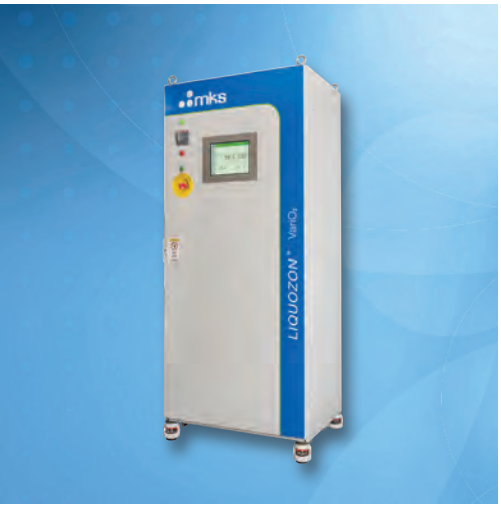
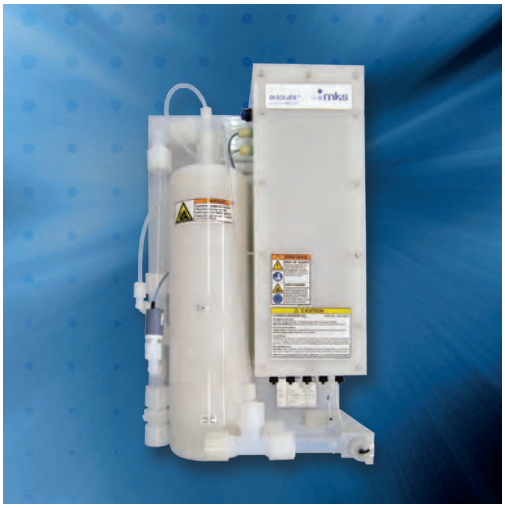
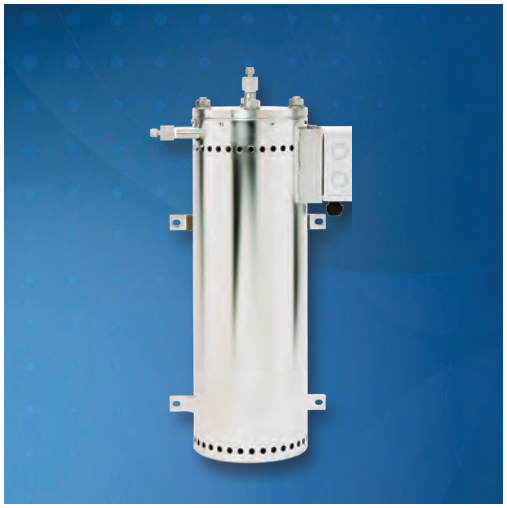
DISSOLVED GAS SYSTEMS

AMMONIA, CARBON DIOXIDE, AND OZONE DELIVERY SYSTEMS





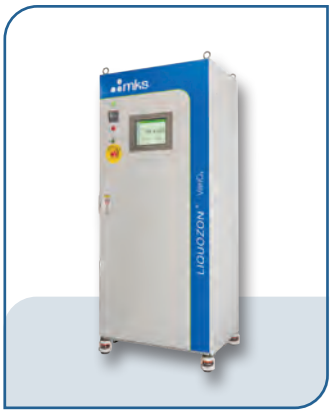


DISSOLVED GAS SYSTEMS

AMMONIA, CARBON DIOXIDE, AND OZONE DELIVERY SYSTEMS

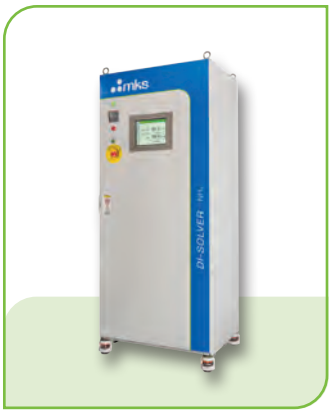
Dissolved gas in deionized water has been widely adopted in manufacturing processes in Electronics, Semiconductors, Flat Panel Displays and Solar applications. These wet techniques increase manufacturing productivity in particle lift-off and wet clean operations. Dissolved gases such as Ammonia, Carbon Dioxide and Ozone are environmentally friendly alternatives to heavy chemicals like sulfuric acid and peroxide acid solutions. MKS offers a large product line of Dissolved Gas systems that improve wet cleaning operations.

- Increase manufacturing productivity
- Environmentally friendly gas alternatives
- Improve wet cleaning operations
- Widely used in manufacturing processes



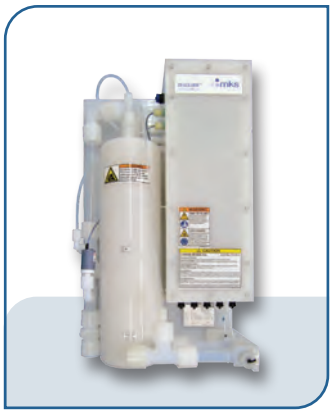
LIQUOZON® VariO$_3$
Ozonated Water Delivery System

- Ensures high purity surfaces by removing organic, metallic and particle contamination
- High yield oxide growth created by superior concentration control
- Unit to unit control for repeatable process performance
- Cost effective water, power and chemical consumption management reduces operational spending
- Eliminates environmental waste impact with easy conversion back to oxygen



DI-SOLVER™ NH$_3$
Dissolved Ammonia Delivery System

- Best dynamic conductivity control and accuracy at point of use from proprietary control of gas
- Increases yields by inhibiting Electro Static Discharge
- Improves interconnect reliability and yield by preventing metal surface and post CMP clean corrosion



DI-SOLVER™ CO$_2$
Ultrapure Water Delivery System

- Precise gas dosage through proprietary mass flow controller system
- Precise conductivity control in range from 5 to 50 µS/cm
- Up to 60 lpm flow
- Repeatable unit to unit performance
- Field proven sub-components life
- Maintenance free

Dissolved Gas Systems

LIQUOZON® VariO$_3$ Ozonated Water Delivery System

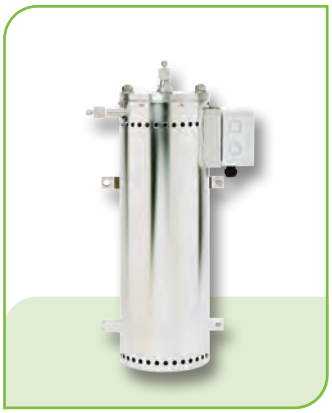
MKS' LIQUOZON® VariO$_3$ is a dissolved ozone gas delivery system providing high purity ozone in ultrapure water for Semiconductor and Electronic Thin Film applications like contaminant removal and surface conditioning via wet clean or rinsing methods. The high redox potential of ozone causes rapid conversion back to oxygen making it an environmentally friendly alternative to other chemical processes.

DI-NH$_3$ Dissolved Ammonia Delivery System

MKS' DI-NH$_3$ is a compact, stand-alone system providing dissolved ammonia water. With Semiconductor 3D IC architectures using new materials like Cu-Co and Si-SiGe, the ability to wet clean with precise alkaline chemistries is growing in frequency and importance. The DI-NH$_3$ delivers dissolved ammonia, providing optimal cleaning capability in an alkaline chemistry, minimizing material loss and contamination and inhibiting Electrostatic Discharge (ESD). Using closed-loop control, conductivity and pressure are kept stable under changing flow conditions. The dissolved ammonia concentration is monitored and adjusted, delivering the specific NH_4OH concentration needed. Dissolved ammonia's alkaline chemistry provides ESD protection during rinsing, particle lift-off, and residual photoresist removal in middle-of-line (MOL) and prevents corrosion of cobalt/copper interfaces.

DI-CO$_2$ Ultrapure Water Delivery System

The DI-Solver™ CO_2 is used in single substrate cleaning tools for rinsing steps to prevent ESD effects and/or metallic corrosion. By adding carbon dioxide to UPW (ultrapure water) conductive DI-CO_2 water (carbonated DI-water) is created, which prevents surface charging. Dissolved carbon dioxide provides optimal cleaning capability in an acidic chemistry, improving cleanliness. The prevention of ESD effects reduces structural damage such as punch through holes, arcing and improves yield.



OVS

Ozone Gas Destruct

- Fast, reliable ozone destruction
- Eliminates high concentrations of ozone
- Models for dry or moist ozone environments
- Double-shell design for personnel protection

STATIC MIXER

Contactor for Dissolving Ozone Gas

- No moving parts, no contamination
- High efficiency mass transfer for maximum dissolved ozone
- Quartz and PFA/PTFE versions available to accommodate multiple chemistries

Ozone System Accessories

OVS Ozone Gas Destruct

The OVS Ozone Gas Destruct unit is designed to safely convert high levels of ozone into oxygen by use of a catalyst, reducing the ozone level down to detection limit - well below safety thresholds. The catalyst material is contained within a robust stainless steel cylinder. Due to the exothermal reaction, the stainless steel cylinder can get hot. In order to protect personnel and the environment from the hot cylinder surface, the cylinder is contained within a secondary exterior shell.

Static Mixer

The Static Mixer is designed to dissolve gases efficiently in fluids. Both gas and fluid are injected into the Static Mixer under pressure. A series of baffles converts the kinetic energy into turbulence, which results in improved mixing and solution.

WHY MKS?

CRITICAL TECHNOLOGIES

World-class technology and development capabilities for leading-edge processes

PROVEN PARTNER

Recognized leader delivering innovative, reliable solutions for our customers' most complex problems

OPERATIONAL EXCELLENCE

Consistent execution across all aspects of our business

COMPREHENSIVE PORTFOLIO

Extensive offering of products and services for the markets we serve

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+1 978.284.4000

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MKS Corporate Headquarters
2 Tech Drive, Suite 201
Andover, MA 01810
+1 978-645-5500
+1 800-227-8766 (in USA)

MKS INSTRUMENTS, INC. enables technologies that transform our world. We deliver foundational technology solutions to leading edge semiconductor manufacturing, electronics and packaging, and specialty industrial applications.

We apply our broad science and engineering capabilities to create instruments, subsystems, systems, process control solutions and specialty chemicals technology that improve process performance, optimize productivity and enable unique innovations for many of the world's leading technology and industrial companies.

Our solutions are critical to addressing the challenges of miniaturization and complexity in advanced device manufacturing by enabling increased power, speed, feature enhancement, and optimized connectivity. Our solutions are also critical to addressing ever-increasing performance requirements across a wide array of specialty industrial applications.

Additional information can be found at **www.MKS.com**.