

Technical Information

May 2007



Kalrez® perfluoroelastomer
parts

From DuPont Performance Elastomers

Kalrez® 9100

Product Description

Kalrez® 9100 is a new, amber translucent product targeted specifically for deposition process applications, i.e., HDPCVD, PECVD, SACVD, Metal CVD, ALD, etc. It has also exhibited excellent performance in "select" etching and ashing/stripping process applications. Kalrez® 9100 has been specifically designed for low erosion and ultra-low particle generation in harsh plasma environments. It offers outstanding 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 parts made from Kalrez® 9100.



Features/Benefits

- Low erosion rate and ultra-low particle generation in oxygen and fluorine-based plasmas
- Excellent resistance to dry process chemistry
- Excellent thermal stability
- Very low outgassing properties and metals content
- Excellent elastic recovery and low compression set properties

Suggested Applications

- Gas inlet/orifice seals
- Chamber lid seals
- Isolation valve seals
- Bonded gate valves/slit valve door seals

Typical Physical Properties¹

Property	Typical Value
Color	Amber Translucent
Hardness, Shore M ²	74
100% Modulus ³ , MPa	4.27
Tensile Strength @ Break ³ , MPa	11.85
Elongation @ Break ³ , %	220
Compression Set ⁴ , %	
70 Hrs. @204°C	17
70 Hrs. @250°C	21
70 Hrs. @300°C	53
Maximum Continuous Service, Temperature ⁵ , °C	300

¹ Not to be used for specification purposes

² ASTM D2240 & D1414 (AS568 K214 O-ring test specimens)

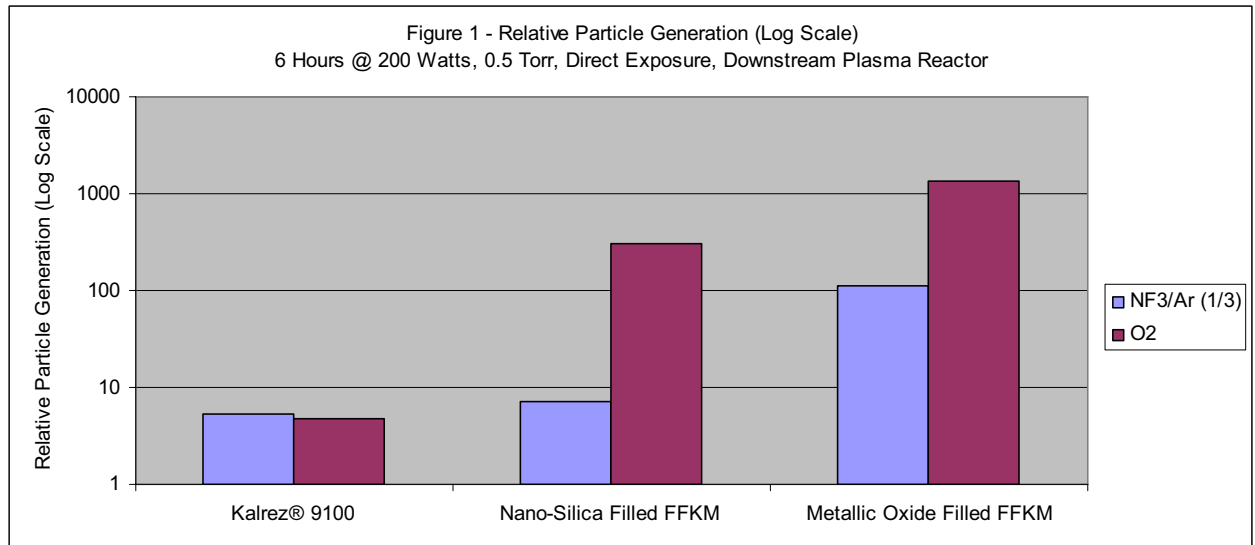
³ ASTM D412 & D1414 (AS568 K214 O-ring test specimens)

⁴ ASTM D395B & D1414 (AS568 K214 O-ring test specimens)

⁵ DuPont Performance Elastomers proprietary test method

Particle Generation

Conventional perfluoroelastomer (FFKM) sealing materials normally contain carbon black and/or mineral fillers. Newer compounds are either unfilled or formulated with polymeric fillers. Plasma resistance can be significantly different depending on the type of filler used. If the filler has high resistance to plasma, such as BaSO₄, TiO₂, etc., it can “shield” the polymer to reduce erosion or weight loss, but have the high potential for particle generation by leaving discrete particles behind once the polymer has become etched. Unfilled and polymeric filled compounds essentially contain no other elements other than carbon, fluorine and oxygen, which can be completely etched to form volatiles, thereby significantly reducing the potential for contamination. Figure 1 shows the relative particle generation of Kalrez® 9100 versus a nano-silica and a metallic oxide filled FFKM compound in different plasmas.



Fabs Choose Kalrez® 9100 For Improved Performance

Kalrez® 9100 has been reported to significantly improve wafer production in a variety of semiconductor process applications, i.e., HDPCVD, PECVD, etching, ashing, etc., where oxygen and fluorinated plasmas are used during the cleaning cycle. In a number of evaluations at fabline customers, Kalrez® 9100 exhibited less erosion, lower particle generation and longer seal life compared to competitive perfluoroelastomers in both static and dynamic sealing applications.

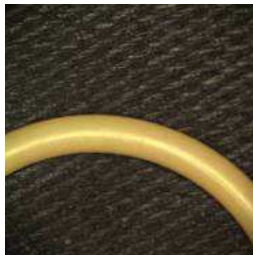
Case Report # 5903 - PM Cycle Extended 3X! @ Major US Fab Line

- Fab line has extended pm cycle from 60 to 180 days
- No evidence of erosion, leakage, mechanical damage or compression set after 180 days of service
- Equipment Platform -- Novellus Concept Two Speed®
- Process -- HDPCVD / STI
- Process Chemistry -- SiH₄, He, O₂
- Cleaning Chemistry -- NF₃ plasma @ 4000 watts
- Seal Locations -- slit valve door, inner gas manifold ring, MESC flange insert, Iso-poppet valve, turbo gate, dome lid

Case Report # 6441 –PM Target Exceeded @ Major European Research Center

- No/minimal evidence of erosion or degradation after processing 5,000 wafers
- Research center is currently conducting testing to determine maximum practical seal life
- Equipment Platform – Applied Materials Centura® Ultima®
- Process – HDPCVD / STI
- Process Chemistry – SiH₄, He, O₂,
- Cleaning Chemistry -- NF₃ plasma @ 3000 watts
- Seal Location – roughing isolation valve poppet seal, top nozzle assembly o-ring seal

Figure 2. Kalrez® 9100 and incumbent seals after processing 5000 wafers. It was the research center's opinion that the Kalrez® 9100 seals could have continued to function beyond the scheduled PM cycle of 5,000 wafers.



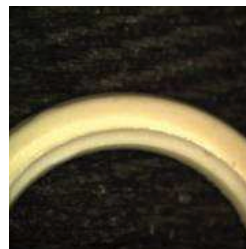
Kalrez® 9100 Poppet Seal



Incumbent FFKM Poppet Seal



Kalrez® 9100 Top Nozzle Seal



Incumbent FFKM Top Nozzle Seal

Case Report # 6376- PM Cycle Improved 2X! @ Major European Fab Line

- Fabline has extended pm cycle from 30,000 to >55,000 pairs of wafers
- No evidence of erosion, mechanical damage, compression set or deformation of the seal lip after processing >55,000 pairs of wafers
- Equipment Platform -- Applied Materials Producer® Low-k
- Process -- PECVD / Black Diamond®
- Process Chemistry -- Trimethyl silane (TMS), O₂
- Cleaning Chemistry -- NF₃ plasma via remote plasma source
- Seal Location -- VAT MONOVAT® bonded door

Case Report # 6738 - PM Cycle Extended 3X! @ Major US Fab Line

- Fabline has extended pm cycle from 400 to 1200 Rf hours
- No evidence of degradation or cracking after 1200 Rf hours of service
- Equipment Platform – Lam Research TCP-9600
- Process – Metal Etch & Resist Strip/Ash
- Process Chemistry – Cl₂, BCl₃, Water Vapor
- Cleaning Chemistry – O₂ plasma (cleans ash deposits after every wafer)
- Seal Location – custom seal for slit valve opening

Case Report # 6302 - PM Cycle Extended 3X! @ Major US Fab Line

- Fab line has extended pm cycle from 6,000 to 18,000 wafers
- No evidence of erosion, cracking or compression set after processing 18,000 wafers
- Equipment Platform – Tokyo Electron SCCM Etch Chamber
- Process – Oxide Etch & Dual Damascene Copper
- Process Chemistry – C₄F₈, C₄F₆, C₅F₈, O₂, Ar
- Cleaning Chemistry – CF₄ & O₂ plasma
- Seal Location – pendulum valve seal kit

Case Report # 5415 - PM Cycle Extended 3X! @ Major US Fab Line

- Fab line has extended pm cycle from 6 to 18 months
- No evidence of erosion, cracking or leakage after 18 months of service
- Equipment Platform – Mattson Aspen II (Grid Shielded System)
- Process – ICP (Ashing)
- Process Chemistry – CF₄, O₂, Forming Gas
- Cleaning Chemistry – N/A
- Seal Location – quartz tube

For further information please contact one of the offices below, or visit our website at www.dupontelastomers.com/kalrez

Global Headquarters – Wilmington, DE USA

Tel. +1-800-853-5515
+1-302-792-4000
Fax +1-302-792-4450

European Headquarters - Geneva

Tel. +41-22-717-4000
Fax +41-22-717-4001

South & Central America Headquarters - Brazil

Tel. +55-11-4166-8978
Fax +55-11-4166-8989

Asia Pacific Headquarters - Singapore

Tel. +65-6275-9383
Fax +65-6275-9395

Japan Headquarters – Tokyo

Tel. +81-3-6402-6300
Fax. +81-3-6402-6301

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