DuPont™ Kalrez®

Semiconductor Product Selector Guide

Technical Information—Rev. 16, June 2011

	Process Type	Typical Seal Temperature	Typical Process Environment	Suggested Products*	Comments	Typical Applications
Plasma Processes	PECVD ALD	25–200 °C	TMS, DEMS, TEOS, SiH_4, C_3H_6, NH_3, SiF_4, O_2, N_2O, NF_3	**9100** 9500	**9100 – Low erosion rate and ultra-low particle generation in harsh plasma environments** **9500 – Excellent resistance to ozone, ammonia, water vapor and plasma radicals** **9300 – Specifically designed for processes where the plasma environment is a combination of ions ("physical") and radicals ("chemical")**	Dynamic: • Door seals • Gate valves • Pendulum valves Static: • Chamber lid seals • Exhaust valves • Gas inlet/outlet/mixing block seals • Window seals • Center rings Carrier: • Wafer/FPD Support/Transport
	HDPCVD	25–200 °C	TEOS, SiH_4, NH_3, SiF_4, O_2, C_2F_6, N_2O, NF_3, CF_4	**9100** 8002		
	SACVD	25–250 °C	TEP, TEBO, TEOS, O_3, NF_3	**9500** 8085		
	Ash/Strip	25–250 °C	O_2, CF_4, CHF_3, NH_3, H_2O Vapor Forming Gas	**9500** 8002		
	Dielectric Etch	25–200 °C	CF_4, C_3F_8, CHF_3, SF_6, O_2, H_2,	**9300** 9100		
	Conductor Etch	25–200 °C	CF_4, CHF_3, HBr, BCl_3, CCl_4, Cl_2	**9300** 9500		
Thermal Processes	Metal CVD ALD LPCVD	25–300 °C	Organic precursors, WF_6, $TiCl_4$, SiH_4, HF, F_2, Cl_2, ClF_3, NF_3, H_2O Vapor, O_2, O_3	**8900** 9100	**8900 – Suggested product for metal CVD, ALD, LPCVD, oxidation and diffusion processes.** **8475 – Suggested product for lamp anneal and RTP processes.**	• Quartz chamber seal • Fittings • Center ring • Plenum seals
	Oxidation Diffusion	150–300 °C	N_2, O_2, H_2O, HCl, Cl_2	**8900** 8475		
	Lamp Anneal RTP	150–300 °C	Resistance to IR absorption	**8475**		
Wet Processes	Wafer Prep	25–125 °C	UPDI, Piranha, SC-1, SC-2, O_3, HF (49%)	**6375UP**	**6375UP – General purpose product for all wet process applications.**	• Door/lid seals • Drain seals • Seals for chemical containers • Fittings • Seals for filters/ connectors • Flow meters
	Etching	25–180 °C	HNO_3, HF, H_2O, H_3PO_4, HNO_3,			
	Photolithography	25–125 °C	H_2SO_4 + Oxidant, Organic Acids, nMP			
	Stripping	25–125 °C	nMP/Alkanolamine Hydroxlamine	**6375UP** 1050LF		
	Copper Plating	25–100 °C	$CuSO_4$ Solution H_2SO_4, H_2O_2	**6375UP**		

* Please consult a Kalrez® Application Engineer to assess performance fit in your application. Products in **BOLD** are preferred. Please refer to the Kalrez® Application Guide (www.dupontelastomers.com/kag) for specific chemical compatibility ratings for Kalrez® products.

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The miracles of science™

DuPont™ Kalrez® Parts for the Semiconductor Industry

Kalrez® perfluoroelastomer parts have been used successfully in highly aggressive sealing environments for over 30 years. Kalrez® parts combine the resilience and sealing force characteristics of an elastomer with the chemical inertness and thermal stability of DuPont™ Teflon® fluoropolymer resin. DuPont offers molded O-rings and custom seals using a series of specialty products and ultrapure processing for the semiconductor industry. DuPont™ 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 325 °C. DuPont 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 DuPont to introduce new products that continue to increase seal life and reduce process contamination levels.

Ultrapure Processing Reduces Residual Contamination

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.

Ultrapure processing is standard for Kalrez® 9100, Kalrez® 9300, Kalrez® 9500, Kalrez® 8002, Kalrez® 8085, Kalrez® 8900, Kalrez® 8475 and Kalrez® 6375UP. It is optional for Kalrez® 1050LF. For these products, ultrapure processing can be specified by adding a “UP” suffix to the product designation (e.g., Kalrez® 1050UP).

Suggested Products for Semiconductor Use

DuPont™ Kalrez® 9100 is an amber translucent product targeted specifically for HDPCVD and PECVD processes. It has also exhibited excellent performance in “select” etch process applications. Kalrez® 9100 has been specifically designed for low erosion and ultra-low particle generation in harsh plasma environments. It offers excellent thermal stability, very low outgassing as well as excellent elastic recovery and 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 Kalrez® 9100 parts.

DuPont™ Kalrez® 9300 is a brown general purpose product for all etch processes, e.g., dielectric etch, conductor (poly/metal) etch, etc. It has been specifically designed for use in applications where the plasma environment is a combination of ions (“physical”) and radicals (“chemical”), i.e., where a balance of “physical” and “chemical” plasma erosion resistance is typically required. Kalrez® 9300 exhibits excellent resistance to oxygen and fluorine-based plasma and etch process chemistry. It also offers very low metals content, excellent thermal stability and mechanical strength 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 Kalrez® 9300 parts.

DuPont™ Kalrez® 9500 is a tan product targeted specifically for deposition processes where ozone is used for processing, e.g. SACVD, PECVD UV-cure chamber, etc., PECVD ultra-low K (BLOK™), and ash/strip processes. It has been specifically designed for use in applications where the plasma environment is more “chemical”, i.e., where oxygen and fluorine radicals are more dominant. Kalrez® 9500 exhibits excellent resistance to CVD and ash/strip process chemistry, i.e., ozone, ammonia and water vapor. It also offers outstanding thermal stability, very low outgassing and excellent mechanical strength and is well suited for both static and dynamic sealing applications. A maximum continuous service temperature of 310 °C is suggested. Kalrez® 9500 can also withstand short term excursions up to 325 °C. Ultrapure post-cleaning and packaging is standard for all Kalrez® 9500 parts.

DuPont™ Kalrez® 8900 is a black product for all thermal processes, e.g., oxidation, diffusion furnace, metal CVD, ALD and LPCVD. It offers outstanding thermal stability, very low outgassing and excellent (low) compression set properties. Kalrez® 8900 exhibits excellent retention of physical properties at elevated temperatures, has excellent mechanical strength and is well-suited for both static and dynamic sealing applications. A maximum continuous service temperature of 325 °C is suggested. Short excursions to higher temperatures may also be possible. Ultrapure post-cleaning and packaging is standard for all Kalrez® 8900 parts.

DuPont™ Kalrez® 8475 has been specifically developed to meet the challenging requirements associated with lamp anneal and RTP sealing applications in semiconductor thermal processes. It exhibits excellent thermal stability and long-term sealing performance and has less IR absorption significantly reduced outgassing properties at elevated temperatures. Kalrez® 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). A maximum continuous service temperature of 300 °C is suggested. Ultrapure post-cleaning and packaging is standard for all Kalrez® 8475 parts.

DuPont™ Kalrez® 6375UP is a general purpose black product for all 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 and flow meters). A maximum continuous service temperature of 275 °C is suggested. Ultrapure post-cleaning and packaging is standard for Kalrez® 6375UP parts.

Additional Products Available

DuPont™ Kalrez® 8002 is a clear product for ash/strip and “select” etch and deposition processes. This unfilled product offers excellent plasma cracking resistance and ultra-low particle generation in oxygen and fluorine-based plasmas versus mineral-filled products. Kalrez® 8002 exhibits excellent resistance to dry process chemistry has good mechanical strength 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 all Kalrez® 8002 parts.

DuPont™ Kalrez® 8085 is a beige, general purpose product for “select” etch, ash/strip and deposition processes, e.g., HDPCVD, PECVD and SACVD. It has been formulated for minimal particle generation in NF_3 plasma. Kalrez® 8085 exhibits very low particle generation and low weight loss in oxygen and fluorine-based plasma, has excellent mechanical strength 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 feed-through seals, chamber lid seals). A maximum continuous service temperature of 240 °C is suggested. Kalrez® 8085 can also withstand short-term excursions to 275 °C. Ultrapure post-cleaning and packaging is standard for all Kalrez® 8085 parts.

DuPont™ Kalrez® 1050LF is a black product targeted specifically for 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.

Semiconductor Product Information[1]

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, %
9100	Amber translucent	68[11]	74	300	4.27[10]	17[8]
9300	Brown	74[11]	79	300	4.65[10]	28[8]
9500	Tan	75[11]	80	310	5.67[10]	22[8]
8002	Clear	69[3]	76	275	2.88[6]	15[8]
8085	Beige	80	86	240	7.50	42[8]
8900	Black	73	80	325	10.73[10]	8[8]
8475	White	60	71	300	2.20	23[8]
6375UP	Black	75	83	275	7.23	25
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 proprietary test method
[10] ASTM D412 and ASTM D1414 (AS568 K214 O-ring test specimens)
[11] ASTM D2240 (plied slab test specimens)

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