



ZEISS Semiconductor Mask Solutions



www.zeiss.com/mask-solutions

Seeing beyond

Achieving excellent yield with connected mask solutions.



Our Competencies

ZEISS is a leading supplier of both metrology and manufacturing equipment for the global Semiconductor Industry. With focus on a key component in the semiconductor manufacturing process, the photomask, ZEISS enables their customers to produce optimal photomasks achieving highest yields.

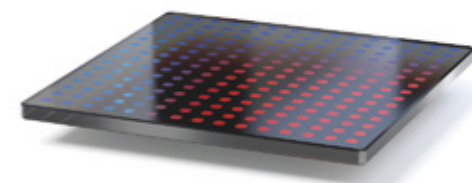
Core expertise in light and electron optics, complemented by a pioneering femtosecond laser technology form the foundation of a product portfolio comprising in-die metrology, actinic qualification, repair, and tuning of photomasks.

Our advanced mask solutions empower our customers in the mask making industry to develop and manufacture zero defect photomasks. A suite of metrology tools, capable of measuring in-die features, allows manufacturing and qualification of masks with the largest possible process windows for wafer printing, a characteristic which is vital for improved performance and yield.

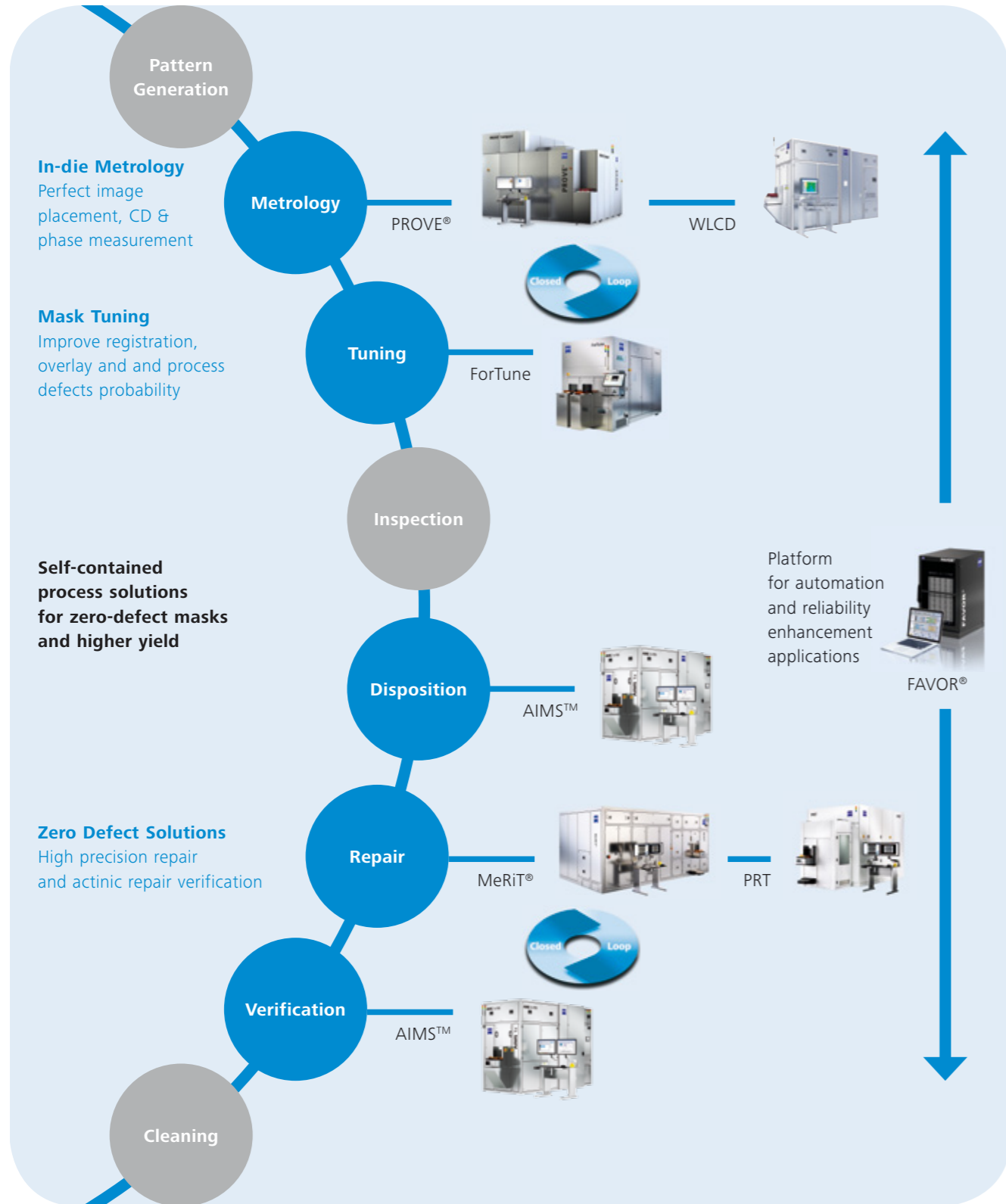
To ensure close geographical proximity to our customers we can rely on a dense global network of local branches and representatives. Spare part hubs in Asia, USA und Europe allow fast response times to fulfil production requirements.

Development cooperations with industry consortia as well as individual customers keep us tuned to the rapidly emerging and changing requirements of photomask technology.

ZEISS' long-term commitment to the industry paired with our outstanding technology, engineering and support capabilities make us a reliable partner for your development and manufacturing equipment needs today and in the future.

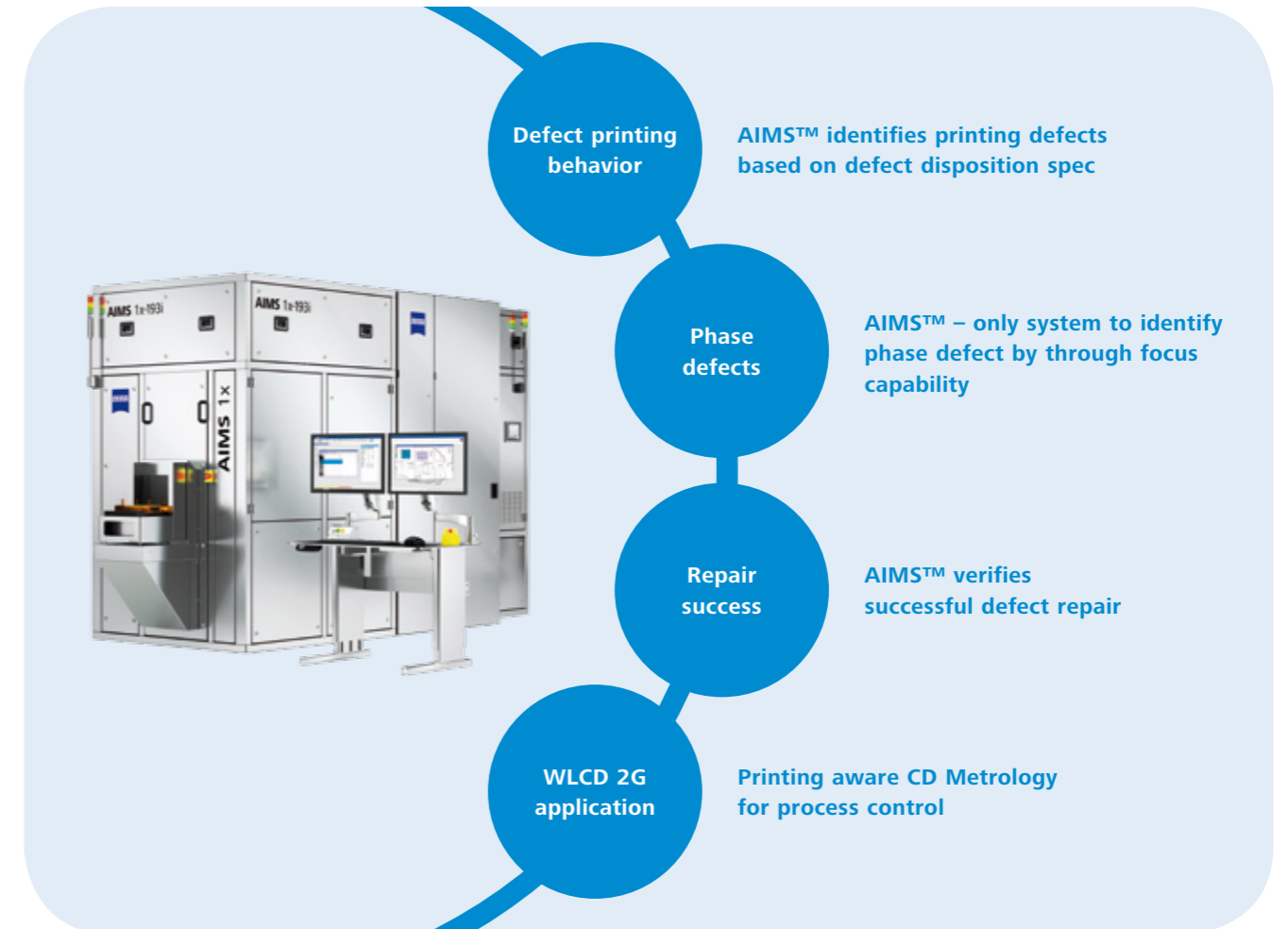


ZEISS Perfect Mask Solutions



Mask Qualification

ZEISS AIMS – Aerial Image Measurement System



AIMS™ – The industry standard for defect review and repair verification!

AIMS™ (Aerial Image Measurement System) is a unique mask qualification system for defect review, printability analysis, and repair verification of today's and future generation photo-masks. The product portfolio supports ArF immersion, KrF and EUV lithography.

By measuring and analyzing the aerial image of the photo-mask under the same optical conditions as in the wafer printing process the ZEISS AIMS technology provides reliable characterization of mask defects with respect to their real effect in the lithographic process. Based on the AIMS™ 1x

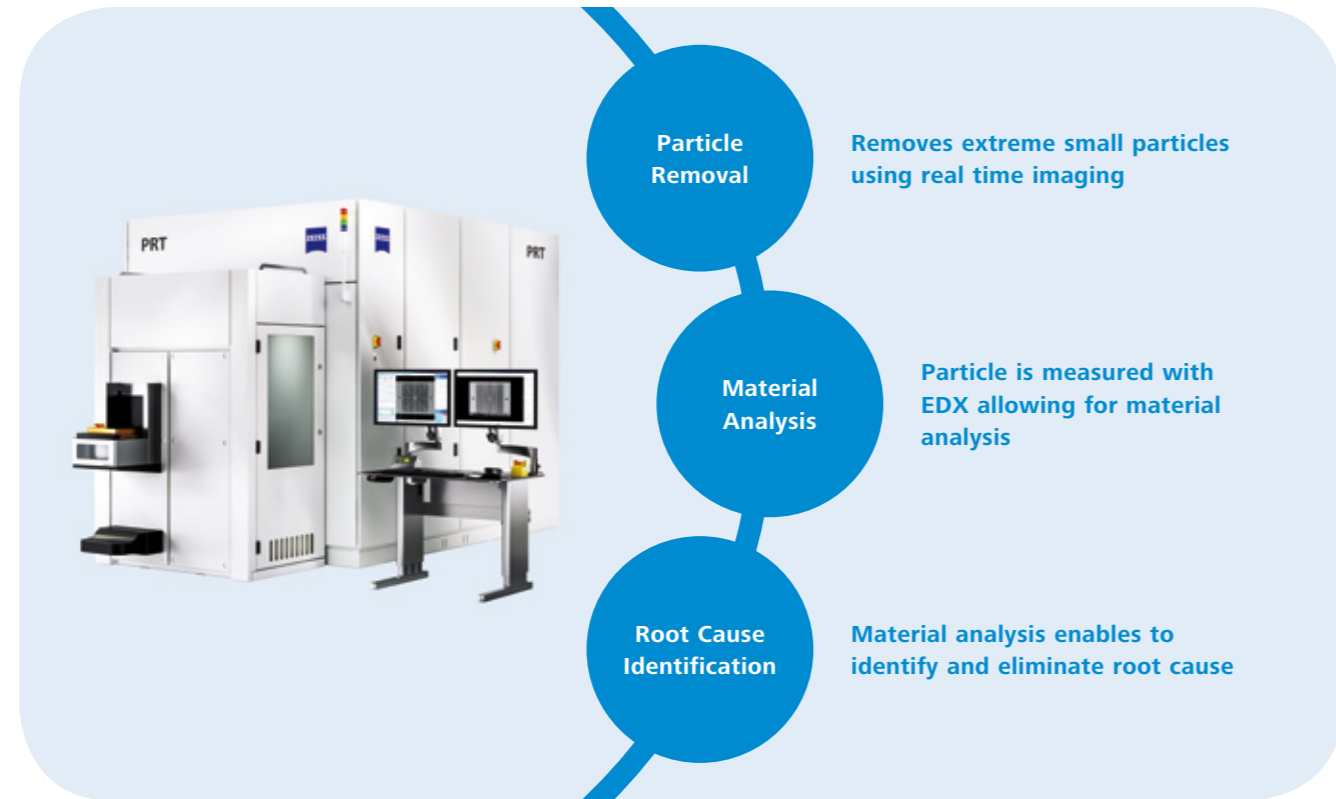
platform ZEISS offers the WLCD 2G application providing the capability to measure the CD in aerial image capturing OPC, MEEF and mask 3D effects. It addresses the CD metrology challenges of advanced lithography nodes with high MEEF pattern having an increased risk to fail in wafer printing.

Additionally ZEISS offers further productivity enhancements applications, such as the AIMS™ AutoAnalysis, that run on the FAVOR® platform.

Learn more: www.zeiss.com/mask-qualification

Mask Repair

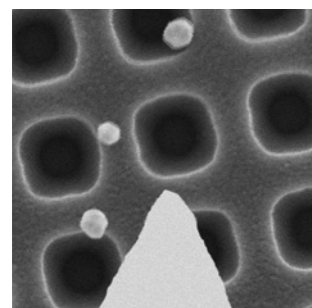
ZEISS PRT – Fast Particle Removal on Photomasks



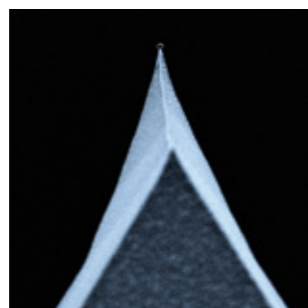
PRT – Control your repair process!

The Particle Removal Tool (PRT) removes even the smallest particle from photomasks. It picks particles out of very small features such as EUV contact holes. The real-time imaging capability gives the user real-time feedback and the ability to fully control the removal process.

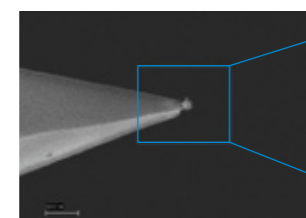
Five different removal analysis and rejuvenation modes allow for maximized flexibility. PRT measures the particle material with EDX, enabling to identify and eliminate the root cause.



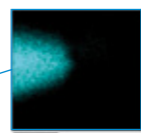
Removal of particle from contact hole



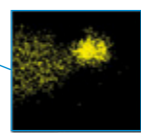
PRT allows for separated analysis...



Tip carrying a particle



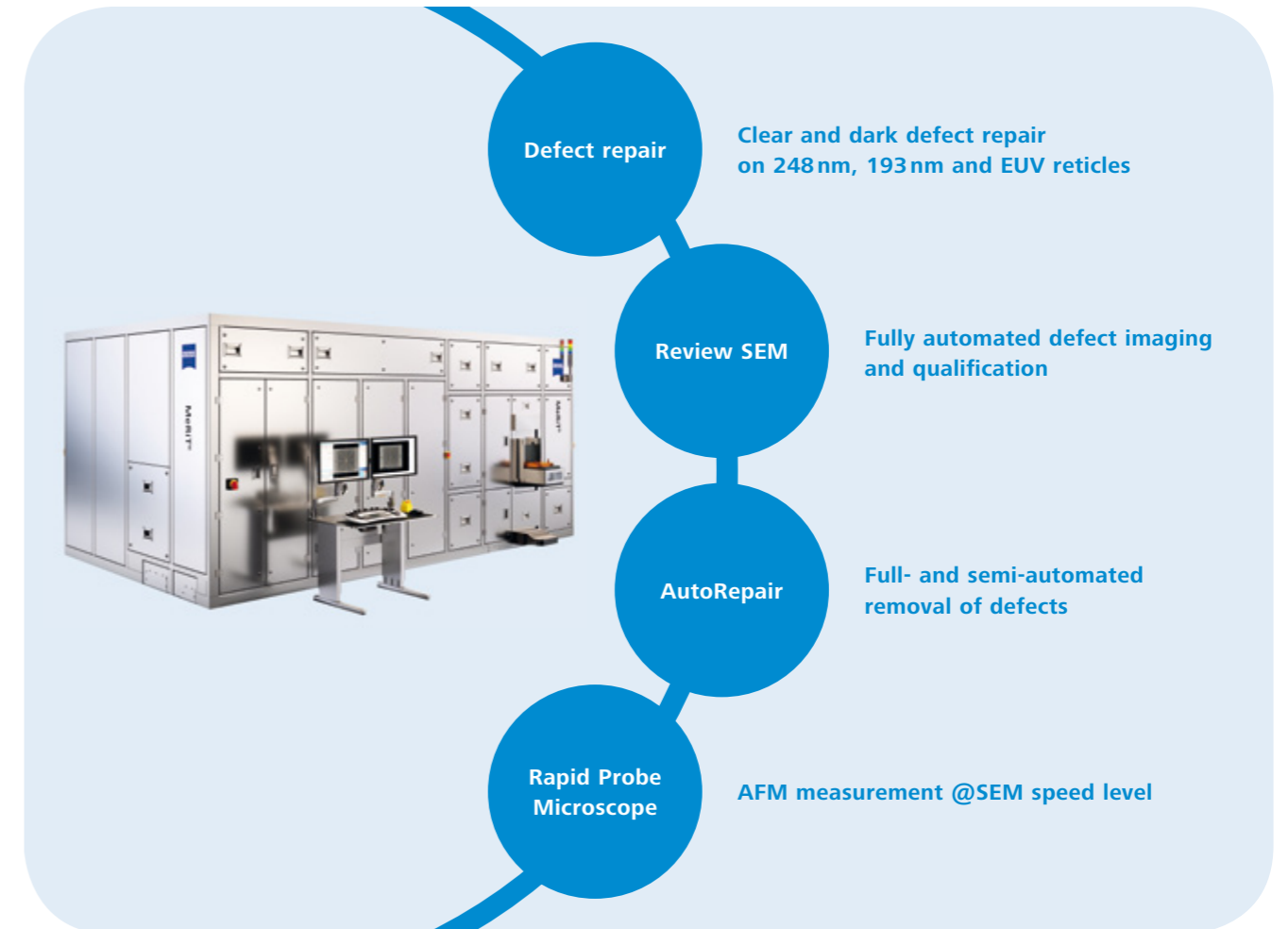
...of tip material and...



...particle material

Mask Repair

ZEISS MeRiT – E-beam based Mask Repair Technology



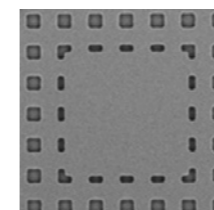
MeRiT® – Elevating your repair performance!

MeRiT® enables the repair of all kind of photomask defects with the highest precision. Based on e-beam technology the system covers opaque and clear defect repair in one platform. MeRiT® achieves superior resolution and accuracy for repair,

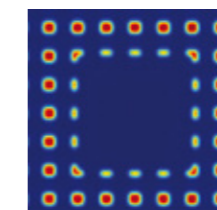
while the repair process causes no unwanted transmission loss and no contamination. The system is able to repair all mask materials including EUV photomasks.

Learn more: www.zeiss.com/mask-repair

Pre-Repair image

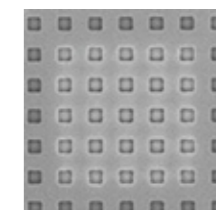


SEM@MeRiT®

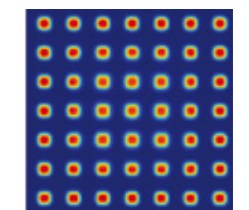


AIMS™ EUV image

Post-Repair image



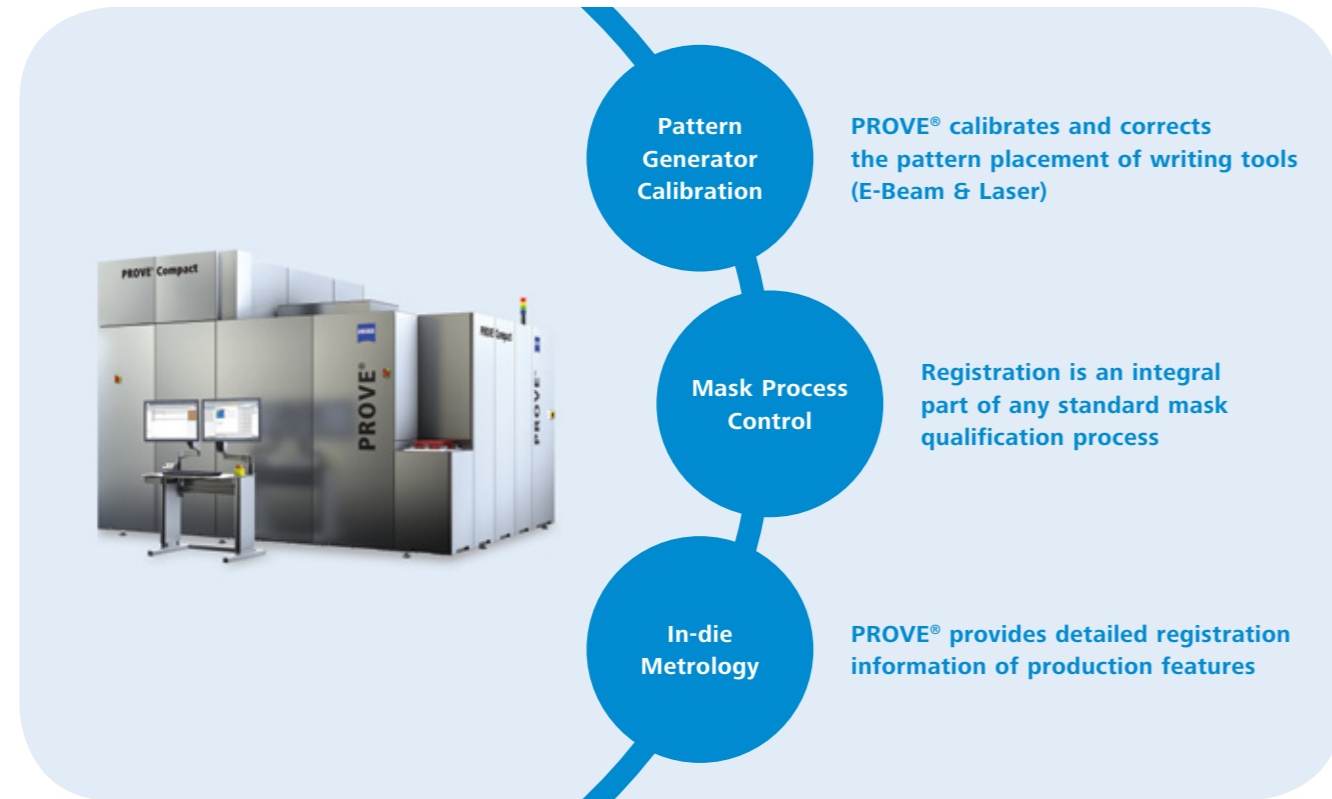
SEM@MeRiT®



AIMS™ EUV image

Mask Metrology

ZEISS PROVE – A high precision pattern placement metrology tool



PROVE® – You can correct what you can measure!

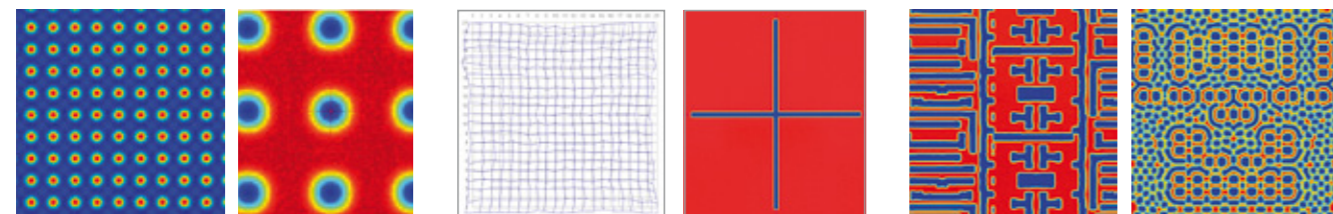
The photomask registration and overlay metrology system ZEISS PROVE measures image placement with sub-nanometer repeatability and accuracy.

The key component of ZEISS PROVE is the diffraction limited, high resolution imaging optics operating at 193 nm – corresponding to at-wavelength metrology for the majority of

current and future photomask applications.

The high precision stage is actively controlled in all six degrees of freedom. The only moving part in the metrology system is the stage.

Learn more: www.zeiss.com/mask-metrology



Mask Tuning

ZEISS ForTune – Intra-Field solutions of High Lateral Resolution



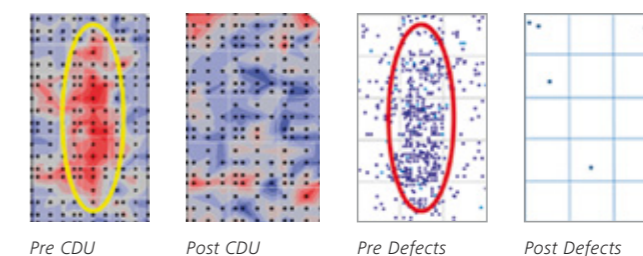
ForTune – Exceeding the boundaries of lithography!

ForTune is the next generation tuning system that helps the IC manufacturers to meet the tightest specifications of mask registration, wafer On-Product-Overlay (OPO) and reduces the probability of process defects on wafer.

Each of these key parameters can be optimized separately or alternatively combined into one tuning solution.

Learn more: www.zeiss.com/mask-tuning

Improved CDU leads to significant defect reduction on wafer



Productivity Enhancement Solutions

ZEISS FAVOR – Platform for smart automation solutions



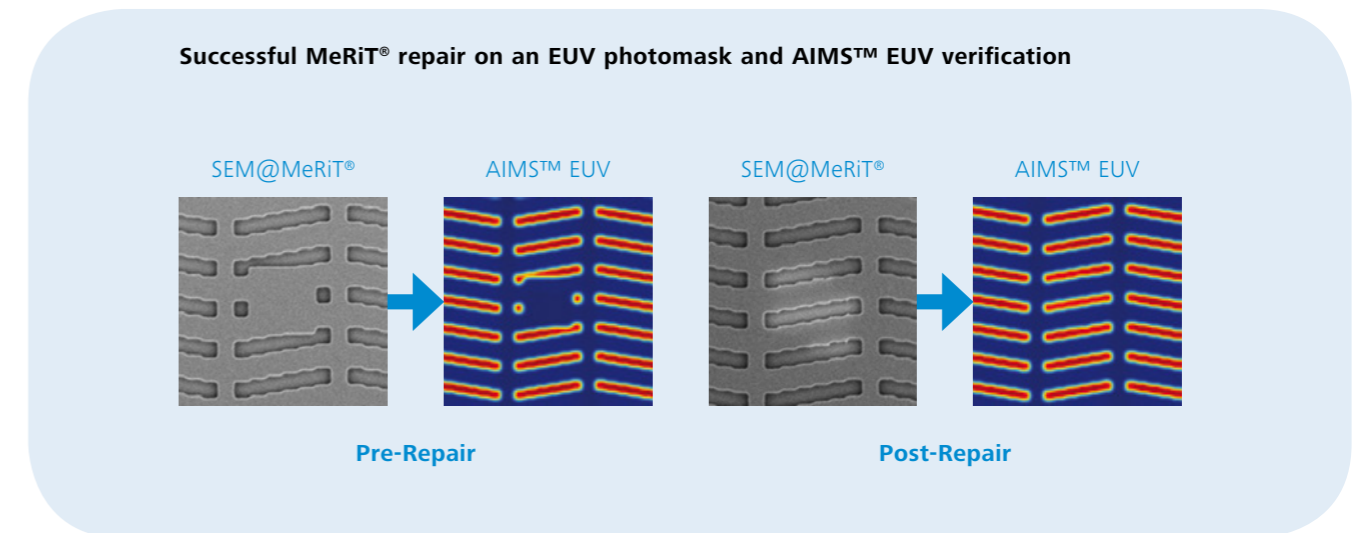
FAVOR® – Power your productivity!

The FAVOR® platform enables productivity and reliability enhancement through intelligent automation. ZEISS offers several automation applications running on the FAVOR® platform. One main application is the AIMS™ AutoAnalysis (AAA) allowing for fully automated analysis of aerial images, data flow and information processing. The image processing and evaluation runs in parallel to the AIMS™ measurements therefore eliminating time consuming, post measurement analysis. AutoAnalysis shortens cycle time and increases reliability ensuring your quality targets are met. The Advanced Repair Center (ARC) is a powerful software

solution facilitating effective data management and process flow optimization for the entire defect handling process. Repair enhancement features provide tools to improve repair success. ARC allows you to significantly reduce mask returns and cycling time. The ForTune Tuning Module (FTM) enhances the performance of the ForTune Mask Tuning System. It facilitates recipe creation as well as extensive data analysis and simulations prior to the process. This module's versatile job handling capabilities ensure high process efficiency, superior prediction accuracy and on-the-spot decision making.

EUV Mask Solutions

ZEISS solutions supporting the EUV mask infrastructure



Ready for EUV!

The EUV lithographic process has been constantly achieving a higher degree of readiness and is now on the threshold of introduction into high volume manufacturing. Along with the technological efforts on the wafer side, the EUV mask infrastructure has successfully overcome several challenges empowering the implementation of EUV technology both into mask shop and wafer fab. ZEISS is providing several tools enabling the EUV roadmap.

AIMS™ EUV

A key enabler is the actinic mask qualification system AIMS™ EUV, which fully addresses the industry requirements for EUV defectivity review. The AIMS™ EUV platform is capable to provide a full understanding of the EUV imaging process and allows for mask qualification applications based on the employment of proven aerial image technology. Automation in image analysis and data processing can be enhanced employing the AIMS™ EUV AutoAnalysis software package.

MeRiT® neXT

The system provides a wide range of application modules for EUV repair. A suite of repair process modules allows to repair opaque as well as clear defects on all state of the art EUV reticles. Furthermore, the EUV compensational repair module allows to repair the EUV typical multilayer defects enabling zero-defect EUV masks.

ForTune EUV

ZEISS is currently designing a system to correct registration on EUV masks and to improve Wafer Intra-Field Overlay.

PROVE® neXT

The latest PROVE® generation enables the measurement of EUV mask with superior repeatability and accuracy. With its best in class resolution it is the tool of choice to localize EUV – Blank defects with highest precision. Powerful and fast DB – mode measurement schemes support extensive sampling as needed for the calibration of state of the art multibeam writers.



Learn more under
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