

# Visualization of 3D polymer photonics wire bonds by means of confocal laser scanning microscope

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**Abstract:** The development of technology DLW (direct laser writing) - lithography with the idea of STED (stimulated emission depletion) has been growing rapidly for manufacturing micro optics and photonics structures. The technique of DLW is based on nonlinear interaction

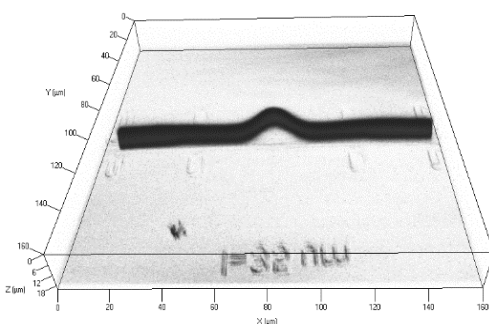


Fig. 1. 3D luminescent image of PWB (IP-dip) fabricated on silicon nitride photonic chip.

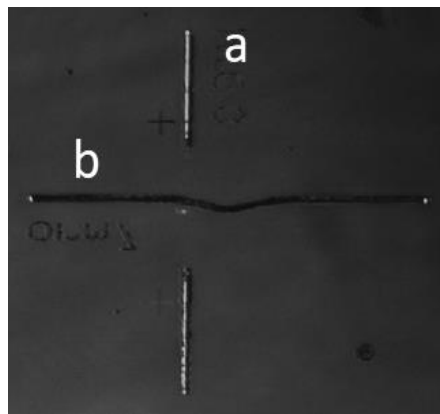


Fig. 2. Luminescence map of two PWBs structures fabricated on glass substrate using IP-L (a) and Ormocomp (b) photoresists

between laser radiation and photoresists medium (two-photon absorption). In micro optics and photonics structure, photonics wire bonds (PWBs) [1] became a new promising concept for chip-to-chip interconnects in photonic integrated circuits. Analysis and characterization of structures fabricated by means of STED-DLW lithography are one of the crucial tasks in the context of development and optimization for future application of the structures fabricated and the techniques used for the investigation in order to obtain luminescence map, morphology and optical properties of structure fabricated. Our team has fabricated PWBs [2] which can be used to improve optical performance of 3D photonic devices. Here we presented the information about the structures fabricated using technology of DLW lithography that has been applied in both commercial Nanoscribe and home-made STED-DLW setup. We used a confocal laser scanning microscope (CLSM) to scan photonic maps of the 3D structures in various conditions e.g PWBs fabricated on glass substrate, hybrid nanowaveguide which contains 3D polymer PWB and planar silicon nitride waveguide (Fig.1) and PWBs fabricated using different photoresists (high luminescent IP-L and low luminescent Ormocomp) on glass substrate (Fig.2). We measured and analyzed morphology, optical properties and luminescence signal of complex nano photonic structures, PWBs with emitters and visualized PWBs on real silicon nitride photonics chips with CLSM. Funding

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**References:** [1] N. Lindenmann, G. Balthasar, D. Hillerkuss, R. Schmogrow, M. Jordan, J. Leuthold, W. Freude, and C. Koos, Photonic wire bonding: a novel concept for chip-scale interconnects, *Opt. Express* 20(16) (2012) 17667.

[2] R. D. Zvagelsky, D. A. Chubich, D. A. Kolymagin, E. V. Korostylev, V. V. Kovalyuk, A. I. Prokhodtsov, A.V. Tarasov, G. N. Goltsman, A. G. Vitukhnovsky, Three-dimensional polymer wire bonds on a chip: morphology and functionality, *Journal of Physics D: Applied Physics* 53 (2020) 355102