

## **Advanced two-photon photolithography and novel ionic liquid – polymer composite enhance fundamental studies in biology**

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The combination of light-sensitive non-conductive photoresist, as a host network, with an ionic liquid brings superior advantages in terms of material characteristics. Compatibility with the advanced two-photon (2-PP) nanolithography yields the opportunity to produce high-resolution (down to 150 nm) conductive structures in a single-step process and opens up a variety of potential applications. For example, real-time monitoring the motility of small model organisms, such as *Caenorhabditis elegans*, remains a key challenge for in situ manipulation and stimulation. Tracking of this motile microorganism provides an efficient method of investigating a variety of biological processes through the miniaturization and functional integration of bioanalytical devices. The approach to this challenge includes the integration of electrodes, fabricated by 2-PP nanolithography, into a microfluidic platform. Transparency and conductivity of the presented material in combination with highly standardized electrodes inside microfluidic channels provides a simple means of creating electro-fluidic chips to flexibly control the movement of *C. elegans* in a sensitive and reproducible manner without blocking optical visibility. As a result, performance of numerous experiments, including electrochemical impedance spectroscopy and microscopy-based imaging, in parallel on the same chip with fewer reagents, improved sensitivity and increased resolution has become possible. This will most certainly bring about more precise quantitative and qualitative *in vivo* analyses for novel true 3D applications in the near future.

### **Biography**

Natalia Bakhtina has been a PhD candidate in Department of Microsystems Engineering at University of Freiburg, Germany under the supervision of Jan G Korvink since 2012. The outcome of her investigations has resulted in several publications in journals. She was awarded by the very prestigious Outstanding Student Paper Award at IEEE MEMS conference in 2015 and SPIE 3D Printing Best Paper Award at SPIE Photonics West in 2016, San Francisco, USA.

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