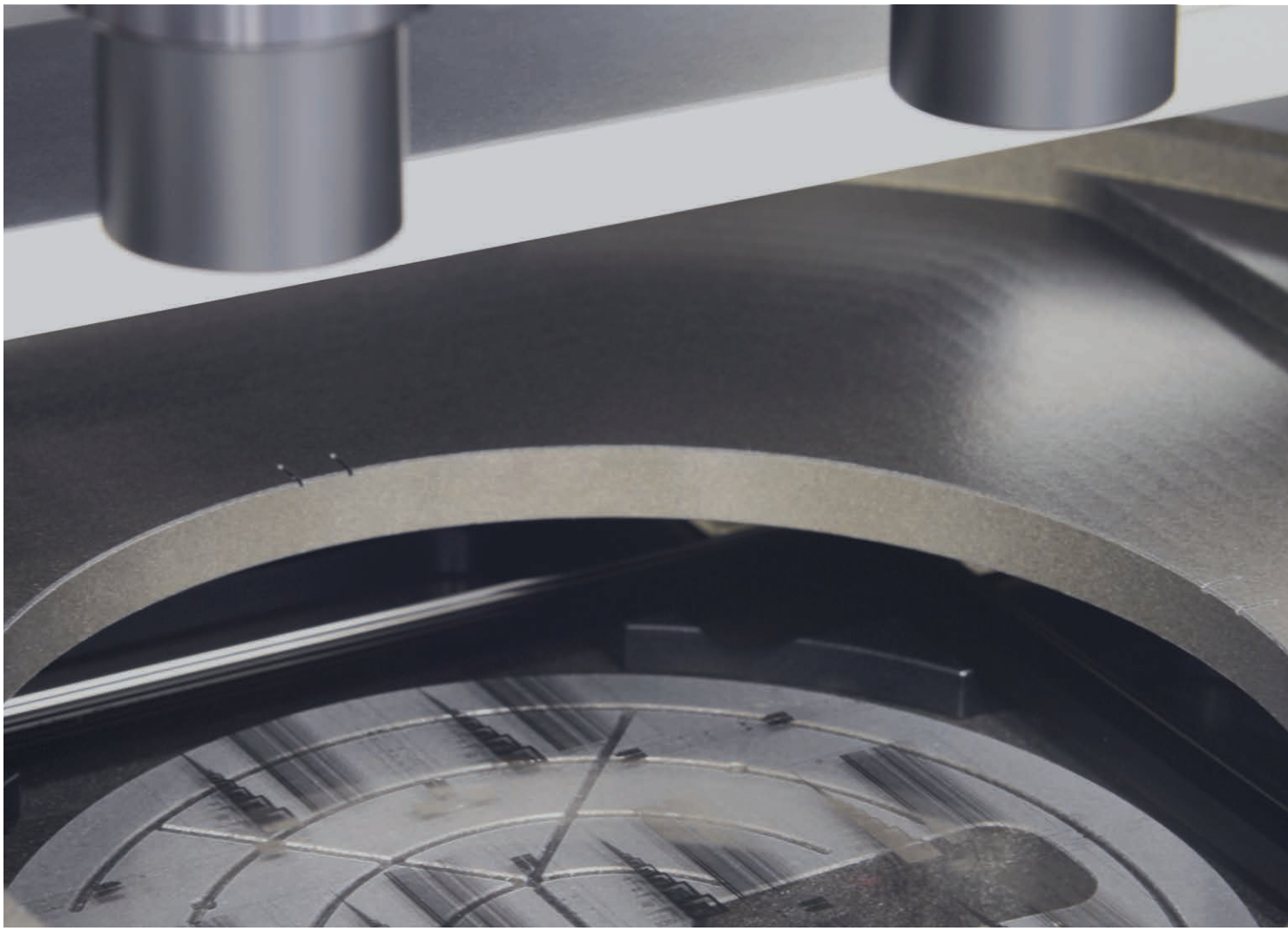
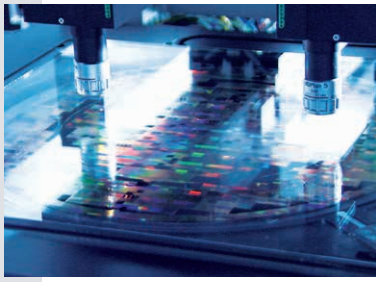
EV GROUP® | **Products** // Lithography

Mask Alignment Systems





Introduction

EVG's inventions, such as the world's first bottom-side alignment system in 1985, have pioneered and set industry standards in both top and double-sided lithography, aligned wafer bonding and nanoimprint lithography.

EV Group contributes in these areas through continuous development of mask aligner generations to augment the foremost lithography technology. Accommodating wafers and substrates up to 300 mm, varying in size, shape and thickness, EV Group's mask alignment ambition is to simultaneously provide high-tech complex solutions for advanced applications and full flexibility for research and development. EVG's mask aligners and process competence are field-proven, installed and well integrated in the world-wide network, found in numerous applications, including advanced packaging, compound semiconductors, power devices, LED, sensors and MEMS. Furthermore, EVG constantly looks out at future market trends – such as optical 3D sensing and photonics – and develops and adapts its solutions to meet the constantly evolving needs of our customers. This is proven by our continued technology and market leadership, including EVG's unsurpassed experience in using a variety of non-standard resists that are optimized for distinctive requirements and parameters. Understanding customer needs and efficient worldwide support are important stepping stones when it comes to our solutions' priorities.

Mask Alignment Product Series

State-of-the-Art Engineering

Today's main requirements for proximity aligners are defined by several key parameters. Sub-micron alignment accuracy, controlled uniform proximity gap between mask and wafer, as well as a clearly defined and easily controlled exposure spectrum corresponding to the resist sensitivity are among the most important criteria. In addition, high light intensity and uniformity across the full wafer surface are among many other crucial parameters taken into account when designing and constantly enhancing EVG's mask aligner product portfolio. Innovation drives our daily business along with our philosophy, which enables us to think outside the box.

Multi-purpose systems optimized to your needs

Our mask alignment systems are designed for quick and easy conversion from mask alignment to bond alignment. Furthermore, optional toolsets for imprint lithography, such as UV-nanoimprint lithography, hot embossing or microcontact printing, are available. All systems support in-situ alignment verification software for increased alignment accuracy and repeatability performance on manually operated systems. The EVG620 NT / EVG6200 NT is field-upgradeable from manual to automated substrate handling. Furthermore, EVG's proprietary NIL technology is supported on all mask aligners.

Research and Development

EVG has been working with research facilities for more than 35 years, giving us insight into their unique requirements. Our dedicated R&D tools provide superior technology combined with maximum flexibility, enabling universities, research institutions and technology development partners to scale processes across multiple research projects and applications. What's more, the R&D equipment integrates seamlessly with EVG's core technology platforms, which span the entire manufacturing chain from R&D all the way to small-scale and high-volume production. Software and recipe compatibility between R&D and full-scale production systems enables researchers to migrate their processes to volume-production environments.

High-Volume Mask Alignment Systems

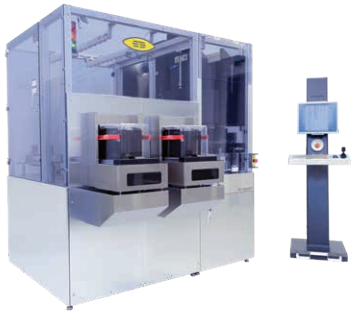
For lithographic patterning in the single micrometer range, mask aligners are the most cost-efficient technology and provide cost savings of more than 30 percent per layer compared to other solutions. EVG's high-volume manufacturing systems are designed for optimal cost efficiency combined with the highest technological standards, supported by an excellent worldwide service infrastructure. Most importantly, large depth-of-focus exposure optics perfectly matches for patterning thick resists, topography and non-flat substrates in high-volume production.

EVG®610 Mask Alignment System

- Wafer sizes up to 100 mm / 150 mm / 200 mm
- Top-side / bottom-side alignment down to ± 0.5 µm / ± 1.0 µm
- High-resolution top- and bottom-side splitfield microscopes for double-side alignment
- Soft-, hard-, vacuum contact and proximity exposure
- Automated wedge compensation
- Bond Alignment and NIL option
- Supports the latest UV-LED technology

EVG®620 NT / EVG®6200 NT
Mask Alignment System (semi-automated / automated)

- Production system for wafer sizes up to 150 mm / 200 mm
- Proximity wedge error compensation
- Handling of multiple wafer sizes with quick changeover time of less than 5 min.
- Up to 180 wph first print mode / 140 wph automatic alignment mode
- Optional stand-alone version with anti-vibration granite table
- Dynamic alignment function featuring real-time offset correction
- Supports the latest UV-LED technology



IQ Aligner®

- Wafer size up to 200 mm / 300 mm
- Throughput (first print / aligned) > 90 wph / 80 wph
- Top-side / bottom-side alignment down to ± 0.5 µm / ± 1.0 µm
- Proximity processing capability 100% contactless
- Ergoload casettes, SMIF or FOUP option
- Precise run-out compensation for best overlay alignment
- Manual substrate loading capability
- IR alignment capability – transmissive and / or reflective

IQ Aligner® NT

- Zero assist bridge tool - dual substrate concept supporting flexibility of production for 200 mm and 300 mm
- Unmatched throughput (first print / aligned) > 200 wph / 160 wph
- Top-side / bottom-side alignment down to ± 250 nm / ± 500 nm
- Proximity processing capability 100% contactless
- Darkfield alignment capability / full clearfield mask movement (FCMM)
- Precise run-out compensation for best overlay alignment
- Smart process control and performance analysis framework software platform

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HERCULES®

- Fully automated lithography track system based on modular design for mask alignment and exposure with integrated pre- and post-processing
- Wafer processing with high throughput
- Up to 8 wet-processing modules plus up to 24 additional bake, chill and vapor prime plates
- Mask alignment and exposure based on EVG's IQ Aligner® or EVG®6200 NT technology
- Chemistry handling in separate cabinet
- Supporting Continuous Mode of Operation (CMO)

Options

Manual and Automated Handling

All of our automated systems also support manual substrate and mask loading capability for process evaluation. In addition, the systems can be configured to handle bowed, warped, thinned or non-SEMI-standard-shaped wafers and substrates. Various wafer chuck designs bring maximum process flexibility and substrate handling without compromises. Our mask aligners are equipped with mechanical or non-contact optical pre-aligners in order to secure the optimum process capability and throughput. The Load & Go option offers ultra-fast process start on automated systems.

Alignment Enhancements

Fully motorized top- and bottom-side split field microscopes support live, large gap, wafer flat or IR alignment, automatically positioning at preprogrammable positions. Optimum pattern contrast is ensured and recipe-controlled for brightfield as well as darkfield illumination. Advanced pattern recognition algorithms, auto-origin function, synthetic alignment key pattern import and training ensure highly reproducible alignment results.

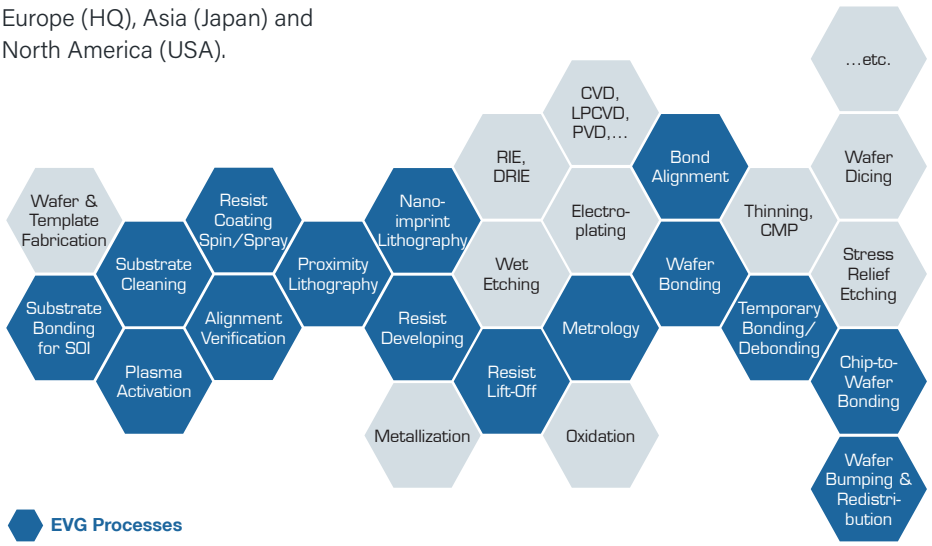
Exposure Optics

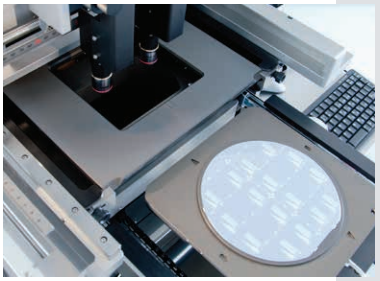
Different configurations of exposure optics are available, designed to fulfill maximum flexibility of any application. Mercury arc lamp exposure optics are optimized for 150, 200 and 300 mm substrates and can be used with various filters for narrow-band exposure requirements, such as i-, g-, and h-line filters or even deep ultra-violet setup. Specially developed Resolution Enhanced Optics (REO) deliver 50 percent higher intensity and significantly improved resolution, reaching feature sizes of less than 3 µm in proximity mode. REO's special design facilitates controlled interference effects to gain resolution.

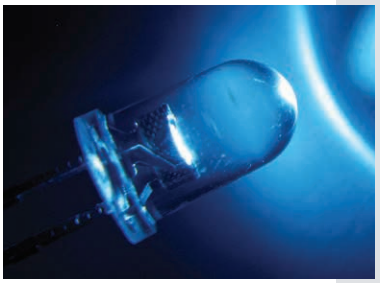
EVG's latest enhancement for exposure optics is an LED lamp setup. Low energy consumption and long lifetime are among the UV-LED light source's biggest advantages, as no warm-up or cool-down phase is required. Exposure spectrum setup is easily and practically done in the user software interface. In addition, LEDs need to be powered only during the exposure, and the technology eliminates the need for additional facility (exhaust, cooling gases) and lamp changes, which are regularly needed for mercury arc lamps. This ideal combination will not only minimize your running and maintenance costs but also add value in regards to the operator safety and environmental friendliness.

Software and Support

The Windows-based, graphical user interface is designed with a strong focus on user-friendliness, and easily navigates the operator through each process step. Multi-language support, individual user account settings and integrated error logging / reporting and recovery can simplify the user's daily operation. All EVG systems can also communicate remotely. Thus, our service includes field-proven, real-time remote diagnostics and troubleshooting via secured connection, phone or email. EVG's experienced process engineers are ready to support you anytime thanks to our de-centralized worldwide support structure, including cleanroom space on three different continents:
Europe (HQ), Asia (Japan) and
North America (USA).

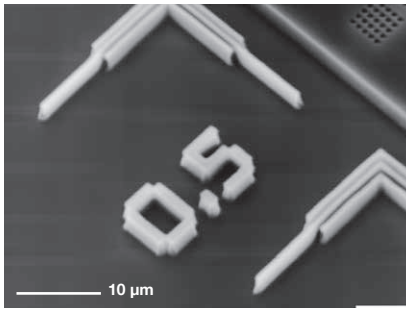




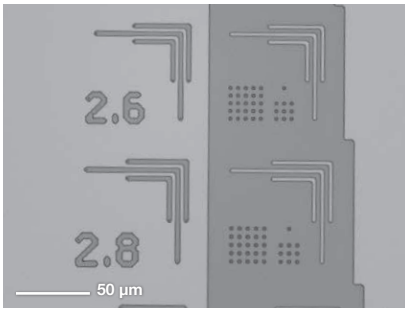


Process Results

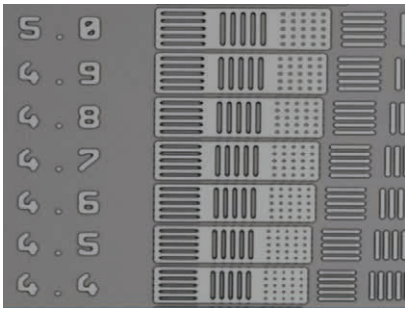
EVG's core competencies in lithographic technology lie in high-throughput proximity and contact exposure capabilities of its mask alignment systems (EVG6xx and IQ Aligner series) and in its highly integrated coating platform (EVG1xx series). All of EVG's lithography equipment platforms are 300-mm ready, can be fully integrated into its HERCULES lithography track systems and are complemented by its metrology tools for top-to-bottom side alignment verification.



3 µm thick resist with 0.5 µm line/space exposed using deep ultra-violet setup
Source: EVG

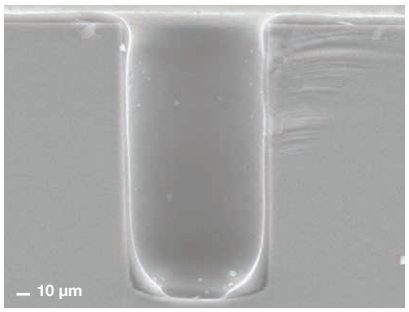


1 µm thick resist with 2.6 µm resolution exposed on EVG®620 NT in 15 µm proximity
Source: EVG

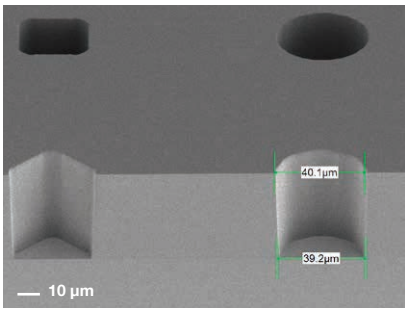


1 µm thick resist with a resolution below 5 µm with a large proximity gap of 50 µm exposed on EVG® IQ Aligner®, REO setup **Source: EVG**

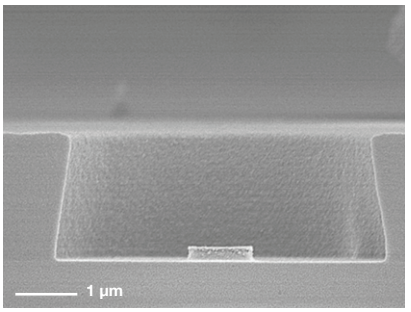
Advanced Packaging



Bottom opening of a coated TSV combining NanoSpray™ exposure on EVG® IQ Aligner®
Source: EVG

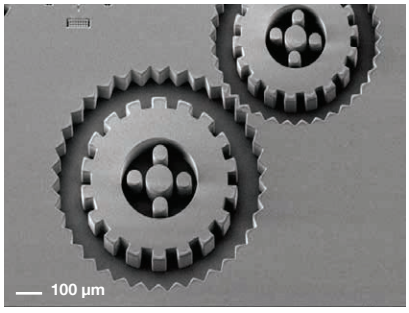


Bumping results in a 40 µm thick resist performed on EVG® IQ Aligner NT®
Source: EVG

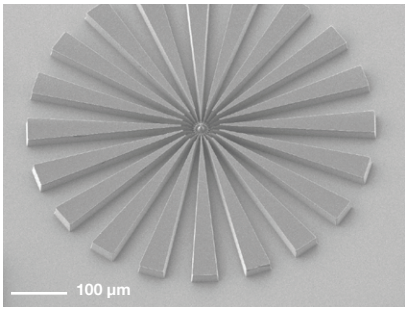


Negative sidewall with a metal-compatible lift-off resist coating; metal pad in the middle of the structure
Source: EVG

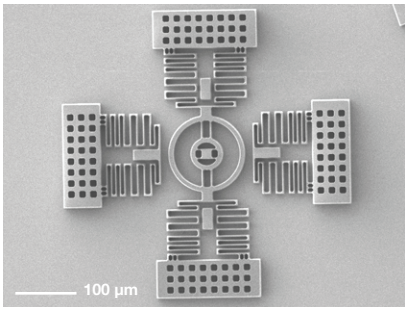
MEMS



High aspect ratio structures for LIGA structures with a 200 µm thick resist exposed on EVG® IQ Aligner®
Source: EVG

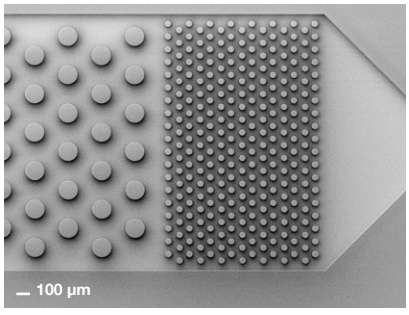


Siemens star exposed on EVG®6200 NT showing high resolution capabilities for thick resist patterning
Source: EVG

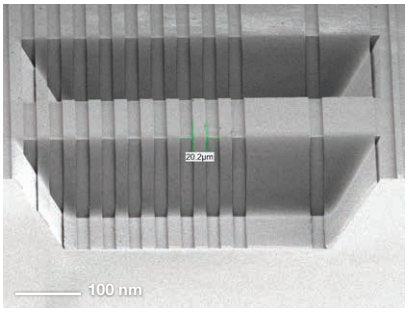


MEMS Structures patterned in 20 µm thick resist.
Source: EVG

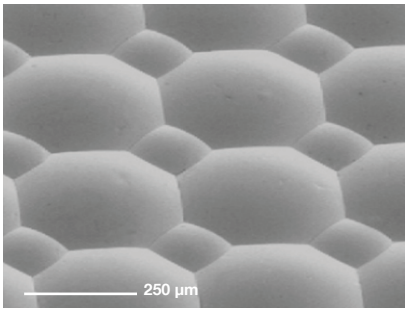
Photonics, special applications



High aspect ratio pillars for cell sorting & micro fluidic applications, 100 µm thick resist patterning on EVG® IQ Aligner® NT **Source: EVG**



High depth of focus exposure on EVG®620 NT of KOH etched cavities with a depth of 150 µm
Source: EVG



Microlenses
Source: EVG

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