Volumetric 3D Printing of Viscous Photopolymers with Xolography

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Xolography as novel volumetric 3D printing technology rapidly produces objects from subcentimeter scale up to the size of dental models within a matter of minutes.[1] The technology exploits dual-color photoinitiatiors, which molecularly combine type II photoinitiation motifs with a photoswitching function. This makes the dual-color photoinitiator responsive to light of two differing wavelengths, in a way that light of the first wavelength pre-activates the dormant initiator A, while light of the second wavelength transforms the pre-activated form B into the initiating species C, which induces curing of the photopolymer. Thus, with dual-color photoinitiation the zone of polymerization is restricted to regions, where light of *both* wavelength is present *at the same time*.

In Xolography we intersect a thin UV light sheet plane with a visible light projection within the volume of a photopolymer-containing vat. Only at the intersection points curing of the photopolymer is induced, generating a freely floating object within the resin. The technology fundamentally differs from other layer-based 3D printing methods allowing new perspectives for object design, material selection and fabrication processes[2], e.g. the use of highly viscous resins and the 3D-printing of layer-less objects with isotropic material properties and optical grade surfaces.

In this presentation we will discuss the basic working principles of dual-color photoinitiation and the uniqueness of Xolography in terms of fabrication speed, material selection and its application for optics printing and biofabrication.

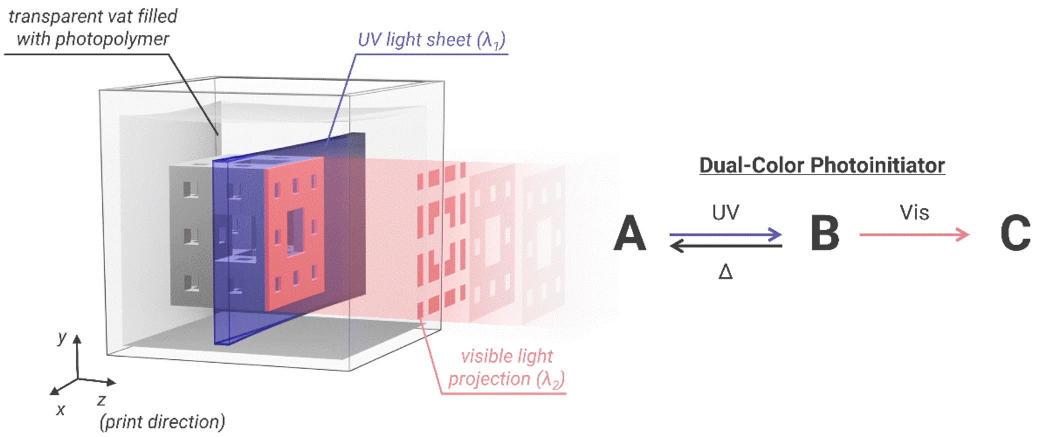

Figure 1. Principles of dual-color photoinitiation and volumetric 3D printing with Xolography.

References

1. M. Regehly et al., Nature, 588, 620–624, 2020.
2. L. Stüwe et al., Adv. Mater., 36, 2306716, 2024.