Multi-Photon Exposure Strategy and its Combination with Single-Photon Direct Laser Writing Technology

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The field of 3D printing, particularly with micro- and nanoscale resolution, has experienced significant advancements in recent years. However, one persisting challenge is the limited throughput of techniques like Two-Photon-Polymerization (TPP) compared to established direct laser writing systems. For instance, UV Maskless Aligners (e.g. MLA 150) can expose a 4-inch wafer in a matter of minutes, however limited to 2D structures, while the TPP Technology (e.g. MPO 100) may take several days to achieve the same task. Although this direct comparison is not fully applicable as of different applications served, it is still of interest as for TPP fabrication many designs combine bulky 2D volume with 2.5D or even 3D topographies. A boost in throughput not only for 2D volumes would be beneficial for TPP as this would further expand its target applications.

For this purpose, we evaluate different TPP exposure strategies from conventional layer-to-layer scanning to more advanced voxel tuning and even further to hybrid lithography steps by combining TPP with single photon direct laser writing.

In this presentation, we will discuss our results based on various topographies like microlens arrays and gearwheels. Hybrid exposures as introduced in this talk, demonstrate the compatibility with respect to application, materials as well as process steps and highlight the potential for innovative applications in fields ranging from micro-optics to micromechanics among others.