EVERFLON

Processing Guide

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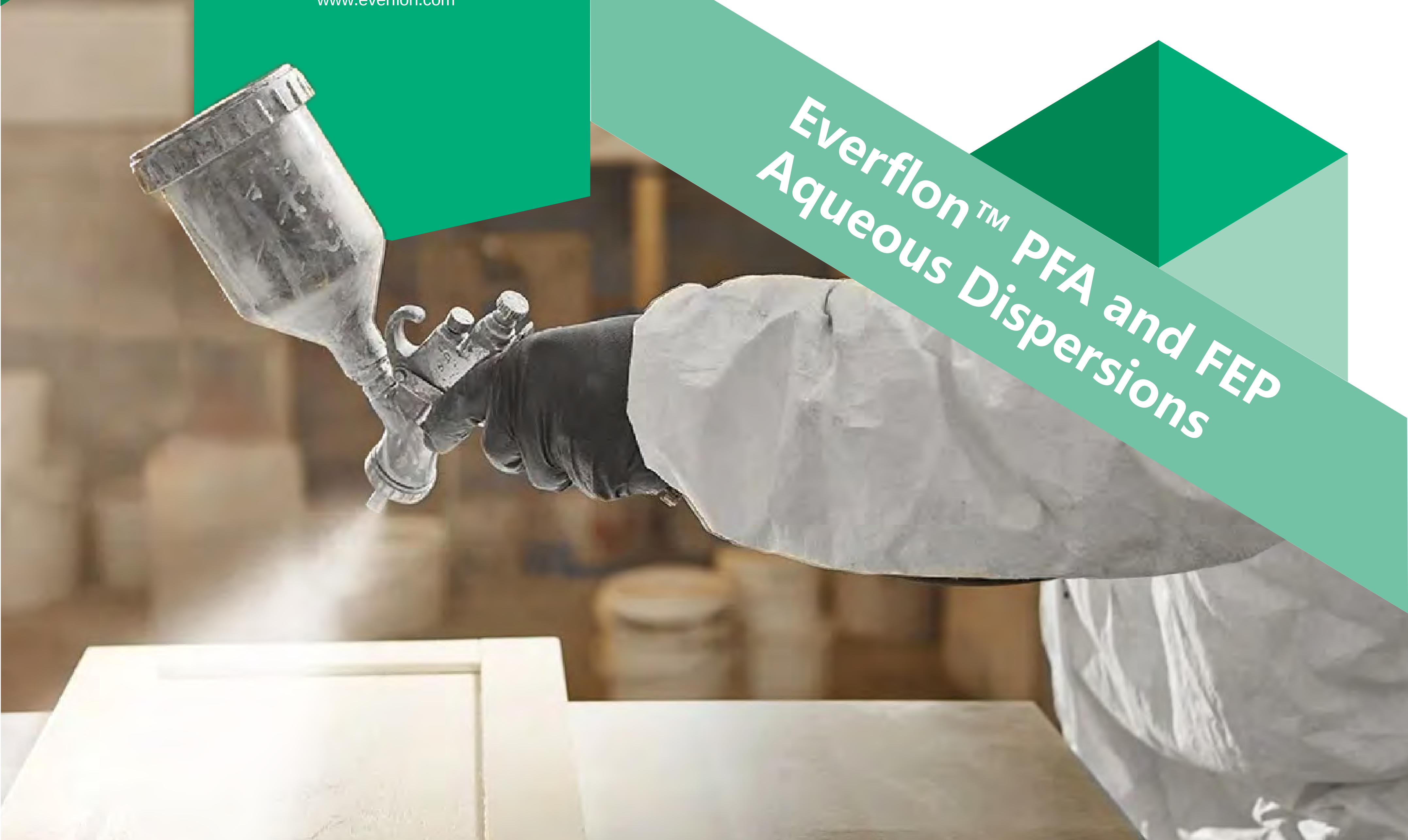
Everflon™ PFA and FEP Aqueous Dispersions



Fluorinated Ethylene Propylene
FEP D50
EVERFLON
Fluoropolymers
Aqueous Dispersion
Manufactured by
Hubei Everflon Polymer Co.,Ltd
Add: Futian Road,C&F industrial Park,C&F Ave,Chaidian,Wuhan,China
Tel:+86-27-8488-8055
info@everflon.com
WWW.EVERFLON.COM
C&F
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INTRODUCTION

Everflon™ PFA and FEP resins are thermo-processable perfluorinated polymers. They are composed from semi-crystalline copolymers of TetraFluoroEthylene (TFE) and other modified monomers.

Due to their very low surface energy and coefficient of friction, Everflon™PFA and FEP resins are known for providing superior long-term non-stick and release properties.

Compared to PTFE, Everflon™PFA and FEP are fully melt processable without any reduction of thermal or chemical properties.

Everflon™ PFA and FEP dispersions provide remarkable improvements to the applied substrate such as:

- Exceptional chemical inertness
- Outstanding thermal resistance
- High gloss
- Outstanding smoothness and surface finish
- Good rub and abrasion resistance
- High moisture repellency
- Good permeation resistance
- Excellent weathering resistance
- High surface cleanability
- Very good weldability in case of heat sealing or lamination
- Excellent dielectric properties

EVERFLON™ PFA AND FEP PRODUCT RANGE

Everflon Fluoropolymers supplies the following white water-based APFO-free Everflon™ PFA and FEP dispersion grade:

- Everflon™ FEP D50
- Everflon™ PFA D450

Both exhibit excellent wetting properties and high shear stability. They have a very good film forming behavior and are especially suited for top-coat applications to produce final items with superior gloss.

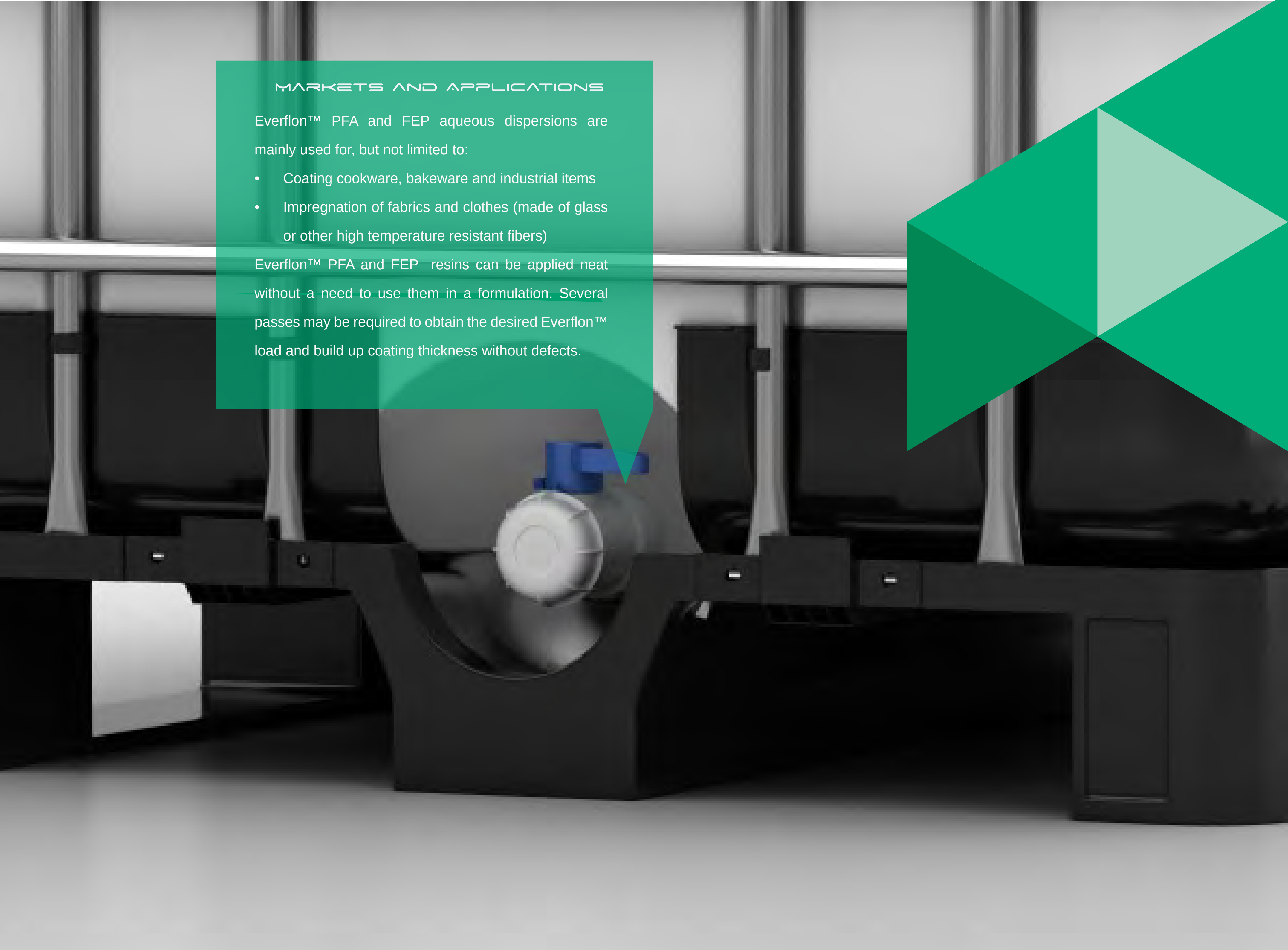
Property	Units	Everflon™ FEP D50	Everflon™ PFA D450
Polymer content (on the mixture)	% by weight	50	50
Non ionic surfactant (on the mixture)	% by weight	6	6
pH		> 9	> 9
Density	g/cm^3	1.4	1.4
Melting point	°C	260	305
Melt Flow Index (372°C, 5kg)	g/10’	6~12	6~12
Brookfield viscosity (20°C)	mPa·s	20	22
Average particle size	µm	0.18	0.20
Critical thickness	µm	7~10	10~15
APFO content	ppm by weight	0	0

MARKETS AND APPLICATIONS

Everflon™ PFA and FEP aqueous dispersions are mainly used for, but not limited to:

- Coating cookware, bakeware and industrial items
- Impregnation of fabrics and clothes (made of glass or other high temperature resistant fibers)

Everflon™ PFA and FEP resins can be applied neat without a need to use them in a formulation. Several passes may be required to obtain the desired Everflon™ load and build up coating thickness without defects.



MARKETS AND APPLICATIONS

Common substrates include:

- Carbon steel
- Stainless steel
- Aluminized steel
- Aluminum
- Glass
- CeramicsGlass
- Ceramics

Typical industries include:

- Chemical processing
- Food processing
- Packaging
- Pharmaceutical
- Pulp and paper
- Electrical and Semiconductor
- Textile

COATING PROCESSING

Metal, ceramic and other surfaces are coated with Everflon™ PFA and FEP dispersions to protect them from corrosion and to improve their non-stick and chemical resistance characteristics. Of course substrates must be able to resist the high temperature of PFA and FEP sintering. Everflon™ PFA and FEP dispersion grades can be used in their original form, in suitable formulation, and/or suitable primers to improve adhesion to the substrate.

Typical methods for coating application include spray coating, roller coating, or curtain coating.

1 Substrate Preparation

Good coating adhesion greatly depends on substrate roughness. Roughening can be obtained either by sand blasting or by chemical etching. Sand blasting is commonly used for general purpose applications and chemical etching is advised for high quality applications. Special formulations can be applied on untreated surfaces as well.

The residual dust from blasting and abrasion should be blown off with clean, dry air. It is then advisable to clean the blasted surface to assure good coating adhesion to the substrate. This can be accomplished with a light cleaning using a solvent (i.e. toluene or MEK) or alternatively with a chlorinated solvent using a clean rag. Using paper towels should be avoided to prevent contamination.

All possible care should be taken to avoid depositing lint onto the part.

To avoid surface contamination, only wear clean gloves or use tongs while handling the substrate.

2 Paint Formulation

For best results, dispersions must be formulated according to the specific end use and application technology. It is recommended to use spraying equipment to apply the primer and finish coat. In the case of one-coat painting systems, a roller application is recommended. This system could be used to apply both primer and finish coatings.

In the formulation of primers, adhesion promoters are required to obtain a good bond to the substrate. Primers can be based on either inorganic compounds, such as lithium and silicon salts mainly used in industrial coating applications, or organic compounds, mainly polyamide-imide derivates).

To formulate the finish coat, various additives such as organic solvents, resins, inorganic fillers, pigments, etc., can be used.

3 Paint Application

The paint is applied in two passes:

•Priming

•Finishing

The parts should be coated immediately after cleaning the substrate. A primer can be used to improve the bond between the coating and the substrate and also help in providing better surface finish and coverage.

The prepared surface can be primed with a substrate primer so as to improve the bonding of the coating to the substrate, to better cover up the substrate surface, and provide a more uniform appearance for the final coating. In general, only one layer of primer is needed.

Usually the finish coat is applied in several layers to achieve the desired final thickness of the coating. Often the paint formulation includes two finishing layers:

•Intermediate coat

•Top coat

The intermediate coat can be applied on both wet and dry primer, and the top coat can be applied on wet or dry intermediate.

4 Drying

The coating must be carefully oven dried in order to avoid mud cracking. Recommended drying temperature is above 100 °C according to working conditions. Ovens equipped with extractor cowls are recommended.

5 Sintering

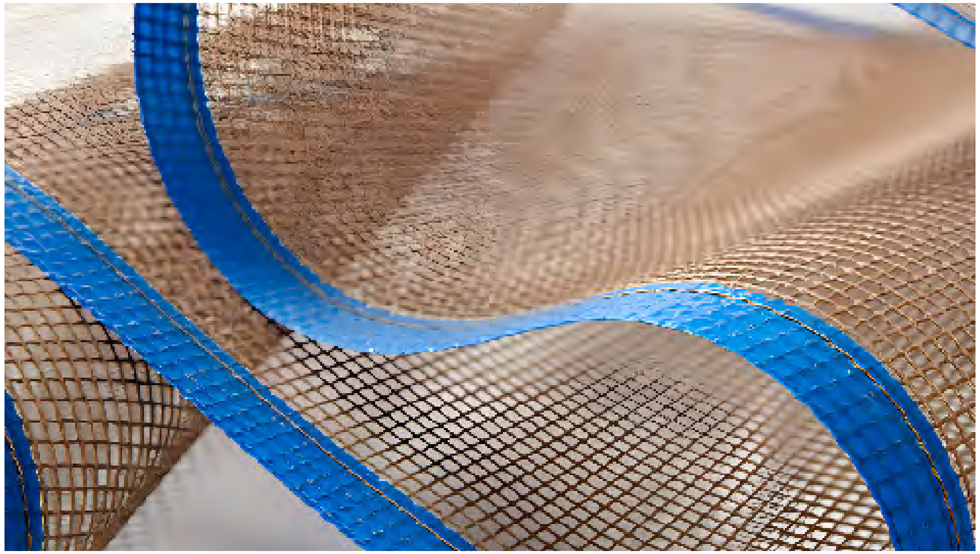
Sintering time and temperature profile must be experimentally fixed depending on the dimensions of the item and oven characteristics. Usual sintering temperature is in the range of 350 °C to 400 °C for about 5 – 10 minutes. Due to possible evolution of thermal decomposition vapors, which could contain surfactant and polymer degradation products, ovens equipped with extractor cowls are used.

6 Forming

To obtain pans and special shapes, the sintered semi-finished items are molded in suitable drawing dies.

Characteristic	Suggested Additives	Potential Drawbacks
Surface homogeneity (no mud-cracking)	High boiling organic solvents Wetting agents	Foaming
Coating critical thickness	Silicon or acrylic resins	Discoloration
Coating hardness	Silicon or acrylic resins Metallic powders Thermosetting resins	Dispersion settling Dispersion settling Discoloration
Coating appearance	Mica Inorganic pigments	Dispersion settling Dewetting

Main improvement effects of additives in coatings



IMPREGNATION PROCESSING

The impregnation of fabrics is a complex procedure that includes several passes to obtain the desired final Everflon™ PFA and FEP deposition. Further, there are slight differences according to the kind of substrate chosen (glass fiber, woven glass cloth, and polyaramide or other high temperature resistant fibers or fabrics).

Yarn impregnation is similar to that of fabric impregnation, but simpler and faster. In this case squeezing and sintering are not necessary and only one impregnation step is usually sufficient to achieve the desired Everflon™ PFA and FEP deposition.

The top layer can be prepared from anyEverflon™ PFA and FEP dispersion for the purpose of:

- Improving surface finish and gloss
- Enhancing rub and abrasion resistance
- Providing better weldability in case of heat sealing or lamination processes

1

Substrate Preparation

A fabric roll is positioned on the delivery spool of the impregnation machine. The free end of the fabric is coupled to a driving belt to run through the machine. The glass fabrics are usually sized in order to protect the twisting of strand filaments. The size is often removed by heating in the oven of the impregnation machine.

2

Dispersion Formulation

Everflon™ PFA and FEP dispersions can be diluted in order to promote penetration of polymeric particles through the fabric meshes. The final thickness of Everflon™ PFA and FEPis reached by several passes at different dispersion dilutions.

3

Dipping

Everflon™ PFA and FEP dispersion is poured into the bath of the impregnation machine.
The fabric is dipped by passing it through the bath.
Applicators may have to optimize the number of passes and relevant dispersion formulations according to their specific needs.

4

Drying

The operation is done to eliminate excess dispersion at each pass. Suitable devices for squeezing are squeeze rollers or blade systems.

Characteristic	Suggested Additives	Potential Drawbacks
Wettability No fish-eyes	Wetting agents	Foaming
Surface homogeneity No mud-cracking	Silicon or acrylic resins	Discoloration
No bubbles	Antifoaming agents	Dewetting
Surface hardness	Mica Glass beads	Dispersion settling Dispersion settling
Antistatic surface	Superconductive Carbon	Dispersion settling and dewetting

5

Sintering

The impregnated fabric must be carefully oven dried in order to avoid mud cracking and bubbles due to flash evaporation of water. Recommended drying temperature is 100 – 150 °C according to working conditions. Ovens equipped with extractor cowls are advised.

6

Forming

The first section of the oven is devoted to heating the fabric to remove additives. The maximum temperature in this section is 300 °C. The second section of the oven is devoted to sintering Everflon™ PFA and FEP dispersion. Sintering time and temperature profile must be experimentally fixed depending on fabric speed and oven characteristics. Usual sintering temperature is in the range of 350 – 400 °C. Due to possible evolution of vapors, ovens equipped with extractor cowls are used. The fabric is then wound on a crabbing spool.

7

Manufacturing

Impregnated fabrics are mainly utilized as conveyor belts and tapes. Cloths of suitable length are cut from crabbing spools and finished. Conveyor belt edges are reinforced by sewing or sticking, similarly tapes and bosses are inserted.

ADDITIONAL TECHNICAL INFORMATION

Storage and Handling

The usual precautions for safe storage and handling of fluoropolymer dispersions must be enforced according to material safety documentation and experience. Please contact Everflon Fluoropolymers for a copy of the relative Safety Data Sheet (SDS).

Everflon™ PFA and FEP dispersions must be stored under suitable temperature conditions to ensure prolonged stability. Temperatures lower than 5 °C must be avoided to prevent irreversible settling. Also, some settling may occur on prolonged standing and/or heat exposure. It is therefore strongly recommended that the product is always kept at temperatures below 35 °C. The optimum storage temperature range is 10 – 25 °C. It is also advisable that the product be gently rolled or stirred once per month and prior to use.

Prolonged exposure of the liquid to air could lead to some coagulation at the surface due to water evaporation. For this reason and also to avoid contamination, keep the containers closed when not in use.

Ammonium hydroxide is used by Everflon Fluoropolymers to set pH to approximately 9.0 at the time of shipment. High ambient temperatures can deplete the ammonia level and reduce pH. Declining pH eventually favors bacterial growth, which causes odor and scum. The pH should be measured and maintained between 9 and 10.

See SDS for detailed advice on waste disposal methods.

SAFETY AND TOXICOLOGY

Before using Everflon™ PFA and FEP dispersions consult the product Safety Data Sheet and follow all label directions and handling precautions.

As with all fluoropolymer materials, handling and processing should only be carried out in well ventilated areas. Vapor extractor units should be installed above processing equipment. Fumes must not be inhaled and eye and skin contact ought to be avoided. In case of skin contact, wash with soap and water. In case of eye contact, flush with water immediately and seek medical help. Do not smoke in areas contaminated with powder, vapor or fumes.

STAY IN TOUCH

Everflon Fluoropolymers

www.everflon.com

info@everflon.com

+86-185-7168-9228