

Technical Information

Applications and Product Selector Guide Rev. 8, June 2006



Kalrez[®] perfluoroelastomer
parts

From DuPont Performance Elastomers

Semiconductor Applications and Product Selector Guide

	Process Type	Typical Seal Temperature	Typical Process Environment	Suggested Products*	Comments	Typical Applications
 Plasma and Gas Deposition	Etching	25–220°C	CF ₄ , C ₃ F ₈ , CHF ₃ SF ₆ , O ₂ , H ₂ , HBr BCl ₃ , CCl ₄ , Cl ₂	8085 8002	8085 —Optimum for all plasma and gas deposition applications 8002—Ultralow particle generation in oxygen and fluorine-based plasmas	Dynamic: • Door seals • Gate valves • Pendulum valves • Lip seals Static: • Chamber lid seals • Electrode seals • Lamp seals • Exhaust valves • Gas inlets/outlets • PVD seals • Center rings • Fittings Carrier: • Wafer/FPD Support/Transport
	Ashing	25–250°C	O ₂ , CF ₄ , CHF ₃ , NH ₃			
	HDPCVD/PECVD/SACVD	25–250°C	TMS, TEP, TEBO TEOS, SiH ₄ NH ₃ , SiF ₄ O ₂ , O ₃ NF ₃ , CF ₄ , C ₂ F ₆ N ₂ O			
	PVD Metal CVD/ALD	25–250°C	High Vacuum Ar, N ₂ WF ₆ , SiH ₄ Organic Precursors H ₂ , N ₂ NF ₃			
 Thermal	Oxidation Diffusion	150–300°C	N ₂ O ₂ H ₂ O HCl	7075UP 8475	7075UP — Optimum for oxidation, diffusion furnace and LPCVD thermal process applications 8475 —Optimum for RTP and lamp anneal thermal process applications	• Quartz chamber seal • Fittings • Center ring • Plenum seals
	LPCVD	150–300°C	NH ₃ SiH ₂ Cl ₂ HCl			
	Lamp Anneal RTP	150–300°C	Resistance to IR absorption/low outgassing	8475		
 Wet	Wafer Prep, Cleaning, and Rinsing	25–125°C	UPDI, Piranha SC-1, SC-2, O ₃ , HF (49%)	6375UP 4079	6375UP —Optimum for wet process applications 4079—Excellent chemical resistance 1050LF—Excellent amine resistance	• Door/lid seals • Drain seals • Seals for chemical containers • Fittings • Seals for filters/connectors • Flow meters
	Etching	25–180°C	HNO ₃ , HF, H ₂ O H ₃ PO ₄ , HNO ₃ , Acetic, H ₂ O			
	Photolithography Developing, and Rinsing	25–125°C	H ₂ SO ₄ + Oxidant Organic Acids NaOH, TMAH Xylene, nMP			
	Stripping	25–125°C	nMP/Alkanolamine Hydroxylamine	6375UP 1050LF		
	Copper Plating	25–100°C	CuSO ₄ Solution H ₂ SO ₄ , H ₂ O ₂ UPDI, Citric Acid	6375UP		

* For more detailed information, refer to "Chemical Compatibility Guide." Products in **BOLD** are preferred.

Kalrez® Parts for the Semiconductor Industry

Kalrez® perfluoroelastomer parts have been used successfully in highly aggressive sealing environments for over 30 years. Kalrez® combines the resilience and sealing force characteristics of an elastomer with the chemical inertness and thermal stability of Teflon® fluoropolymer resin. DuPont Performance Elastomers (DPE) offers molded O-rings and custom seals using a series of specialty products and ultrapure processing for the semiconductor industry. Kalrez® UltraPure™ parts have excellent chemical and thermal stability and have been specially formulated and processed to meet the unique requirements of wafer processing environments.

Chemical and Thermal Resistance

Kalrez® seals resist attack by over 1,800 chemicals including reactive gases and plasmas, alkalis, acids and solvents. Even in contact with these corrosive chemicals, Kalrez® seals retain their elastomeric properties at temperatures as high as 327°C. DPE has over 30 years experience in perfluoroelastomer research including polymer development, compounding, and parts manufacturing. As the sealing needs of the semiconductor industry have evolved, this experience has enabled DPE to introduce new products that continue to increase seal life and reduce process contamination levels.

Ultrapure Processing Reduces Contamination

Particle contamination in critical wafer processing applications spells trouble. The post-cleaning process used by DPE for all Kalrez® UltraPure™ parts yields part-cleanliness levels significantly superior to those available from other perfluoroelastomer parts suppliers as shown by recent independent laboratory comparison tests. Ultrapure post-cleaning and packaging is performed on Kalrez® parts as a secondary operation in a Class 100 clean room. Parts are cleaned using a proprietary process, followed by multiple rinses in UPDI water, and then dried under a filtered air stream. The parts are sealed in certified-clean, antistatic packaging material and shipped double-bagged, permitting easy clean room use by OEMs and fablines. This process can reduce the number of particles >1 µm in size present on the part surface by a factor of 20.

Ultrapure processing is standard for Kalrez® Sahara™ 8085, Kalrez® 8002, KLR-9100, Kalrez® 7075UP, Kalrez® 8475, Kalrez® 6375UP and Kalrez® Sahara™ 8575. It is optional for Kalrez® 4079, Kalrez® 2037, and Kalrez® 1050LF. For these products, ultrapure processing can be specified by adding a "UP" suffix to the product designation (e.g., Kalrez® 4079UP).

Suggested Products for Semiconductor Use

Kalrez® Sahara™ 8085 has been specifically developed for plasma and gas deposition applications, i.e., etching, ashing, HDPCVD, PECVD, SACVD, etc. It has been formulated for minimal particle generation in NF₃ plasma. Kalrez® Sahara™ 8085 exhibits very low particle generation and low weight loss in oxygen and fluorine-based plasma, has excellent mechanical properties and is well-suited for both static and dynamic sealing applications (e.g., bonded slit valve doors, bonded gate valves, bonded pendulum valves, gas orifice seals, gas inlets, gas feedthrough seals, chamber lid seals, etc.). A maximum continuous service temperature of 240°C is suggested. Kalrez® Sahara™ 8085 can also withstand short-term excursions up to 275°C. Ultrapure post-cleaning and packaging is standard for parts made from Kalrez® Sahara™ 8085.

Kalrez® 8002 is a clear, transparent product targeted specifically for select semiconductor plasma and gas deposition applications, i.e. etching, ashing HDPCVD, PECVD, SACVD, etc. This unfilled product offers very low particle generation in oxygen and fluorine-based plasmas versus mineral-filled products. Kalrez® 8002 exhibits excellent resistance to dry process chemicals, has good mechanical properties and is well suited for static, low stress/low sealing force and select bonded door seal applications. A maximum continuous service temperature of 275°C is suggested. Ultrapure post-cleaning and packaging is standard for parts made from Kalrez® 8002.

KLR-9100 is a new, developmental product targeted specifically for semiconductor plasma and gas deposition applications, i.e., ALD, HDPCVD, PECVD, SACVD, etc. It has been specifically designed for minimal particle generation and low contamination in harsh plasma environments. It has exhibited excellent performance in HDPCVD STI and in MONOVAT® bonded door applications in PECVD Black Diamond® Processes @ Major US and European Semiconductor Fablines. KLR-9100 offers outstanding thermal stability, very low outgassing and excellent mechanical strength properties and is well suited for both static and dynamic sealing applications. A maximum continuous service temperature of 300°C is suggested. Ultrapure post-cleaning and packaging is standard for all parts made from KLR-9100.

Kalrez® 7075UP is a black product targeted specifically for semiconductor oxidation, diffusion furnace and LPCVD thermal process applications. It offers outstanding thermal stability, very low outgassing and excellent compression set properties. Kalrez® 7075UP exhibits excellent seal force retention, has good mechanical properties and is well suited for both static and dynamic sealing applications. A maximum continuous service temperature of 327°C is suggested. Short excursions to higher temperatures may also be possible. Ultrapure post-cleaning and packaging is standard for all parts made from Kalrez® 7075UP.

Kalrez® Sahara™ 8475 has been specifically developed to meet the challenging requirements associated with sealing applications in semiconductor thermal processes (i.e., oxidation, diffusion furnace, LPCVD, RTP, lamp anneal, etc.). It exhibits excellent thermal stability and long-term sealing performance, less IR absorption and significantly reduced outgassing properties at elevated temperatures. Kalrez® Sahara™ 8475 has good mechanical properties and is well-suited for static and low stress/low sealing force applications (e.g., quartz tube seals, ball joint seals, bell jar seals, plenum seals, etc.). A maximum continuous service temperature of 300°C is suggested. Ultrapure post-cleaning and packaging is standard for all parts made of product 8475.

Kalrez® 6375UP is a black product for semiconductor wet process applications. This product exhibits excellent chemical resistance to all different types of wet process chemicals including acids, bases and amine-base strippers. It features low elemental extractables with good mechanical and compression set properties and is well-suited for both static and dynamic wet process seal applications (e.g., filter seals, drain seals, flowmeters). A maximum continuous service temperature of 275°C is suggested. Ultrapure post-cleaning and packaging is standard for parts made of product 6375UP.

Additional Products Available

Kalrez® Sahara™ 8575 is a white product for select etching, ashing, PVD, metal CVD and ALD processes. It offers lower weight loss in oxygen and fluorine-based plasmas, low outgassing and excellent elastic recovery properties. Kalrez® Sahara™ 8575 has excellent vacuum and long-term sealing performance, good mechanical properties and is well-suited for both static and dynamic sealing applications (e.g., gas inlets, chamber lid seals, slit valve door seals, etc.). A maximum continuous service temperature of 300°C is suggested. Ultrapure post-cleaning and packaging is standard for all parts made of Kalrez® Sahara™ 8575.

Kalrez® 4079 is a black, low compression set product for use in many dry and wet semiconductor process environments. It has excellent chemical resistance, good mechanical properties, and outstanding thermal stability. Kalrez® 4079 exhibits low weight loss in reactive plasmas and has good response to temperature cycling effects. It is not recommended for use in amines. A maximum continuous service temperature of 316°C is suggested. Short excursions to higher temperatures are possible. Ultrapure post-cleaning and packaging is optional.

Kalrez® 2037 is a white product that is suitable for use in some plasma and gas deposition applications. It exhibits very low weight loss in oxygen and fluorine-based plasmas and has good mechanical strength properties. A maximum service temperature of 220°C is suggested. Ultrapure post-cleaning and packaging is optional.

Kalrez® 1050LF is a black product for use in select semiconductor wet process applications where high concentrations of certain amines are present. It exhibits excellent amine resistance and has excellent thermal stability and mechanical strength properties. Kalrez® 1050LF is not recommended for use in organic or inorganic acids at elevated temperatures. A maximum continuous service temperature of 288°C is suggested. Ultrapure post-cleaning and packaging is available. Please order this product as 1050UP when specifying ultrapure post-cleaning and packaging.

Kalrez® Parts Semiconductor Product Information¹

Product	Color	Hardness Shore A (pellet) ²	Hardness Shore M (O-ring) ⁴	Max. Continuous Service Temp., ⁹ °C	100% Modulus ⁵ MPa	Compression Set ⁷ at 70 hr 204°C, %
8085	Beige	80	86	240	7.50	42 ⁸
8002	Clear translucent	69 ³	76	275	2.88 ⁶	15 ⁸
KLR-9100	Amber translucent	—	74	300	4.27 ¹⁰	17 ⁸
7075UP	Black	75	—	327	7.55	15
8475	White	60	71	300	2.20	23 ⁸
6375UP	Black	75	83	275	7.23	25
8575	White	62	72	300	2.47	29
4079	Black	75	—	316	7.23	25
2037	White	79	—	220	6.20	27
1050LF	Black	82	—	288	12.40	35

¹ Not to be used for specification purposes

² ASTM D2240 (pellet test specimens unless otherwise noted)

³ JIS 6253 (plied slab test specimens)

⁴ ASTM D2240 and ASTM D1414 (AS568 K214 O-ring test specimens)

⁵ ASTM D412 (dumbbell test specimens unless otherwise noted)

⁶ JIS 6251 (dumbbell test specimens)

⁷ ASTM D395B (pellet test specimens unless otherwise noted)

⁸ ASTM D395B and ASTM D1414 (AS568 K214 O-ring test specimens)

⁹ DuPont Performance Elastomers proprietary test method

¹⁰ ASTM D412 and ASTM D1414 (AS568A K214 O-Ring test specimens)

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