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EVG and SwissLitho co-developing nanoimprint lithography for single-nanometer-scale 3D optical structures – August 1, 2021

EV Group of St Florian, Austria – a supplier of wafer bonding and lithography equipment for semiconductor, micro-electro-mechanical systems (MEMS), compound semiconductor, power device and nanotechnology applications – and SwissLitho AG of Zurich, Switzerland (which makes maskless nanolithography tools) have announced a joint solution to enable the production of 3D structures down to the single-nanometer scale.

Initially demonstrated within the Single Nanometer Manufacturing for Beyond CMOS Devices (SNM) project funded by the European Union's Seventh Framework Program (EU FP7), the joint solution uses SwissLitho's novel NanoFrazor thermal scanning probe lithography system to produce master templates with 3D structures for nanoimprint lithography (NIL), and EVG's HERCULES NIL system with SmartNIL technology to replicate those structures at high throughput.

EVG and SwissLitho will initially target the development of diffractive optical elements and other related optical components that support photonics, data communications, augmented/virtual reality (AR/VR) and other applications, with the potential to expand into biotechnology, nanofluidics and other nanotechnology applications.

SwissLitho's NanoFrazor system will be used to create imprint masters. Compared with conventional approaches, including electron beam (e-beam) and grayscale lithography, the novel technology has the unique ability to print 3D structures with what is claimed to be unsurpassed accuracy. EVG's HERCULES NIL system will then be used to create working templates for production use, cost-effectively and at high throughput, using the firm's proprietary large-area nanoimprint SmartNIL technology.

"SwissLitho's NanoFrazor solution is highly complementary to EVG's SmartNIL technology," comments EVG's corporate technology director Dr Thomas Glinsner. "Together, we can offer a complete NIL solution for photonics and other applications involving 3D structure patterning, providing significant opportunity for both companies to expand our customer base and market reach," he adds. "Our NILPhotonics Competence Center will be the first point of contact for customers interested in this joint solution, where we will be able to offer feasibility studies, demonstrations and pilot-line production."

Thermal scanning probe lithography (the technology behind the NanoFrazor) was invented at IBM Research in Zurich and acquired by SwissLitho. The maskless, direct-write lithography approach involves spin-coating a unique, thermally sensitive resist onto the sample surface before patterning. A heated ultra-sharp tip is then used to decompose and evaporate the resist locally while simultaneously inspecting the written nanostructures. The resulting arbitrary resist pattern can then be transferred into almost any other material using lift-off, etching, plating, molding or other methodologies.

"We developed our NanoFrazor line to provide a high-performance, affordable alternative and extension to costly e-beam lithography systems," says SwissLitho's CEO Dr Felix Holzner. **"The technology allows manufacturing of the master with many 'levels' in a single step. In particular, 3D structures with single-nanometer accuracy can be produced more easily and with greater fidelity compared to traditional e-beam or grayscale lithography methods."**
The HERCULES NIL combines EVG's expertise in NIL, resist processing and high-volume manufacturing solutions into a single integrated system that offers throughput of up to 40wph (wafers per hour) for 200mm wafers. Its configurable, modular platform accommodates a variety of imprint materials and structure sizes, allowing greater flexibility in addressing manufacturing needs. In addition, its ability to fabricate multiple-use soft stamps helps to extend the lifetime of master imprint templates.

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