Leica EBPG5000 Series

Electron Beam Lithography Systems

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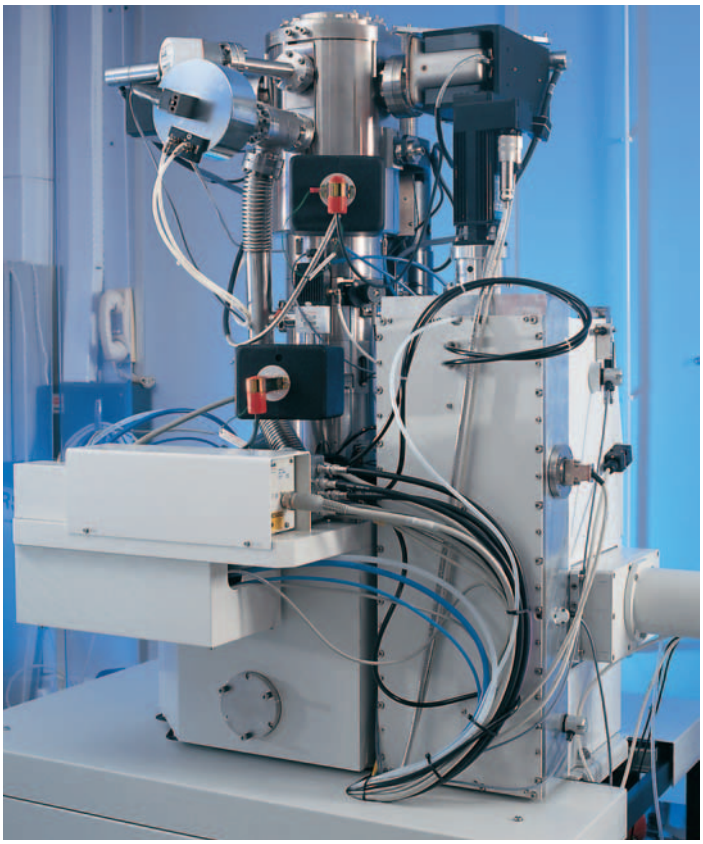
Leica Microsystems - Your Dedicated Performance Partner!

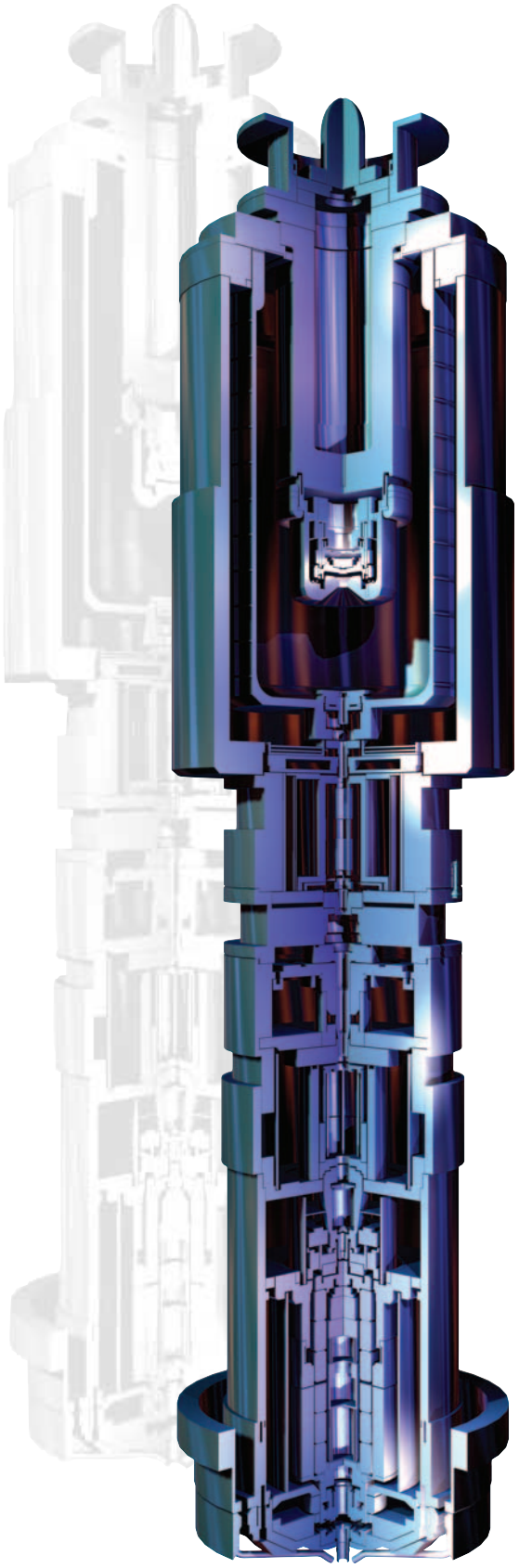
Leica has a 30-year record of successful design, manufacture and supply of Electron Beam Lithography Tools. During this period over 200 systems have been installed and supported in more than 25 different countries worldwide. Today, Leica Microsystems Lithography is providing leading edge technology solutions in all areas of advanced lithography, both in the manufacturing roles of direct write & maskwriting as well as the key enabling nanolithography role for research and development.



All of these applications are addressed with systems that are characterized by their state of the art resolution, accuracy and throughput as well as extensive software control. They deliver wide application versatility combined with ease of use. Our dedicated field service, training and support teams and our established upgrade policy ensure that the value of customers' investments is maintained over a long productive system life.

The latest Leica EBPG5000 Series Beamwriter systems continue the evolution of this highly respected and field proven Gaussian beam – vector scan product. Improved application functionality and operational specifications have been defined and developed from the wide range of dedicated user feedback. This has enabled Leica to create very specific solutions to some of the most demanding patterning requirements of the widely experienced Beamwriter community.

These nano-resolution tools provide a cost effective solution to many of today's sub-100nm lithography needs in a proven and productive package.

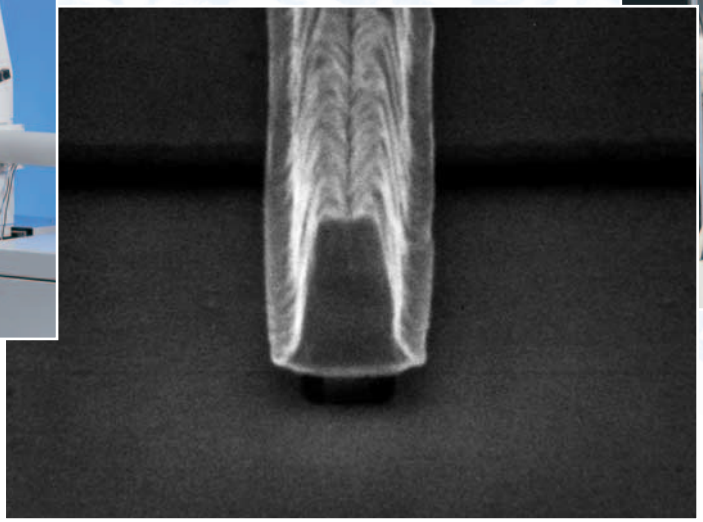


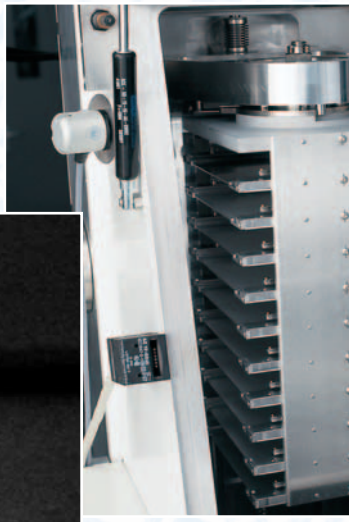
EBPG5000 Series System Technology

Writing Mode
The EBPG5000 Beamwriter series systems use the Gaussian beam, step and expose writing strategy to pattern over extended substrate areas. All models feature the Leica high current density Thermal Field Emission electron gun with the powerful advantage of field proven beam energy up to 100KeV.

Advanced Pattern Generation
Rapid exposure is provided by a 25MHz intelligent pattern processor, central to this new sub-system is its distributed processing power. This dramatically reduces the amount of off-line pattern pre-processing required, speeding pattern transcription and, in many critical cases, reducing file sizes and run times. This architecture is the key enabler that permits many applications to be cost effectively written which otherwise would prove impractical through sheer data volume or uneconomic through unrealistic runtimes. Such patterning needs are now commonplace in an emerging range of premium device applications in nano-electronics, photonics and storage technologies.

Accuracy
Thermal stabilization of the substrate loader and stage systems helps to ensure metrology grade placement accuracy for the patterning process. This is complemented by a precision deflection system which is fully compensated for the deflection-induced aberrations of distortion, defocus and astigmatism. This system ensures a highly linear field with minimal butting errors and excellent CD control throughout. In highly critical applications a number of write strategy options can be used to further improve accuracy.

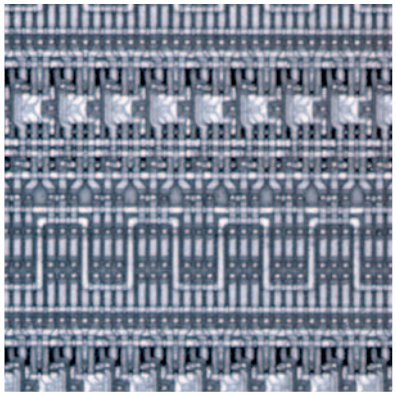


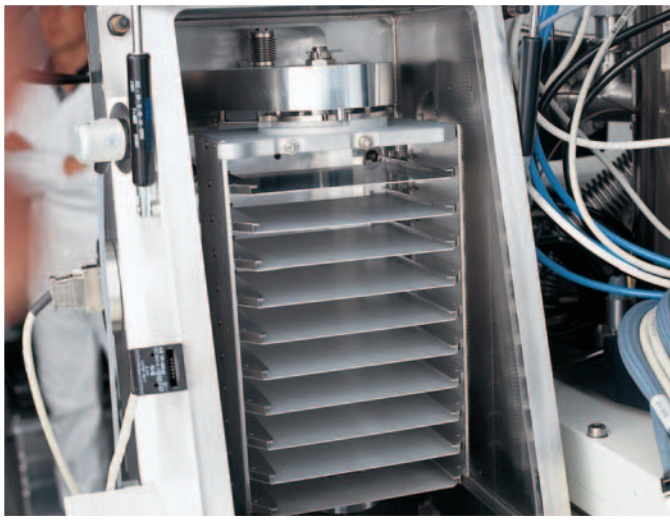


Substrate Handling
The systems are specifically designed to handle a wide range of substrate types. Wafer sizes up to 150mm diameter as well as standard and next generation lithography mask formats up to 150mm are supported. Precision substrate holders are available for these wafer and photoplates as well as a wide range of piece part and custom substrates. A front access batch mode multi-substrate loadlock is provided for multiple job loading. This enables fully automatic unattended operation on up to 10 substrates.

System Software
The well proven "BEAMS" software is a comprehensive operating system controlling all major automated subsystems. These include stage movement, beam formation, deflection, pattern generation, monitoring and logging as well as Job Control File execution. This versatile system uses a feature rich range of instructions with an intuitive structure. Stored parameters such as identifiers for frequently used stage positions, deflection field compensation sets, EO column set up, etc. simplify job preparation. Job Control uses fully automatic run time interpretation and execution of stored job files.

Registration and Alignment
A wide range of mark detection and location algorithms is provided for multi-layer direct write mix and match applications. Resist covered alignment marks are detected using backscattered electron contrast from either topographical or material mark structure. Versatile alignment schemes provide stepper block size (or whole wafer) global alignment and full die-by-die registration.



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Manufacturing & Prototyping Applications

Advanced compound semiconductor microwave devices have long required accurately controlled gate structures down to 100 nm CD or less. In addition they demand the added complexity of "T" shaped (or other profile) cross-section in order to deliver adequate gate conductance with low gate capacitance. The larger geometry source/drain metalization layer of such devices is typically patterned using lower cost optical systems. These typically suffer from stepper lens distortions, which further complicates achieving good overlay accuracy when using a mix and match of tools.

These demanding gate level requirements are being very successfully addressed using Leica e-beam lithography systems. Over 25 such Leica units are currently in use worldwide for this application both in full manufacturing and R&D/Prototyping roles. They deliver profitable manufacturing throughput as well as CD resolution, control and overlay accuracy to satisfy the most demanding R&D requirements.

Leica EBPG5000 Series systems have many unique characteristics which have led to their wide adoption in this role. Their reliable, high brightness 100keV TFE electron source minimizes exposure time and delivers a stable high precision writing beam. Throughput is further improved by the low mass, fast stepping stage which greatly reduces non-exposure overhead times compared with unnecessarily large stage system tools.

Programmable exposure dosage of individual pattern features in real-time is used with multi-layer resists to provide the critical developed resist profile suitable for “clean” lift-off metalization with good process latitude.

The extensively proven operating software suite “BEAMS” provides many overlay accuracy enhancing facilities. It has the benefit of many years of user feedback and offers versatile mark detection algorithms with a range of “Die by die” or “cluster alignment” overlay strategies. These provide the necessary sub 30 nm gate alignment even in the presence of quite distorted base layer patterning.

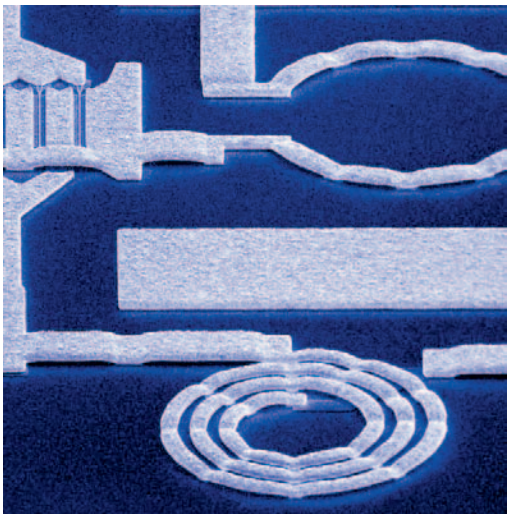
These are some of the many user-appreciated qualities of the Beamwriter systems but there are many more specific EBPG5000 Series benefits which this latest series provides.

Much greater depth of focus, freedom from planarization restrictions, ease in producing contoured resist profiles and structure periodicity set to fractions of a nanometer are all inherent capabilities that can become compelling application solutions.

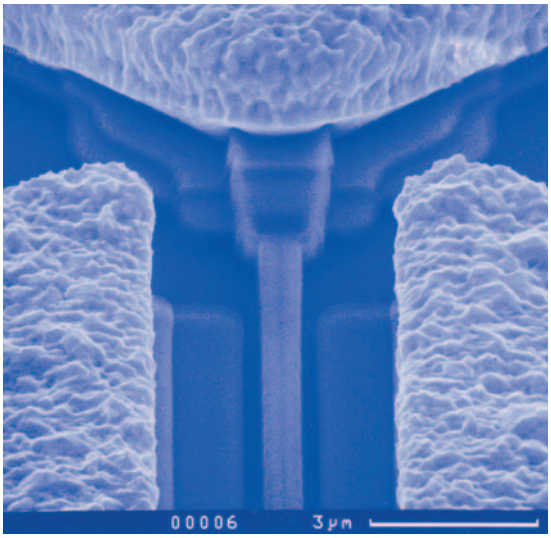
Nanolithography and R&D Applications

Wide application versatility has been one of the most important design criteria in the evolution of the EBPG5000 Series. The success of this goal is clearly evident in the diversity of the user base. Research and Development patterning for CMOS and microwave devices, Quantum Functional Devices, Photonic elements, and a variety of NGL mask technologies are all current routine applications for Beamwriter systems.

In addition many other novel high resolution structures necessary for emerging nano-electronics, optics, nano electromechanical systems, and biological/medical devices have been successfully patterned. These more “exotic” devices often require patterning on non-semiconductor industry substrates with a wide diversity of material types, irregular shape and non-planar imaging surfaces. The EBPG5000 is well matched and configured for all of these applications.



Micro-optical elements like gratings, computer-generated diffractive optical elements (DOE), micro-lenses and lens arrays are typical of this emerging class of components They are fast becoming essential for micro-systems in sensor, communication, metrology and medical applications. Complex non-Manhattan geometries with multiple level patterning on insulating substrates like SiO2 are common place requirements in this application field. EBPG5000 system qualities like versatility in substrate fixturing and pattern representation as well as lithographic precision ensure cost effective prototyping for these application critical components.

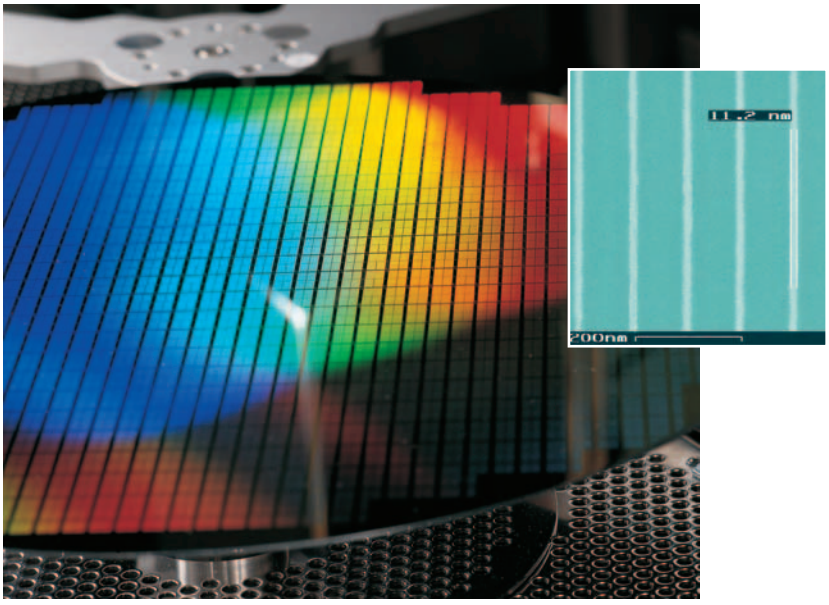


Sensor and actuator devices using nano-electromechanical techniques are another application field for Beamwriter systems. They are used to define such diverse components as a magnetizing coil/nano-Hall probe combination at the tip of an AFM probe and biological nano-blood sensors.

Resolution, accuracy and versatility are also the main reasons why EBPG5000 Series systems are relied on to prototype low dimensional silicon device structures. Such quantum functional devices now provide the promise of continuing levels of integration beyond that considered feasible with conventional semiconductor device structures.

Leica EBPG5000 Series systems offer the most cost effective system of choice for many of today's R&D lithographic needs. Beamwriter systems are in use at many of the world's most advanced industrial companies. They are also placed in many of the world's leading government and academic research laboratories, providing solutions for a wide variety of lithographic requirements in many diverse application fields. Such versatility stems from the continuing success of a hardware and software platform that has truly field proven credentials.

To find out more detailed information on how the EBPG5000 Series products can help solve your advanced lithography requirements please contact your nearest Leica Microsystems office as listed overleaf.



Leica Microsystems – the brand for outstanding products

Leica Microsystems' mission is to be the world's first-choice provider of innovative solutions to our customers' needs for vision, measurement, lithography and analysis of microstructures.

Leica, the leading brand for microscopes and scientific instruments, developed from five brand names, all with a long tradition: Wild, Leitz, Reichert, Jung and Cambridge Instruments. Yet Leica symbolizes innovation as well as tradition.

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