

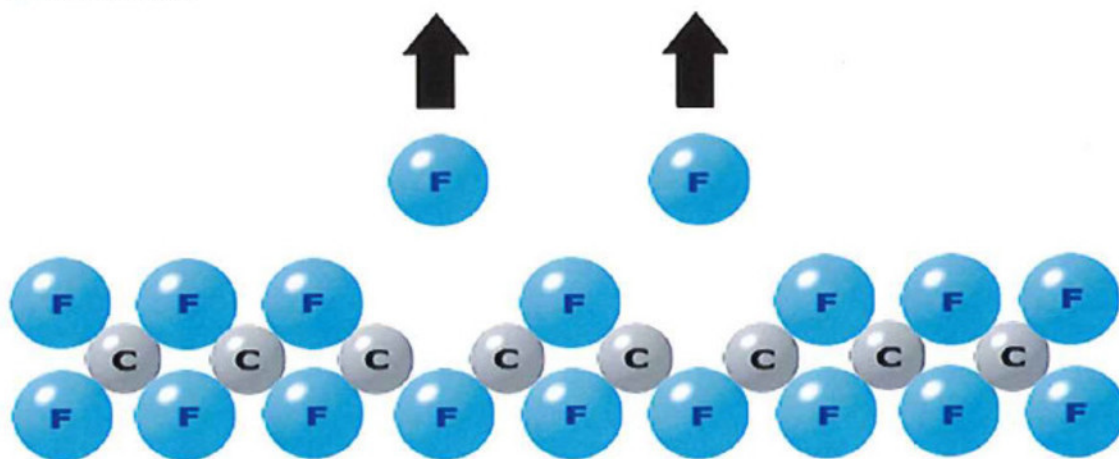
1. What is FluoroBonder

Nonstick cookware is a typical example of fluoropolymer application utilizing its excellent water repellency (hydrophobicity). This water-repellent property, however, is disadvantageous when bonding is required. For bonding something to fluoropolymer, a specific treatment is required to alter the surface of fluoropolymer to be bondable (hydrophilicity). But the conventional surface treatment requires specially designed working environment and expensive equipment to avoid hazard happenings, and the results could not be satisfactory enough.

FluoroBonder-E (etching agent) is a safe, effective, cost-efficient, and easy-to-use surface treatment agent that solves such problems.

2. Etching mechanism

Fluoropolymer is a chainlike macromolecule polymer consisting, mainly, of large number of $-CF_2-$ units whose carbon atoms chain ($-C-C-$) is covered fluorine atoms (F). FluoroBonder chemically extracts fluorine atoms out of the polymer chain to leave carbon atoms deficient of electron, such as double bond. In this case, fluoropolymer is hydrophilicity, because, it is not covered fluorine atoms. And then the fluoropolymer is taken out from the FluoroBonder and exposed the air, electron-deficiency is solved by oxygen, hydrogen, and humidity of the air, and then hydroxyl ($-OH$), carboxyl ($-COOH$), carbonyl ($=CO$) and so on are formed to make the processing effect better.



3. Advantages of FluoroBonder

- Proven treatment effectiveness
- High safety (will not be ignited upon contact with water)
- Excellent cost performance
- Easy adjustment of viscosity

FluoroBonder-E alone can serve usual surface treatment, but its viscosity is easily adjusted by mixing with FluoroBonder-T, if necessary.

4. How to use

Etching process of FluoroBonder is usually made as follows:

①Pre-treatment

Rinse the object with an organic solvent such as acetone, MEK, methanol, etc., to remove pollutants and dirt, and then dry.

②Surface treatment

Bring the refrigerated FluoroBonder-E (etching agent) back to room temperature, and pour the necessary amount into a container. When shake the bottle, sometimes, sound of solid which consist active ingredient in the bottle is heard. In this case, shake the bottle well, and then dissolve the solid, until no sound is heard and active ingredient is become uniform.

③Etching time

Fluorine extracting action of FluoroBonder-E is more active when the content of fluorine in the polymer is higher and the molecular structure is less complicated. Thus, the adequate etching time depends on the kind of fluoropolymer as shown below. In all cases, the etching takes only a short time.

※Allowable extension of the etching time depends on processing conditions, but it could be several tens of times longer than the following specified time without any problem.

PTFE	FEP, PFA	Fluoro-rubber	ECTFE, ETFE, PVDF
Approx. 3 second	Approx. 7 second	Approx. 15 second	Approx. 25 second

④Post-treatment

After past the time of etching of set, take out etched object from FluoroBonder soon, clean it first with an organic solvent, and then with warm water (40°C-80°C), and dry. Cleaning order of organic solvent and warm water may be reversed. Insufficient washing may cause down of treatment effect, repeat washing which organic solvent and hot water. Cleanness of the organic solvent and hot water should be controlled precisely for a good etching results.

5. Appropriate Container for FluoroBonder

①Materials of container

Materials that are non-reactive to FluoroBonder such as stainless steel, polyethylene, polypropylene, glass and etc., are recommended as appropriate containers.

②Shape of container

To keep the FluoroBonder active, the contact area of FluoroBonder exposed to the air should be minimize. A deep and narrow shape, such as a standing book, makes an appropriate shape of container.

6. How to test the results of etching

Typical methods for testing the etching results are as follows:

- ①An aqueous felt pen, can wright well on the surface, or not.
- ②A water-drop spreads out flat on the etched surface, or not.
- ③Watch a change of color of etched surface to brown, or not.
- ④Measurement of contact angle of a water-drop on the etched surface can represent the results of etching by form of a numeral.

7. Shelf life of FluoroBonder

Our quality assurance is valid for 6 months after the date of shipment if the products are unopened and stored below 10° C. In this condition, FluoroBonder could be used mostly for almost one year after the date of shipment.

FluoroBonder is affected by oxygen, carbon dioxide and humidity in the air. After opening the bottle use up FluoroBonder as soon as possible and avoid contact with the air for keeping the shelf life longer.

8. How to test etching-ability of FluoroBonder-E

①Color of FluoroBonder-E

Showing dark green is effective, faded blown is not effective.

②Change of color of etched surface

When PTFE of white color is etched by FluoroBonder for 3 seconds and the surface color will be changed to brown, the FluoroBonder is effective.

③In case of colored fluoropolymer, an aqueous felt pen can wright properly on the etched surface after 3 seconds etching is effective.

④Etced-ability of FluoroBonder can be decided precisely by titration with 1-butanol. End point of titration is a point of change of etchant color form dark green to light-yellow or white, FluoroBonder is effective at a titer of 0.9ml per a 100ml of FluoroBonder.

Products literature

9. FluoroBonder uses

Major uses of the FluoroBonder are shown below.

Fields of Industry	uses
Automobile	surface treatment of oil seal, gasket, and molded articles
Electric wires	pre treatment for potting, bonding, and coloring of fluoropolymer insulated wires • cables
Medical	pre treatment for junction stabilization and coloring of catheters, tubes and endoscopes
Electrical And Electronics	pre treatment for surface bonding of heat transfer rolls, fluoropolymer printed circuit board through hole plating, improvement of plating, bonding • stabilizing of heat sensors and light sensors
Butteries	hydrophilic treatment of fuel cell separator, etc.
Advertisement	pre treatment for coloring • printing • bonding on fluoropolymer sheets and signboards
Foods	pre treatment for bonding and coloring of fluoropolymer tubes, containers, cases, etc.
Others	pre treatment for bonding, color plating, printing, etc. on fluoropolymer sheets, tubes, molded articles, etc.

1 0. FluoroBonder-T(Thinner for FluoroBonder-E)

FluoroBonder-E alone can serve most usual surface treatment purpose, however sometimes, viscosity adjustment of the FluoroBonder-E improves process efficiency, workability and cost-efficiency, in such cases as printed circuit board through hole plating, stabilizing consecutive processing or reducing solid deposits. The viscosity adjustment is readily possible simply by mixing of FluoroBonder-E and FluoroBonder-T at the time of etching. (The mixing ratio could be at any rate up to 1:5 of E to T)

1 1. Major properties of FluoroBonder

Appearance	: Dark green
Composition	: Sodium/naphthalene complex solvent solution
Boiling point	: Approx. 90°C
Flash point	: Approx. 1°C
Auto ignition point	: Approx. 190°C

1 2. Cautions

- Category iv, Class I, Water soluble, by Japan's Fire Service Act.
- FluoroBonder is flammable and volatile, and may be ignited with naked flame.
- Vapor of FluoroBonder has naphthalene and ether odor, and excessive inhalation may cause dizziness or respiratory irritation.
- Contact with skin or eyes may cause irritation or burns.
- Sufficient ventilation, and use of safety goggles, rubber or polyethylene gloves and aprons upon application of FluoroBonder are recommended.

1 3. Other informations

①How to open the bottle

Before open the bottle, back to room temperature and shake it well. Then open the screw cap slowly to release the build-up pressure in the can. If you need to use FluoroBonder quickly, you may immerse the can in warm water (30~40°C). Heating on an open fire is inhibited.

②Etched surface

FluoroBonder etchant does not form an adhesive film on the fluoropolymer, but changes the surface by a chemical reaction (fluorine abstraction reaction). The fluorine atoms are stripped from the chain, exposing the carbon atoms that make the surface of fluoropolymer to be brown and bondable.

Products literature

③Poor adhesion after etching

This is probably due to insufficient cleaning of the part, some decomposition products of the etchant being left. They can be removed by dissolving the caustics and salts with hot water (40 - 80°C), followed by immersion in an organic solvent (acetone, MEK, methanol, etc.) for 10 - 30 seconds.

④White deposit after etching

The deposit appears when the residue on the etched part is dried before washing or when the washing is not sufficient. It consists mainly of naphthalene. Since the dried residue covers the surface, formation of bondable radicals (e.g., hydroxyl-, carbonyl-, carboxyl-, etc.) on the surface is hindered. If removal of the solid deposit is delayed, the number of radicals runs short, hindering the adhesion. The deposit should be removed by dissolution with a solvent, such as acetone, MEK, isopropyl-alcohol, methyl-alcohol, ethyl-alcohol, etc. If the deposit does not come off by the solvent dip, add light brushing.

⑤Life of the etched surface

The etched surface remains adherable for more than a year, as long as it is well protected from UV radiation, abrasion and contamination. The etched parts should be kept in dry containers from UV. Refrigeration is not necessary.

⑥External effects on the etched surface

i) Mechanical stress (abrasion)

If the etched surface is damaged by abrasion (e.g., the brown color on PTFE is scratched away, and the white substrate is exposed), adhesion is not possible.

ii) UV irradiation

A long time irradiation (>72 hours) of the long wavelength UV such as sunlight will fade the brown color of the etched surface, thus making it less bondable. A short time irradiation has little effect. The short wavelength UV has less or no effect.

iii) High temperature

Dry heat above 150°C affects the etched surface, thus making it less bondable.

iv) Oxidant (sodium hypochlorite, sodium per carbonate, etc.)

Oxidant will fade the brown color of the etched surface, thus making it less bondable.

Products literature

⑦Effect on dielectric constant

The dielectric constant of Fluoropolymer does not change due to etching, because the thickness of the etched layer is negligibly smaller than that of the unaffected material.

⑧Method of masking

Masking the areas where etching is not required can be made by sticking a polyethylene adhesive tape or applying a 10% solution of polyisobutylene in naphtha or hexane. And then rinse the residue with organic solvent after etching. Choose a polyisobutylene grade having low to medium molecular weight from various commercial grades.

⑨Anti-wicking

In order to prevent wicking of the etchant at the ends of fluoropolymer insulated wire or cable, the ends should be dipped in melted paraffin wax. The melted wax at the end is then cooled to give a solid barrier for the etchant to penetrate.

1 4. Products identification

FluoroBonder-E and FluoroBonder-T will be supplied in screw-capped steel cans as shown in the following tables:

FluoroBonder-E (Etching agent)	
Products code	Quantity (net)
E01	100g/can
E05	500g/can
E10	1000g/can

FluoroBonder-T (Thinner for FluoroBonder-E)	
Products code	Quantity (net)
E01	100g/can
E05	500g/can
E10	1000g/can

※Quantities exceeding 1000g /can is available upon request.

1 5. Disclaimer

This document has been prepared with sufficient care to the reliability of the data. However, this document is for illustration and information purposes only. Technos Corporation makes no warranties and assumes no responsibility as to the accuracy or suitability of this information for any purchaser' s use or for any consequence of its use.

Technos Corporation
320-27 Shiba, Namerikawa-shi, Toyama-ken, 936-0841 Japan
Phone: 076-476-1717
Fax : 076-476-1616
URL : <http://www.technos-corp.co.jp>
Email: info@technos-corp.co.jp