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Advanced Nanopatterning With Cell Projection Electron Beam Lithography

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Electron beam lithography (EBL) can accomplish highly advanced and versatile nanopatterning, due to fine resolution and maskless writing, and is therefore a powerful and widely used method. While mass production in the latest technology nodes is served by specialized and expensive multibeam EBL systems, there is a growing need in other markets for flexible and cost-efficient electron beam writing.

Vistec offers EBL systems which are optimized for fast writing on different types of wafer and mask substrates and have a fully automated substrate handling. These systems are used for fabrication of optical masks in mid-range technology nodes, manufacturing of nanoimprint templates, fast prototyping for initial device evaluation, and manifold small-volume production in semiconductor and micro-optics markets.

Vistec EBL systems utilize electron optics with variable shaped beam, increasing throughput by high-speed variation of the beam size according to the pattern data. With the additional cell projection mode, the electron beam can be pre-shaped to multiple profiles (cells), e.g. dot arrays or line gratings or circle elements, and many others. Thousands of different customized cells can be implemented in a single EBL system. Thereby not only repetitive structures are exposed even faster, with simultaneously smoother pattern edge. Due to the ability to perform dense patterning on large areas in a feasible time, ambitious applications become possible, like metasurfaces with high optical quality on full 300 mm wafers.

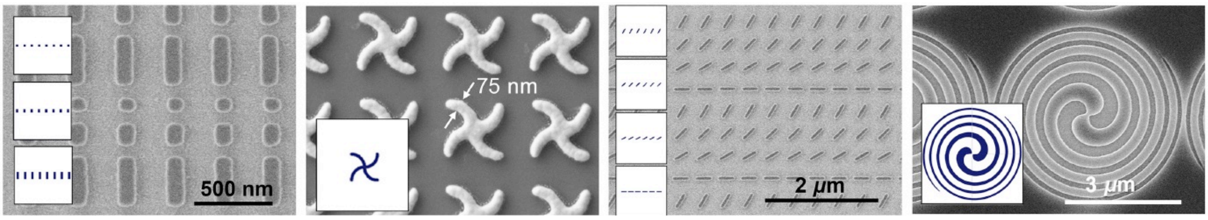

Fig. 1: SEM-images of complex patterns generated by EBL with the cell projection. The insets are showing the pre-shaped beam profile. From: U.D. Zeitner, M. Banasch, M. Trost, J. Micro/Nanopattern. Mater. Metrol. 22(4) 041405-3 (2023).

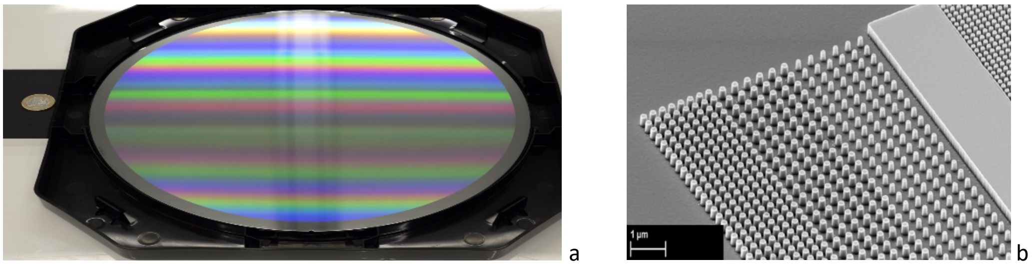

Fig. 2: a) 300 mm wafer fully patterned with an effective-medium blazed grating by cell projection. b) SEM image of the grating dots. From: M. Haedrich, et al., PhotonicsViews 5/2022, DOI: 10.1002/phvs.202200036.