Types of Teflon®

"Teflon®" is the registered trademark of the DuPont Company for its fluorocarbon resins. DuPont pioneered the use of Teflon® PTFE and FEP resins following the discovery that they could be made into articles having a combination of mechanical, electrical, chemical, temperature and friction-resisting properties unmatched by articles made of any other material. Teflon® fluorocarbon resins' unique combination of physical, electrical, and chemical properties have found application in nearly every field of modern industrial, scientific, and technological endeavor.

PTFE

Structurally, there are different types of Teflon® resin. Teflon® PTFE resin is a polymer consisting of recurring tetrafluoroethylene monomer units with the formula: (CF2-CF2)n

The maximum molecular weight of this greater than 90°/0 crystallinic TFE Polymer is about 9x106. PTFE displays a series of unique properties: Nearly universal chemical resistance (exceptions: elemental fluorine, CF3, molten alkali metals) *Insoluble in all solvents below 300°C High service temperature stability up to 250°C Very low adhesiveness Very low friction coefficient Extremely hydrophobic Physiologically inert, contaminant free Very good electrical (high resistance) and dielectrical (very low dielectric number and loss factor) properties Nonflammable Highly weather resistant (UV resistant) Good mechanical properties: tough elastic, easily manufactured*

These advantages of PTFE, especially its universal chemical resistance, are the reason labware and accessories made of PTFE or other fluorocarbon resins are a must in any laboratory. Its broad service temperature range and its unbreakability are further advantages of PTFE.

Stirrer blades, magnetic stir bars encapsulated in PTFE, joint sleeves, adapters and boiling accessories are just a few of the items available in PTFE along with standard Labware items such as Flasks, Bottles, Beakers, etc. They are indispensable if the chemical resistance of glass or rare metals does not suffice. Digestion in boiling hydrofluoric acid or boron trifluoride is possible as well as hot alkali-hydroxide melts.

Labware made of PTFE resists temperatures of -200°C without becoming brittle. The maximum service temperature is +250°C, (but 300°C is possible) for a short time period. PTFE is extremely nonadhesive. This is an advantage for working with lacquers, adhesives, resins and hydroscopic substances. PTFE is biologically inert. Therefore it is used in many applications in biology, microbiology, medicine, pharmacy and in the food industry.

Pure PTFE, because of its chemical resistance and its antiadhesive surface, prevents any sample contamination by abrasion or etching. Vessels made of PTFE therefore are absolutely necessary in trace element analysis methods. The production of PTFE-ware is performed using the so called isostatic pressing process. PTFE powder is filled in forms and isostatically pressed at high pressures. The pressed parts are sintered at temperatures up to 400°C. The characteristics of the material are substantially influenced by the pressing and sintering process. Porous PTFE is made by controlled sintering of powders with defined particle sizes. Stock PTFE in rods, sheets, etc. are available for customer use. *PTFE : Teflon®, Hostaflon, Malon, Fluon, Polyflon*

FEP

Similar properties are displayed by the Tetrafluoroethylene Hexafluoropropylene-copolymer FEP: [CF(CF3)-CF2(CF2-CF2)n]m
The molecular weight of this copolymer is 50,000 to 500,000 and the crystallinity is about 50%. The maximum service temperature of 205°C is lower than PTFE. FEP is thermoplastically moldable (injection molded at temperatures of 320°-360°C extruded at 350°C - 410°C) is translucent, flexible, and feels heavy because of its high density. *FEP : FEP-Resin. Teflon®. N fl- n*

PFA

Perfluoroalkyoxy-polymers, PFA has the same advantages as PTFE Teflon® with the structure: [CF(OR,)-CF2(CF2-CF2)n]m OR, represents a perfluoroalkoxy group.
PFA can be melt processed (extruded). The chemical resistance is comparable to PTFE. PFA is translucent and slightly flexible. It has greater mechanical strength and higher temperature tolerance than PTFE. Its melting temperature is 305°C.
"PFA was first used in the semiconductor industry for injection molded wafer carriers and similar articles that resisted aggressive chemicals and high temperature chemical processing. Now, PFA is also considered to be the best Teflon® for semiconductor piping applications, and is accepted for both liquid reagents and UPDI water handling in advanced processlng appllcations." *PFA : Teflon® PFA*