XOLOGRAPHY FOR VOLUMETRIC 3D PRINTING

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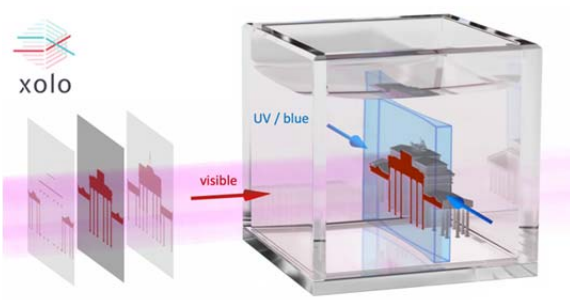
The principal advantages of light-based additive manufacturing techniques due to the unrivalled speed and resolution of photopolymerization processes have thus far been partially upset by slow build rates and material inhomogeneities due to point-wise or layered object generation common for methods including stereolithography (SLA) and digital light processing (DLP). Although volumetric 3D printing is the next evolutionary step to realize a continuous printing process, both currently established methods, two-photon photopolymerization (TPP) and computed axial lithography (CAL), suffer from either low volume generation rates or limited resolution, primarily originating from the necessity for a nonlinear process that defines a local polymerization threshold.

To overcome this limitation, we have developed xolography as a new and powerful volumetric printing technique [1]. It is based on the use of photoswitchable photoinitiators that require a sequence of two one-photon processes taking place at distinctly different wavelengths. Therefore, these dual color photoinitiators enable the precise confinement of the polymerization into regions defined by two orthogonal light sources consisting of an activating UV/blue light sheet and an orthogonal visible light projector (Figure). Since the crossing (x) light beams generate an entire (holos) object by this printing process, we refer to it as xolography. The linear nature of the process in combination with the high-definition of the projection allow for rapid printing of homogeneous materials and complex multicomponent objects in high resolution and without the need for support structures.



The presentation will highlight the action principle of xolography and discuss advantages and disadvantages with regard to build speed and resolution, object dimensions and complexity, as well as employable materials.

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