The key to your success
Our highly qualified employees are part of a worldwide network.

www.EVGroup.com
Solutions for Lithography

Since introducing the industry’s first backside-alignment microscope on a proximity mask alignment system more than two decades ago, EV Group has been committed to pioneering advances in lithography for semiconductor and MEMS manufacturing.

The company’s key competencies in lithographic technology lie in the high-throughput contact and proximity exposure capabilities of its mask alignment systems (EVG600, EVG6000 and IQ series) and in its highly integrated coating platform (EVG100 series). All of EV Group’s lithography equipment platforms are 300 mm ready, can be fully integrated into its HERCULES lithography track systems, and are complemented by its metrology tools for top-to-bottom side alignment verification.

Other important advancements by EV Group in the lithography space include the company’s special resist coating technologies - OmniSpray and the revolutionary NanoSpray. Not only do these unique technologies allow for extremely conformal coatings over high-topography structures - for example, through-silicon-via (TSV) structures with an aspect ratio of 1:5 (W:H) - but, ultimately, they enable customers to realize significantly reduced fabrication costs.

Through its commitment to continued innovation and customer collaboration, EV Group has consistently raised the bar for cost-effective, nanometer-scale lithography processing. This future-focused approach enabled the accelerated introduction of its UV-nanoimprint lithography (UV-NIL) and hot-embossing systems.

Today, the company holds the dominant market share in these promising technologies.

Supported Lithography Process Steps

- Top and bottom side mask alignment both near-ultraviolet (NUV) or deep-ultraviolet (DUV) in proximity and contact exposure mode
- Spin coating and resist development
- Dry-film resist lamination
- OmniSpray and NanoSpray coating
- Top-to-bottom side alignment inspection
- UV-NIL, hot embossing and Micro Contact Printing (μ-CP)
- Metrology tasks like CD-, Box-in-Box- or Overlay measurement
Customer Support

We act globally. Our lithography, bonding and imprint equipment is designed for reliability, productivity and quality, without any limits. Our highly qualified employees are part of a worldwide network and react quickly and flexibly to customer requests and inquiries.

We are always prepared for new challenges.

<table>
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<tr>
<th>EVG Services</th>
<th>Key Benefits</th>
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| **Field Service On-Site Visits** | • Preventive maintenance and repair carried out in accordance with EV Group’s high-quality standards  
• Immediate assistance by factory trained, certified field service engineers  
• On call support  
• Equipment relocation  
• Worldwide service through our subsidiaries and partners | • Certified engineers are taking care of all equipment related issues  
• Engineers’ long-term experience and technology expertise  
• ISO certification ensures consistent high quality |
| **Technical Support** | • Remote diagnostics and trouble shooting via secure internet line, phone and e-mail  
• Assistance with spare part number research | • Access to Best Known Methods (BKM’s) and trouble shooting advise  
• Expert help from experienced Senior Engineers  
• Guaranteed fast response time |
| **Spare Parts** | • Recommended spare parts packages  
• Guaranteed lead times  
• Regional spare part stocks  
• Parts repair and refurbishment services  
• Consignment stock options | • Cost optimization through parts repair, refurbishment or new parts replacement  
• Customized spare part packages  
• Short lead times due to customized spare part stocking options |
| **Upgrades** | • Off the shelf upgrades for additional features and performance enhancement  
• Tailored soft- and hardware upgrades based on your requirements | • Performance enhancement based on your actual production needs  
• Customized solutions for new challenges |
| **Product Training** | • Worldwide distributed training locations  
• Standardized modules for operation, maintenance & process training from novice to expert level available on-site and at EV Group training centers. | • Optimum uptime and tool performance through EV Group certified operators and maintenance personnel |
| **Extended Equipment Warranty** | • Includes spare parts and labor | • Set costs with priority support |
Process Development and Services

With state-of-the-art application labs based at its headquarters in Austria, as well as in the U.S. and Japan, EV Group (EVG) is focused on delivering superior process expertise to its growing global customer base - from the initial development until the final integration at the customers’ site. Featuring state-of-the-art cleanrooms and a highly experienced staff of process and application engineers, the company’s process development business unit works hand in hand with customers on a number of areas.

The company’s application labs provide demonstrations of its various products for potential customers looking to leverage EV Group’s extensive line up of advanced wafer processing solutions for semiconductor, MEMS and nanotechnology markets. Furthermore, our labs provide process development support for custom applications to address customer’s unique and challenging requirements - at any stage of the development process.

These advanced process development and application labs are designed to accommodate independent research work to explore and develop baseline processes that will open up new market opportunities. This includes working with key partners, like material suppliers, to develop and optimize new processes and capabilities. Case in point, EV Group’s ongoing relationship with Brewer Science, who by working closely together, have demonstrated temporary wafer bonding capabilities for a wide range of backside processes.

EV Group's process development team works with customers needing "demonstrator" parts for their respective customer-specific requirements. As a result, EV Group's multiple application labs are equipped to conduct small-volume pilot line runs to simulate an actual production line process, when necessary. This is very advantageous, especially for those customers with extremely complex demands - ensuring seamless process capability that suits all parties ahead of time and ultimately puts EV Group’s customers a step ahead of the competition.

In all, these advanced labs provide customized tooling capabilities - enabling EV Group’s customers to effectively compete in today’s ever-changing, fast-paced environment by enabling a shorter time to market, easing integration headaches and eliminating the risk to schedule across multiple industries and applications.

This is the passion and commitment that makes EV Group a value-added partner and why companies demanding nothing less than the best continue to turn to EV Group for its unparalleled world-class process and technology expertise.

EVG Process Expertise

EVG Processes
The introduction of EV Group’s wafer-bonding approach, which separates the bond alignment from the bonding step, immediately revolutionized the market.

Utilizing high-contact forces under elevated temperatures and a controlled atmosphere, this novel approach is today’s process standard, with EV Group holding the dominant market share for both semi- and automated wafer bonding systems and a growing installed base of more than 800 bond chambers. Regarding systems applying low-contact forces under room temperature at outmost clean conditions, EV Group is also leading the market.

EV Group’s wafer bonding systems offer manufacturers numerous benefits, including optimal total cost of ownership (TCO), as well as a real wafer-wedge compensation unit to maximize the bonding yield. Their bond alignment systems can be integrated into a GEMINI Automated Production Bonding System. These systems, such as the patented (U.S. Pat.: 6,214,692 B1) SmartView face-to-face Bond Aligner, can support sub-micron alignment accuracies even with non-infrared (IR) transparent wafers.

As it did with MEMS manufacturing, the company is now leveraging its technology strengths to accelerate the success of 3D wafer stacking. For this the GEMINI FB Automated Production Fusion Bonding System has been developed. In further support of this technology transfer, EV Group developed chip-to-wafer bonding tools for high-yield heterogeneous 3D integration schemes and was the first to market with 300 mm wafer bonding systems.

Addressing new market challenges in “beyond CMOS” applications, power devices, silicon photonics and high-vacuum MEMS packaging, EVG has introduced the automated high-vacuum wafer bonding system EVG580 ComBond. The ComBond technology enables covalent and conductive wafer bonding processes at room temperature or low temperatures. This process facilitates the direct integration of heterogeneous materials, including III-V compound semiconductor materials like gallium nitride (GaN), gallium arsenide (GaAs) and indium phosphide (InP) on silicon substrates, GaAs on germanium (Ge), crystalline silicon carbide (cSiC) on SiC or on silicon, and lithium tantalate (LiTaO₃) on silicon. Key markets and applications include engineered substrates, high efficiency solar cells and MEMS devices.

Building on its success in permanent wafer bonding, EV Group introduced automated temporary bonding and debonding technology to address compound semiconductor and 3D IC manufacturers’ immediate need for high-yield processing of ultra-thin and fragile wafers. The EV Group technology temporarily mounts a wafer onto a carrier by applying thermal or UV-release intermediates (e.g., spin-on polymers, waxes, resists and dry-film laminates), providing manufacturers with several key benefits. These include optimal design-process flexibility, high yield (via the rigid carrier support), ease of integration into an existing fabrication infrastructure, and a highly reliable debonding step following complete front and backside processing.

**SUPPORTED WAFER BONDING STEPS**

- Permanent wafer bonding and chip-to-wafer bonding
- Thermal and UV cured bonding interfaces
- Anodic, glass-frit, metal-diffusion, eutectic, silicon-direct, polymer bonding, and LowTemp™ plasma activated bonding
- Face-to-face SmartView®, backside, IR and transparent bond alignment
- Temporary bonding to carrier substrates with spin-on polymers or dry-film laminates
- Debonding of thin wafers from carrier substrates
- Void and alignment inspection
- ComBond technology: room temperature bonding, oxide-free conductive interface
- High vacuum encapsulation
Application Examples

Advanced Lithography
EV Group’s solutions enable a broad range of applications that are key in the manufacture of today’s leading edge electronics products.

Nanoinprint Lithography (NIL)
Nanoinprint lithography is a cost efficient manufacturing technique for sub-100 nm features and complex 3D structures. It enables the fabrication of new, demanding applications requiring single step or step&repeat processes.
Nanoimprint Lithography Systems (UV-NIL, μ-CP, HE)

- **EVG®610 Semi-Automated UV-NIL, μ-CP System up to 150 mm**
- **EVG®620 Semi-Automated UV-NIL, μ-CP System up to 150 mm**
- **EVG®620NT Semi-Automated UV-NIL, μ-CP System up to 150 mm**
- **EVG®620HBL Semi-Automated UV-NIL System up to 200 mm**
- **EVG®6200 Semi-Automated UV-NIL, μ-CP System up to 200 mm**
- **EVG®6200NT Semi-Automated UV-NIL, μ-CP System up to 200 mm**
- **IQ Aligner® Automated Mask Alignment System up to 300 mm**
- **EVO®PHABLE™ Automated Displacement Talbot Lithography System up to 150 mm**
- **HERCULES® Lithography Track System coat-align & expose/develop configuration up to 300 mm**
- **HERCULES®L Lithography Track System resist processing & expose configuration up to 300 mm**

Inspection Systems

- **EVG®40 Semi-automated Top-to-Bottom Side Measurement System up to 200 mm**
- **EVG®40 Advanced Manual Top-to-Bottom Side Measurement System up to 200 mm**
- **EVG®40NT Automated Measurement System up to 200 mm**
- **EVG®40NT Semi-Automated Measurement System up to 300 mm**
- **EVG®40NT Automated Measurement System up to 300 mm**

Resist Processing Systems

- **EVG®101 Advanced Resist Processing System up to 300 mm**
- **EVG®105 Bake Module up to 300 mm**
- **EVG®101LA Large Area Coating System for > 300 mm**
- **EVG®150 Automated Resist Processing System up to 200 mm**
- **EVG®150NT Automated Resist Processing System up to 150 mm**
- **EVG®150 Automated Resist Processing System up to 200 mm**
- **IQ Aligner® Automated Mask Alignment System up to 200 mm**
- **EVO®PHABLE™ Automated Displacement Talbot Lithography System up to 150 mm**
- **HERCULES® Lithography Track System coat-align & expose/develop configuration up to 300 mm**
- **HERCULES®L Lithography Track System resist processing & expose configuration up to 300 mm**

Mask Alignment Systems

- **EVG®610 Semi-Automated Mask Alignment System up to 200 mm**
- **EVG®620 Semi-Automated Mask Alignment System up to 150 mm**
- **EVG®620NT Automated Mask Alignment System up to 150 mm**
- **EVG®620HBL Automated Mask Alignment System up to 150 mm**
- **EVG®6200 Semi-Automated Mask Alignment System up to 200 mm**
- **EVG®6200NT Semi-Automated Mask Alignment System up to 200 mm**
- **EVG®6200NT Semi-Automated Mask Alignment System up to 300 mm**
- **IQ Aligner® Automated Mask Alignment System up to 300 mm**
- **EVO®PHABLE™ Automated Displacement Talbot Lithography System up to 150 mm**
- **HERCULES® Lithography Track System coat-align & expose/develop configuration up to 300 mm**
- **HERCULES®L Lithography Track System resist processing & expose configuration up to 300 mm**
EV Group's solutions enable a broad range of applications that are key in the manufacture of today's leading edge electronics products.

**Advanced Lithography**

**Application Examples**

- **High-Q-3D solenoid inductors**
  - Sidewall angles approaching 90°
  - 80 µm SU-8 resist features with 50 nm hot embossed resolution

- **5-layer photonic crystal in Si/SiO2**
  - Imprinted using EVG®PHABLE™
  - Hexagonal array with 260 nm pitch.

- **20 nm wide 3D structure produced**
  -Courtesy of TU-Delft DIMES
  -in anisotropically etched cavity

- **Patterned, spray coated resist layer**
  -Courtesy of CEETAM

- **Source:** EVG

**NANOIMPRINT LITHOGRAPHY SYSTEMS (UV-NIL, -CP, HE)**

- **EVG®720**
  -Up to 150 mm
  -UV-NIL System

- **EVG®610**
  -Up to 200 mm
  -Mask Alignment System

- **EVG®610S**
  -Semi-automated
  -Wafer Bonding System up to 200 mm

- **EVG®620**
  -Semi-automated
  -Bond Alignment System up to 150 mm

- **EVG®620S**
  -Semi-automated
  -Wafer Bonding System up to 300 mm

- **EVG®640**
  -Automated
  -Wafer Bonding System up to 300 mm

- **EVG®560**
  -Automated
  -Wafer Bonding System up to 200 mm

- **EVG®560BL**
  -Automated
  -Wafer Bonding System for H8-LED up to 300 mm

- **EVG®580 ComBond®**
  -Automated
  -High-Vacuum Wafer Bonding System up to 200 mm

**INTEGRATED BONDING SYSTEMS**

- **GEMINI®**
  -Automated Production Wafer Bonding System up to 200 mm

- **GEMINI®**
  -Automated Production Wafer Bonding System up to 300 mm

- **GEMINI®FB**
  -Automated Production Fusion Bonding System up to 200 mm

**SOI & ENGINEERED SUBSTRATES BONDING SYSTEMS**

- **EVG®301**
  -Semi-automated
  -Single Wafer Cleaning System up to 300 mm

- **EVG®320**
  -Automated Single Wafer Cleaning System up to 300 mm

- **EVG®810LT LowTemp™**
  -Plasma Activation System for SOI and Direct Wafer Bonding up to 200 mm

- **EVG®850LT**
  -Automated Production Bonding System for SOI and Direct Wafer Bonding up to 300 mm

- **EVG®850**
  -Automated Production Bonding System for SOI and Direct Wafer Bonding up to 300 mm

**TEMPORARY BONDING and DEBONDING SYSTEMS**

- **EVG®805**
  -Semi-automated
  -Debonding System up to 300 mm

- **EVG®820**
  -Lamination System up to 200 mm

- **EVG®850TB**
  -Automated Temporary Bonding System up to 300 mm

**INSPECTION SYSTEMS**

- **EVG®20**
  -IR Inspection Station up to 200 mm

- **EVG®40NT**
  -Automated Debonding System up to 300 mm

- **EVG®850DB**
  -Automated Bonding System up to 300 mm

- **EVG®850DB XT Frame**
  -Automated Debonding System up to 300 mm
Application Examples

The different drivers for employing wafer bonding, as well as the applications served by EV Group bonding technology, are as diversified as the markets from which these applications originate.

Markets

The key below denotes each systems' market applicability.

- MEMS
- Advanced Packaging & 3D Interconnect
- SOI & Engineered Substrates
- Compound Semiconductor
- Nanotechnology