Nanotech SWHL GmbH

To Academic Counsel D 002.045.01,
Institute of Computational Mathematics
Russian Academy of Sciences
Moscow, Russia

06 December 2016

Dear Sirs,

In view of the forthcoming defense of Petr Mikheev's Thesis «Software-based methods of calculation and correction of electromagnetic fields», we are pleased to inform you that our company has used the method of calculation developed by P.Mikheev in co-operation with our company, to calculate holographic masks to produce aerial images with sub-wavelength elements.

The most commonly used lithographic technology is projection microphotolithography with deep ultraviolet light source (known as "DUVL" or "193 nm ArF" and ArFi) based on light imaging, has been driving the semiconductor industry for decades. Recently it became clear that DUVL has exhausted its potential to further resolution decrease at reasonable costs.

Our company is engaged in the development of Sub-Wavelength Holographic Lithography (SWHL) that radically simplifies the lithography process and decreases (multi-fold!) the cost of lithographic equipment and masks. SWHL, with very simple lithography tool (holographic stepper), and holographic masks that are considerably easier to produce and service (due inter alia to their low sensitivity to defects), has all the potential to become DUVL successful alternative and to overcome the difficulties faced by traditional projection microelectronics.

Calculation of a holographic mask is a complicated mathematical problem. However it the holographic mask that is the core of SWHL technology ultimately resulting in radical simplification of holographic steppers, masks and lithographic stage ovf IC manufacturing process.

Petr Mikheev Thesis solves a number of principal problems that we encountered when calculating holographic masks. The software package that he developed allowed us to produce images with sub-wavelength elements with line edge roughness meeting SEMI standards. It also guarantees the quality of aerial images and is by far simpler to execute. Certain results obtained by P. Mikheev helped us to demonstrate that SWHL is capable of producing 3D-structures in one exposure – unlike any other existing lithography technologies. This advantage of SWHL is fundamental for the production of such electronic devices like MEMS, MOEMS sensors and IoT elements, with the global market of these devices projected to reach $7T in 2025.

We would also like to point out that P. Mikheev a co-author of a number of our patents related to SWHL technology.

Beat Müller

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