EVG®500 Series

Wafer Bonding Systems

EVG®

Introduction

With over 15 years experience in designing and manufacturing precision wafer bonding equipment, EVG wafer bonding systems are well recognized in setting industry standards for the MEMS production industry. Besides supporting wafer-level and advanced packaging, 3D interconnects and MEMS fabrication, the EVG500 series wafer bonding systems can be configured for R&D, pilot-line or volume production. They accommodate the most demanding applications by bonding under high vacuum, precisely controlled fine vacuum, temperature or high pressure conditions.

Multiple bonding methods including anodic, thermo compression, glass-frit, epoxy, UV and fusion bonding are covered. Based on a unique modular bond chamber design the EVG500 series allow for an easy technology transfer from R&D to high volume production.

Unique Features / System Configuration

EVG®501 Wafer Bonding System

- Optimum total cost of ownership (TCO) for R&D and pilot line production
- Bonds up to 20 kN force at temperatures up to 450 °C
- Real and low-force wafer wedge compensation system for highest yield
- Large process window: temperature uniformity <± 1.2 % and pressure uniformity <± 5 %
- Fully recipe compatible to EVG production bonding systems (EVG510, EVG520IS, EVG560, GEMINI)
- High-vacuum capable bond chamber (down to 10^{-5} mbar with turbo molecular pump)
- Open chamber design for fast conversion and maintenance
- Windows® based control software and operation interface
- Smallest footprint for a 200 mm bonding system: 0.88 m^2

EVG®510 Semi-automated Wafer Bonding System

- Single chamber system for up to 150 mm and 200 mm wafers
- Lowest cost-of-ownership for R&D and pilot-line production
- Unmatched pressure and temperature uniformity
- High yield through automatic wedge compensation
- Recipe compatible to EVG production bonding systems
- High throughput with fast heating and pumping specifications

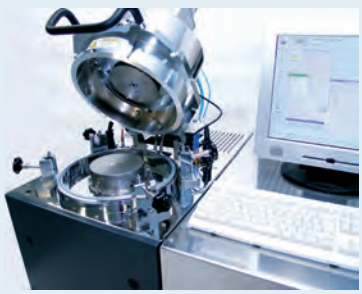
EVG®520IS Semi-automated Wafer Bonding System

- Single or double chamber automated system up to 200 mm
- Automated bond process execution and bond cover movements
- Integrated cooling station for high throughput
- Pressure bonding up to 100 kN
- Vacuum capability down to 1 x 10^{-6} mbar

EVG®540 Automated Wafer Bonding System

- Single chamber production bonder up to 300 mm
- Automatic handling of up to four bond chucks
- Compliant to high safety standards
- Modular bond chamber design
- Active bottom side cooling

EVG®501



Bond chamber of **EVG®510**

EVG®560 Automated Wafer Bonding System

EVG®540 Automated Chip-to-Wafer Bonding System

- Single chamber production bonder up to 300 mm
- Dedicated for chip-to-wafer and wafer-to-wafer bond processes
- Unique compliant layer system to compensate chips thickness variations

EVG®560 Automated Wafer Bonding System

- Up to four bond chambers for various bonding processes
- Automatic loading and unloading of bond chambers and cooling station
- Remote online diagnostics

Cooling station and handling tool on **EVG®520IS**

Bond chamber of **EVG®560**

Modular Design

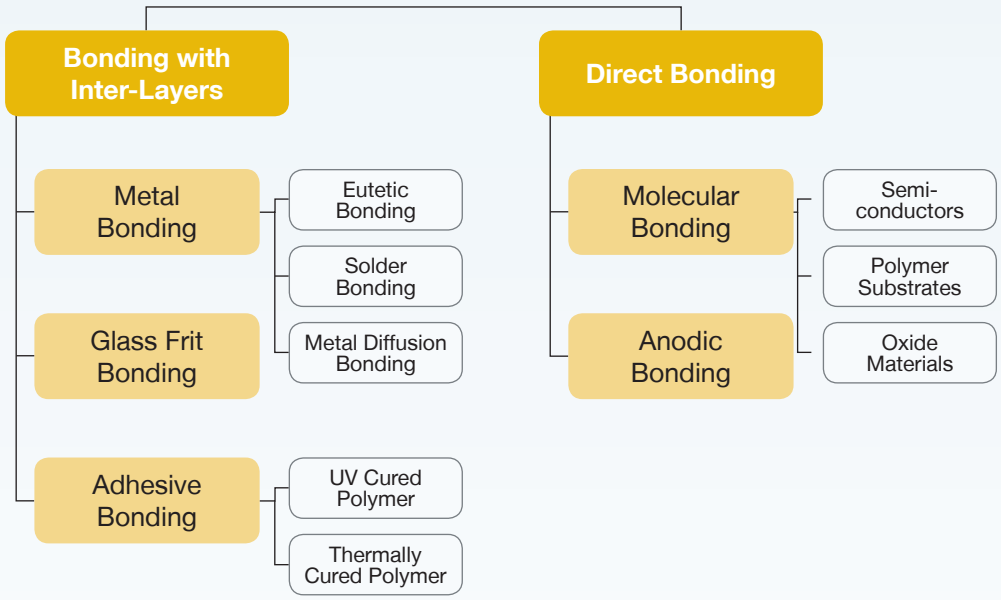
Bond Chamber

The bond chamber is equipped with an universal bond cover that allows fast evacuation, rapid heating and cooling. Both anodic and pressure bonding processes are possible within one chamber. Bonding can be performed under vacuum or controlled atmosphere conditions. Independent temperature control of the top and bottom wafer compensates for different thermal expansion coefficients, resulting in stress-free bonding and excellent temperature uniformity. SOI/SDB pre-bonding under vacuum can be performed without hardware reconfiguration.

Bond Chucks

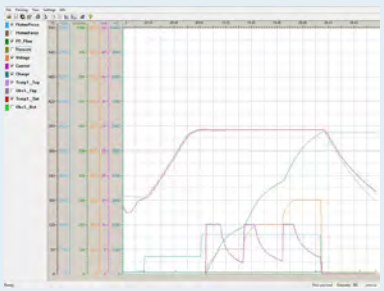
The bond chucks carry the aligned wafer stacks from the aligner to perform the subsequent bonding procedure. Various wafer sizes and bond applications can be handled with a dedicated chuck that fits into each universal bond chamber.

Wafer Bonding Processes on EVG Wafer Bonders



Software features

The EVG500 series systems are computer controlled with a Windows® based graphical user interface. All process parameters and accessories, such as vacuum pumps, automatic valves and gauges are software controlled, monitored and recorded. Continuous recording of process parameters allows for quality inspection and optimal process control.



Automatic recording of bonding process

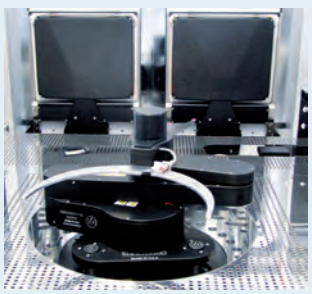
EVG®560 Automated Wafer Bonding System up to 300 mm

Automated handling on EVG®560

The EVG560 is equipped with a robotic handling system for automated cassette-to-cassette wafer bonding with mechanical alignment. The station layout is designed to accept a wide range of equipment configurations for all bonding processes.

Utilizing EVG's unique process separation principle, the EVG560 can be linked to a GEMINI integrated alignment and bonding system.
This combination provides automated optical alignment and bonding operations at a minimum footprint area.

Please refer to GEMINI brochure for further details.



Automated handling on **EVG®560**

Technical Data

		EVG®501	EVG®510	EVG®520IS	EVG®540
					
Maximum Wafer Diameter = Heater size	150 mm Heater	•	•	•	•
	200 mm Heater	•	•	•	•
	300 mm Heater				•
Minimumk Wafer Diameter (Substrate size / mm)	150 mm Heater	Single Chips	Single Chips	Single Chips	50
	200 mm Heater	100			
	300 mm Heater				200
Bond Alignment System / Wafer Bonder & Heater Size	150 mm Heater	EVG®610, 620, 6200,	EVG®610, 620, 6200,	EVG®610, 620, 6200,	EVG®610, 620, 6200,
	200 mm Heater	EVG®6200, MBA300, Smart View®	EVG®6200, MBA300, Smart View®	EVG®6200, MBA300, Smart View®	EVG®6200, MBA300, Smart View®
	300 mm Heater				Smart View®, MBA300
Maximum Contact Force		10 kN, 20 kN	10 kN, 20 kN, 60 kN	10 kN, 20 kN, 60 kN, 100 kN	
Maximum Temperature		450 °C	550 °C (650 °C optional)		
Vacuum		$1x10^{-1}$ mbar (standard), $1x10^{-5}$ mbar (optional)		$1x10^{-1}$ mbar (standard), $1x10^{-6}$ mbar (optional)	
Power Supply for Anodic Bonding		0-2.000 V / 50 mA			
Loading of Chamber		Manual			3-Axis Robot
Process (recipe) Compatible with GEMINI®		•	•	•	•
C2W Compatible		•	•	•	•
Max. Number of Bond Chambers		1	1	2	1
Customer / Application		R&D			
				Pilot-line + manufacturing	
				High volume manufacturing	

GEMINI®

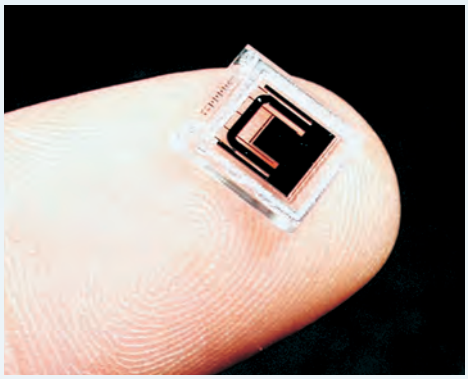
- Integrates alignment and bonding system into one cluster tool
- This combination provides automated optical alignment and bonding operations at a minimum footprint area
- Multiple pre-processing capabilities for highest flexibility

Please refer to GEMINI brochure for further details.

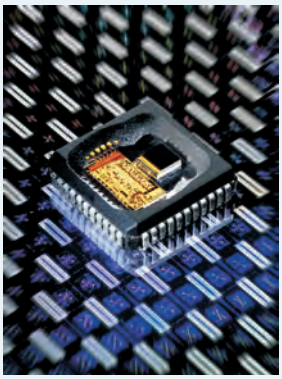
Process Results

EVG®560	EVG®560HBL
	
•	
•	•
•	•
50	
100	up to 10 pieces based on 50 mm substrates
200	up to 22 pieces based on 50 mm substrates
EVG®610, 620, 6200,	
EVG®6200, MBA300, Smart View®	N/A
Smart View®, MBA300	N/A
10 kN, 20 kN, 60 kN, 100 kN	
550 °C (650 °C optional)	
$1x10^{-1}$ mbar (standard), $1x10^{-6}$ mbar (optional)	
0-2.000 V / 50 mA	N/A
5-axis robot*	
•	•
•	•
4	4
High volume manufacturing	

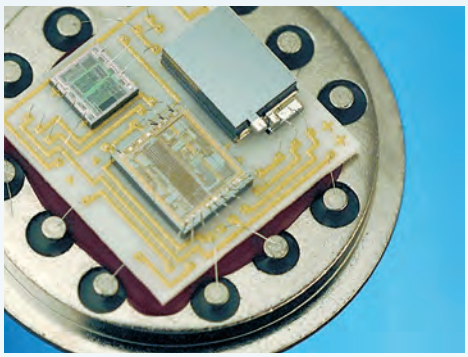
*EFEM (optional)



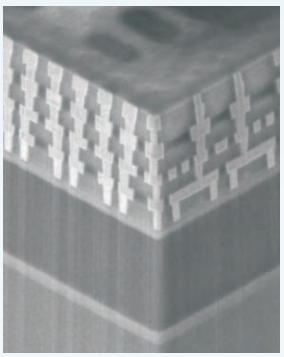
Flow sensor chip, MEMS chip made utilizing wafer bonding **Courtesy of ISSYS**



Yaw rate sensor in silicon micro-machined technology **Courtesy of Robert Bosch GmbH**



MEMS capacitive accelerometer
Courtesy of Colibrys



Cross-section of CMOS SOI Wafer after double bonding/ thinning, BCB ashing and sawing
Courtesy of Freescale

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