

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

EVG®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

EVG®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



EVG®301 Semi-automated single wafer cleaning system



EVG®320 Automated single wafer cleaning system

Semi-automated Single Wafer Cleaning

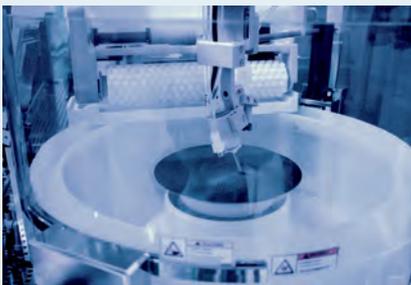
The EVG301 employs one cleaning station, which cleans wafers using standard DI-water rinse as well as megasonic, brush and diluted chemicals as additional cleaning options. With manual loading and pre-alignment, the EVG301 is a versatile R&D type system for flexible cleaning procedures.

Automated Single Wafer Cleaning

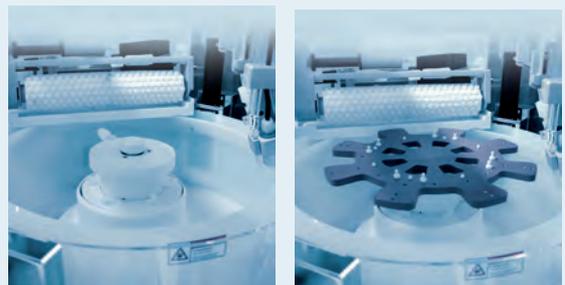
The EVG320 handles wafers and substrates automatically between the process stations. The robot handling system ensures pre-alignment and loading of the wafers automatically in a cassette-to-cassette or FOUP-to-FOUP operation. Besides DI-water rinse, configuration options include megasonic, brush and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



EVG®320 cleaning stations with megasonic nozzle and brush cleaning



Cleaning station on EVG®300 series



Spinner chucks for wafers and square substrates on EVG®300 series

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.

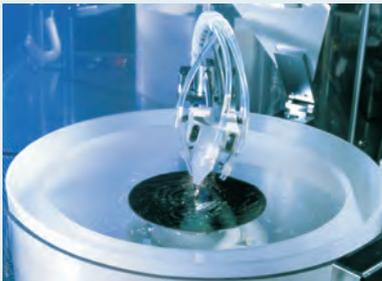
Automated Wafer Handling System

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.

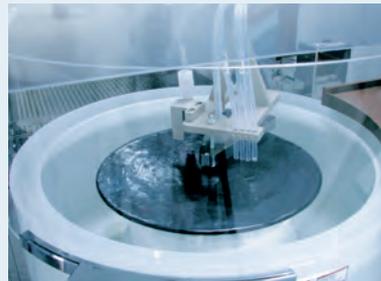
Class 1* Mini-Environment

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 cleaning on EVG®300 series



Megasonic area transducer cleaning on EVG®300 series

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.



EVG®301 Semi-automated single wafer cleaning system up to 300mm



Brush cleaning on **EVG®300 series**



Software and process control on **EVG®300 series**

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

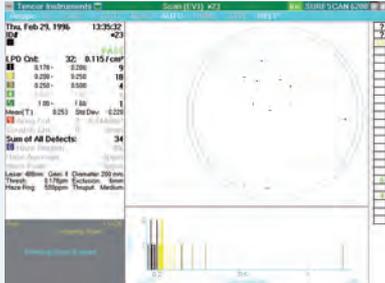
Technical Data

	EVG®301	EVG®301	EVG®301LA	EVG®320	EVG®320	EVG®320	
							
Max. wafer size (mm)	200	300	ø up to 770mm	200	300	450	
Min. wafer size (mm)	50	100	300	100	150	300	
Max. substrate size (mm x mm)	200 x 200 pieces (optional)	280 x 280	550 x 550	200 x 200	280 x 280	380 x 380	
Min. substrate size (mm x mm)	50 x 50 pieces (optional)	100 x 100	200 x 200	100 x 100	150 x 150	200 x 200	
Cleaning media (option)	Diluted chemicals	NH ₄ OH and H ₂ O ₂ with max. 2% concentration, Extran®, ElectroScrub3™, Ethanol					
	Solvents	IPA, Acetone, Xylol					
	Removers	WaferBOND™ Remover, SafeStrip™					
Cleaning station	Features	Cleaning system: open chamber with splash protection, spinner and cleaning arm Chamber: made of PP or PFA (option) Spinner chuck: vacuum chuck (standard) and edge handling chuck (option) made of metal ion free and clean materials, rotation up to 3000 rpm, acceleration to 3000rpm in 5 s Cleaning arm: for up to 6 media lines Media: DI-water (standard), other cleaning media (option)					
Megasonic nozzle (option)	Features	Frequency: 1 MHz (option: 2MHz, 3MHz, 4MHz, dual nozzle) Output Power: 30-40 W DI-water flow rate: 0.9 Liter/min - 1.5 Liter/min Effective cleaning area: ø 4.0 mm Material: PTFE					
	Wafer and substrate sizes	Max. and min. wafer / substrate sizes as mentioned on top One nozzle covers all wafer / substrate sizes					
Megasonic area transducer (option)	Features	Frequency: 1 MHz Power: max. 2 W/cm ² active area DI-water flow rate: 0.5 Liter/min - 3 Liter/min Effective cleaning area: triangle shape that guarantees radio uniformity on whole wafer per each rotation Material: SS and Sapphire					
	Wafer and substrate sizes	Single Zone: 50mm, 75mm, 100mm, 125mm, 150mm, 200mm, 300mm, 450mm Dual zone: 75mm/100mm, 100mm/150mm, 150mm/200mm, 200mm/300mm, 300mm/450mm					
Brush (option)	Features	Material: PVA Programmable parameters: brush and wafer speed (rpm) Adjustable parameters: brush compression, Media dispense					
	Number of units per system	1	1	1	4	4	4
	Max. wafer size (mm)	200	300	up to 770mm	200	300	450
	Min. wafer size (mm)	50	100	300mm	100	150	300
	Max. substrate size (mm x mm)	150 x 150	200 x 200	550 x 550	150 x 150	200 x 200	320 x 320
	Min. substrate size (mm x mm)	50 x 50	100 x 100	200 x 200	100 x 100	150 x 150	200 x 200
High Pressure Nozzle (option)	up to 140 bar						
IR-inspection station for pre-bonding (option)	Features	Alignment type: flat-to-flat or notch-to-notch Bond force: up to 5 N Bond wave initiation position: flexible from wafer edge to center			N/A		
	Wafer and substrate sizes	Max. and min. wafer and substrate sizes as mentioned on top			N/A		
Wafer / substrate loading	Manual			Automated			
Process compatibility with EVG®850				Standard			
Max. number of cleaning stations	1			4			
Class 1 mini-environment*				Option			
Automated wafer handling system	N/A			Standard			
Fab automation integration (SECS/GEM)				Option			
Throughput (wafers/substrates per hour)	Up to 40			Up to 150			
Production Scale	R&D	•	•	•	•	•	
	Pilot	•	•	•	•	•	
	HVM				•	•	

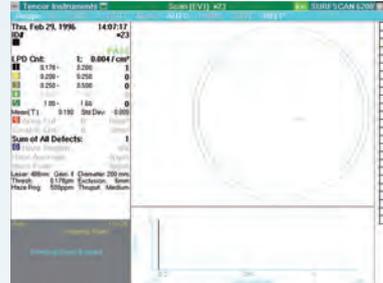
Other sizes, media, features and configurations upon request

*according to US FED STD 209E

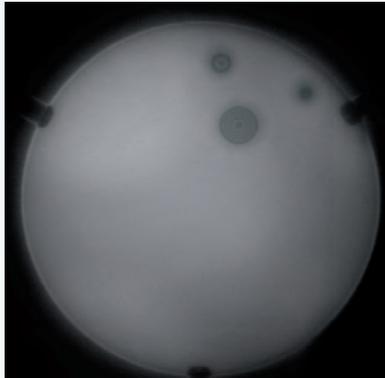
Process Results



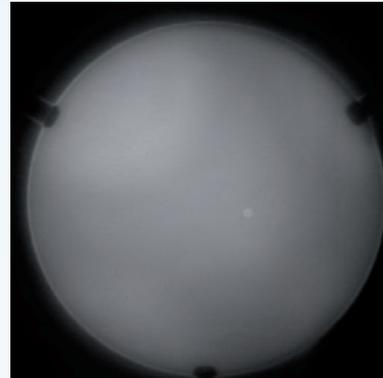
Particle map of contaminated wafer
Source: EVG



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 on EVG®301

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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