Teflon™ AF

Amorphous Fluoroplastic Resins

Product Information

Product names may be followed by an X. Products labeled AF 1600 and AF 1600 X are equivalent, as are AF 2400 and AF 2400 X.

Description

Teflon™ AF is a family of amorphous fluoroplastics. These materials are similar to other amorphous polymers in optical clarity and mechanical properties, including strength. They also resemble fluoroplastics in their performance over a wide range of temperatures, outstanding electrical properties, and chemical resistance. They are distinct from other fluoroplastics in that they are soluble in selected solvents and have high gas permeability, high compressibility, high creep resistance, and low thermal conductivity. They have the lowest dielectric constant and refractive index of any known fluoroplastic.

Processing

Teflon™ AF can be compression molded, injection molded, or extruded. Through these processes, various solid shapes can be formed using the product. Forms include rods, tubes, bars, and sheet of various thicknesses.

In addition, Teflon™ AF can be dissolved in certain perfluorinated solvents for the production of highly uniform thin films and coatings. Methods used to produce such forms include spin, spray, and dip coating.

Typical molding temperatures for Teflon™ AF 1600 range from 240 to 275 °C (464 to 527 °F); for Teflon™ AF 2400, the range is 340 to 360 °C (644 to 680 °F). The polymer begins to decompose above 360 °C (680 °F), so processing above that temperature should be avoided. Corrosion-resistant tooling is recommended, as it is for Teflon™ FEP and PFA fluoroplastic resins.

Electrical Applications

In electronics, Teflon™ AF may be used in optoelectronic devices, where its optical clarity, temperature resistance, and dielectric properties are beneficial. It is essentially transparent to microwaves and can function as a "window" for high frequency antennas. The low dielectric constant and dissipation factor may be advantageous in the construction of electronic devices, including special circuit boards and hybrid devices.

Some specific uses are:

- Teflon™ AF has the ability to be cast from solution into a thin film that is transparent and stable to very short wavelength radiation (deep UV). This makes it an excellent candidate for use in pellicles. It has superior electrical properties, particularly for low signal distortion at high frequencies.
- Chemically resistant coating—where its low dielectric constant and electrical absorption coefficient are important.
- Its moldability plus its low thermal expansion coefficient make it an excellent candidate for connectors.
- It can also be used as a sight window in harsh chemical environments.

Optical Applications

Teflon™ AF can be used as a low-refractive index coating or covering for optical devices, including those that must operate over a wide temperature range and in chemically aggressive environments. Teflon™ AF offers a high level of transmission throughout the optical spectrum from infrared through ultraviolet.

Some specific uses are:

- In fiber optics as a low refractive index, high temperature cladding material over silica, methacrylates, and polycarbonates.
- Its optical properties of high transmission and broad spectrum transmission make it practical as an anti-reflective coating for high energy laser applications.
- The properties of high temperature tolerance, chemical resistance, high transmission, and mechanical strength make the material ideal for use as a window. It would also be good for optical sensing and diagnostic devices.
- The low refractive index combined with its other optical properties make Teflon™ AF useful as an anti-reflective coating. It is also good as a protective coating, where optical transmission is important.

Typical Property Data for Teflon™ AF Resins

Property	ASTM Method	Unit	Grade 1600	Grade 2400
Electrical				
Dielectric Constant	D150		1.93	1.90
Dissipation Factor	D150		0.0001–0.0002	0.0001–0.0003
Dielectric Strength	D149	kV/0.1 mm	2.1	1.9
Optical				
Optical Transmission	D1003	%	>95	>95
Refractive Index	D542		1.31	1.29
ABBE Number			92	113
Mechanical				
Yield Strength		MPa		
23 °C (73 °F)			27.4 ± 1.0	26.4 ± 1.9
220 °C (428 °F)			6.7 ± 5.9	8.7 ± 4.0
Tensile Strength	D638	MPa		
23 °C (73 °F)			26.9 ± 1.5	26.4 ± 1.9
220 °C (428 °F)			7.7 ± 6.1	4.2 ± 1.8
Elongation at Break	D638	%		
23 °C (73 °F)			17.1 ± 5.0	7.9 ± 2.3
220 °C (428 °F)			89.3 ± 13.1	8.4 ± 4.1
Tensile Modulus	D638	GPa	1.6	1.5
Flexural Modulus	D790	GPa		
23 °C (73 °F)			1.8 ± 0.1	1.6 ± 0.1
220 °C (428 °F)			1.0 ± 0.1	0.7 ± 0.1
Hardness				
Rockwell, 23 °C (73 °F)	D785		103	97.5
Durometer, Shore D	D1706			
23 °C (73 °F)			77	75
220 °C (428 °F)			70	65
Impact Strength	Notched Izod	N	—	—
Deflection Temperature	D648	°C (°F)		
66 psi			156 (313)	200 (392)
264 psi			154 (309	174 (345)
Chemical				
Contact Angle with Water	D570	Degrees	104	105
Critical Surface Energy		Dynes/cm	15.7	15.6
Taber Abrasion		cc/2000 cycles	0.107	0.2
Chemical Resistance				
Water Absorption		%	<0.01	<0.01
Gas Permeability				
H_2O		Barrer	1142	4,026
O_2		Barrer	340	990
N_2		Barrer	130	490
CO_2		Barrer		2800
Other				
T_g	D3418	°C (°F)	160 (320) ± 5	240 (464) ± 10
Specific Gravity	D792		1.78	1.67
Melt Flow Rate (5.0 kg)	D1238	g/10 min	4 ±2 (at 260 °C [500 °F])	13 ±4 (at 360 °C [680 °F])
Volume Coefficient of Thermal Expansion	E831	ppm/°C (°F)	260 (500)	301 (572)

Mechanical Applications

Teflon™ AF exhibits excellent mechanical and physical properties at end-use temperatures up to the glass transition temperature. Teflon™ AF also demonstrates good dimensional stability, reduced mold shrinkage, a smooth surface, and rigidity at high use temperatures. These characteristics, coupled with machinability and processing versatility, make Teflon™ AF an excellent candidate for specialized chemical and industrial applications.

Some specific uses are:

- For chemically resistant molded parts and objects
- Sight windows in harsh chemical environments
- Connectors

Chemical Applications

As a fluoroplastic, Teflon™ AF has high resistance to chemical attack. Teflon™ AF can be fabricated into films, coatings, and smooth surfaced products, and also molded into high performance mechanical parts that can function in severe exposure conditions of high temperature, harsh chemicals, and destructive environmental agents. Teflon™ AF is an excellent candidate for the demanding and stringent conditions that exist in the electronic, chemical, military, and aerospace industries.

Some specific uses are:

- As a protective coating—where chemical resistance as well as the ability to withstand high temperatures is important: pipes and fittings; conveyor belts; sheets that are in contact with chemicals.
- Chemical containers (for specialty applications)—where it is necessary that the container not react with the contents and optical transmission is important: stopper coatings; bottles (can be shaped).
- Process windows—where optical properties as well as chemical inertness are important.
- Membranes and/or separators—the high gas permeability and chemical inertness make it an ideal candidate.
- Its low surface energy makes a good release surface.
- Its high gas permeability makes it an excellent separation medium for gases and liquids.

Safety Precautions

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

Before using Teflon™ AF, read the Safety Data Sheet and detailed information in the latest edition of the "Guide to the Safe Handling of Fluoropolymer Resins", published by the Fluoropolymers Division of The Society of the Plastics Industry (www.fluoropolymers.org) or by PlasticsEurope (www.plasticseurope.org).

Handling Practices

Teflon™ AF resins may contain parts per million of residual hexafluoroacetone (HFA). Because HFA hydrates are readily absorbed through the skin, it is necessary to avoid skin contact with the resin during processing. Chemours recommends the use of protective gloves when handling resin during manufacturing operations. Residual gases (including HF, COF_2, CO, and HFA) that diffuse from Teflon™ AF resins, even at room temperature, may be harmful. To avoid exposure, all resin containers should be opened and used only in well-ventilated areas using local exhaust ventilation (LEV).

HOW TO USE THE TEFLON™ BRAND NAME WITH YOUR PRODUCT

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Replaces: K-26985
C-10233 (9/16)