sup>-6</sup>	
<b>Other</b>					
Chemical resistance		D 543		Excellent	
Water absorption, 24 h		D 570	%	<0,03	
Weathering		–	–	Excellent	

\* Depending on fabrication conditions.

**Note:** Teflon® 450 HP meets the requirements of ASTM D 3307, Type II.  
Typical properties are not suitable for specification purposes.

1) ASTM unless otherwise specified.

2) Definition of continuous service temperature:

The continuous service temperature is based on accelerated heat-ageing tests, and represents the temperature at which tensile strength and ultimate elongation retain 50% of the original values, after 20000 h thermal ageing. Continuous service temperature above 260°C, may be feasible, depending on such factors as chemical exposure, support from the substrate, etc. Particularly when considering uses of Teflon® PFA 450 HP above 260°C, preliminary testing should be done to verify suitability.

3) These results are based on laboratory tests, under controlled conditions, and do not reflect performance under actual fire conditions.

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**Caution:** Do not use in medical applications involving permanent implantation in the human body. For other medical applications, see "DuPont Medical Caution Statement", H-51459.



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