DuPont FEP

FLUOROCARBON FILM

Properties Bulletin

Description

DuPont FEP film is a transparent, thermoplastic film that can be heat sealed, thermoformed, vacuum formed, heat bonded, welded, metalized, laminated—combined with dozens of other materials, and can also be 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

- DuPont 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 6500 V/mil for 1 mil film (260 kV/mm for 0.025 mm film)
- No electrical tracking, non-wetting, and 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

- DuPont 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 DuPont ensures uniform gauge, void-free film

The convenience of 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 fluorocarbon and by the wide choice of product dimensions available from DuPont.

*Type C film is not recommended for outdoor use

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Table 1 – Types and Gauges of DuPont FEP Fluorocarbon 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	2.5	2	1.2	0.6
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 DuPont film is clearly identified as to resin type, film thickness, and film type.

FEP	500	C
Resin type	Film thickness, 500 gauge, 5 mil	Film type, cementable one side

Property Values of DuPont FEP Fluorocarbon Film

		Typical Value[a]	
Property	**Test Method**	**SI Units**	**English Units**
Mechanical			
Tensile Strength at Break	ASTM D-882	21 N/mm^2	3000 psi
Elongation at Break	ASTM D-882	300%	
Yield Point	ASTM D-882	12 MPa	1700 psi
Elastic Modulus	ASTM D-882	480 MPa	70,000 psi
Impact Strength	DuPont pneumatic impact tester	7.7 X 10^3 J/m	144 ft-lb/in
Folding Endurance (MIT)	ASTM D-2176	10,000 cycles	
Tear Strength–Initial (Graves)	ASTM D-1004	2.65 N	270 g force
Tear Strength–Propagating (Elmendorf)	ASTM D-1922	1.23 N	125 g
Bursting Strength (Mullen)	ASTM D-774	76 kPa	11 psi
Thermal			
Melt Point	ASTM D-3418 (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/h×ft^2×°F
Specific Heat	—	1172 J/kg×K	0.28 Btu/lb×°F
Heat Deflection Temperature at 0.46 N/mm2 (66 psi) at 1.82 N/mm2 (264 psi)	ASTM D-648 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	ASTM D-2863	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.

[d]Samples melted in arc did not track.

[e]To convert to $cm^3/100\ in^2$×24 h×atm, multiply by 0.0645.

Property Values of DuPont FEP Fluorocarbon Film (continued)

		Typical Value[a]	
Property	**Test Method**	**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 60 Hz, 500 V/s rate of rise: 0.025 mm (1 mil) film 5 mm (20 mil) film	ASTM D-149 Method A	 260 kV/mm 70 kV/mm	 6500 V/mil 1800 V/mil
Dielectric Constant, 25°C (77°F), 100 Hz to 1 MHz –40 to 225°C (–40 to 437°F), 1000 Hz	ASTM D-150	 2.0 2.02–1.93	
Dissipation Factor, 25°C (77°F), 100 Hz to 1 MHz –40 to 225°C (–40 to 437°F), 1000 Hz –40 to 240°C (–40 to 464°F), 1 MHz	ASTM D-150	 0.0002–0.0007 0.0002 0.0005	
Volume Resistivity, –40 to 240°C (–40 to 464°F)	ASTM D-257	>1 X 10^{18} ohm.cm	
Surface Resistivity, –40 to 240°C (–40 to 464°C)	ASTM D-257	>1 X 10^{16} ohm/sq	
Surface Arc Resistance	ASTM D-495	>165 sec[d]	
Insulation Resistance at 100°C (212°F) at 150°C (302°F) at 200°C (392°F)	Based upon 0.2 MF wound capacitor sections, using single layer, Teflon® 50A Film	 350,000 Mohm×µF 250,000 Mohm×µF 65,000 Mohm×µF	
Chemical			
Moisture Absorption	—	< 0.01%	
Weatherability	Continuous exposure in Florida	No adverse effects after 20 yr	
Permeability, Gas: Carbon Dioxide Hydrogen Nitrogen Oxygen	ASTM D-1434	cm^3/m^2×24 h×atm[e] 25.9 X 10^3 34.1 X 10^3 5.0 X 10^3 11.6 X 10^3	
Permeability, Vapors: Acetic Acid Acetone Benzene Carbon Tetrachloride Ethyl Alcohol Hexane Water	ASTM E-96	g/m^2×d 6.3 14.7 9.9 4.8 10.7 8.7 7.0	g/100 in^2×24 h 0.41 0.95 0.64 0.31 0.69 0.56 0.40

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Property Values of DuPont FEP Fluorocarbon Film (continued)

		Typical Value[a]	
Property	**Test Method**	**SI Units**	**English Units**
Miscellaneous			
Density	ASTM D-1505	2150 kg/m^3	134 lb/ft^3
Coefficient of Friction, Kinetic (Film-to-Steel)	ASTM D-1894	0.1–0.3	
Refractive Index	ASTM D-542	1.341–1.347	
Solar Transmission	ASTM E-424	96%	

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