

## **Three-dimensional optical laser lithography: No limits? Martin Wegener**

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### **Abstract**

Three-dimensional (3D) direct laser writing (DLW) has become a commercially available workhorse and can be seen as the 3D counterpart of planar electron-beam lithography. However, DLW was previously subject to seemingly fundamental limitations regarding (i) spatial resolution due to the Abbe diffraction barrier, (ii) accessible sample heights due to finite microscope-lens working distances, and (iii) writing speed. This talk gives an introduction and presents the state-of-the-art.

(i) Stimulated-emission-depletion (STED) 3D DLW has recently broken the diffraction barrier [1]. For example, this has enabled the first 3D visible-frequency polarization-independent invisibility cloak and the first visible-frequency 3D complete-photonics-band-gap material.

(ii) 3D “dip-in” DLW has enabled the first 3D pentamode mechanical metamaterial.

### **References**

[1] J. Fischer and M. Wegener, *Laser Photon. Rev.* **7**, 22 (2013).

### **Figures**