EVG®300 Series
Single Wafer Cleaning Systems
Introduction

The EVG300 series single wafer cleaning systems are designed for efficient removal of particles. In semiconductor processing, efficient cleaning and particle removal prior to critical process steps, enables maximum yield. Wafer Bonding is a process which is strongly affected by particles: each particle on the wafer surface produces a void orders of magnitude larger than its diameter, contributing to a dramatic yield loss.

The EVG300 series systems can be combined with EVG’s wafer alignment and bonding equipment in integrated systems enabling reliable processes and high throughput. The cleaning processes available on EVG300 single wafer cleaning systems include DI-water rinse, megasonic cleaning, brush scrubbing and use of diluted chemicals for enhanced cleaning.

EVG’s single wafer cleaning systems are available in semi-automated and automated versions. Each of these versions can be configured for wafer sizes up to 200mm, up to 300mm, up to 450mm (automated systems only) or for large area substrates.

Unique Features / System Configuration

E VG®301 Semi-automated Single Wafer Cleaning System

- High efficiency cleaning using 1 MHz megasonic nozzles or area transducers (option)
- Brush scrubbing unit for single side cleaning (option)
- Diluted chemicals for wafer cleaning
- IR-inspection station for pre-bonding with mechanical flat or notch alignment (option)
- Prevents cross-contamination from back to front side

E VG®320 Automated Single Wafer Cleaning System

- Up to four cleaning stations
- Fully-automated cassette-to-cassette or FOUP-to-FOUP handling
- Edge handling for double-sided cleaning processes available (option)
- Advanced remote diagnostics

Semi-automated Single Wafer Cleaning

The EVG301 employs one cleaning station, which cleans wafers using standard DI-water rinse as well as megasonic, brush and diluted chemicals as additional cleaning options. With manual loading and pre-alignment, the EVG301 is a versatile R&D type system for flexible cleaning procedures.

Automated Single Wafer Cleaning

The EVG320 handles wafers and substrates automatically between the process stations. The robot handling system ensures pre-alignment and loading of the wafers automatically in a cassette-to-cassette or FOUP-to-FOUP operation. Besides DI-water rinse, configuration options include megasonic, brush and diluted chemicals cleaning.
Cleaning Station

The cleaning station allows the effective removal of particles, with low chemical consumption and quick spin drying without back splash. Each single wafer cleaning station can be configured, besides standard DI-water rinse, with following options: megasonic nozzle, area transducer, brush and diluted chemicals for single-side cleaning.

Spinner Chucks

Spinner chucks are available for different wafer and substrate sizes to allow easy setup for different processes. Various types and sizes of wafers and square substrates can be handled on the EVG300 single wafer cleaning systems. Edge handling is an available option as well as square substrate handling using pin chucks.
Modular Design

EVG®300 Cleaning Station
The EVG300 series single wafer cleaning station can be integrated in various EVG equipment enabling reliable processes and high yield. Besides for surface conditioning and final particle removal on mechanically aligned SOI direct wafer bonding systems (EVG850), it is also used on debonding systems (EVG850DB) for adhesive residual removal. Even on EVG’s fully integrated optically aligned fusion bonding systems (GEMINI FB) the cleaning station of the EVG300 series can be integrated to perform cleaning as a bonding pre-process.

IR-inspection Station for Pre-bonding
The EVG301 semi-automated single wafer cleaning system can be equipped with an optional direct wafer bonding capability on an IR-inspection station (lamp and IR sensitive CCD camera) for bond monitoring and quality inspection. Wafer pre-bonding processes, such as silicon-on-insulator applications, can be carried out immediately after cleaning using the manual stage.

Automated Wafer Handling System
The field proven class 1* compatible wafer handling robot on EVG320 enables 24 hour automated cassette-to-cassette or FOUP-to-FOUP operation for the highest throughput. Surfaces in contact with wafers do not cause any metal ion contamination.

Class 1* Mini-Environment
EVG300 series single wafer cleaning systems can be equipped with class 1 mini-environment filter fan unit to ensure particle-free operation.

*according to US FED STD 209E

Megasonic Nozzle
The megasonic cleaning nozzle is based on water molecules energizing with high frequency vibrations. The water molecules hit the surface of the wafer and the result is a very efficient removal of particles having submicron dimensions. The DI-water flow prevents particles to reattach on the wafer surface.

Megasonic Area Transducer
The area transducer is designed to provide megasonic energy to a rotating substrate surface with patented radial uniformity. All portions of the substrate receive the same amount of megasonic dosage with no transducer scanning or moving parts. Transducer and substrate are coupled with a thin layer of cleaning fluid.
Brush

The brush for single side cleaning is available additionally to DI-water rinse, megasonic and diluted chemical cleaning. Brush and wafer rotation speed are fully programmable as well as brush compression and media flow. All parameters can be set in one recipe and will be monitored during the process.

Software and Process Control

A Windows® based graphical user interface provides three access levels of the process control software (operator, engineer and maintenance). The cleaning process is fully software controlled with programmable parameters that include speed, time and cycle of cleaning. The speed and time of the drying process can also be controlled via software. All process data is stored in log files.
# EVG®300 Series | Single Wafer Cleaning Systems

## Technical Data

<table>
<thead>
<tr>
<th></th>
<th>EVG®301</th>
<th>EVG®301</th>
<th>EVG®301LA</th>
<th>EVG®320</th>
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<tr>
<td>Max. wafer size (mm)</td>
<td>200</td>
<td>300</td>
<td>ø up to 770mm</td>
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<tr>
<td>Cleaning media (option)</td>
<td>Diluted chemicals NH₄OH and H₂O₂ with max. 2% concentration, Extran®, ElectroScrub3™, Ethanol</td>
<td>Solvents IPA, Acetone, Xylol</td>
<td>Removers WaferBOND™ Remover, SafeStrip™</td>
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<tr>
<td>Cleaning station Features</td>
<td>Cleaning system: open chamber with splash protection, spinner and cleaning arm</td>
<td>Chamber: made of PP or PFA (option)</td>
<td>Spinning chuck: vacuum chuck (standard) and edge handling chuck (option) made of metal ion free and clean materials, rotation up to 3000 rpm, acceleration to 3000 rpm in 5 s</td>
<td>Cleaning arm: for up to 6 media lines</td>
<td>Media: DI-water (standard), other cleaning media (option)</td>
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<td>Megasonic nozzle (option) Features</td>
<td>Frequency: 1 MHz (option: 2 MHz, 3 MHz, 4 MHz, dual nozzle)</td>
<td>Output Power: 30–40 W</td>
<td>DI-water flow rate: 0.9 Liter/min - 1.5 Liter/min</td>
<td>Effective cleaning area: ø 4.0 mm</td>
<td>Material: PTFE</td>
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<td>Megasonic area transducer (option) Features</td>
<td>Frequency: 1 MHz</td>
<td>Power: max. 2 W/cm² active area</td>
<td>DI-water flow rate: 0.5 Liter/min - 3 Liter/min</td>
<td>Effective cleaning area: triangle shape that guarantees radio uniformity on whole wafer per each rotation</td>
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<td>Brush (option) Features</td>
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<td>Programmable parameters: brush and wafer speed (rpm)</td>
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<td>IR-inspection station for pre-bonding (option) Features</td>
<td>Alignment type: flat-to-flat or notch-to-notch</td>
<td>Bond force: up to 5 N</td>
<td>Bond wave initiation position: flexible from wafer edge to center</td>
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<td>High Pressure Nozzle (option) up to 140 bar</td>
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<td>Throughput (wafers/substrates per hour)</td>
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</table>

Other sizes, media, features and configurations upon request* according to US FED STD 209E
Process Results

Particle map of contaminated wafer
Source: EVG

Particle map of cleaned wafer
Source: EVG

IR image of bonded wafer pair showing particle generated voids Source: EVG

IR image of bonded wafer pair showing no voids Source: EVG

IR-inspection Station for Pre-bonding

The IR-inspection station includes a light source and IR-sensitive CCD for bond quality inspection. This station also offers direct wafer bonding capability which allows the user to monitor in-situ bond wave propagation. Images can be stored together with wafer IDs for later reference.
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