

DuPont™ Kalrez® Perfluoroelastomer Parts

In Semiconductor Industry – Plasma Processes

DuPont™ Kalrez® perfluoroelastomer parts have been used successfully in highly aggressive sealing environments for more than 40 years. Kalrez® parts have excellent chemical and thermal stability and have been specially formulated and processed to meet the unique requirements of wafer processing environments. DuPont Kalrez® seals are available in standard and custom sized O-rings, as well as customized shapes that meet the demanding requirements of wafer processing in plasma environments. A proprietary ultraclean process and cleanroom handling is standard for all Kalrez® products utilized in the Semiconductor Industry.

Product Selector for Plasma Processes

The following table provides a quick and easy tool for the selection of Kalrez® parts depending on the production process type:

Process Type	Maximum Service Temperature	Typical Chemistries	Suggested Products ¹
HDPCVD	250 °C to 300 °C	TMS, DEMS, TEOS, SiH ₄ , NH ₃ , SiF ₄ , O ₂ , N ₂ O, C ₄ F ₈ , NF ₃	Kalrez® 9100/9500
PECVD / PEALD	275 °C to 310 °C	TMS, DEMS, TEOS, SiH ₄ , NH ₃ , SiF ₄ , O ₂ , N ₂ O, C ₄ F ₈ , NF ₃	Kalrez® 9600
PECVD Curing Process	150 °C to 200 °C	O ₃ + UV light	Kalrez® 8705 ² Kalrez® 9500 ³
SACVD / FCVD	280 °C to 300 °C	TEP, TEBO, TEOS, O ₃ , NF ₃ , NH ₃	Kalrez® 9500/9600
Conductor (Poly/Metal) Etch	150 °C to 225 °C	CF ₄ , CHF ₃ , HBr, BCl ₃ , CCl ₄ , Cl ₂ , NF ₃	Kalrez® 9100/9300
Dielectric (Oxide) Etch	100 °C to 180 °C	CF ₄ , C ₃ F ₈ , CHF ₃ , SF ₆ , O ₂ , H ₂	Kalrez® 9300
Ash/Strip	180 °C to 250 °C	O ₂ , CF ₄ , CHF ₃ , NH ₃ , Water Vapor, H ₂ , Forming Gas	Kalrez® 9300/8002

¹ Please consult the Kalrez® Application Guide and/or your Kalrez® Representative to assess performance fit for your specific application

² Quartz Window Seal

³ All other seal locations

Typical Applications for Plasma Processes:

Dynamic:

- Door seals
- Gate valves
- Pendulum valves

Static:

- Chamber lid seals
- Exhaust valves
- Gas inlet/outlet/mixing block seals
- Window seals
- Center ring seals

Other:

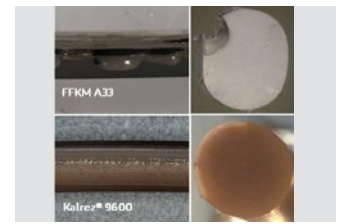
- Seals for heat-traced lines in sub-fab foreline and exhaust systems*

* Please consult a Kalrez® TS&D Engineer to assess performance fit for your specific application

Current Kalrez® Product Offerings for Plasma Application

Kalrez® 9600

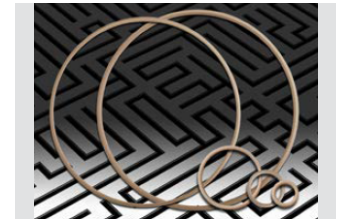
Kalrez® 9600 parts are designed for high purity, high temperature vacuum applications where seals are exposed to damaging Fluorine and Oxygen plasma radicals. It has an **extremely low erosion rate and weight loss from plasma attack** and provides **excellent chemical resistance to Ammonia, Ozone, and Water Vapor**. Its outstanding resilience in compression and ultra-low outgassing at high temperature conditions makes it especially suitable for applications where purity is paramount, such as Plasma-Enhanced Atomic Layer Deposition and Chemical Vapor Deposition processes.



High Temperature PECVD process:
FFKM A33 vs. Kalrez® 9600

Kalrez® 9500

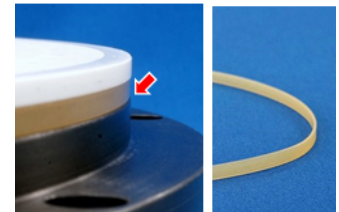
Kalrez® 9500 parts are targeted specifically for **deposition processes where ozone, ammonia and water vapor** are used for processing, e.g. SACVD, FCVD, PECVD curing processes, etc. It has been specifically designed for use in applications where the plasma environment is more “chemical”, i.e., where oxygen and fluorine radicals are more dominant. Kalrez® 9500 also offers outstanding thermal stability, very low outgassing and excellent mechanical strength and is well suited for both static and dynamic sealing applications.



Kalrez® 9500 parts are based on a proprietary crosslinking system which is only available from DuPont

Kalrez® 9300

Kalrez® 9300 parts are designed for **Dielectric (Oxide) Etch** applications. 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.



Kalrez® 9300 Electro Static Chuck (ESC) protective seal

Kalrez® 9100

Kalrez® 9100 parts are targeted specifically for **PECVD, ALD, HDPCVD and Conductor (Poly/Metal) Etch** 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 good mechanical strength properties and is well suited for both static and “select” dynamic sealing applications.



Kalrez® 9100 seals

Kalrez® 8002

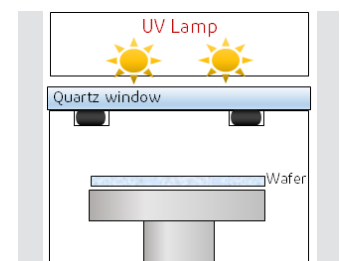
Kalrez® 8002 parts are a clear product for **ash/strip** applications. This unfilled product offers **excellent plasma-cracking resistance and ultra-low particle generation in oxygen and fluorine-based plasmas versus mineral-filled products**. Kalrez® 8002 exhibits excellent resistance to dry process chemistry, has good mechanical strength and is well suited for static, low stress/low sealing force and “select” bonded door seal applications.



Kalrez® 8002 O-Rings

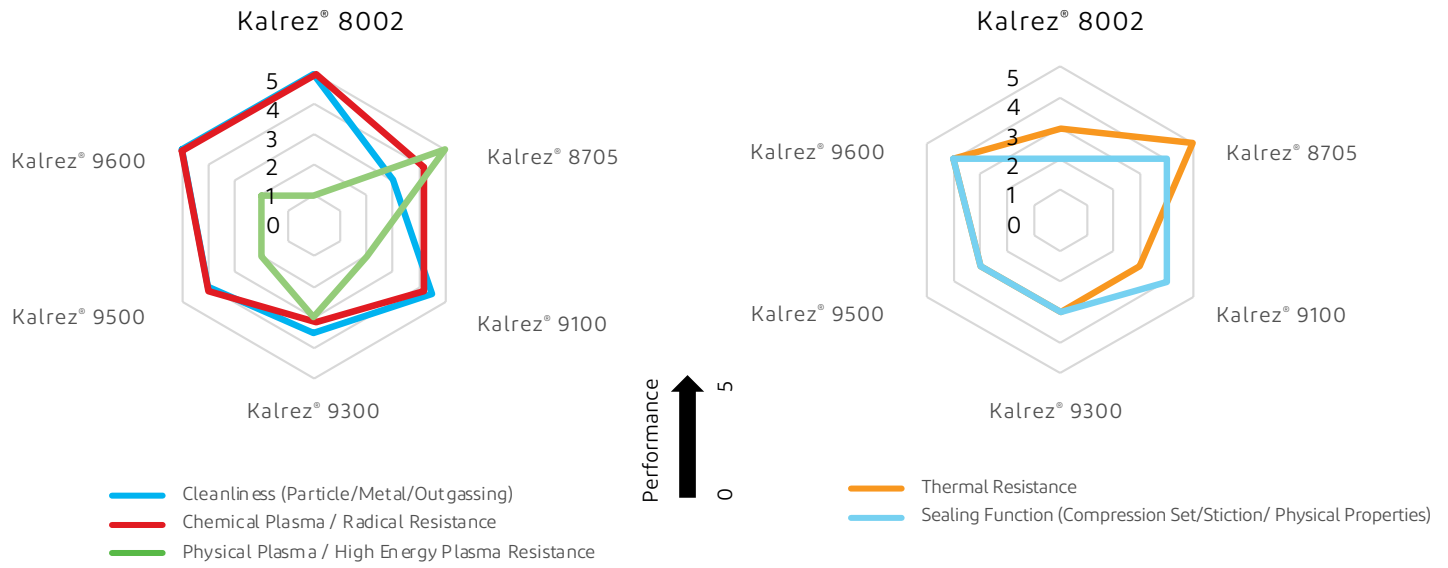
Kalrez® 8705

Kalrez® 8705 perfluoroelastomer parts are primarily designed for seal locations in the direct path of **high energy ultraviolet (UV) radiation** emitted from a conventional light source or from plasma. They also provide excellent resistance to high concentrations of damaging **oxygen free radicals**, and outstanding sealing functionality in **high temperature vacuum** applications. Their **extremely low sticking force** makes them ideal for sealing quartz surfaces like quartz windows in UV cure chambers and quartz tubes in photoresist strip equipment, without leaving undesirable residues.



UV cure process

Typical Product Positioning



Typical Physical Properties*

Kalrez® grade	Color	Hardness ¹ , Shore A	Maximum Service Temperature ² , °C (°F)	Compression Set ³ at 70 hours, 204 °C, %
9600	Olive-Green	70 ⁴	315 (599)	15
9500	Tan	76 ⁴	310 (590)	20
9300	Brown	77 ⁴	300 (572)	25
9100	Amber	70 ⁴	300 (572)	18
8002	Clear	69 ⁴	275 (527)	12
8705	Black	77 ⁴	327 (621)	24

1 ASTM D2240 (pellet test specimens unless otherwise noted)

2 DuPont proprietary test method; useful temperature range may vary with seal design and application specifics

3 ASTM D395B and ASTM D1414 (AS568 K214 O-ring test specimens unless otherwise noted)

4 ASTM D2240 (plied slab test specimens)

* Not to be used for specification purposes

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