Optical Lithography Refinement Essential to Meet Increasing Challenge from NGL Technologies

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Optical lithography may currently offer the advantage of high wafer throughputs, but to sustain in the long term and compete with the **next generation lithography (NGL) technologies**, it must deliver finer resolution and achieve the desired quality, reliability, and cost targets.

“Constant improvements in optical lithography are likely to play a crucial role in assisting the semiconductor industry to achieve shrinking device sizes and increased chip performance,” says Technical Insights Research Analyst Sivakumar Muthuramalingam.

Extending optical lithography toward the 193-nm wavelength is expected to provide feature sizes of 65-nm and beyond for the high-volume production of advanced memory and semiconductor devices. Extensions beyond 193-nm wavelength require better enhancement techniques and precision sources than are currently available.

Optical lithography must also tackle the issue of low contrast aerial image to reduce mask error. Sophisticated engineering techniques such as advanced lithography masks and off-axis illumination are likely to be critical in minimizing mask error.

However, with optical lithography methods approaching their limits and semiconductor manufacturers looking at the sub-50 nm node to create smaller, lighter, faster, and more powerful devices, NGL technologies

are anticipated to prove to be the future of the semiconductor industry.

“A successful NGL candidate must demonstrate extendibility below 70-nm, reduced cost of ownership, high wafer throughput, and defect-free mask technology,” emphasizes Muthuramalingam.

Despite technical and economical hurdles, extreme ultra violet lithography (EUVL) and electron projection lithography (EPL) with their ability to pattern features as small as 32-nm are the prime contenders to replace optical lithography.

Researchers believe EUVL is the right step toward a 32-nm node, although certain concerns such as masks, costs, and timing need to be addressed before commercialization.

EUVL improves the quality of the pattern projected onto the silicon wafer, thereby increasing the chip performance. This technology is likely to be extremely useful for creating universal language translators and high-volume applications such as processors and dynamic random access memories (DRAMs).

EPL is also an attractive candidate vying to succeed optical lithography. In EPL standard stencil masks reduce costs while the mature electron beam resists eliminate the timing risks associated with EUVL.

However, the relatively low throughput works against EPL as a possible successor to optical lithography. Scaling the throughput from the present 10-15 wafers to 25-30 wafers per hour is anticipated to allow EPL to meet increasing demands from the semiconductor industry.

Nano-imprint lithography (NIL) is also a promising and cost-effective NGL solution that avoids the use of expensive optics and sophisticated enhancement techniques such as phase-shift masks.

NGL prototype tools have to first be developed and demonstrated successfully in the laboratories. Their commercial success will depend on the amount of applied and product-oriented research conducted in the near future.

“Researchers must develop adequate techniques to manufacture and assemble NGL tools into prescribed geometries and also adopt comprehensive quality assurance steps that ensure adherence to requirements,” concludes Muthuramalingam.

Semiconductor Microlithography, part of the Semiconductor Vertical Subscription Service, examines challenges facing the optical lithography technology and the potential of next-generation lithography technologies. Apart from key technology drivers, evaluation of the challenges facing NGL technologies is also provided. Executive summaries and interviews are available to the press.

If you are interested in an analysis overview which provide manufacturers, end-users and other industry participants an overview, summary, challenges and latest coverage of Semiconductor Microlithography - then send an email to Julia Paulson – North American Corporate Communications at jpaulson@frost.com with the following information: Full name, Company Name, Title, Contact Tel Number, Contact Fax Number, Email. Upon receipt of the above information, an overview will be emailed to you.

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