Although this is a smaller segment of the semiconductor chip manufacturing industry, it still plays an important role. Wet processes can be used in cleaning, etching, and other steps in chip manufacture. Wafers may be cleaned and rinsed after initial wafer preparation. This step removes residual particles and other contamination on the wafer surface. The wafer may then be exposed to chemicals for adhesion promotion and/or photoresist deposition. After photoresist is applied to the wafer surface, the wafer can be exposed to a number of photolithography steps. The wafer may then be exposed to liquid developer solutions and photoresist stripping solutions. Resist strippers usually involve aggressive acids or organic solvents. Finally, wet processes can also be used in etching processes, which typically involve strong acids.

**Perfluoroelastomer Seal Requirements in Wet Processes**

Wet processes by their very nature do not involve high temperatures as in many plasma and thermal applications. However, elastomers must resist attack by aggressive chemicals such as acids, amines, and aggressive “stripper” chemicals. Perfluoroelastomers provide the
broadest range of chemical resistance and can be used in most wet process applications. Unlike many plasma processes, the elastomers must be resistant to wet chemical attack. Chemical attack often causes swelling of an elastomer, which can lead to extrusion and/or general elastomer degradation over time. For example, fluoroelastomers are resistant to a wide range of chemicals, but amines strippers can quickly degrade these products. The elastomers used in these processes may employ standard filler systems, such as carbon blacks, and still perform satisfactorily in this environment. However care must be taken to avoid contamination due to metallic ion extraction and/or carbon black particles. Perfluoroelastomers remain a top choice for these applications due to their near universal chemical resistance and low extractables/contamination.
Wet Process Applications

The applications for perfluoroelastomers in wet processes are not unlike applications that are seen in the general chemical process industry. Groove design does not need to account for elastomer thermal expansion, however proper groove design is still critical for seal performance. Leakage of process chemicals can cause issues with environmental and operator exposure.

Chemical Containers

Liquid chemicals must be transported and hence containers must be properly sealed to avoid leakage of liquids or gases into the environment. The elastomer seals need to maintain integrity considering that containers may set for a relatively long time before use. The seals should not swell in aggressive chemical solutions and should resist compression set.

Flange Fittings

Piping and transport of chemicals, both new and spent, require flange seals. The seals must resist all types of aggressive chemicals without leakage or degradation. Elastomer seal degradation could result in the release of particles or metallic ions into the process stream or cause leaks to the environment.

Instrumentation Seals

Examples of these include seals for temperature probes, flow meters, and conductivity probes. These are typically o-ring seals and they must maintain their integrity against numerous aggressive solvents without degradation. Proper seal design is critical for these applications.
About the Author

Russell Schnell spent more than 37 years as an engineer with DuPont, the last 26 years as a Senior Application Engineer with the Kalrez® perfluoroelastomer parts business. Recognized for his expertise in elastomer applications, seal design and failure analysis, he provided technical support for a wide range of industries including: chemical processing, aerospace, oil and gas, pharmaceutical and semi-con. He created and conducted hundreds of training seminars and workshops in this field and was solely responsible for the development of the Kalrez® Application Guide software tool.

Russ received a Bachelor of Science in Chemical Engineering from Columbia University in New York and MBA from the University of Delaware.