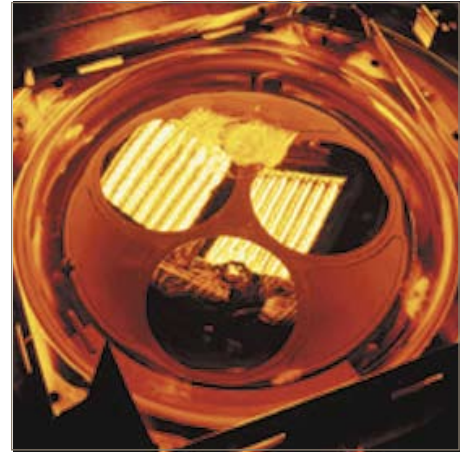


Microelectronics Sealing Guide

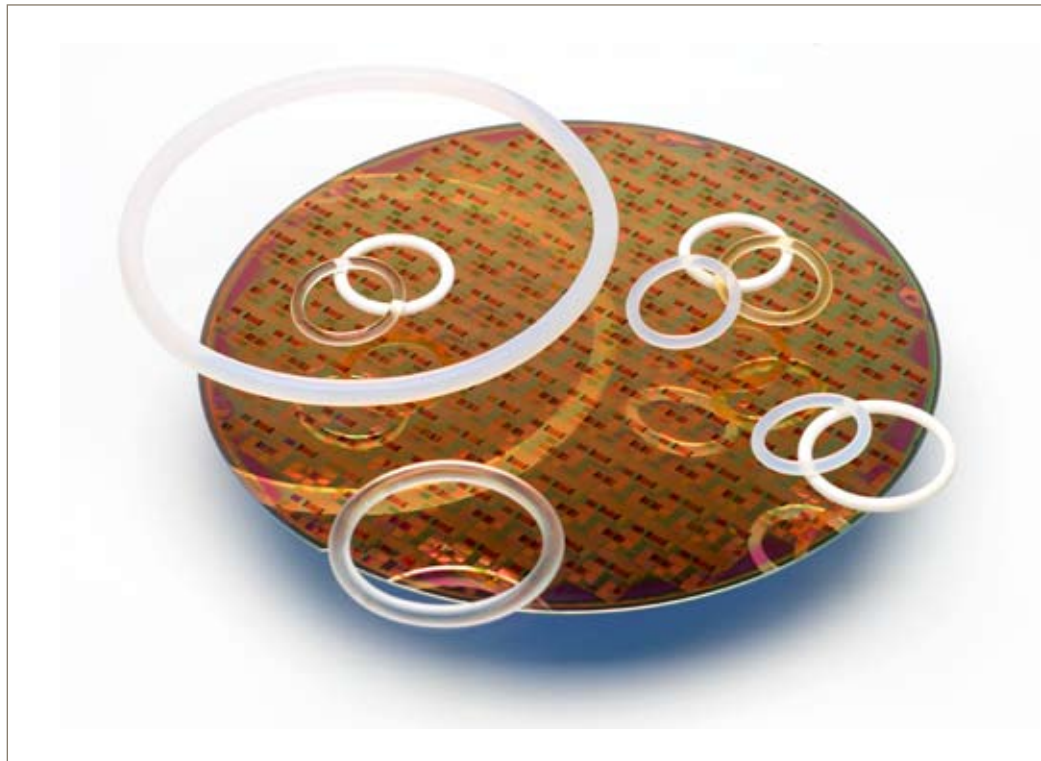
High Performance Fluorinated Elastomers
for Semiconductor Service



Outstanding Performance :

In the semiconductor market, cleanliness and performance of seals is paramount in maximizing chip output and decreasing down time. Parker supports the market in those ends by continuously developing next generation compounds that are designed to improve MTBF and WPM.

Through extensive R&D efforts, Parker has developed HiFluor, Parofluor, and Parofluor ULTRA lines of elastomeric compounds to support the semiconductor market in every process; from surface preparation to completed wafer testing. When looking for ways to improve your semiconductor applications, why not build with the best? Build with Parker.



Contact Information:

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fax 859 335 5128

www.parker.com

Value Added Services:

- Superior material technology
- Depth of product offering/
total sealing solutions
- Logistics (distributors/
service centers)
- Competitively priced
- Speed to market, 2-4 week
delivery if not in stock
- Field support
- Applications engineering
assistance



ENGINEERING YOUR SUCCESS.

Semiconductor Media Compatibility

Chemical	Formula	Parofluor ULTRA (FFKM)	Hifluor (FKM)	Fluorocarbon (FKM)
Acetic acid 30%	CH ₃ COOH	1	1	3
Acetic acid, glacial	CH ₃ COOH	1	1	2
Acetone	CH ₃ COCH ₃	1	2	4
Ammonia	NH ₃	2	4	4
Ammonium fluoride	NH ₄ F	1	1	1
Ammonium hydroxide	NH ₄ OH	1	2	4
Ammonium persulfate	(NH ₄) ₂ S ₂ O ₈	1	2	4
Aqua Regia	HNO ₃ :HCl(1:3)	1	2	2
Argon	Ar	1	1	1
Arsenic trioxide	As ₂ O ₃	1	1	4
Arsine	AsH ₃	1	1	4
Boron tribromide	BBr ₃	1	1	4
Boron trichloride	BCl ₃	1	1	4
Bromine	Br ₂	1	1	1
Bromide trifluoride	BrF ₃	1	1	X
Bromotrifluoroethylene (BFE)	BrFC:CF ₂	1	1	X
Buffered oxide etchants (BOE)	NH ₄ :HF	1	1	X
Butyl (n-) acetate	CH ₃ COO(CH ₂) ₄	1	1	4
Carbon dioxide	CO ₂	1	1	1
Carbon tetrachloride	CCl ₄	1	1	1
Chlorine plasma	Cl ₂	2	3	4
Chlorine trifluoride	ClF ₃	1	2	4
Chloroform	CHCl ₃	1	1	1
Chromic acid (50%)	H ₂ CrO ₄	1	1	1
Cyclohexanone	C ₆ H ₁₀ O	1	1	1
Deionized water (UPDI)	H ₂ O	1	1	3
Diborane	B ₂ H ₆	1	1	X
Diethylene glycol monomethyl ether (DGMME)	CH ₃ O(CH ₂) ₂ O(CH ₂) ₂ OH	2	3	4
Dimethyl acetamide (DMAC)	CH ₃ CON(CH ₃) ₂	1	1	3
Dimethyl ether	CH ₃ OCH ₃	1	1	2
Dimethyl sulfoxide (DMSO)	(CH ₃) ₂ SO	1	1	3
Dimethylamine (DMA)	(CH ₃) ₂ NH	1	1	4
Ethyl acetate	CH ₃ COOC ₂ H ₅	1	2	4
Ethyl lactate (EL)	CH ₃ CHOHCOOC ₂ H ₅	1	1	3
Ethylene	H ₂ C:CH ₂	1	1	2
Ethylene glycol	(CH ₂ OH) ₂	1	1	1
Ethylene glycol monoethyl ether acetate (EGMEEA)	CH ₃ COO(CH ₂) ₂ OC ₂ H ₅	2	3	4
F-11 (CFC) (Trichlorofluoromethane)	CFCI ₃	2	2	2
F-12 (CFC) (Dichlorodifluoromethane)	CF ₂ Cl ₂	2	2	3
F-13 (CFC) (Chlorotrifluoromethane)	CF ₃ Cl	1	1	1

1 Satisfactory

2 Fair (normally okay for static seal)

3 Doubtful (sometimes okay for static seal)

4 Unsatisfactory

X Insufficient data

Semiconductor Media Compatibility

Chemical	Formula	Parofluor ULTRA (FFKM)	Hifluor (FKM)	Fluorocarbon (FKM)
F-13B1 (FC) (Bromotrifluoromethane)	CBrF_3	2	2	2
F-14 (FC) (Tetrafluormethane)	CF_4	1	1	1
F-22 (HCFC) (Chlorodifluoromethane)	CHClF_2	1	1	4
F-23 (HFC) (Fluoroform)	CHF_3	2	2	X
F-113 (CFC) (Trichlorotrifluoroethane)	$\text{CCl}_2\text{FCClF}_2$	2	2	2
F-115 (CFC) (Chloropentafluoroethane)	CClF_2CF_3	2	2	2
F-116 (FC) (Hexafluoroethane)	C_2F_6	2	2	2
F-123 (HCFC) (Dichlorotrifluoroethane)	CF_3CHCl_2	3	4	4
F-124 (CFC) (Chlorotetrafluoroethane)	$\text{C}_2\text{CF}_4\text{Cl}$	2	2	X
F-125 (HFC) (Pentafluoroethane)	C_2HF_5	2	2	X
F-134a (HFC) (Tetrafluoroethane)	$\text{CF}_3\text{CH}_2\text{F}$	3	3	4
F-141b (HCFC) (Dichlorofluoroethane)	CFCI_2CH_3	1	1	X
F-142b (HCFC) (Difluorochloroethane)	CF_2CICH_3	2	2	2
F-152a (HCFC) (Difluoroethane)	CH_3CHF_2	2	3	X
Fluorine (Gas)	F	2	2	X
Germane	GeH_4	1	1	X
Helium	He	1	1	1
Hexamethyldisilazane (HMDS)	$(\text{CH}_3)_3\text{SiNHSi}(\text{CH}_3)_3$	1	1	X
Hydrochloric acid (37%)	HCl	1	1	1
Hydrofluoric acid (40%)	HF	2	3	4
Hydrogen	H_2	1	1	1
Hydrogen bromide	HBr	1	1	X
Hydrogen chloride	HCl	1	1	1
Hydrogen fluoride	HF	1	1	X
Hydrogen peroxide	H_2O_2	1	1	1
Hydrogen selenide	H_2Se	1	1	X
Hydrogen sulfide	H_2S	1	1	4
Iodine pentafluoride	IF_5	2	2	4
Isobutane	$(\text{CH}_3)_2\text{CHCH}_3$	1	1	1
Isopropyl alcohol (IPA)	$(\text{CH}_3)_2\text{CHOH}$	1	1	2
MEA (Ethanamine)	$\text{HO}(\text{CH}_2)_2\text{NH}_2$	1	1	4
MEK (Methyl ethyl ketone)	$\text{CH}_3\text{COCH}_2\text{CH}_3$	1	2	4
Methane	CH_4	1	1	1
Methanethiol (Methyl mercaptan)	CH_3SH	1	1	X
Methyl alcohol	CH_3OH	1	1	4
Methyl bromide	CH_3Br	1	1	4
Methyl chloride	CH_3Cl	1	1	1
Methylamine	CH_3NH_2	1	1	3
Methylene chloride	CH_2Cl_2	1	1	2
MIBK (Methyl isobutyl ketone)	$(\text{CH}_3)_2\text{CHCH}_2\text{COCH}_3$	1	1	4

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Semiconductor Media Compatibility

Chemical	Formula	Parofluor ULTRA (FFKM)	Hifluor (FKM)	Fluorocarbon (FKM)
Nitric acid (0-50%)	HNO ₃	1	1	1
Nitrogen	N ₂	1	1	1
Nitrogen trifluoride	NF ₃	1	2	X
Nitrous oxide	N ₂ O	1	1	1
NMP (Methyl (n-) pyrrolidone (2-))	CH ₃ NCH ₂ CH ₂ CH ₂ CO	1	1	4
Octafluoropropane	C ₃ F ₈	1	X	X
Oxygen	O ₂	1	1	2
Ozonated deionized water	O ₃ :H ₂ O	1	2	3
Ozone	O ₃	1	1	1
Phosgene	COCl ₂	1	1	X
Phosphine	PH ₃	1	1	X
Phosphoric acid (20%)	H ₃ PO ₄	1	1	1
Phosphorous oxychloride	POCl ₃	1	1	X
Piranha fluid (H ₂ SO ₄ /H ₂ O ₂ @ 70/30)	H ₂ SO ₄ :H ₂ O ₂	1	1	X
Potassium hydroxide	KOH	1	1	4
Silane	SiH ₄	1	1	X
Silicon tetrachloride	SiCl ₄	1	1	X
Silicon tetrafluoride	SiF ₄	1	1	X
Standard Clean 1 (SC-1)	NaOH:H ₂ O ₂	1	2	X
Standard Clean 2 (SC-2)	HCl:H ₂ O	1	1	X
Stoddard solvent	-	1	1	1
Sulfur hexafluoride	SF ₆	2	2	3
Sulfur tetrafluoride	SF ₄	2	2	X
Sulfuric acid (conc.)	H ₂ SO ₄	1	1	1
TEOS (Tetraethylorthosilicate)	(C ₂ H ₅) ₄ SiO ₄	1	1	X
Tetrahydrofuran (THF)	CH ₂ CH ₂ CH ₂ CH ₂ O	1	1	4
Tetramethyl ammonium hydroxide (TMAH)	(CH ₃) ₄ NOH	1	1	3
Toluene	C ₆ H ₅ CH ₃	1	2	2
Trichloroacetic acid (TCA)	CCl ₃ COOH	1	1	3
Trichloroethylene (TCE)	CHCl:CCl ₂	1	1	1
Trichlorosilane	SiHCl ₃	1	1	1
Trimethylamine (TMA)	(CH ₃) ₃ N	1	1	3
Trimethyl borate (TMB)	(CH ₃ O) ₃ B	1	1	1
Trimethyl phosphite (TMP)	(CH ₃ O) ₃ P	1	1	2
Vinyl chloride (VC)	CH ₂ :CHCl	1	1	1
Vinyl fluoroide	CH ₂ :CHF	1	1	1
Xenon	Xe	1	1	1
Xylene	C ₆ H ₄ (CH ₃) ₂	1	1	1

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X Insufficient data

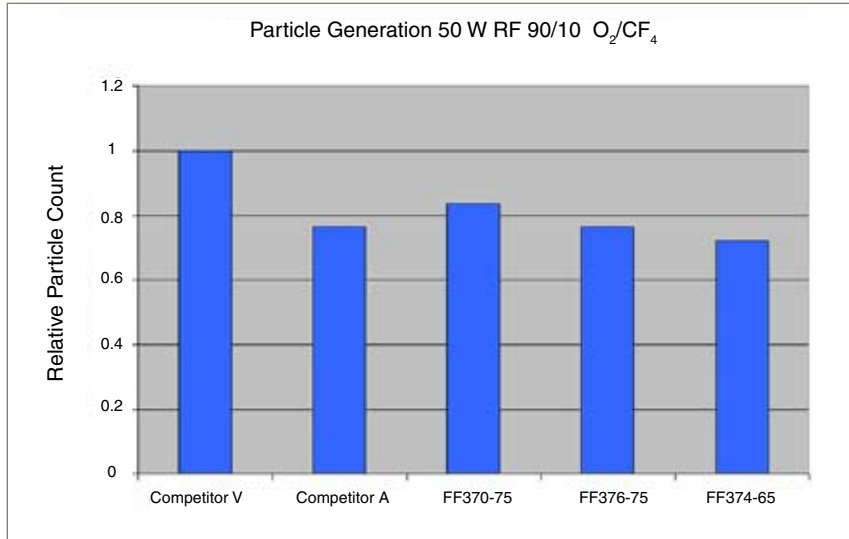
Description of Semiconductor Focused Materials

Compound	Processes	Common Wet Chemisitries	Common Plasmas	Attributes
		Mixtures of:	Mixtures of:	
FF374-60	Photolithagraphy HPCVD CVD Metal CVD SACVC Wet Etch Surface Prep Cleaning Wet Strip Etch*	UPDI SC ₁ SC ₂ HF HCl H ₂ SO ₄ CuSO ₄ NaOH KOH	TEOS/O ₃ NF ₃ C ₂ F ₆ CF ₄ SiH ₄ O ₂ WF ₆ O ₂	Low closure force, Extreme low particle generation, Extreme low extractables (Best in Class), Contains no phosphorous, Temperature capabilities up to 300°C, *Moderate etch rate
FF370-75	HPCVD CVD Metal CVD SACVD Etch*	UPDI SC ₁ SC ₂ HF HCl H ₂ SO ₄ CuSO ₄	TEOS/O ₃ SiH ₄ O ₂ NF ₃ C ₂ F ₆ CF ₄ WF ₆ O ₂	Low particle generation, Low extractables, Temperature capabilities up to 300°C, *Moderate Etch rate
FF376-80	Photolithagraphy HPCVD CVD Metal CVD SACVD Wet Etch Surface Prep Cleaning Wet Strip Etch*	UPDI SC ₁ SC ₂ HF HCl H ₂ SO ₄ CuSO ₄ NaOH KOH	TEOS/O ₃ NF ₃ C ₂ F ₆ CF ₄ SiH ₄ O ₂ WF ₆ O ₂	Extreme low particle generation, Extreme low extractables (Best in class), Contains no phosphorous, Temperature capabilities up to 300°C, *Moderate etch rate
FF350-75	HPCVD PECVD CVD Metal CVD SACVD Etch	Due to metal extractables, recommendation is FF370/FF374/FF376	TEOS/O ₃ NF ₃ C ₂ F ₆ CF ₄ WF ₆ O ₂	Moderate particle generation, Moderate extractables, Low etch rate, Temperature capabilities up to 300°C
FF352-75	Etch Ashing HPCVD PECVD CVD Metal CVD SACVD LPCVD	Due to metal extractables, recommendation is FF370/FF374/FF376	TEOS/O ₃ NF ₃ C ₂ F ₆ CF ₄ WF ₆ O ₂	Extreme low etch rate (Best in class), High particle generation, High extractables, Excellent compression set, Temperature capabilities up to 300°C
FF354-65	Etch Ashing HPCVD PECVD CVD Metal CVD SACVD LPCVD Low closure force	Due to metal extractables, recommendation is FF370/FF374/FF376	TEOS/O ₃ NF ₃ C ₂ F ₆ CF ₄ WF ₆ O ₂	Low closure force, Extreme low etch rate (Best in class), High particle generation, High extractables, Excellent compression set, Temperature capabilities up to 300°C

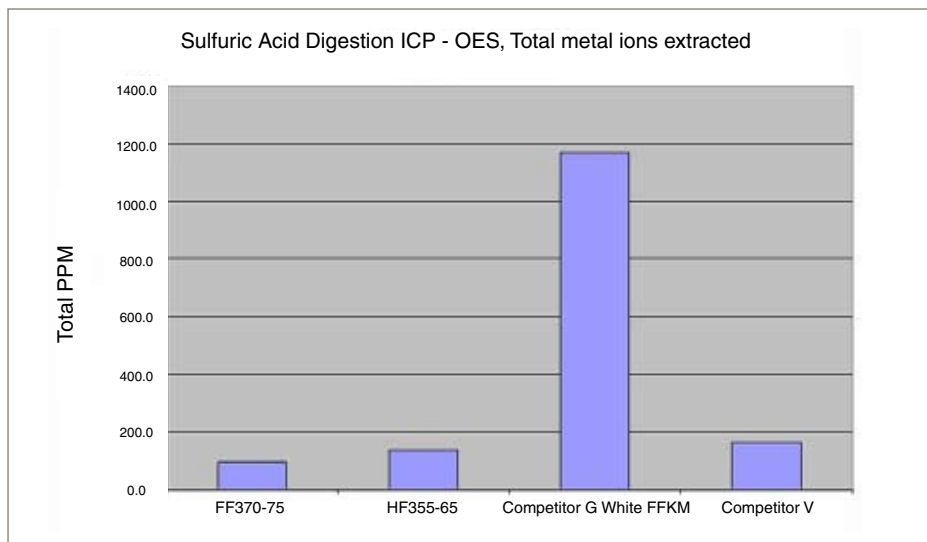
Description of Semiconductor Focused Materials

Compound	Processes	Common Wet Chemistries	Common Plasmas	Attributes
		Mixtures of:	Mixtures of:	
FF200-75	Oxidative diffusion LPCVD RTP Copper plating**	UPDI SC ₁ SC ₂ HF HCL H ₂ SO ₄ CuSO ₄	O ₂ O ₃ H ₂ O NH ₃	Excellent compression set, Good chemical resistance, Temperature capabilities up to 300°C **Good for select processes in copper plating (acidic)
FF580-75	Surface prep cleaning Rinse Wet etch Copper plating Photolithography developing Wet strip	UPDI SC ₁ SC ₂ HF HCL H ₂ SO ₄ CuSO ₄ NaOH KOH Piranha		Extreme chemical resistance (Best in class), Good compression set, Temperature capabilities up to 250°C
FF500-75	Surface prep cleaning Rinse Wet etch Copper plating Photolithography developing Wet strip	UPDI SC ₁ SC ₂ HF HCL H ₂ SO ₄ CuSO ₄ NaOH KOH Piranha		Excellent chemical resistance, Good compression set, Temperature capabilities up to 250°C
FF102-75	Surface prep cleaning Rinse Wet etch Copper plating Photolithography developing Wet strip	UPDI SC ₁ SC ₂ HF HCL H ₂ SO ₄ CuSO ₄ NaOH KOH Piranha		Low cost, Great chemical resistance, Temperature capabilities up to 250°C
V8581-90	Etch	Due to metal extractables, recommendation is FF370/FF374/FF376	TEOS O ₃ C ₂ F ₆ CF ₄ WF ₆	Very low etch rate, Reduced stiction, Temperature capabilities up to 275°C
HF355-65 (Hifluor)	HDPCVD PECVD CVD PVD ALS	UPDI HCl CuSO ₄	TEOS O ₃ CF ₄ O ₂	HiFluor material, Low particle generation, Low extractables (relative to FKM), Low permeation (relative to FFKM), Moderate etch rate, Temperature capabilities up to 205°C

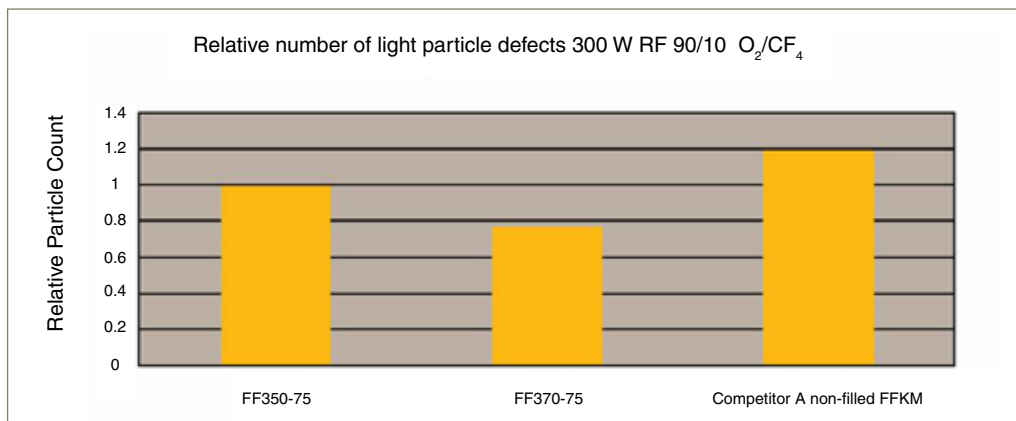
Relative Particle Generation Against Industry






Metal Ion Extraction Against Industry Leading Materials



Comparative Data of Light Particle Defects in FFKM Materials



Semiconductor Process Guide

	 Plasma & Gas Deposition (25° to 250°C)	 Thermal (150° to 300°C)	 Wet (25° to 175°C)	
Process Types	Etch Ash HDPCVD PECVD CVD PVD Metal CVD ALD	Oxidation Diffusion LPCVD RTP	Surface Prep Cleaning Rinsing Wet Etch Photolithography Developing Wet Stripping Copper Plating	
Common Possible Chemistries	F Cl CF ₃ CF ₄ TEOS SiH ₄ NF ₃ Ar	O ₂ O ₃ H ₂ O C ₂ F ₆ WF ₆	N ₂ O ₂ H ₂ O NH ₃	UPDI SC ₁ HF HCl H ₂ SO ₄ nMP NaOH CuSO ₄
Typical Applications, Concerns for elastomers	<ul style="list-style-type: none"> Etch rate Particle generation Particle size Cost 	<ul style="list-style-type: none"> Thermal stability Particle generation 	<ul style="list-style-type: none"> Chemical compatibility Metal ion extractables Cost 	
Suggested Compounds (listed in order of preference)	Etch rate: <ul style="list-style-type: none"> FF352 FF350 Particle generation: <ul style="list-style-type: none"> FF374 FF376 FF370 Cost: <ul style="list-style-type: none"> HF355* 	Thermal stability: <ul style="list-style-type: none"> FF200 FF352 FF350 Particle generation: <ul style="list-style-type: none"> FF374 FF376 FF370 	Chemical compatibility: <ul style="list-style-type: none"> FF580 FF500 Metal ion extractables: <ul style="list-style-type: none"> FF376 FF374 FF370 Cost: <ul style="list-style-type: none"> HF355* FF102 	
	* temperature capabilities up to 200°C			