3 beams for “3Beams”

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Most recently, new equipment has been added to Raith´s product portfolio thus having systems with 3 different beam technologies at its disposal. Perfectly complementing Electron Beam Lithography (EBL) and Focused Ion Beam (FIB) Nanofabrication, Laser Beam Lithography (LBL) - also referred to as direct write photolithography or maskless photolithography - now significantly extends the range of possible applications with Raith equipment. The *Picomaster* series ideally fits the equipment philosophy of Raith by offering flexible and high performance LBL systems for both R&D-focused and productive environments. So, Raith customers will be able to choose from a wide range of micro- and nanofabrication instrumentation for applications extending from single-digit nanoscale resolution tasks up to fast large-area patterning. The complementary LBL, EBL and FIB solutions, all offered from a single supplier, with the future perspective of profound system connectivities including integrated workflow and sample handling, will improve nanofabrication process efficiency at many customer labs.

Regarding dedicated EBL, a lot of advanced automation features and unique functionalities have recently been implemented into *VOYAGER*, that is now representing a new class of EBL systems. A new and fully automated workflow enables pushbutton-type performance and simplifies access to professional electron beam lithography even for unexperienced users. Furthermore, *VOYAGER* now provides unique application solutions for Photonics and Optoelectronics. A new module for designing and exposing DFB gratings with finest pitch modulation is available. And, a long-awaited solution for seamlessly writing tapered waveguides with lowest line edge roughness (LER) has been developed. Last but not least, metalenses can now be efficiently manufactured by exploiting efficient algorithmic (formula based) patterning strategies even without the need for a GDSII design.

For FIB nanofabrication, Raith will release an additional universal ion source for *VELION*. This liquid metal alloy ion source (LMAIS) contains and emits Lithium, Gallium and Bismuth simultaneously which can be separated in an ExB filter. This allows for rapid, easy, and reliable toggling between light Lithium ions and heavy Bismuth ions thus enabling novel nanofabrication processes by taking advantage of the benefits of the different ion beams, e.g for highest resolution nanopatterning or imaging (Li), or for higher sputter yield at higher vertical resolution (Bi) [1,2].

[1] W. Pilz, N. Klingner, L. Bischoff, P. Mazarov, and S. Bauerdick, Lithium ion beams from liquid metal alloy ion sources, JVSTB 37, 021802 (2019).
[2] A. Tolstogouzov, P. Mazarov, A.E. Ieshkin, S.F. Belykh, N.G. Korobeishchikov, V.O. Pelenovich, D.J. Fu, Sputtering of silicon by atomic and cluster bismuth ions: An influence of projectile nuclearity and specific kinetic energy on the sputter yield Vacuum 188 110188 (2021).