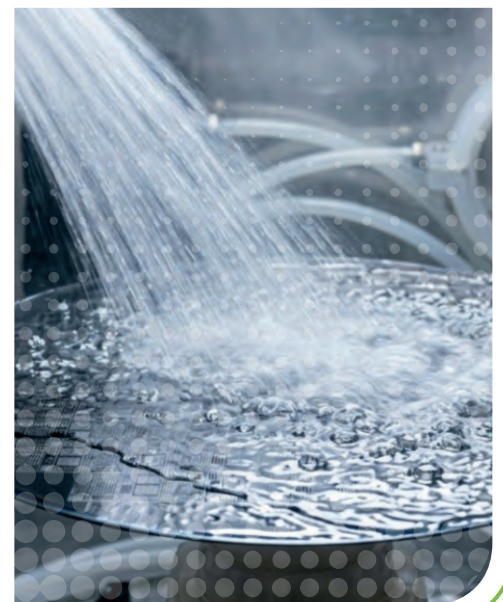
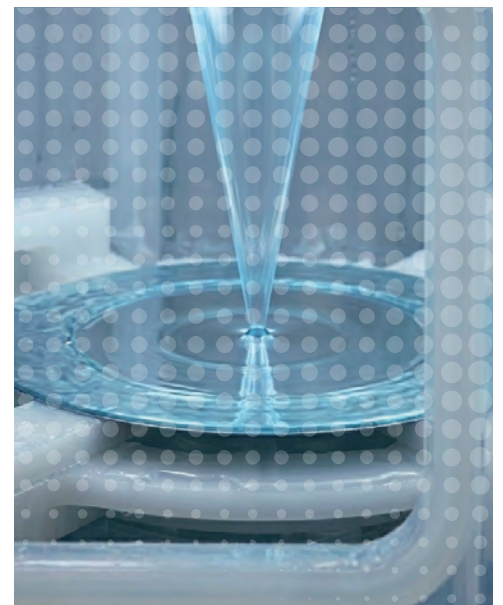
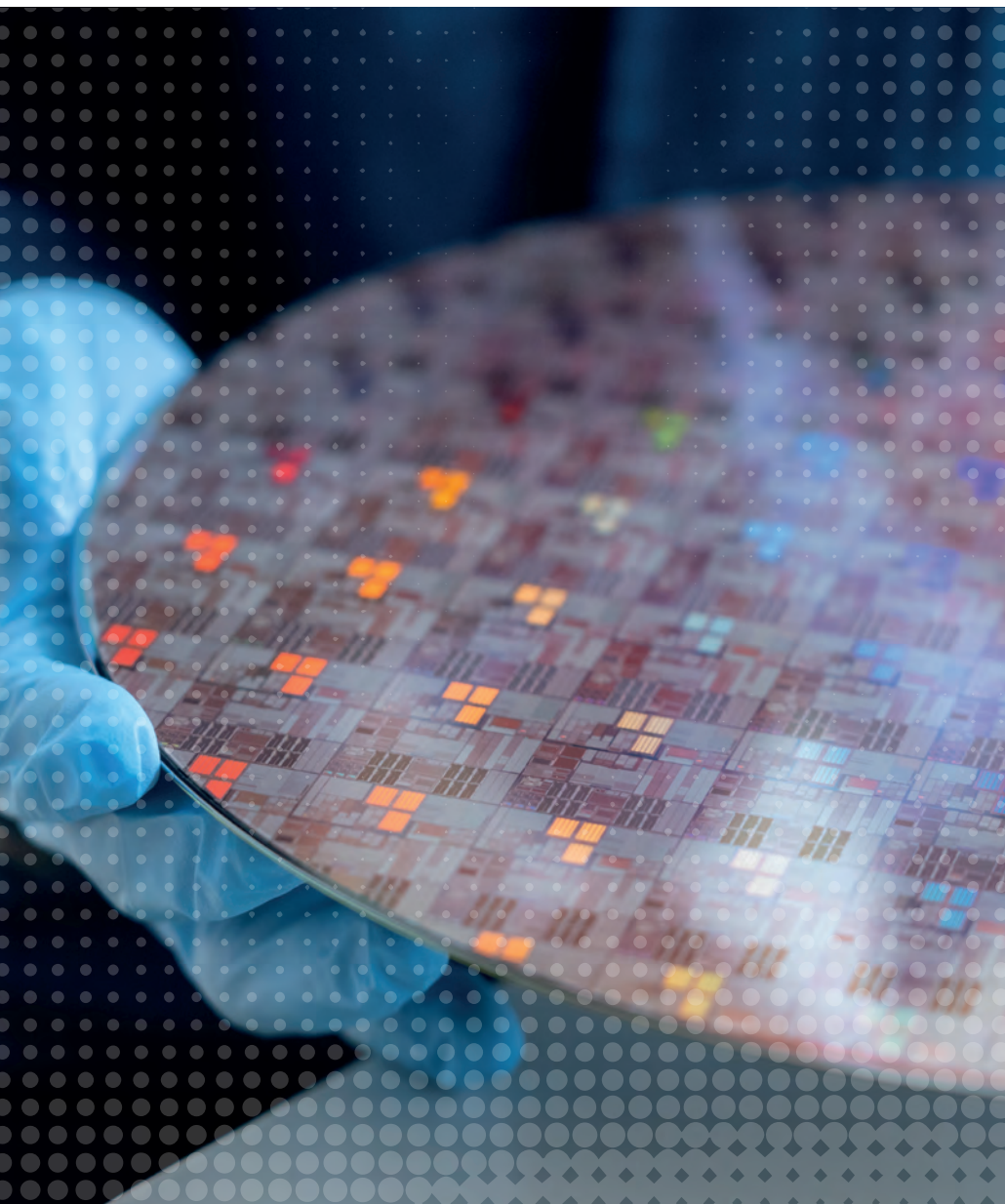


# DISSOLVED GAS SYSTEMS FOR WAFER WET CLEANING APPLICATIONS IN ADVANCED SEMICONDUCTOR MANUFACTURING



# DISSOLVED GAS SYSTEMS FOR WAFER WET CLEANING APPLICATIONS

Wet substrate surface cleaning is essential to yield, reliability, and performance in advanced semiconductor manufacturing. As device features shrink and complexity grows, microscopic particles or trace chemical residues can create contamination resulting in defects and variability. Wet cleaning removes particles, organic residues, metals, and native oxides, protecting critical surfaces and ensuring wafers are ready for every downstream process. MKS supports these processes with our customized Dissolved Gas system enabling environmentally-friendly solutions for OEM single wafer tools.

## Ozonated Water Solutions for Advanced Wet Cleaning

MKS enables advanced wet cleaning through its portfolio of LIQUOZON® Dissolved Ozone Delivery products, supporting the generation and controlled delivery of DI water/ozone ( $\text{DIO}_3$ ) solutions.  $\text{DIO}_3$  has emerged as a clean, safe, and highly effective alternative to traditional Piranha and RCA SC 1/SC 2 chemistries for many surface cleaning applications, reducing chemical consumption while maintaining excellent cleaning performance.

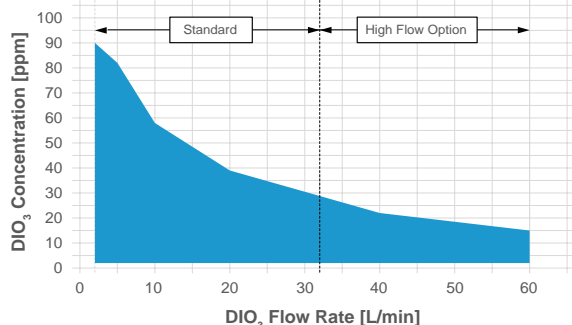
### Dissolved Ozone Applications:

- Removal of organics, metals and particles
- Oxide layer formation on Si
- Photoresist stripping and post cleans
- CMP post clean
- Replace classic chemistry ( $\text{H}_2\text{O}_2$ ,  $\text{H}_2\text{SO}_4$ ) to reduce carbon footprint
- Selective etching and trimming of Si
- Hard mask cleaning
- Wafer backside cleaning
- Glass cleaning and pre-treatment

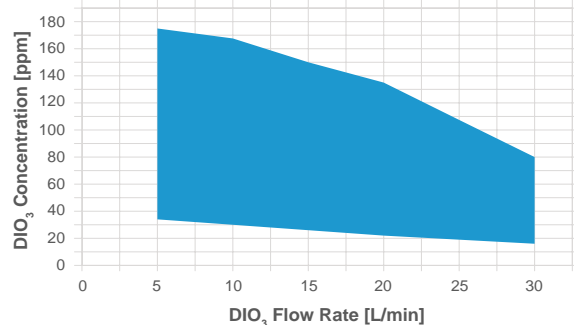


### Key Benefits

- High-purity grade Dissolved Gases leading to no added metal contamination compared to conventional chemistry
- Repeatable, unit to unit process performance
- Lower operating costs with efficient water and power management
- Environmentally responsible chemistry:  $\text{O}_3 \rightarrow \text{O}_2$



Characteristic performance of a low concentration delivery system



Characteristic performance of a standard concentration and flow rate

## Dissolved Ammonia and Carbon Dioxide for Metal Wet Clean and Specialty Etches

MKS DI-Solver™ products for ammonia and carbon dioxide are specifically designed to provide optimal cleaning capability at a given conductivity in FEOL and BEOL applications.

Precisely controlling conductivity is crucial for electrostatic discharge (ESD) prevention and avoiding damages on wafer through arcing. Both dissolved gases leave no contamination

residue on wafer surfaces, and rinse steps using it have been shown to minimize ESD build-up on wafer surfaces.

Available ranges are between pH 3.9 – 4.9 for DI-CO<sub>2</sub> and 9.3 – 10.2 for DI-NH<sub>3</sub>. Controlling pH is crucial to avoid material loss during rinsing by corrosion and in lithography wet cleans. The unique product features of the Di-Solver NH<sub>3</sub> is its low level of dissolved oxygen that minimizes metal corrosion specifically required in advance BEOL and backside power applications.

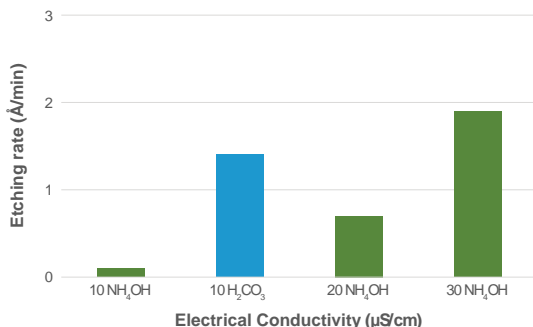
### Product Features:

- Patented system to deliver DI-NH<sub>3</sub> or DI-CO<sub>2</sub> gas ultrapure water mixing
- Precise gas dosage through proprietary mass flow controller system
- Up to 40 lpm for DI-Solver NH<sub>3</sub> and up to 60 lpm for DI-Solver CO<sub>2</sub>
- <5% conductivity stability
- Precise conductivity control DiNH<sub>3</sub> in range from 5 to 40 μS/cm i.e. 1.5 to 58 ppm
- For acidic or alkaline rinsing

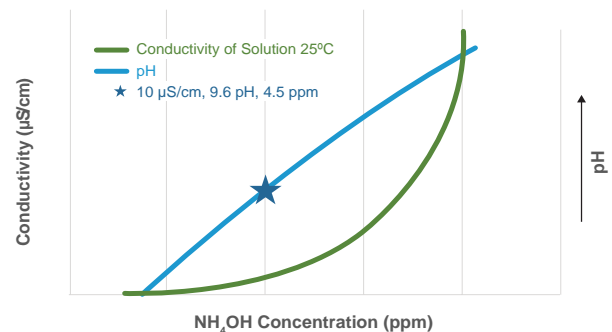


### Key Benefits

- Superior dynamic conductivity control and accuracy at point-of-use
- Increases yield through the inhibition of ESD
- Improved interconnect reliability and yield through the prevention of metal surface and post CMP clean corrosion
- Cost effective water, power, and chemical consumption reduces operating costs
- Low level of dissolved oxygen



Copper etch rate as function of conductivity during wafer rinsing



Conductivity and pH value correlated to NH<sub>4</sub>OH concentration

## 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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MKS Inc. (NASDAQ: MKSI) 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](http://www.MKS.com).

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