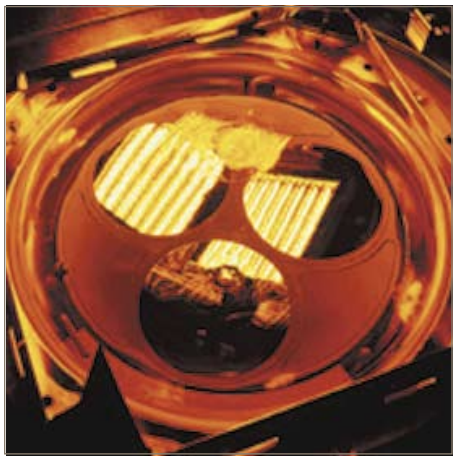
Microelectronics Sealing Guide

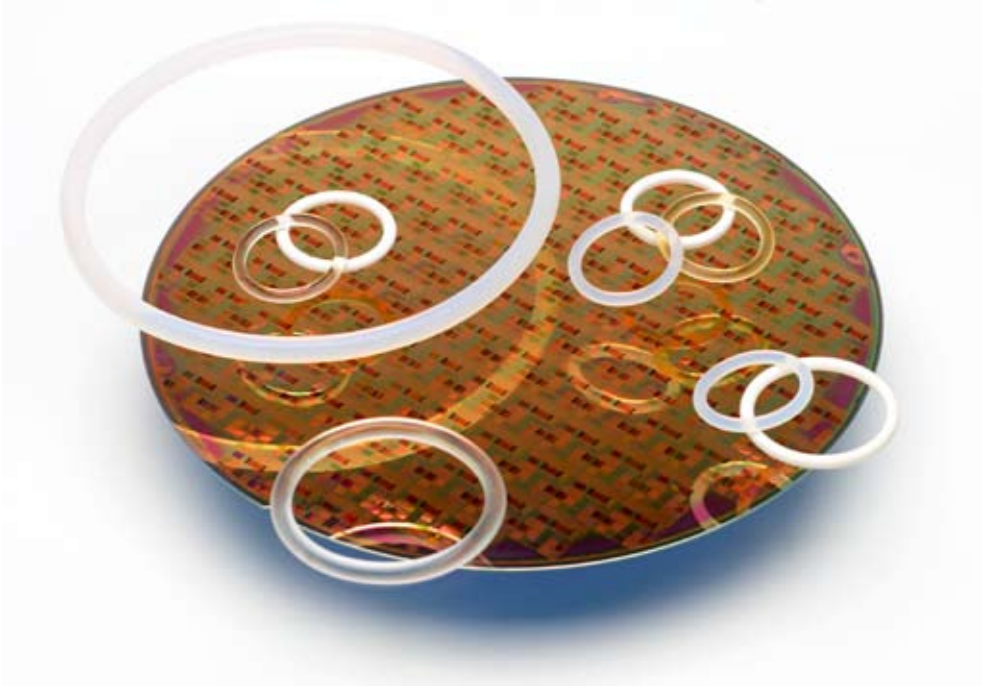
High Performance Fluorinated Elastomers for Semiconductor Service



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.



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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

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ENGINEERING **YOUR** SUCCESS.

Semiconductor Media Compatibility

Chemical	Formula	Parofluor ULTRA (FFKM)	Hifluor (FKM)	Fluorocarbon (FKM)
Acetic acid 30%	CH_3COOH	1	1	3
Acetic acid, glacial	CH_3COOH	1	1	2
Acetone	CH_3COCH_3	1	2	4
Ammonia	NH_3	2	4	4
Ammonium fluoride	NH_4F	1	1	1
Ammonium hydroxide	NH_4OH	1	2	4
Ammonium persulfate	$(NH_4)_2S_2O_8$	1	2	4
Aqua Regia	HNO_3:HCl(1:3)	1	2	2
Argon	Ar	1	1	1
Arsenic trioxide	As_2O_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	$CH_3COO(CH_2)_4$	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_2CrO_4	1	1	1
Cyclohexanone	$C_6H_{10}O$	1	1	1
Deionized water (UPDI)	H_2O	1	1	3
Diborane	B_2H_6	1	1	X
Diethylene glycol monomethyl ether (DGMME)	$CH_3O(CH_2)_2O(CH_2)_2OH$	2	3	4
Dimethyl acetamide (DMAC)	$CH_3CON(CH_3)_2$	1	1	3
Dimethyl ether	CH_3OCH_3	1	1	2
Dimethyl sulfoxide (DMSO)	$(CH_3)_2SO$	1	1	3
Dimethylamine (DMA)	$(CH_3)_2NH$	1	1	4
Ethyl acetate	CH_3COOC_2HS	1	2	4
Ethyl lactate (EL)	$CH_3CHOHCOOC_2H_5$	1	1	3
Ethylene	H_2C:CH_2	1	1	2
Ethylene glycol	$(CH_2OH)_2$	1	1	1
Ethylene glycol monoethyl ether acetate (EGMEEA)	$CH_3COO(CH_2)_2OC_2H_5$	2	3	4
F-11 (CFC) (Trichlorofluormethane)	$CFCl_3$	2	2	2
F-12 (CFC) (Dichlorodifluoromethane)	CF_2Cl_2	2	2	3
F-13 (CFC) (Chlorotrifluoromethane)	CF_3Cl	1	1	1

1 Satisfactory 2 Fair (normally okay for static seal) 3 Doubtful (sometimes okay for static seal) 4 Unsatisfactory X Insufficent 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)	CCl_2FCClF_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)	C_2CF_4Cl	2	2	X
F-125 (HFC) (Pentafluoroethane)	C_2HF_5	2	2	X
F-134a (HFC) (Tetrafluoroethane)	CF_3CH_2F	3	3	4
F-141b (HCFC) (Dichlorofluoroethane)	$CFCl_2CH_3$	1	1	X
F-142b (HCFC) (Difluorochloroethane)	CF_2ClCH_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
Hexamethyldisilizane (HMDS)	$(CH_3)_3SiNHSi(CH_3)_3$	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	$(CH_3)_2CHCH_3$	1	1	1
Isopropyl alcohol (IPA)	$(CH_3)_2CHOH$	1	1	2
MEA (Ethanolamine)	$HO(CH_2)_2NH_2$	1	1	4
MEK (Methyl ehtyl ketone)	$CH_3COCH_2CH_3$	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
Methlene chloride	CH_2Cl_2	1	1	2
MIBK (Methyl isobutyl ketone)	$(CH_3)_2CHCH_2COCH_3$	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_2O	1	1	1
NMP (Methyl (n-) pyrrolidone (2-))	$CH_3NCH_2CH_2CH_2CO$	1	1	4
Octafluoropropane	C_3F_8	1	X	X
Oxygen	O_2	1	1	2
Ozonated deionized water	O_3:H_2O	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_3PO_4	1	1	1
Phosphorous oxychloride	$POCl_3$	1	1	X
Piranha fluid (H_2SO_4/H_2O_2 @ 70/30)	H_2SO_4:H_2O_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_2O_2	1	2	X
Standard Clean 2 (SC-2)	HCl:H_2O	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_2SO_4	1	1	1
TEOS (Tetraethylorthosilicate)	$(C_2H_5)_4SiO_4$	1	1	X
Tetrahydrofuran (THF)	$CH_2CH_2CH_2CH_2O$	1	1	4
Tetramethyl ammonium hydroxide (TMAH)	$(CH_3)_4NOH$	1	1	3
Toluene	$C_6H_5CH_3$	1	2	2
Trichloroacetic acid (TCA)	CCl_3COOH	1	1	3
Trichloroethylene (TCE)	CHCl:CCl_2	1	1	1
Trichlorosilane	$SiHCl_3$	1	1	1
Trimethylamine (TMA)	$(CH_3)_3N$	1	1	3
Trimethyl borate (TMB)	$(CH_3O)_3B$	1	1	1
Trimethyl phospite (TMP)	$(CH_3O)_3P$	1	1	2
Vinyl chloride (VC)	CH_2:CHCl	1	1	1
Vinyl fluroide	CH_2:CHF	1	1	1
Xenon	Xe	1	1	1
Xylene	$C_6H_4(CH_3)_2$	1	1	1

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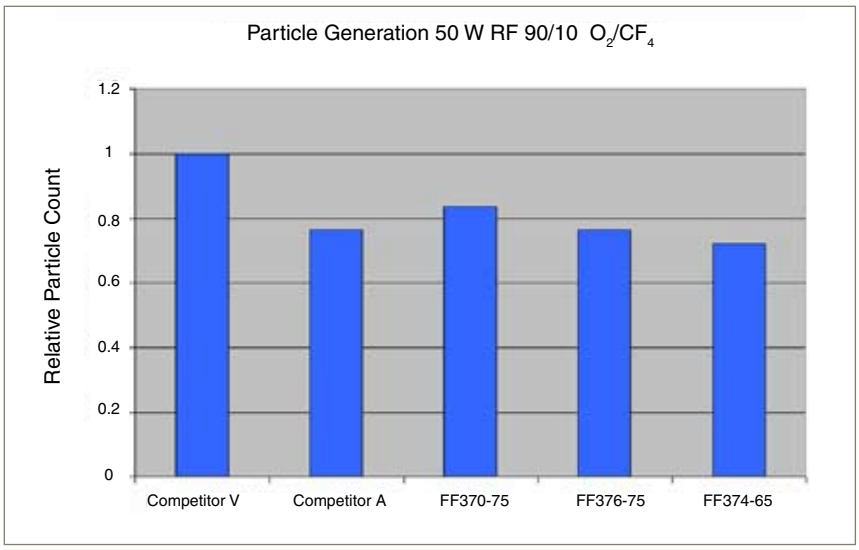
Description of Semiconductor Focused Materials

Compound	Processes	Common Wet Chemisitries Mixtures of:	Common Plasmas Mixtures of:	Attributes
FF374-60	Photolithagraphy HPCVD CVD Metal CVD SACVC Wet Etch Surface Prep Cleaning Wet Strip Etch*	UPDI SC_1 SC_2 HF HCl H_2SO_4 $CuSO_4$ NaOH KOH	$TEOS/O_3$ NF_3 C_2F_6 CF_4 SiH_4O_2 WF_6 O_2	Low closure force, Extreme low particle generation, Extreme low extractables (Best in Class), Contains no phosporous, 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_2SO_4 $CuSO_4$	$TEOS/O_3$ SiH_4O_2 NF_3 C_2F_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_2SO_4 $CuSO_4$ NaOH KOH	$TEOS/O_3$ NF_3 C_2F_6 CF_4 SiH_4O_2 WF_6 O_2	Extreme low particle generation, Extreme low extractables (Best in class), Contains no phosporous, Temperature capabilities up to 300°C, *Moderate etch rate
FF350-75	HPCVD PECVD CVD Metal CVD SACVD Etch	Due to metal extractables, recommenda-tion is FF370/ FF374/FF376	$TEOS/O_3$ NF_3 C_2F_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, recommenda-tion is FF370/ FF374/FF376	$TEOS/O_3$ NF_3 C_2F_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, recommenda-tion is FF370/ FF374/FF376	$TEOS/O_3$ NF_3 C_2F_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

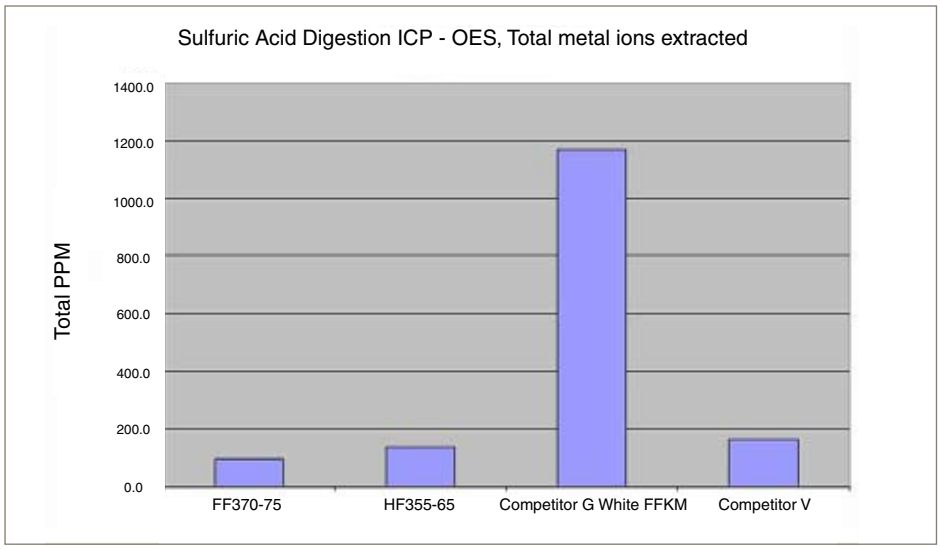
Description of Semiconductor Focused Materials

Compound	Processes	Common Wet Chemistries Mixtures of:	Common Plasmas Mixtures of:	Attributes
FF200-75	Oxidative diffusion LPCVD RTP Copper plating**	UPDI SC_1 SC_2 HF HCL H_2SO_4 $CuSO_4$	O_2 O_3 H_2O 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_2SO_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_2SO_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_2SO_4 $CuSO_4$ NaOH KOH Piranha		Low cost, Great chemical resistance, Temperature capabilities up to 250°C
V8581-90	Etch	Due to metal extractables, recommenda-tion is FF370/ FF374/FF376	TEOS O_3 C_2F_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

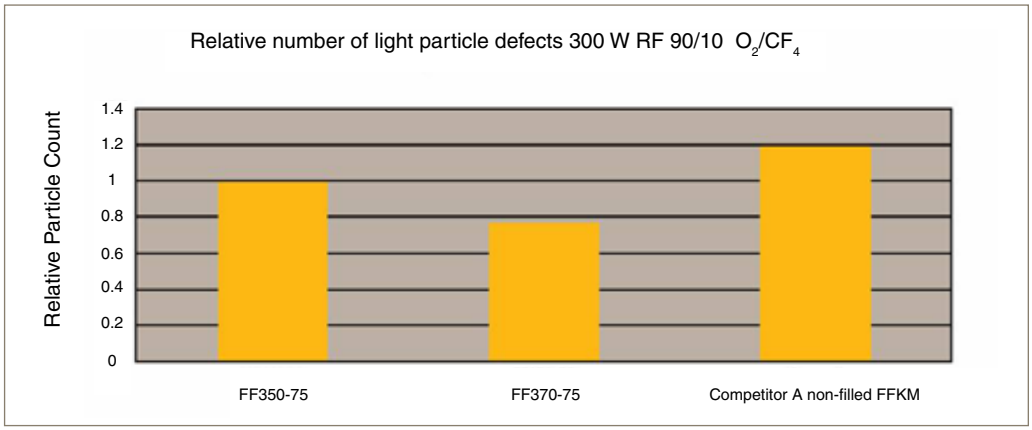
Relative Particle Generation Against Industry



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 ClF_3 CF_4 TEOS SiH_4 NF_3 Ar Cl O_2 O_3 H_2O C_2F_6 WF_6	N_2 O_2 H_2O NH_3	UPDI SC_1 HF HCl H_2SO_4 nMP NaOH $CuSO_4$
Typical Applications, Concerns for elastomers	• Etch rate • Particle generation • Particle size • Cost	• Thermal stability • Particle generation	• Chemical compatibility • Metal ion extractables • Cost
Suggested Compounds (listed in order of preference)	Etch rate: • FF352 • FF350 Particle generation: • FF374 • FF376 • FF370 Cost: • HF355*	Thermal stability: • FF200 • FF352 • FF350 Particle generation: • FF374 • FF376 • FF370	Chemical compatibilty: • FF580 • FF500 Metal ion extractables: • FF376 • FF374 • FF370 Cost: • HF355* • FF102
	* temperature capabilities up to 200°C		

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