Teflon™ FEP

Fluoropolymer Film

Properties Bulletin

Description

Teflon™ FEP film is a transparent, thermoplastic film that can be heat sealed, thermoformed, vacuum formed, heat bonded, welded, metalized, and laminated to many other materials, as well as used as an excellent hot-melt adhesive.

This wide variety of fabrication possibilities combines with the following important properties to offer a unique balance of capabilities not available in any other plastic film.

Chemical Compatibility

- Teflon™ FEP film is chemically inert and resistant to virtually all chemicals, except molten alkali metals, gaseous fluorine, and certain complex halogenated compounds, such as chlorine trifluoride, at elevated temperatures and pressures.
- Low permeability to liquids, gases, moisture, and organic vapors

Electrical Reliability

- Superior reliability and retention of properties over large areas of film
- High dielectric strength, over 6,500 V/mil for 1-mil film (260 kV/mm for 0.025-mm film)
- No electrical tracking, non-wetting, and/or non-charring
- Very low power factor and dielectric constant, only slight change over wide ranges of temperature and frequency

Wide Thermal Range

- Continuous service temperature: –240 to 205 °C (–400 to 400 °F)
- Melting range: 250 to 280 °C (500 to 540 °F)
- Heat sealable

Mechanical Toughness

- Superior anti-stick and low frictional properties
- High resistance to impact and tearing
- Useful physical properties at cryogenic temperatures

Long Time Weatherability*

- Inert to outdoor exposure; no measurable change after 20 years in Florida
- High transmittance of ultraviolet and all, but far, infrared radiation

Reliability

- Teflon™ FEP film contains no plasticizers or other foreign materials.
- Conventional equipment and techniques can be used for processing; basic composition and properties will not be influenced.
- Rigid quality control by Chemours ensures uniform gauge, void-free film.

Teflon™ FEP Film

The convenience of Teflon™ FEP fluoropolymer in easy-to-use film facilitates the design and fabrication of this low-friction thermoplastic for all sorts of high-performance jobs. It is transparent and can be heat sealed, thermoformed, welded, and heat bonded.

Superior anti-stick properties make it an ideal release film for many applications. A cementable type with an invisible surface treatment is available for bonding to one or both sides with adhesives. This versatility is augmented by the superior properties of a true melt-processible fluoropolymer and the wide choice of product dimensions available from Chemours.

*Type C film is not recommended for outdoor use.

Chemours™

Table 1. Types and Gauges of Teflon™ FEP Fluoropolymer Film

	Gauge								
	50	100	175	200	300	500	750	1000	2000
Thickness, mil	0.5	1	1.75	2	3	5	7.5	10	20
Thickness, µm	12.5	25	44	50	75	125	190	250	500
Approx. area factor, ft^2/lb	180	90	51	45	30	18	12	9	4.5
Approx. area factor, m^2/kg	36	18	10.3	9	6 4	3.8	2.5	1.9	0.95
Availability									
Type A—FEP, general-purpose	X	X	X	X	X	X	X	X	X
Type C—FEP, one side cementable	—	X	X	X	X	X	—	—	—
Type C-20—FEP, both sides cementable	—	X	—	X	—	X	—	—	—

Note: Each roll of Teflon™ film is clearly identified as to resin type, film thickness, and film type.
FEP: Resin type 500: Film thickness, 500 gauge, 5 mil C: Film type, cementable one side

Typical Properties of Teflon™ FEP Fluoropolymer Film

Property	Test Method	Typical Value[a] SI Units	English Units
Mechanical			
Tensile Strength at Break	D882	21 N/mm^2	3000 psi
Elongation at Break	D882	300%	
Yield Point	D882	12 MPa	1700 psi
Elastic Modulus	D882	480 MPa	70,000 psi
Impact Strength	Chemours pneumatic impact tester	7.7 X 10^3 J/m	144 ft-lb/in
Folding Endurance (MIT)	D2176	10,000 cycles	
Tear Strength–Initial (Graves)	D1004	2.65 N	270 g force
Tear Strength–Propagating (Elmendorf)	D1922	1.23 N	125 g
Bursting Strength (Mullen)	D774	76 kPa	11 psi
Thermal			
Melt Point	D3418 (DTA)	260-280 °C	500-536 °F
Zero Strength Temperature[b]		255 °C	490 °F
Coefficient of Thermal Conductivity	Cenco-Fitch	0.195 W/(m·K)	1.35 Btu·in/(hr·ft^2·°F)
Specific Heat	—	1172 J/(kg·K)	0.28 Btu/(lb·°F)
Heat Deflection Temperature at 0.46 N/mm^2 (66 psi) at 1.82 N/mm^2 (264 psi)	D648 Tensile Bars	70 °C 51 °C	158 °F 124 °F
Dimensional Stability	30 min at 150 °C (302 °F)	MD = 0.72% expansion TD = 2.2% shrinkage	
Flammability Classification[c]	ANSI/UL 94	VTM-0	
Oxygen Index	D2863	95%	

[a]For 0.025 mm (1 mil) film at 25 °C (77 °F), unless otherwise specified.
[b]Temperature at which a film supports a load of 0.14 N/mm^2 (20 psi) for 5 sec.
[c]This classification rating is not intended to reflect hazards presented by this or any other material under actual fire conditions.

Typical Properties of Teflon™ FEP Fluoropolymer Film (cont'd.)

Property	Test Method	Typical Value[a] SI Units	English Units
Electrical			
Dielectric Strength, short-time, in air at 23 °C (73 °F), 6.35 mm (1/4 in) diameter electrode, 0.79 mm (1/32 in) radius	ASTM D149 Method A		
60 Hz, 500 V/s rate of rise:			
0.025 mm (1 mil) film		260 kV/mm	6500 V/mil
0.5 mm (20 mil) film		70 kV/mm	1800 V/mil
Dielectric Constant	ASTM D150		
25 °C (77 °F), 100 Hz–1 MHz		2.0	
–40–225 °C (–40–437 °F), 1000 Hz		1.93–2.02	
Dissipation Factor	ASTM D150		
25 °C (77 °F), 100 Hz–1 MHz		0.0002–0.0007	
–40–225 °C (–40–437 °F), 1000 Hz		0.0002	
–40–240 °C (–40–464 °F), 1 MHz		0.0005	
Volume Resistivity	ASTM D257		
–40–240 °C (–40–464 °F)		>1 X 10^{18} ohm·cm	
Surface Resistivity	ASTM D257		
–40–240 °C (–40–464 °F)		>1 X 10^{16} ohm/sq	
Surface Arc Resistance	ASTM D495	>165 sec[b]	
Insulation Resistance	Based upon 0.2 MF		
at 100 °C (212 °F)	wound capacitor sections,	350,000 Mohm·µF	
at 150 °C (302 °F)	using single layer,	250,000 Mohm·µF	
at 200 °C (392 °F)	Teflon™ 50A film	65,000 Mohm·µF	
Chemical			
Moisture Absorption	—	<0.01%	
Weatherability	Continuous exposure in Florida	No adverse effects after 20 yr	
Permeability, Gas:	ASTM D1434	cm^3/m^2·24 hr·atm[c]	
Carbon Dioxide		25.9 X 10^3	
Hydrogen		34.1 X 10^3	
Nitrogen		5.0 X 10^3	
Oxygen		11.6 X 10^3	
Permeability, Vapor:	ASTM E96	g/m^2·d	g/100 in^2·24 hr
Acetic Acid		6.3	0.41
Acetone		14.7	0.95
Benzene		9.9	0.64
Carbon Tetrachloride		4.8	0.31
Ethyl Alcohol		10.7	0.69
Hexane		8.7	0.56
Water		7.0	0.40

[a]For 0.025 mm (1 mil) film at 25 °C (77 °F), unless otherwise specified.
[b]Samples melted in arc did not track.
[c]To convert to $cm^3/(100\ in^2 \cdot 24\ hr \cdot atm)$, multiply by 0.0645.

Teflon™ FEP fluoropolymer is chemically inert and solvent-resistant to virtually all chemicals, except molten alkali metals, gaseous fluorine, and certain complex halogenated compounds, such as chlorine trifluoride, at elevated temperatures and pressures.

Property Values of Teflon™ FEP Fluoropolymer Film (cont'd.)

Property	Test Method	Typical Value* SI Units	English Units
Miscellaneous			
Density	ASTM D1505	2150 kg/m^3	134 lb/ft^3
Coefficient of Friction, Kinetic (Film-to-Steel)	ASTM D1894	0.1–0.3	
Refractive Index	ASTM D542	1.341–1.347	
Solar Transmission	ASTM E-424	96%	

*For 0.025 mm (1 mil) film at 25 °C (77 °F), unless otherwise specified.

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