

## Semiconductor Industry Sealing Solutions

Your Technology Specialist

**simrit**<sup>®</sup>

# Simrit Semiconductor Sealing Solutions

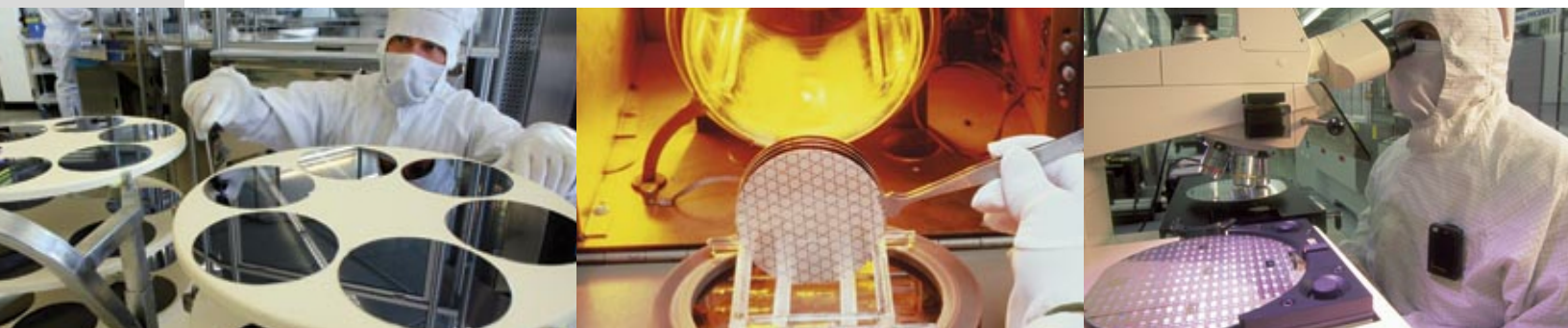
Encapsulating the power to move information at virtually instantaneous speeds, semiconductors clearly don't become a reality by accident. Yet, throughout such a uniquely high-precision and volatile creation process, the potential for accidents is all too real. Extreme chemicals, temperatures, and highly corrosive materials are just some of the ongoing hazards, as are the constant threats of contamination and leaks. Ultimately, the stability of the entire manufacturing process depends on the integrity that seals the actual systems. Seals that swell, deteriorate, or outgas are simply not up to the job. The wet and dry phases of manufacturing also present specific demands on seals, requiring chemical resistance and low extractables versus high plasma resistance with low particulation, respectively. These are exacting orders for any industry, but particularly for one in which a single manufacturing cycle can take weeks and an hour of downtime can cost thousands of dollars. Clearly, the quality of sealing solutions in this environment cannot be left to chance.

## **Welcome to the unrivaled power of Simrit Semiconductor Sealing.**

Simrit is the industrial sealing products division of the Freudenberg and NOK Group companies, the world's largest supplier of elastomeric seals and custom-molded products. There is no other truly worldwide company that provides the same wealth of experience, products, and global customer coordination, as evidenced by over \$12 billion in annual sales. Technology interchange happens continuously between Simrit Americas, Simrit Europe, and

NOK in Asia, providing best-in-class material development, product design, and manufacturing capabilities. Our presence in the semiconductor industry took hold in 1998 when Simrit acquired International Seal, adding flexibility in O-ring manufacturing and expanding our material offering. Simrit perfluoroelastomer materials come from a wholly owned division of NOK that produces base polymers exclusively for Simrit and other Freudenberg and NOK Group companies.

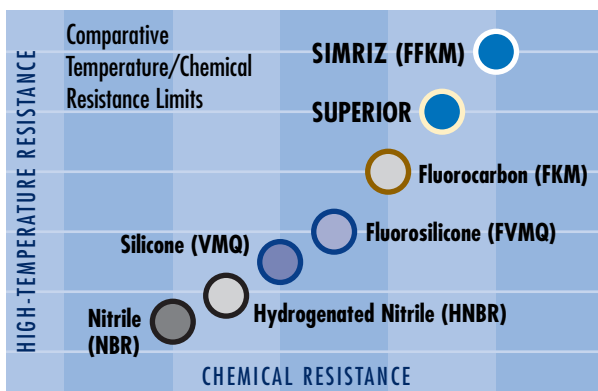
*A world leader in O-rings for semiconductor production sealing, International Seal Company was acquired by Simrit in 1998, bringing years of experience and expertise to the semiconductor market.*



# Simrit Semiconductor Sealing Materials

The Simrit advantage starts with our super-premium base polymers and the expertise to perfect them. The benefits of our streamlined process are unequalled focus and efficiency, from base polymer manufacturing to compounding to molding, which results not only in cost-effective sealing solutions but also in exceptional cleanliness. Our materials start out clean and stay that way.

While all our materials share a distinctive path of evolution and precision manufacturing, we design each one to offer many application-specific benefits.



## Simriz®

Designed for thermal stability and nearly universal protection against chemical attack, our proprietary family of **Simriz** perfluoroelastomer compounds offers premier sealing performance. **Simriz** compounds approach PTFE chemical resistance and have excellent plasma resistance for dry processing. Simrit is the single-source developer of **Simriz**, starting with the base polymer, thus ensuring complete oversight and continuity in the compounding process, and eliminating any need for costly outsourcing.

## Superior™

Well suited for wet and dry processes, **Superior** material comes in two grades designed to perform between fluoroelastomers and perfluoroelastomers. Grade F815 is free of metal fillers, thus decreasing particle emission and fully eliminating the threat of metal contamination, while F850 provides improved plasma resistance. The most recent addition is F880, an ivory-colored material with excellent high-temperature compression set resistance. Significant benefits of **Superior** are its patented material and processing technology. The results are that **Superior** provides a finer molding accuracy and it allows our cure system to ensure a more resilient outer surface.

## Liqui-Last™ Liquid Elastomers

Another exclusive Simrit offering, these formulated liquid elastomers provide a new level of sealing freedom, as they are injection-moldable and can be robotically dispensed for cure-in-place sealing.

## Fluoroelastomers

Simrit offers a full range of fluorocarbon (FKM) and fluorosilicone (FVMQ) compounds to meet advanced material requirements for general sealing applications.

## Other Materials

- Silicone (VMQ)
- Hydrogenated nitrile (HNBR)
- Nitrile (NBR)

*The Freudenberg-NOK organization draws from more than 150 years of experience and offers quality, well-known brand names including Freudenberg®, NOK®, International Seal®, Disogrin®, and Merkel™. Call Simrit today at 1-866-2SIMRIT to find out how our total sealing solutions can benefit you. Or visit [www.simrit.com](http://www.simrit.com).*



# Simrit Semiconductor Seals Manufacturing

Given the tremendous costs and quality concerns involved in IC manufacturing, we are proud to supply your industry with the most reliable sealing solutions in the world. Simrit manufacturing is exceptionally lean and reduces in-process inventory and waste while increasing quality that already far exceeds industry standards. By focusing on individual parts versus batch processing, problems are isolated and corrected without jeopardizing an entire production run. Moreover, we continually push to exceed our Six Sigma certification, using state-of-the-art automated vision systems to detect flaws imperceptible to the human eye. In fact, Simrit manufacturing provides **better than Six Sigma quality**. The purity of our seals is paramount, as evidenced by our dedicated clean-room manufacturing and packaging facility in LaGrange,

Georgia. Our manufacturing edge carries over to our Santa Ana, California, facility where many of Simrit's materials are expertly molded.



*Class 1000 clean-room manufacturing with Class 10 cleaning and packaging*

## Simrit Testing Capabilities

The cornerstone of our state-of-the-art testing capabilities is Simrit's 55,000-square-foot Technology Center in Plymouth, Michigan. As our engineers develop and extensively test materials in this lab, they are in constant collaboration with the finest chemists from our lead centers throughout the world. This global cooperation not only ensures a material's manufacturability, but also that the production process will be realized at the absolute highest level of our collective expertise.

Some of our testing capabilities include:

- Atomic absorption
- Atomic force microscopy
- Chromatography
- DMA
- DSC
- Energy dispersive x-ray spectroscopy

- FTIR
- Mass spectroscope
- Particle counter for plasma unit
- Permeation
- Plasma testing
- Scanning electron microscope
- TGA
- Thermal analysis
- X-ray fluorescence

*Simrit's 55,000-square-foot Technology Center based in Plymouth, Michigan, is a \$25 million marvel of state-of-the-art testing capabilities. As our engineers develop and extensively test materials in this lab, they are in constant collaboration with the finest chemists from our lead centers throughout the world.*



# Simrit Semiconductor Sealing Applications

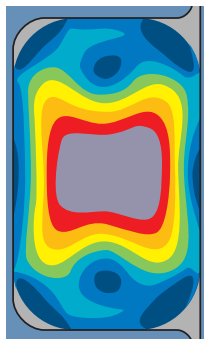
Sealing solutions for all areas of semiconductor fabrication, in both wet and dry applications:

PROCESS	REQUIREMENTS	RECOMMENDED SEAL MATERIALS
Crystal Growth and Wafer Preparation	High temperature resistance and low outgassing	High-Temperature Silicone, Fluoroelastomer, Simriz® Perfluoroelastomer
LPCVD/Oxidation: Nitride, Oxide, and Polysilicon	High temperature resistance	Simriz Perfluoroelastomer
Epitaxial Silicon	High temperature, purity	High-Temperature Silicone, Fluoroelastomer, Simriz perfluoroelastomer
CVD: Oxide, Nitride, Tungsten, Titanium Nitride, Aluminum, and Copper	Plasma resistance, purity, and low outgassing	Fluoroelastomer, Specialty Viton®, Superior™, Simriz Perfluoroelastomer
PVD	Low outgassing and good physical properties	Fluoroelastomer, Specialty Viton, Superior,
Lithography	Solvent resistance	Fluoroelastomer, Specialty Viton, Superior, Ethylene Propylene (EPDM), Simriz Perfluoroelastomer
Wet Etching: Metal, Oxide, Polysilicon, and Silicone Nitrides	Acid resistance and low extractables	Fluoroelastomer, Specialty Viton, Superior, Simriz Perfluoroelastomer
Dry Plasma Etching: Metal, Oxide, Polysilicon, and Silicon Nitrides	Plasma resistance, low contaminant	Fluoroelastomer, Specialty Viton, Superior, Simriz Perfluoroelastomer
Resist Stripping	Good chemical compatibility	Fluoroelastomer, AFLAS®, Specialty Viton, Superior, Ethylene Propylene (EPDM), Simriz Perfluoroelastomer
Photoresist Removal-Ashing	Plasma resistance	Fluoroelastomer, Specialty Viton, Superior, Silicone, Fluorosilicone, Simriz Perfluoroelastomer
Cleaning/Rinsing/Drying	Chemical resistance and low extractables	Fluoroelastomer, Specialty Viton, Superior, Ethylene Propylene (EPDM), Simriz Perfluoroelastomer
Diffusion, Annealing, Rapid Thermal Processing (RTP)	High temperature resistance	High-Temperature Silicone, Fluoroelastomer, Simriz Perfluoroelastomer

Viton is a registered trademark of DuPont. AFLAS is a registered trademark of Asahi Glass Company

## Simrit Customer Services

Our valued clients receive the kinds of benefits that only a global technology company can provide. In fact, our network of distributors is selected specifically for their knowledge of both sealing and the semiconductor



industry. We base our designs on an understanding of the industry's requirements, enabling us to not only provide the best solutions, but also to avoid costly mistakes.

For example, FEA allows us to design parts with computer modeling to simulate stress levels under

*Representative FEA diagram*

actual conditions. This highly effective tool can optimize seal performance, and in the rare event that a part has actually failed in an application, we use advanced analysis techniques to determine how and why it failed and design a solution accordingly. We can do this with a competitor's product as well as our own.

Simrit parts are readily available from our global stocking locations, and all Simrit products and services are accessible online through our comprehensive website at [www.simrit.com](http://www.simrit.com), which provides ordering, support and on-site seal training, downloadable catalogs with size listings and material compatibility, industry overviews, and much more.

## O-Rings

Developed from **Simriz**<sup>®</sup> perfluoroelastomer materials, Simrit O-rings provide Six Sigma-level sealing solutions with many sizes readily available from stock. Simriz O-rings are offered in nine different Simriz compounds, each delivering additional properties to meet specific application requirements.

Look to **Superior**<sup>™</sup> materials, always available via clean-room manufacturing and packaging, to bridge the gap between fluoroelastomers and perfluoroelastomers.



## Simriz O-rings Material Compounds and Recommendations

There are a number of specially formulated **Simriz** perfluoroelastomer compounds designed for specific applications.

PROCESS ENVIRONMENT	SIMRIZ 486	SIMRIZ 487	SIMRIZ 488	SIMRIZ 489	SIMRIZ 495	SIMRIZ 499
Plasma Etching/Ashing	Recommended	–	Recommended	–	–	–
Plasma Gas Deposition HDPCVD/PECVD	Recommended	–	Recommended	Alternate	–	Alternate
High Temperature (up to 300°C)	–	Recommended	Recommended	–	–	–
Wet Etching	–	Recommended	–	Alternate	Recommended	Alternate

## Custom Molded Products

Simrit is uniquely positioned to solve your most challenging sealing applications. Our unequalled position as both base polymer manufacturer and molder allows us to match the best component design with the right materials to provide the most robust seals for the demanding environments of the semiconductor industry. Some of our custom products include:

- Molded shapes
- Nonstandard cross sections
- Unconventional barrier and lip seal designs



## Magnetic Fluid Seals

Simrit offers a complete array of options to meet ferrofluidic demands, including:

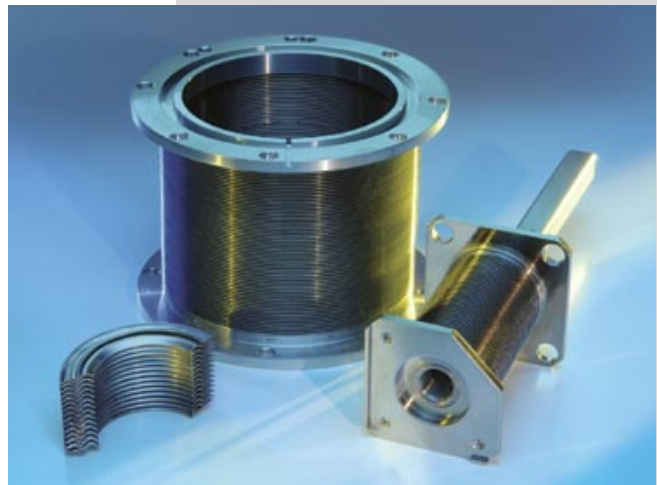
- Standard catalog or custom designs
- Simple axial, multi-axial, and linear translating designs
- Available metal bellows
- Excellent high-temperature capabilities
- Low vapor pressure
- Proprietary magnetic fluid and bearing lubrication
- In-house R&D and testing



## Edge-Welded Metal Bellows

Simrit's nested-type bellows secure a wide stroke within a limited space for a compact equipment design. Made with weldable materials, edge-welded bellows guarantee design efficiency for optimal performance. We offer:

- Full assemblies in a wide range of material offerings, from stainless steel 316 to titanium, Hastelloy®, Inconel®, and other exotics
- Fusion welding technologies and reverse engineering capabilities
- Special surfacing: EP, anodization, nickel plating, etc.
- Sealing performance and longevity are derived from excellent corrosion, pressure, and heat resistance



## Bonded Gates

Through a unique manufacturing process, seal profiles are bonded directly to process chamber gates. This allows for less seal movement, reducing contamination in process.

- Available in a wide range of compounds from FKMs for mild chemical processes to advanced Simriz perfluoroelastomers (FFKM) for the most aggressive and particulation-sensitive environments.
- Available for most of the major OEM tool sets.



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