



Teflon[®] FEP CX5010, FR5020, and FR5030

fluoropolymer resin

Brand

Teflon[®] is a registered trademark of DuPont for its brand of fluoropolymer resins, which can only be licensed by DuPont for use in approved applications. Customers who wish to use the *Teflon[®]* trademark in connection with DuPont products under license from DuPont should contact (800) 262-2745. Without a license, customers may not identify their product as containing *Teflon[®]*, but may refer to the resin as FEP fluoropolymer resin CX5010, FR5020, and FR5030.

Description

The CX/FR range of *Teflon[®]* FEP fluoropolymer resins consists of a *Teflon[®]* FEP fluoropolymer with a nucleating system compounded into it. *Teflon[®]* FEP CX5010 is *Teflon[®]* FEP 100 based while *Teflon[®]* FR5020 and FR5030 are *Teflon[®]* FEP 5100 based. The nucleating systems are designed to give the foaming characteristics needed for a wide range of primary wire conductor insulation performance. Supplied as white pellets, these resins are used in conventional foam extrusion processes with the addition of nitrogen gas to produce foamed dielectric insulations. The product range is formulated to allow the cable designer to use them in a wide range of design dimensions and electrical performances.

The particles in the nucleating packages compounded into these resins act as initiation sites for foam cells. These foam cells are formed when nitrogen, which is absorbed in the melted resin, expands as pressure is relieved when the melt exits the wire-coating crosshead. *Teflon[®]* FEP CX5010, FR5020 and FR5030 are listed in order of ascending nucleating efficiency. Foaming FEP enhances its electronic properties, providing opportunities for miniaturization and weight savings.

Teflon[®] FEP CX5010 is ideal for producing coaxial cable cores in a broad range of sizes. The core diameters can vary from 0.05 in. (1.27 mm) to 0.50 in. (12.7 mm). Foamed coaxial cables of *Teflon[®]* FEP CX5010 are known for high-frequency signal transmission with minimal distortion. A typical coaxial cable core made from *Teflon[®]* FEP CX5010 contains up to 60 percent voids. These voids are closed-cell in nature and range from 0.001 in. (0.025 mm) to 0.010 in. (0.25 mm) in diameter. *Teflon[®]* FEP CX5010 has an MFR range of 6.4 to 7.5.

Teflon[®] FEP FR5020 is an excellent material for producing the foamed primary dielectric insulation in a cable that possesses an overall shield or shields on each twisted pair in that cable. The primary core diameters can vary from 0.05 in. (1.27 mm) to 0.10 in. (2.54 mm). Foamed insulation primaries of *Teflon[®]* FEP FR5020 are known for high-frequency signal transmission with minimal distortion. These foam cores may contain 20 to 40 percent voids. These voids are closed cell in nature and range from 0.0007 in. (0.018 mm) to 0.002 in. (0.05 mm) in diameter. *Teflon[®]* FEP FR5020 and FR5030 have an MFR range of 19 to 25.

Teflon[®] FEP FR5030 is an excellent material for producing the foamed primary dielectric insulation in a cable that possesses unshielded twisted pairs. It is the most efficient nucleated FEP compound in the range. Cable primary core diameters can vary from 0.035 in. (0.89 mm) to 0.050 in. (1.27 mm). Foamed insulation primaries of *Teflon[®]* FEP FR5030 are known for high-frequency signal transmission with minimal distortion. These foam cores may contain 20 to 40 percent voids. These voids are closed cell in nature and range from 0.0007 in. (0.018 mm) to 0.0013 in. (0.033 mm) in diameter.

Safety Precautions

WARNING!

VAPORS CAN BE LIBERATED THAT MAY BE HAZARDOUS IF INHALED.

Before using *Teflon*[®] FEP CX5010, FR5020, or FR5030, read the Material Safety Data Sheet and the detailed information in the “Guide to the Safe Handling of Fluoropolymer Resins,” latest edition, published by the Fluoropolymers Division of the Society of the Plastics Industry. These publications can be obtained from your DuPont Sales Representative.

Open and use containers only in well-ventilated areas using local exhaust ventilation (LEV). Vapors and fumes liberated during hot processing of *Teflon*[®] FEP should be exhausted completely from the work area (Ref: chapter VII, Guide to the Safe Handling of Fluoropolymer Resins). Contamination of tobacco with these polymers should be avoided. Vapors and fumes liberated during hot processing and which are not properly exhausted, or from smoking tobacco or cigarettes contaminated with *Teflon*[®] FEP may cause flu-like symptoms such as chills, fever and sore throat. This may not occur until several hours after exposure and will typically pass within about 24 hours.

Mixtures of *Teflon*[®] FEP with some finely divided metals, such as magnesium or aluminum, can be flammable or explosive under some conditions.

Authorization

DuPont has developed technology for the compounding and processing of these products. Some of that technology is protected by patents. Customers wishing to purchase and process these products should consult their DuPont Sales Representative with a view to obtaining a license authorizing the purchaser to process the resin into cable primaries of various dimensions and to sell these foamed primaries in final cables.

Processing

DuPont foam resins have been fully compounded to allow direct feeding to the extruder. The processor does not have to worry about dispersing the nucleants. The DuPont patented nucleation technology gives a more uniform, finer cell, evenly distributed closed cell form. This technology has been used to make high-quality cables for over a decade. *Teflon*[®] FEP FR5020 and FR5030 are based on the high-speed resin *Teflon*[®] FEP 5100 and as such, give faster production rates than CX5010

Teflon[®] FEP CX5010, FR5020, and FR5030 can be fed directly to a conventional single-screw extruder setup that has the facility to inject nitrogen gas. The process contact metals must be high-nickel, low-iron alloys suitable for fluoropolymer processing. Refer to the Extrusion Guide for Melt-Processible Fluoropolymers. The process should include devices to monitor diameter, concentricity, capacitance, and other insulated primary properties such as structural return loss. These resins have their nucleating ingredients fully dispersed in them and may be fed directly to the process without mixing or further compounding. A “foam concentrate” is not needed. When adding a color pigment, use a conventional one compounded in FEP. The particles in these concentrates may affect the nucleation of the foam to form slightly larger cells, but this is not usually a problem in cable performance terms. Some processors may elect to adjust the foaming characteristics of these resins by adding some of the base FEP. However, this is not usually necessary.

As with all wire-coating melt-extrusion processes, the cable design and production rates will require a balance of extruder output and wire conveyance speed. In the case of foamed insulation, nitrogen addition needs to be controlled also. Generally speaking, the foam structure is improved when the production rate is increased beyond a certain line speed. It is best for the voids to grow after the melt is drawn down onto the wire. Elongated voids in

the insulation indicate early growth of the cells in the draw-down cone. Cell size can be influenced by the positioning of cooling water on the freshly coated wire. Early cooling results in small voids. Increased nitrogen will give more voids, so a finely structured cell formation is possible, especially with FR5030, the most efficiently nucleated of this range of products.

Processing advice is available to customers through their DuPont Sales Representative, as are the following recommended DuPont publications:

- Extrusion Foaming of Coaxial Cables of Melt-Fabricable Fluoropolymer Resins
- Equipment and Design Changes in Extrusion of Foamed Fluoropolymer Resins
- Extrusion Guide for Melt-Processible Fluoropolymers

Packaging

Teflon® FEP CX5010, FR5020, and FR5030 are supplied as pellets packaged in 55-lb (25-kg) bags.

Freight Classification

For rail shipments, *Teflon*® FEP CX5010, FR5020, and FR5030 are classified as “Plastics, Synthetic, O.T.L., NOIBN”; for truck shipments as “Plastic Materials, Granules”; and for express shipments as “Plastics, Synthetic.”

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