

Tefzel™ ETFE

Fluoropolymer Film

Properties Bulletin

Description

Tefzel™ ETFE film is a transparent, thermoplastic film that can be heat sealed, thermoformed, vacuum formed, heat bonded, welded, metallized, laminated (combined with dozens of other materials), and 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 other plastic films.

Chemical Compatibility

Tefzel™ ETFE film 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. It also has 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 160 kV/mm for 0.025-mm film (4000 V/mil for 1-mil film)
- No electric tracking, non-wettable, and non-charring
- Very low power factor and dielectric constant

Wide Thermal Range

- Continuous service temperature: -100 to 150 °C (-150 to 300 °F)
- Melting range: 260 to 280 °C (500 to 536 °F)
- Heat sealable

Mechanical Toughness

- Superior anti-stick and low frictional properties
- High resistance to impact and tearing

Long Time Weatherability*

- Inert to outdoor exposure
- High transmittance of ultraviolet and all, but far, infrared

Reliability

- Tefzel™ ETFE 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.

Tefzel™ ETFE Film

The convenience of Tefzel™ ETFE 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.

Table 1: Typical Properties of Tefzel™ ETFE Fluoropolymer Film

| Property | Test Method* | Typical Value** | |
|---|------------------------------|------------------------------|--|
| | | SI Units | English Units |
| Mechanical | | | |
| Tensile Strength at Break | D882 | 41 MPa | 6000 psi |
| Elongation at Break | D882 | | 300% |
| Flex Modulus | D882 | 830 MPa | 120,000 psi |
| Folding Endurance (MIT) | D2176 | | 50,000 cycles |
| Tear Strength—Initial (Graves) | D1004 | 4.90 N | 500 g |
| Tear Strength—Propagating (Elmendorf) | D1922 | 0.74 N | 75 g |
| Thermal | | | |
| Melt Point | D3418 | 260–280 °C | 500–536 °F |
| Thermal Conductivity | Cenco-Fitch | 0.24 W/(m·K) | 1.65 Btu·in/(hr·ft ² ·°F) |
| Specific Heat | — | 1172 J/(kg·K) | 0.28 Btu/(lb·°F) |
| Dimensional Stability | 30 min at 150 °C (302 °F) | | MD = 1% shrinkage TD = 5% shrinkage |
| Oxygen Index | D2863 | | 30% |
| 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 | D149 Method A | 160 kV/mm | 4000 V/mil |
| Dielectric Constant, 25 °C (77 °F), 1 KHz | D150 | | 2.6 |
| Dissipation Factor, 25 °C (77 °F), 1 KHz | D150 | | 0.0007 |
| Volume Resistivity, 170 °C (338 °F) | D257 | | >1 x 10 ¹⁷ ohm·cm |
| Chemical | | | |
| Moisture Absorption | — | | <0.02% |
| Permeability, Gas: Carbon Dioxide Nitrogen Oxygen | D1434 | | cm ³ /(m ² ·24 hr·atm)*** 3.9 x 10 ³ 0.5 x 10 ³ 1.6 x 10 ³ |
| Permeability, Vapor: Water | E96 | g/(m ² ·d) 7.8 | g/(100 in ² ·24 hr) 0.5 |
| General | | | |
| Density | D1505 | 1700 kg/m ³ | 106 lb/ft ³ |
| Coefficient of Friction Kinetic (Film-to-Steel) | D1894 | | 0.2–0.3 |
| Refractive Index | D542 | | 1.4 |
| Solar Transmission | E424 | | 90% |

*ASTM method, unless otherwise specified

**For 0.050-mm (2-mil) film at 25 °C (77 °F), unless otherwise specified

***To convert to cm³/(100 in²·24 hr·atm), multiply by 0.0645

Table 2: Types and Gauges of Tefzel™ ETFE Fluoropolymer Film

| Gauge | 50 | 100 | 200 | 500 |
|--|------|-----|-----|-----|
| Thickness, mil | 0.5 | 1 | 2 | 5 |
| Thickness, μm | 12.5 | 25 | 50 | 125 |
| Approx. area factor, ft^2/lb | 200 | 100 | 50 | 20 |
| Approx. area factor, m^2/kg | 40 | 20 | 10 | 4 |
| Availability | | | | |
| Type LZ—ETFE, general-purpose | X | X | X | X |
| Type CLZ—ETFE, one side cementable | — | X | X | X |
| Type CLZ-20—ETFE, both sides cementable | — | X | X | — |

Note: Each roll of Tefzel™ film is clearly identified as to resin type, film thickness, and film type.

| | | |
|-------------|----------------------------------|--------------------------------|
| ETFE | 200 | CLZ |
| Resin type | Film thickness, 200 gauge, 2 mil | Film type, cementable one side |

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Replaces: K-26943

C-10201 (9/17)