



## FULLY AUTOMATED 3D PRODUCTION WITHOUT SUPPORT STRUCTURES

### Task

In 3D printing with vat-based photopolymerization (stereolithography and DLP), manual work steps are still a significant cost driver in manufacturing chains. Qualified personnel are required for the time consuming preparation of the data and the individual post-processing of the components (separating, washing, removing support structures, grinding, etc.), all of which cause many interruptions in the production chain. Approaches already exist for partial automation of the process, but full automation has so far failed because support structures, and the resulting connection to a build platform, are still necessary.

### Method

To transfer the high resolution and surface qualities of vat-based photopolymerization to a fully automated process, researchers had to fundamentally modify the technology. With the TwoCure® process from Fraunhofer ILT, classic support structures can be replaced by custom tailored materials and a novel thermally controlled process. In the TwoCure® process, non-polymerized photo resin is thermally (reversibly) solidified within the printed layer, thus supporting the following layer. This process makes it possible to significantly increase volume efficiency, as more components can be produced in

the same amount of time. Since the printed block is ejected automatically, the component can be post-processed without any manual steps at all.

### Results

A prototype was used to demonstrate the operation principle for the first time in a larger format (build volume 130 x 80 x 100 mm³). Currently, Fraunhofer ILT is developing the first production-ready machine, with a build volume of 190 x 110 x 100 mm³, a system that can manufacture components fully automatically. In the future, two additional post-process modules will be developed, both of which will also allow the components to be washed and post-cured (thermally and photochemically).

### Applications

With the TwoCure® process, users can produce small batches or large quantities of individual one-off products in a single step – from digital file to finished product – without any significant process knowledge or manual interrupts. An initial demonstration was given in the area of earmolds. Other fields of application include lost forms (e.g. jewelry), technical products (e.g. waveguides, connectors or housings) and dental applications. A variety of tailored materials are available for these applications.

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- 1 Process chamber of the TwoCure® process.
- 2 High-resolution cross-strut braced wheel (outer diameter: 22 mm).