

PRESS RELEASE

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Multicolumn E-Beam Technology Roadmap Disclosed at Lithography and Device Security Workshops

Dr. David K. Lam details systems progress, applications outlook and market positioning for Multibeam's innovative miniature e-beam columns

SANTA CLARA, CA - July 10, 2018 - Dr. David K. Lam, Chairman/CEO of **Multibeam Corporation**, recently disclosed the significant progress made in applying his company's multicolumn e-beam direct write technology to deliver unprecedented performance and greater cost efficiency on two timely fronts: lithography for low-volume IC fabrication and embedded device-unique security. Synopses of his two workshop presentations follow:

LITHOGRAPHY WORKSHOP (June 18, 2018 – Sun Valley, Idaho)

Dr. Lam began his plenary presentation with sober recognition of how fast the fab-tool industry has matured, and how each market segment is now dominated by a few well-established, entrenched, large equipment makers. He also tipped his hat to IBM for effectively pioneering and commercializing e-beam lithography for semiconductor production in the 1970s-80s.

He then outlined Multibeam's modular approach to building multicolumn e-beam litho systems for "low-volume, high-mix" (i.e., small quantities, large variety) IC production with its proprietary miniature e-beam column technology. He noted that this long-underserved market comprises low-volume IC-makers who bear the brunt of soaring mask costs. He also affirmed that this market is sizable in the aggregate as it encompasses IC producers for both commercial and government uses.

Dr. Lam wove a number of strategic threads into his talk, one of which cautioned e-beam litho startups, no matter how great their technology, against competing head-on with dominant fab-tool leaders. He said litho startups would be well advised to first identify applications that mainstream litho leaders using their current process technology (i.e. 193nm immersion) don't do well or can't do at all.

The highly acclaimed business book "The Innovator's Dilemma" by Clayton Christensen (HBS Press, 1997) was referenced. As Dr. Lam recapped this book's lessons learned in the mechanical excavator industry, he concluded that just as the hydraulic excavator road to high-volume markets was preceded by success in serving low-volume needs - Multibeam was especially well positioned with its versatile e-beam platform to adopt a similar path.

Disclosing his company's 10 year roadmap for the first time in an industry forum, Dr. Lam affirmed, "Our e-beam platform is innovative and versatile. We are on track to achieve two challenging system delivery milestones, initially a low-volume system for the US Government in 2020 followed by a commercial high-volume system in 2022."

DEVICE SECURITY WORKSHOP (June 24, 2018 - San Francisco)

This invited talk was delivered at the IEEE International Workshop on Physical Attacks and Inspection on Electronics (PAINE) with emphasis on physical tampering of IC devices.

Following a brief overview of Multibeam and its miniature e-beam column technology and e-beam direct-write approach, Dr. Lam segued to the theme of his talk: “How can his company’s multicolumn e-beam direct write technology enhance IC device security?”

Challenging the audience to think why a “unique ID” for each critical IC is needed, he noted that current chip-ID solutions are flawed and vulnerable, but securing the global supply chain and testing all chips before use are nonstarters. Unique chip IDs are sorely needed for tracking critical ICs from the time they are produced in a fab to the time they populate circuit boards. Moreover, the unique chip IDs must be embedded without interfering with the IC design and fabrication process as well as the assembly and packaging of the device.

Dr. Lam then addressed why optical lithography, the workhorse in IC fabs, can’t embed a unique ID in each chip. The answer – which may not be obvious to those who are unfamiliar with IC fabrication – is that optical lithography is a mask-based technology that requires all chips be identical if produced with the same mask. Optical litho is a cookie-cutter process, while e-beam litho, being maskless, can write unique data on each IC.

After reviewing the vulnerabilities of two popular chip-ID solutions, he explained how Multibeam’s embedded ID is secure and tamper-proof. Aided by illustrations of the cross-section of an IC, he noted the “Via-1” layer into which a unique code could be embedded. Any attempt to hack into the ID on Via-1 layer would result in destroying the chip.

Being the kickoff speaker of this workshop, Dr. Lam noted that ensuing speakers will examine techniques and tools to ‘delayer’ an IC for reverse engineering and other purposes. This raises the question, “What if determined hackers were able to discover the ID of the destroyed chip?” He assured that if each chip had its own embedded ID, the destroyed chip would be of no use to the hackers, declaring, “That is why ID uniqueness is so critically important.”

Dr. Lam also noted that some chip makers who want to save cost are currently inclined to employ a “group ID”, that is common to a large category of similar chips. Of course, this approach would make the destroyed chip useful. Fortunately, Multibeam’s ID implementation is so cost-efficient that each chip can be given its own unique ID.

He continued, “I expect our e-beam ID-writer to be integrated with other process tools in the wafer fab. When a wafer is ready for ID embedding, it is routed from production flow to the Multibeam e-beam system; after ID writing, followed by typical “etch-and-clean” steps, it is returned to normal production flow. All this is done in the wafer fab and the e-beam writing process is simple and fast – without costly masks.”

Dr. Lam emphasized that Multibeam’s e-beam writing enables a unique ID to be “hard-coded” into each critical IC during fabrication, thereby facilitating its tracking through the entire supply chain, and guarding against counterfeits and tampering. Such secure storage of a unique ID is essential to validate the chip’s true identity and ensure it can be trusted for use. He asserted, “Our multicolumn e-beam direct-write approach offers the industry’s most cost-efficient and practical solution for embedding tamper-proof hardware security. Indeed, no mask-based lithography – such as optical, EUV, or nanoimprint – can do the job.”

About Multibeam Corporation

Multibeam Corporation, led by Dr. David K. Lam, founder and former CEO of Lam Research, is focused on building multicolumn e-beam direct write systems for a number of unique and timely applications, including lithography for low-volume high-mix IC fabrication and embedding unique ID in chips to guard against counterfeits. High-volume fabrication and IoT device security applications are also on the roadmap. With 43 U.S. patents filed (34 awarded), the privately held company received a \$35 million purchase contract from the U.S. Government to deliver its first multicolumn e-beam litho system in 2020.

For more information, visit www.multibeamcorp.com.