

PTFE-AF poly(tetrafluoroethylene-co-2,2-bis(trifluoromethyl)-4,5-difluoro-1,3-dioxole)

PARAMETER	UNIT	VALUE	REFERENCES
GENERAL			
Common name	-	poly(tetrafluoroethylene-co-2,2-bis(trifluoromethyl)-4,5-difluoro-1,3-dioxole), Teflon AF	
ACS name	-	poly[4,5-difluoro-2,2-bis(trifluoromethyl)-1,3-dioxole-co-tetrafluoroethylene]	
Acronym	-	PTFE-AF	
CAS number	-	37626-13-4; 187475-17-8	
SYNTHESIS			
Monomer(s) structure	-	$ \begin{array}{c} \text{F} \\ \\ \text{F}_2\text{C} - \text{CF}_2 \\ \quad \\ \text{F} \quad \text{O} \\ \quad \\ \text{F} \quad \text{O} \\ \\ \text{F} \end{array} $	
Monomer(s) CAS number(s)	-	116-14-3; 37697-64-6	
Monomer(s) molecular weight(s)	dalton, g/mol, amu	100.02; 244.04	
Initiator		bis(perfluoro-2-N-propoxypropionyl) peroxide was used as initiator	Michel, U; Resnik, P; Kipp, B; DeSimone, J M, <i>Macromolecules</i> , 36, 19, 7107-13, 2003.
Yield	%	74	Michel, U; Resnik, P; Kipp, B; DeSimone, J M, <i>Macromolecules</i> , 36, 19, 7107-13, 2003.
STRUCTURE			
Crystallinity	%	amorphous	
COMMERCIAL POLYMERS			
Some manufacturers	-	DuPont	
Trade names	-	Teflon AF	
PHYSICAL PROPERTIES			
Density at 20°C	g cm ⁻³	1.67-1.78	
Refractive index, 20°C	-	1.29-1.31	
Transmittance	%	>95	
Decomposition temperature	°C	360	
Thermal expansion coefficient, 23-80°C	°C ⁻¹	2.6-3E-4	
Glass transition temperature	°C	160-240; 334 (for PDD homopolymer)	
Heat deflection temperature at 0.45 MPa	°C	156-200	
Heat deflection temperature at 1.8 MPa	°C	154-174	
Dielectric constant at 100 Hz/1 MHz	-	1.89-1.93 (lowest of any plastic material)	
Dissipation factor at 100 Hz	E-4	1-3	
Dissipation factor at 1 MHz	E-4	1-3	
Electric strength K20/P50, d=0.60.8 mm	kV mm ⁻¹	19-21	
Permeability to nitrogen, 25°C	barrer	130-490	
Permeability to oxygen, 25°C	barrer	340-990	

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Permeability to water vapor, 25°C	barrer	1142-4026	
Contact angle of water, 20°C	degree	104-105	
MECHANICAL & RHEOLOGICAL PROPERTIES			
Tensile strength	MPa	26.4-26.9	
Tensile modulus	MPa	1,500-1,600	
Tensile stress at yield	MPa	26.4-27.4	
Elongation	%	7.9-17.1	
Flexural modulus	MPa	1,600-1,800	
Shore D hardness	-	75-77	
Rockwell hardness	-	97.5-103	
Melt viscosity, shear rate=100 s ⁻¹	Pa s	2,657 (250°C); 540 (350°C)	
Water absorption, equilibrium in water at 23°C	%	<0.01	
CHEMICAL RESISTANCE			
Alcohols	-	very good	
Aliphatic hydrocarbons	-	very good	
Aromatic hydrocarbons	-	very good	
Esters	-	very good	
Greases & oils	-	very good	
Halogenated hydrocarbons	-	very good	
Ketones	-	very good	
Good solvent	-	perfluoromethylcyclohexane, perfluorobenzene, and perfluorodecalin	
FLAMMABILITY			
Volatile products of combustion	-	HF, COF ₂ , CO, HFA	
WEATHER STABILITY			
Spectral sensitivity	nm	transparent to solar UV	
Activation wavelengths	nm	157	
Products of degradation	-	hexafluoroacetone, main chain and chain-end radicals, char formation	Blakey, I; George, G A; Hill, D J T; Liu, H; Rasoul, F; Rintoul, L; Zimmerman, P; Whittaker, A K, <i>Macromolecules</i> , 40, 25, 8954-61, 2007.
PROCESSING			
Typical processing methods	-	compression molding, extrusion, injection molding	
Processing temperature	°C	240-275 (1600 range) and 340-360 (2400 range)	
Applications	-	microelectronics, optics, clear coatings, semiconductors, dielectric materials, release materials, fiber optics, implantable medical devices, photolithography	
Outstanding properties	-	optical clarity, lowest dielectric constant	