

Kalrez® perfluoroelastomer parts improve

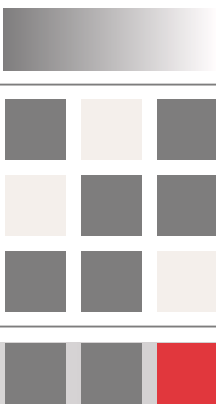
process purity and yield

in aggressive wafer processing applications



Kalrez®

From DuPont Performance Elastomers



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 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 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 Kalrez® 9100 seals exceeded the current PM target of the incumbent by 2X to 6X. Fabline 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 Kalrez® 9100 lasted 55,000+ pairs of wafers in Black Diamond® process and 110,000+ pairs of wafers in Blok® process. Fabline 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	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	Kalrez® Sahara™ 8085 improved wafer production to over 25,000 versus competitive FFKM
Turbo gate O-ring	HDPCVD - SiH ₄ and O ₂ at 150°C with cleaning chemistry of NF ₃ plasma	Competitive FFKM (A2) failed after 10,000 wafers due to excessive particles	Kalrez® Sahara™ 8085 improved wafer production to over 20,000 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	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, Kalrez® 8002 exhibited minimal seal erosion. The Fabline adopted Kalrez® 8002
Gas box, shower head, and foreline	PECVD BPSG Process - TEOS, TMB, O ₃ at 1000 watts and C ₃ F 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	Kalrez® 8002 evaluated for 22,000 wafer cycles with no sign of cracking or leakage and 8002 lowered (improved) particle generation
O-rings, wafer lip seal, robot arm suction cup	Electrochemical plating (ECP) process - O ₃ , H ₂ SO 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	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 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 Performance Elastomers 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.



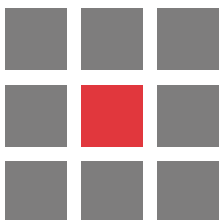
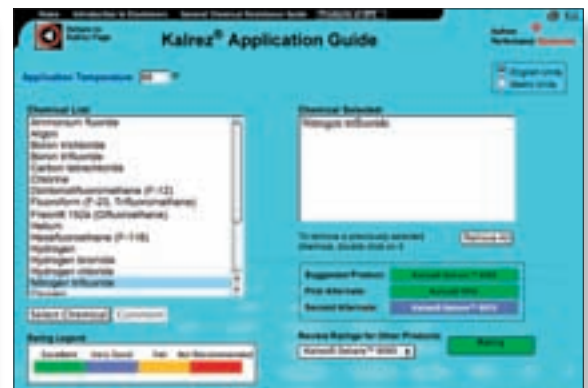
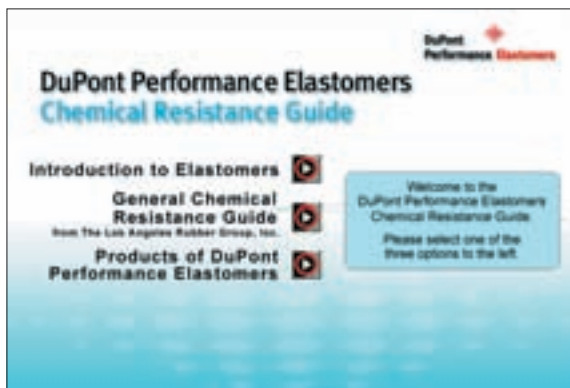
With Kalrez® parts sealing solutions are just a click away

Not all sealing materials are created equal. To help customers specify the most suitable sealing material and seal design for their application, DuPont Performance Elastomers 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 Kalrez® perfluoroelastomer parts and Viton® fluoroelastomers, both products of DuPont Performance Elastomers. 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.



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Kalrez® UltraPure™ parts are available in a wide variety of finished products — from conventional O-rings, to bonded door seals, to custom geometries. From polymer through finished parts, chip manufacturers can be assured of the highest-level quality and performance when they specify Kalrez® parts.

