DuPont™ Kalrez®

PERFLUOROELASTOMER PARTS

PROVEN RELIABILITY IN AGGRESSIVE WAFER PROCESSING ENVIRONMENTS

DUPONT®

The miracles of science™

DuPont™ Kalrez® Parts Provide Better Performance for Higher Yields

Purity is critical to high wafer yield. As a consequence, reducing contamination from particulates, outgassing and extractables caused by seal deterioration are all major goals for semiconductor fabricators. Manufacturers gain seal reliability and process purity when they rely on DuPont™ Kalrez® perfluoroelastomer parts.

Whether it's etching, ashing/stripping, deposition, oxidation, diffusion furnace or "wet" processes, Kalrez® parts are field-proven in the manufacture of semiconductor chips. In a number of evaluations at fabline customers, Kalrez® parts exhibited improved mechanical strength, lower particle generation and longer seal life versus competitive perfluoroelastomers in both static and dynamic sealing applications.

Field-Proven in Semiconductor Processes

Application	Process Environment	Incumbent Performance	Results with DuPont™ Kalrez® Parts
Slit valve door, inner gas manifold ring, MESC flange insert, iso-poppet and others	HDPCVD IMD and STI Processes—SiH_4, He, O_2 with a two-stage cleaning chemistry of NF_3 and O_2 plasma.	PM cycle for the competitive FFKM (A11) seals was 90 days. Some seal locations failed after 1 to 2 months due to high particle count and leakage	All of the DuPont™ Kalrez® 9100 seals exceeded the current PM target of the incumbent by 2X to 6X. Fab line extended PMs from 90 days to 180 days minimum even for the most difficult seal locations.
VAT MONOVAT® bonded door	PECVD Black Diamond® and Blok® Processes—Trimethyl Silane (TMS), O_2 with cleaning chemistry of NF_3 plasma via RPS.	PM cycle for competitive FFKM (F4) in Black Diamond® process was 30,000 pairs of wafers; PM cycle for competitive FFKM (F4) in Blok® process was 60,000 pairs of wafers. Failure was excessive particle generation	MONOVAT® bonded doors using DuPont™ Kalrez® 9100 lasted 55,000+ pairs of wafers in Black Diamond® process and 110,000+ pairs of wafers in Blok® process. Fab line achieved superior performance and reduced cost of ownership.
Door seal on chamber wall (not on valve door)	Metal Etch and Resist Strip/Ash Process - Cl_2, BCl_3 and water vapor with a cleaning chemistry of O_2 plasma.	Competitive FFKM (A3) custom seal lasted approximately 300 Rf hours. Typical failure mode was cracking in the «corners» of the seal.	DuPont™ Kalrez® 9100 custom seal showed no sign of cracking or degradation after 500 Rf hours. The custom seal is still in service and approaching 1000 Rf hours.
Gas box, shower head and plate seal	PECVD—TEOS and O_2 at 400 °C and ~3000 watts with cleaning chemistry of NF_3 plasma at 3500 watts.	Competitive FFKM (A2) failed after 20,000 wafers due to cracking and excessive leakage.	DuPont™ Kalrez® Sahara™ 8085 improved wafer production to over 25,000 versus competitive FFKM.
Slit valve door seal	Tungsten CVD—WF_6 plus others and cleaning chemistry NF_3, in situ.	Competitive FFKM (A11) bonded door seal produced unacceptable particle generation.	DuPont™ Kalrez® Sahara™ 8085 produced 51% less mean particle adders and 33% reduction in mean defect adders.
E-Chuck top O-ring	HDPCVD STI Process—SiH_4, He and O_2 with a cleaning chemistry of NF_3 plasma.	PM Cycle for competitive FFKM (A11) was a maximum of 1.5 years. Typical mode of failure was leakage after 50,000 wafer cycles.	After 80,000+ wafer cycles, DuPont™ Kalrez® 8002 exhibited minimal seal erosion. The Fab line adopted Kalrez® 8002.
Gas box, shower head, and foreline	PECVD BPSG Process—TEOS, TMB, O_3 at 1000 watts and C_3F_8 cleaning gas at 2000 watts. Seal temperature 85–120 °C at ~200 Torr.	Competitive FFKM (A2) showed sign of cracking and leakage at 20,000 wafer PM.	DuPont™ Kalrez® 8002 evaluated for 22,000 wafer cycles with no sign of cracking or leakage and 8002 lowered (improved) particle generation.
Injector, upper and lower cap, tube, pump, T/C port O-ring and others	LPCVD Nitride Process—Si_2Cl_6, NH_3 with a cleaning chemistry of HF and fluorine gas.	PM cycle for the incumbent seals was 4 months. Significant degradation in the tube and pump seal locations was observed.	DuPont™ Kalrez® 8900 seals exceeded the 4 month PM cycle. After 5 months, the tube and pump seals exhibited less degradation than the incumbent seals and were still functioning. The Fab line has adopted Kalrez® 8900.
O-rings, wafer lip seal, robot arm suction cup	Electrochemical plating (ECP) process—O_3, H_2SO_4, $CuSO_4$, citric acid, UPDI, at 100 °C.	Seal degradation of FKM caused sticking which resulted in contamination/metallic residue on back side of wafer.	DuPont™ Kalrez® 6375UP demonstrated the best chemical compatibility and lowest extractables compared to competitive FFKMs (A17 and B4), FKM and EPDM.

Engineered for Reliability and Performance

The exceptional performance of DuPont™ Kalrez® parts are the result of in-depth industry knowledge and broad elastomer experience. Kalrez® parts are specially engineered to withstand process conditions that meet the needs of fablines and OEMs. This outstanding level of performance has been proven over more than 30 years of success in a wide range of industrial and semiconductor grade chemicals. In addition to the exceptional performance of Kalrez® parts, DuPont delivers:

- Deep technical expertise as a result of over 75 years of elastomers experience.
- Integrated manufacturing back to the polymer to enhance quality control and product development. Focused on next-generation product requirements.
- Expertise in developing products for the semiconductor market with a broad product offering for each of the major processes based on application performance targets, e.g., plasma resistance, outgassing, permeability, extractables, etc.
- Advanced Finite Element Analysis (FEA) for calculating stress patterns, and optimizing product selection and groove geometry to aid in the design of new seal shapes.
- Comprehensive applications support including performance and analytical tests for product identification, seal design or failure analysis. On-site seminars available.

Our global laboratories in the US, Switzerland and Japan perform tests including FTIR, ESCA, SEM EDX, and other analytical tests, long-term seal force retention and compression set, outgassing, vacuum and permeability, and polymer identification.

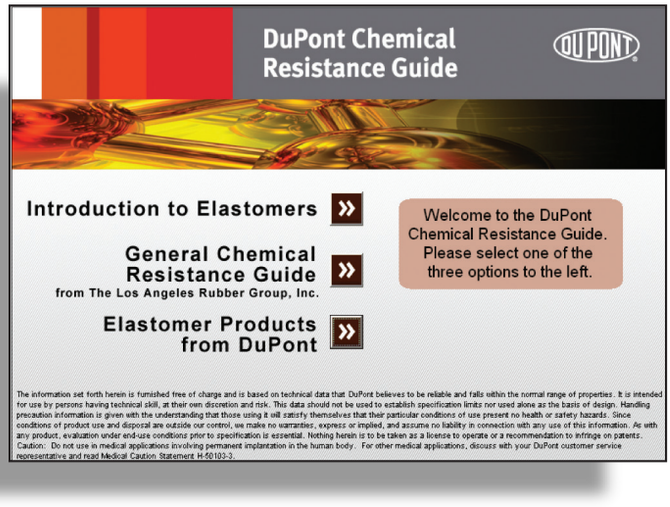
With DuPont™ Kalrez® Parts, Sealing Solutions are Just a Click Away

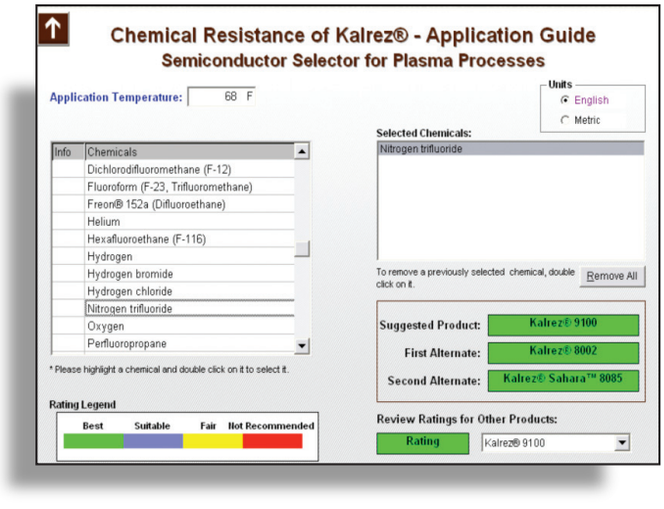
Not all sealing materials are created equal. To help customers specify the most suitable sealing material and seal design for their application, DuPont has several free on-line tools to assist in elastomer selection.

The Chemical Resistance Guide (CRG) is a complete online reference tool that rates how elastomers respond to different environments. In addition to basic chemical and thermal resistance for most elastomers, there is extensive information about DuPont™ Kalrez® perfluoroelastomer parts and DuPont™ Viton® fluoroelastomers, both products of DuPont. View the CRG at www.dupontelastomers.com/crg.

Need help with seal design? The Kalrez® Application Guide (KAG) can assist in the design of a groove for an existing O-ring, help design a custom O-ring or evaluate an O-ring for a specific groove. You may request a downloadable copy of the KAG at www.dupontelastomers.com/kag. The KAG and CRG are updated yearly to ensure that you get the latest products.

Selecting and designing the correct part for an application has never been easier. Please refer to our website www.dupontelastomers.com for the latest information including datasheets and technical information.





Visit us at: kalrez.dupont.com or vespel.dupont.com

Contact DuPont at the following regional locations:

North America
800-222-8377

Latin America
+0800 17 17 15

Europe, Middle East, Africa
+41 22 717 51 11

Greater China
+86-400-8851-888

ASEAN
+65-6586-3688

Japan
+81-3-5521-8484

Reference Number KZS-A10560-00-B0411 Printed in the U.S.A.

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