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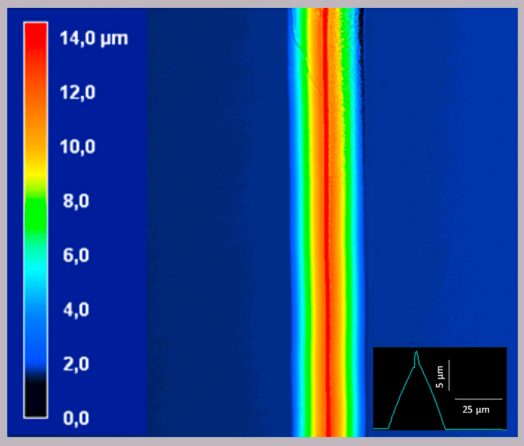

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ADDITIVE FREE THIOL-ENE POLYMER RESINS FOR 3D PRINTING

Task

Stereolithography is a 3D printing process that has a wide range of uses: from fast prototyping to the production of functional end products. While the process largely determines product characteristics, the composition of the photo-resins does so even more decisively. The photochemical thiol-ene (poly) addition provides an alternative to the conventionally used acrylic and epoxy resins. Almost all conventional stereolithography systems use blue or near-UV light (340 - 405 nm) in combination with photoinitiators to cure the photopolymer resins; the curing depth is generated by the addition of absorbers. By contrast, the thiol-ene reaction allows for a homogeneous polymerization at a wavelength of 266 nm without additives such as photoinitiators or absorbers.

Method

The thiol-ene resins are cured by deep UV laser radiation in a spatially controlled manner so as to build up solid three-dimensional objects layer by layer. Since the intrinsic absorption and initiation from the monomers are themselves sufficient to generate layers on the order of 1 - 100 µm, additives can be dispensed with completely. This way, transparent products can be generated with high refractive indices and reduced toxicity.

Result

In the project »Thiolight« a highly transparent, elastic photopolymer was developed from trifunctional thiols and enes. This polymer can be successfully processed with a 266 nm laser (cw) into high-resolution 3D objects in stereolithography without needing photoinitiators and absorbers. The process speeds are comparable to conventional material systems. The low oxygen inhibition, lower tension and the delayed gel point are more process-related advantages of these resins.

Applications

These new photo resins can be applied in, for example, polymer optics, medical devices or implants and in other polymer components with special requirements for mechanical properties, transparency or toxicity.

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3 Stereolithography setup (266 nm) and printed 3D structure.

4 Line profile of a thiol-ene structure to determine the curing depth.

Subject to alterations in specifications and other technical information. 06/2016.